EFFECTIVENESS MONITORING COMMITTEE

RESEARCH THEMES & CRITICAL MONITORING QUESTIONS

Submitted to the California State Board of Forestry and Fire Protection

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1.0 INTRODUCTION

A goal of the Effectiveness Monitoring Committee (EMC) is to develop a process-based understanding of the effectiveness of the California Forest Practice Rules (FPRs) and other natural resource protection statutes and laws, codes and regulations, including the California Endangered Species Act (ESA), federal ESA, Porter-Cologne Water Quality Act, federal Clean Water Act, and Fish and Game Code (FGC). The EMC collectively refers to these as the 'FPRs and associated regulations' and evaluates their effectiveness by utilizing research results stemming from EMC-funded research. Findings are then presented in a formal Adaptive Management (AM) process to inform the California Board of Forestry and Fire Protection ('Board') in its future policy development. This is a key component of AM, providing the basis for decision-making and facilitating adaptation to changing circumstances and unexpected outcomes in dynamic ecosystems.

This document describes current research themes and key questions defined by the EMC through a public process, highlighting gaps in knowledge related to the effectiveness of the FPRs and associated regulations. To facilitate an AM process that informs proposed changes to forestry policy and regulations, the EMC supports research that addresses twelve core research themes. Aligned with these research themes, the EMC has developed a set of Critical Monitoring Questions (CMQ) to guide prospective grantee research questions and help direct EMC funding focus. The research themes and CMQs provided in this document—initially adopted in 2017 and presented in the 2018 Strategic Plan[1]—are updated as determined by the EMC, subject to BOF approval.[2]

Prospective grantees should reference this document as a guide in developing research questions when seeking EMC grant funding. However, provided that that the research questions posed are demonstrably aligned with the established research themes and examine the effectiveness of the FPRs and associated regulations, actual research questions posed by prospective grantees may vary from the listed CMQs.

For more information on the adaptive management process and feedback loop utilized to inform policy development, including modifications to the CA FPRs and related regulations, please see the Strategic Plan (EMC 2022).[3]

2.0 RESEARCH THEMES AND CRITICAL MONITORING QUESTIONS

The Research Themes and Critical Monitoring Questions as finalized in 2023 are as follows:

Theme 1 Watercourse and Lake Protection Zone Riparian Function

The Watercourse and Lake Protection Zone (WLPZ) FPRs were developed to ensure that timber operations do not potentially cause significant adverse site-specific and cumulative adverse impacts to the beneficial uses of water, native aquatic and riparian-associated species, functions of riparian zones or result in an

[1] Effectiveness Monitoring Committee (EMC). 2018. Effectiveness Monitoring Committee (EMC) Strategic Plan. Revised November 6, 2018. https://bof.fire.ca.gov/media/9122/2018-emc-strategic-plan-ada.pdf

[2] In light of changes in recent years, including increased wildfire and related climate change impacts affecting timberlands of the State, the Research Themes and CMQs were revisited and revised by the EMC following public meetings, and approved by the Board on DATE 2023.

[3] Effectiveness Monitoring Committee (EMC). Effectiveness Monitoring Committee (EMC) Strategic Plan. Revised November 2, 2022. https://bof.fire.ca.gov/media/9122/2018-emc-strategic-plan-ada.pdf

unauthorized take of listed aquatic species (14 California Code of Regulations [CCR] § 916 [936, 956]). A primary objective of the FPRs is to maintain or restore riparian and aquatic functions in classified watercourses. Both passive and active management approaches may accomplish these objectives by incorporating options ranging from protection (passive, no touch) to active manipulation of stand structure (e.g., timber harvest) (14 CCR § 916.9 [936.9, 956.9](v)).

The WLPZ FPRs can contribute toward meeting goals of the Fish and Game Commission (FGCom) and/or Joint FGCom and Board policies, including those described in the Endangered and Threatened Species Policy, Salmon Policy, Water Policy, and Joint Pacific Salmon and Anadromous Trout Policies. In addition, the WLPZ FPRs may also contribute to maintaining sufficient shade and supporting beneficial uses contained in Water Quality Control Plans (Basin Plan) for applicable Regional Water Quality Control Boards. Key functions of riparian zones include recruitment of large woody debris, watercourse shading, sediment filtration, nutrient input, microclimate control, streambank/hillslope stability, and habitat for terrestrial wildlife species. Riparian areas occur dynamically within watersheds adjusting to successional vegetation changes, annual hydrologic events, and other disturbances (e.g., wildfires, wind, insect damage, and diseases). The following critical monitoring questions focus on the natural processes and function of WLPZs and allow for the dynamic nature of these management areas.

