EFFECTIVENESS MONITORING COMMITTEE

2022 ANNUAL REPORT & WORKPLAN

Submitted to the State Board of Forestry and Fire Protection

Approved: March 8, 2023

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EXECUTIVE SUMMARY

The Effectiveness Monitoring Committee (EMC) Annual Report and Workplan (Report) is a living document which is updated and approved by the Board of Forestry and Fire Protection (Board) annually and is intended to catalogue the yearly accomplishments and status of ongoing EMC efforts. The Report summarizes EMC accomplishments, details EMC funding actions for the year, and provides an update of current EMC membership and staffing. For Fiscal Year (FY) 2022/2023, the EMC selected three proposed effectiveness monitoring projects to fund and support utilizing a newly developed grant program. Ongoing projects from prior years continued to be funded; numerous project presentations were provided at four open public EMC meetings; a new Strategic Plan was published; a transparent, public process was utilized to begin revisions to the Research Themes and Critical Monitoring Questions; and the EMC welcomed three new members.

I. EMC PROCESS SUMMARY

The EMC was formed to develop and implement an effectiveness monitoring program to address both watershed and wildlife concerns, and to provide an active feedback loop to policymakers, managers, agencies, and the public to better assist in decision-making and adaptive management. As an advisory body to the Board, the EMC helps implement an effectiveness monitoring program by soliciting robust scientific research that addresses the effectiveness of these laws at meeting resource objectives and ecological performance measures related to AB 1492 (AB-1492 California Assembly 2011-2012). In particular, the EMC funds robust scientific research aimed at testing the efficacy of the California Forest Practice Rules (FPRs) and other natural resource protection statutes, laws, codes, and regulations.

Four formal documents guide the activities and goals of the EMC:

(1) Charter (EMC 2013);

(2) Strategic Plan (EMC 2022a), which is updated approximately every three years;

(3) Annual Report and Work Plan (i.e., this report), which is updated every calendar year (see EMC 2022b for most recent); and

(4) Research Themes and Critical Monitoring Questions (2023) (CMQs), which is updated up to annually as determined necessary by the EMC.

All four documents are linked and interact in varying ways to reenforce the direction and activities of the EMC. The EMC reports on its activities in a variety of ways. The EMC Strategic Plan road map lays out how the Committee intends to achieve the EMC goals and objectives. This Annual Report and Workplan tracks progress on individual projects, documents the Committee's ranking and selection of proposed monitoring projects, and details other annual accomplishments and ongoing EMC efforts. The EMC conducts open meetings a minimum of four times per year (quarterly) to conduct EMC business, during which progress reports, final reports, or other presentations on EMC-funded projects or other related research may be provided. The EMC Co-Chair or Board staff also report on the EMC's activities via verbal updates at Board meetings throughout the year.

EMC projects are solicited through an annual Request for Proposals (RFP) which is released following the start of the new FY (see **Figure 1**). The RFP, ranking, and selection process are detailed in the Strategic Plan (EMC 2022a).