Are the FPRs and associated regulations effective in …

(a) maintaining and restoring canopy closure to provide sufficient shade on watercourses necessary to meet Basin Plan temperature objectives?
(b) maintaining and restoring stream water temperature?
(c) retaining predominant conifers in WLPZs and large woody debris input to watercourse channels?
(d) retaining conifer and deciduous species to maintain or restore riparian shade, water temperature, and primary productivity?
(e) maintaining and restoring input of organic matter to maintain or restore primary productivity as measured by macroinvertebrate assemblages?
(f) maintaining and restoring riparian function of Class II-L watercourses in the Coast District?
(g) maintaining and restoring riparian function of Class II-L watercourses in the Northern District?
(h) managing WLPZs to reduce or minimize potential fire behavior and rate of spread?
(i) filtering sediment that reaches WLPZs?

Theme 2 Watercourse Channel Sediment

The amount of hillslope erosion and sediment delivery that occurs following timber operations depends on numerous factors, including the site conditions present (e.g., slope, soil type, vegetative cover), soil disturbance, degree of proper FPR implementation, and intensity and number of large storm events following the completion of logging. Since the implementation of the modern FPRs in 1975, a primary goal of these regulations has been to limit management-related sediment delivered to watercourse channels in California to address protection of water quality and fish habitat. The FPRs have been updated numerous times in the past 40 years to reduce management-related sediment delivery. Specifically, current silviculture practice regulations (14 CCR § 913 [933, 953]); harvesting practices and erosion control measures (14 CCR § 914 [934, 954]); watercourse and lake protection (14 CCR § 916 [936, 956]); and logging roads, landings, and logging road watercourse crossings rules (14 CCR § 923 [943, 953]) provide measures to ensure timber operations meet the goals and intent of the FPRs by limiting sediment delivery to stream channels.

These FPRs can contribute toward meeting goals of FGCom and/or Joint FGCom and Board policies that address protection of water quality and fish habitat, including the Endangered and Threatened Species Policy, Salmon Policy, Water Policy, and Joint Pacific Salmon and Anadromous Trout Policy. In addition, these FPRs may also contribute toward meeting Basin Plan objectives. The following critical monitoring questions address erosion and sediment monitoring at both the watershed (or sub-watershed) scale and project or Plan scale (see Section 2.4.2 for a discussion of appropriate scale).

Are the FPRs and associated regulations effective in minimizing management-related sediment delivery from forest management activities to watercourse channels …

(a) at the watershed and sub-watershed level in managed watersheds?
(b) for individual Plans at the project level?

Theme 3 Road and Watercourse and Lake Protection Zone Sediment

Similar to Theme 2, the Road and WLPZ Sediment theme has been developed to answer critical monitoring questions regarding management-related hillslope erosion and sediment delivery to watercourse channels in forested watersheds but focuses on critical monitoring questions related to the effectiveness of FPR requirements included in the recently implemented Road Rules 2013 requirements (14 CCR § 923 [943, 953]). These FPRs also contribute toward meeting goals of FGCom and/or Joint FGCom and Board policies that address protection of water quality and fish habitat listed above. In addition, these FPRs may also contribute toward meeting Basin Plan objectives. The following critical monitoring questions address management-related sediment delivery from forest and road management activities to watercourse channels, which may impact water quality and adjacent fish habitat in forested watersheds.

Are the FPRs and associated regulations effective in …

(a) reducing or minimizing management-related generation of sediment and delivery to watercourse channels?
(b) reducing generation and sediment delivery to watercourse channels when timber operations implement the Road Rules 2013 measures?
(c) reducing the effects of large storms on landslides as related to roads, watercourse crossings and landings?
(d) maintaining or improving fish passage through watercourse crossing structures? *

** also see Section 3.2.1 of the Strategic Plan (EMC 2022) for discussion of appropriate scale*

Theme 4 Mass Wasting Sediment

To limit mass wasting sediment from anthropogenic sources, the FPRs require that timber operations be planned and conducted using mitigation measures that minimize sediment delivery from unstable geologic features (14 CCR § 923 [943, 953]). While considerable past monitoring efforts have addressed implementation and short-term effectiveness of FPRs designed to limit sediment entry related to surface erosion processes, less is known at a statewide scale about the success of the FPRs in preventing accelerated rates of management-related mass wasting features. This is particularly important in the California Coast Ranges and Klamath Mountains, where landslide features can be the primary mechanism of sediment delivery. Limitation of mass wasting is consistent with the goals of FGCom and/or Joint FGCom and Board policies, including the Endangered and Threatened Species, Salmon, Water, and Joint Pacific Salmon and Anadromous Trout Policies. In addition, these FPRs may also contribute toward meeting Basin Plan objectives. The following critical monitoring questions address specific mass wasting-related topics

to determine if the current rules and regulations are effective in avoiding and limiting management-induced landslides.

Are the FPRs and associated regulations effective in minimizing sediment delivery to maintain water quality from …

(a) existing chronic unstable geologic features?
(b) mass wasting during episodic stochastic events and/or large storms? *
(c) mass wasting from high-risk geologic features?

** also see Section 3.2.2 of the Strategic Plan (EMC 2022) for discussion of rare or large event monitoring*

Theme 5 Fish Habitat

Numerous FPR regulations relate to the protection of fish habitat features in forested watersheds, particularly those found in the WLPZ rule section [14 CCR § 916 (936, 956)]. Specifically, these FPRs require that timber operations be planned and conducted in a manner that provides protection for water temperature control, streambed and flow modifications by large woody debris, filtration of organic and inorganic material, upslope stability, bank and channel stabilization, and spawning and rearing habitat for salmonids [14 CCR § 916.4 (936.4, 956.4) (b)]. As stated above for the other themes, these rule requirements contribute toward meeting the goals of FGCom and/or Joint FGCom and Board policies, including Endangered and Threatened Species Policy, Salmon Policy, Water Policy, and Joint Pacific Salmon and Anadromous Trout Policy. In addition, these FPRs may also contribute toward meeting Basin Plan objectives. The following critical monitoring questions relate to maintaining and/or restoring the quality and connectivity of foraging, rearing, and spawning habitat.

Are the FPRs and associated regulations effective in …

(a) maintaining and restoring the distribution and quality of foraging, rearing and spawning habitat for anadromous salmonids?

Theme 6 Wildfire Hazard

A goal of the FPRs is the production and maintenance of forests which are healthy and naturally diverse (14 CCR § 897). Numerous studies have shown that creating these types of forests reduces the risk of high severity wildfire (Safford et al. 2012, North et al. 2009, Omi and Martinson 2004, Martinson and Omi 2003). Several FPRs address the theme of wildfire hazard, while also providing measures to ensure timber operations meet the goals and intent of the FPRs, including minimum stocking standards (14 CCR § 912.7 [932.7, 952.7]); special silvicultural methods and stocking requirements (14 CCR § 961); silvicultural objectives and regeneration methods (14 CCR § 913 [933, 953]); logging slash and hazard reduction (14 CCR § 917 [937, 957]); exemptions which facilitate removal of dead, dying or diseased trees (14 CCR § 1038); emergency notices which also facilitate removal of burned, dead, dying or diseased trees (14 CCR § 1052); and fuel hazard reduction (14 CCR § 1051).

These FPRs may contribute to meeting the goals of FGCom and/or Joint FGCom and Board policies, including the Endangered and Threatened Species Policy; Salmon Policy; Water Policy; Joint Pacific Salmon and Anadromous Trout Policy; and Interim Joint Policy on Pre, During, and Post Fire Activities and Wildlife Habitat.

Attention to this theme has recently been bolstered due to widespread and increasingly destructive wildland fires within the State. The California Wildfire and Forest Resilience Task Force[4] and associated Action Plan[5] is premised on guiding land management to create healthier, more fire-resilient landscapes. The following critical monitoring questions address specific topics related to wildfire hazard reduction, including the use of prescribed fire and vegetation management to modify horizontal and vertical fuels.

Are the FPRs and associated regulations effective in …

(a) treating post-harvest slash and slash piles to modify fire behavior?

(b) treating post-harvest slash and retaining wildlife habitat structures, including snags and large woody debris?

(c) managing fuel loads, vegetation patterns and fuel breaks for fire hazard reduction?

(d) managing forest structure and stocking standards to promote wildfire resilience?

(e) achieving post-fire recovery and restoration?

(f) mitigating or reducing the cumulative impacts of post-fire recovery and management actions in affected watersheds?

(g) maintaining timberland productivity, including wood quality and sustained yield after wildfire?

Theme 7 Wildlife Habitat - Species and Nest Sites

A goal of the FPRs is to maintain functional wildlife habitat in sufficient condition for continued use by existing wildlife communities within the planning watershed (14 CCR § 897). More specifically, the FPRs require that timber operations shall be planned and conducted to maintain suitable habitat for wildlife species (14 CCR § 919 [939, 959]) and protection of nest sites (14 CCR § 919.2 [939.2, 959.2]). These FPRs are consistent with the goals of FGCom and/or Joint FGCom and Board policies, including the Endangered and Threatened Species Policy and the Raptor Policy. Similar to Themes 4 and 6, extensive effectiveness monitoring on a statewide basis has not been conducted on non-federal timberlands for this or the following wildlife habitat themes. The critical monitoring questions that follow address wildlife habitat requirements related to species and nest sites.

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

(a) following general protection measures in 14 CCR § 919.2 [939.2, 959.2](b)?

(b) following species specific habitat and disturbance measures in 14 CCR § 919.3 [939.3, 959.3]?

Are the FPRs and associated regulations effective for the northern spotted owl in …

(a) ensuring take avoidance following 14 CCR § 919.9 [939.9] and 14 CCR § 919.10 [939.10]?

(b) ensuring take avoidance following 14 CCR § 919.9 [939.9](g)?

(c) maintaining adequate amounts of suitable habitat to protect and conserve owls?

[4] California Wildfire and Forest Resilience Task Force. 2022. Forest & Wildland Stewardship Interagency Tracking System Framework Version 1.0. Revised May 2022. https://wildfiretaskforce.org/wp-content/uploads/2022/05/WFR-TF-Tracking-System-Plan-V1.pdf

[5] California Wildfire and Forest Resilience Task Force. 2021. California's Wildfire and Forest Resilience Action Plan. https://wildfiretaskforce.org/wp-content/uploads/2022/12/californiawildfireandforestresilienceactionplan.pdf

Theme 8 Wildlife Habitat - Seral Stages

A goal of the FPRs is to maintain functional wildlife habitat [14 CCR §§ 897; 919 [939,959)], particularly in terms of late seral stage retention. The FPRs require Registered Professional Foresters (RPF) to provide habitat structure information for late succession forest stands proposed for harvesting that will significantly reduce the amount and distribution of late succession forest stands or their functional wildlife habitat value so that it constitutes a significant adverse impact on the environment as defined in Section 895.1 (14 CCR § 919.16 [939.16, 959.16]). Additionally, Technical Rule Addendum No. 2 of the FPRs (see CAL FIRE 2020) provides specific guidance that the assessment of biological habitat conditions should consider snags and den trees, downed trees, large woody debris, multistory canopy, road density, hardwood cover, late seral forest characteristics, and late seral habitat continuity (14 CCR § 912.9 [932.9, 952.9]). These FPRs appear to contribute to the goals of FGCom policies, including the Endangered and Threatened Species Policy and Raptor Policy. The following critical monitoring questions address wildlife habitat requirements related to seral stages.

Are the FPRs and associated regulations effective in …

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

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

(c) maintaining or recruiting adequate amounts of early- and mid-seral habitats?

Theme 9 Wildlife Habitat - Cumulative Impacts

The FPRs require that timber operations shall be planned and conducted to maintain suitable habitat for wildlife species (14 CCR § 919 [939, 959]). Moreover, the FPRs require a Cumulative Impacts Assessment (14 CCR § 898) be completed that includes, but is not limited to, the overall biological habitat condition within both the Plan and planning area. Technical Rule Addendum No. 2 of the FPRs (see CAL FIRE 2020) provides specific guidance for the assessment of cumulative impacts to biological habitat conditions, including snags and den trees, downed trees, large woody debris, multistory canopy, road density, hardwood cover, late seral forest characteristics, and late seral habitat continuity (14 CCR § 912.9 [932.9, 952.9]). With respect to terrestrial species and their habitats, these FPRs may contribute to the goals of FGCom policies, including the Endangered and Threatened Species Policy and Raptor Policy. The following critical monitoring questions that follow address cumulative biological resources-related questions for species in terrestrial and freshwater habitats.

Are the FPRs and associated regulations effective in …

(a) protecting wildlife habitat and associated ecological processes?

(b) avoiding significant adverse impacts to wildlife species?

Theme 10 Wildlife Habitat - Structures

As previously stated in other wildlife habitat themes, a goal of the FPRs is to maintain functional wildlife habitat in sufficient condition for continued use by existing wildlife communities within the planning watershed (14 CCR § 897). The FPRs require that timber operations shall be planned and conducted in a manner that maintains suitable habitat for wildlife species (14 CCR § 919 [939, 959]), and encourages retention of structural elements or biological legacies through the implementation of Variable Retention

silviculture (14 CCR § 913.4 [933.4, 953.4] (d)). With respect to terrestrial species and their habitats, these FPRs may contribute to the goals of FGCom policies, including the Endangered and Threatened Species Policy and Raptor Policy. The following critical monitoring questions were designed to determine if the FPRs are effective in maintaining a proper level of structure required for wildlife habitat of terrestrial species.

Is Variable Retention silviculture effective in meeting …

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

Are the FPRs and associated regulations effective in retaining …

(a) a mix of stages of snag development that maintain properly functioning levels of wildlife habitat?
(b) native oaks where required to maintain wildlife habitat (14 CCR § 959.15)?

Theme 11 Hardwood Values

Hardwoods are valued as ecological, economic, and cultural resources, and in this context, refers to trees within timberland that are not conifers, both commercial and non-commercial species, including but not limited to: tanoak (*Notholithocarpus densiflorus*), true oaks (*Quercus* spp.), alders (*Alnus* spp.), Pacific madrone (*Arbutus menziesii*), California bay (*Umbellularia californica*), golden chinquapin (*Chrysolepsis chrysophylla)*, and aspen and cottonwoods (*Populus* spp.). The FPRs recognize hardwood ecological values in the Appendix to Technical Rule Addendum No. 2 of the FPRs (see CAL FIRE 2020), wherein hardwood cover is recognized as a significant biological factor in cumulative impacts assessments. More generally, the FPRs state that while growing trees for high quality timber, "the goal of forest management…shall be the production or maintenance of forests which are healthy and *naturally diverse,* with a *mixture of trees* and under-story plants [emphasis added] …" (14 CCR § 897 (b)(1)).

The FPRs also have special prescriptions and exemptions from normal Plan preparation for the purposes of restoring hardwood stands (14 CCR § 913.4 [933.4, 953.4] I, (f); § 1038 (l)). Additionally, the FPRs identify hardwoods as an important component of riparian vegetation in the WLPZ (14 CCR 916 [936, 956]). With respect to hardwoods, the FPRs may contribute toward the goals of the Joint FGCom and Board policies. The following critical monitoring questions were developed to determine if the FPRs are effective in maintaining and restoring hardwoods on timberland.

Are the FPRs and associated regulations effective in retaining…

(a) diverse forests with a mixture of tree species that includes hardwoods (14 CCR § 897 (b)(1))?
(b) native oaks where required to maintain wildlife habitat (14 CCR § 959.15)?
(c) aspen stands (14 CCR § 913.4 [933.4, 953.4] (e))?
(d) California black oak (*Quercus kelloggii*) and Oregon white oak (*Quercus garryana*) woodlands (14 CCR § 913.4 [933.4, 953.4] (f); § 1038 (l))?

Theme 12 Resilience to Disturbance in a Changing Climate

Resilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks that would naturally occur (Walker et al. 2004[6]). Recent studies have also examined how to promote wildfire resilience or reduce wildfire hazard as a management objective (North et al. 2022[7]). The FPRs and associated regulations (e.g., California Environmental Quality Act, Timberland Productivity Act, Fish and Game Code, Porter-Cologne Water Quality Control Act, etc.) are intended to promote and encourage sustainable forest management and restoration practices and therefore also improve forest resilience to stress factors such as fire, pests, drought, and disease. Understanding how the FPRs affect forest ecosystem function and state will help determine whether the management objective is achieved and help gauge the extent of the forest ecosystem resilience to disturbance.

Are the FPRs and associated regulations effective in …

(a) improving overall forest wildfire resilience and the ability of forests to respond to climate change (e.g., in response to drought or bark beetle; reducing plant water stress) and variability, and extreme weather events (evaluate ecosystem functional response to fuel reduction and forest health treatments)?

(b) maintaining conifer and broadleaf stands which are well adapted to climate in order facilitate riparian functions (e.g., shade, temperatures, primary productivity, stream flow)?

(c) meeting ecological objectives and adaptation to future climate (e.g., resilience of wildlife habitats; variable retention silviculture as it relates to wildlife habitat structures)?

(d) maintaining or recruiting adequate amounts of early- and mid-seral wildlife habitats which are well adapted to future climate?

[6] Walker, B.H, C.S. Holling, S.R. Carpenter, and A. Kinzig. 2004. Resilience, adaptability and transformability in social–ecological systems. Ecology and Society 9(2):5. http://www.ecologyandsociety.org/vol9/iss2/art5

[7] North, M.P., R.E. Tompkins, A.A. Bernal, B.M. Collins, S.L. Stephens, and R.A. York. 2022. Operational resilience in western US frequent-fire forests. Forest Ecology and Management 507:120004.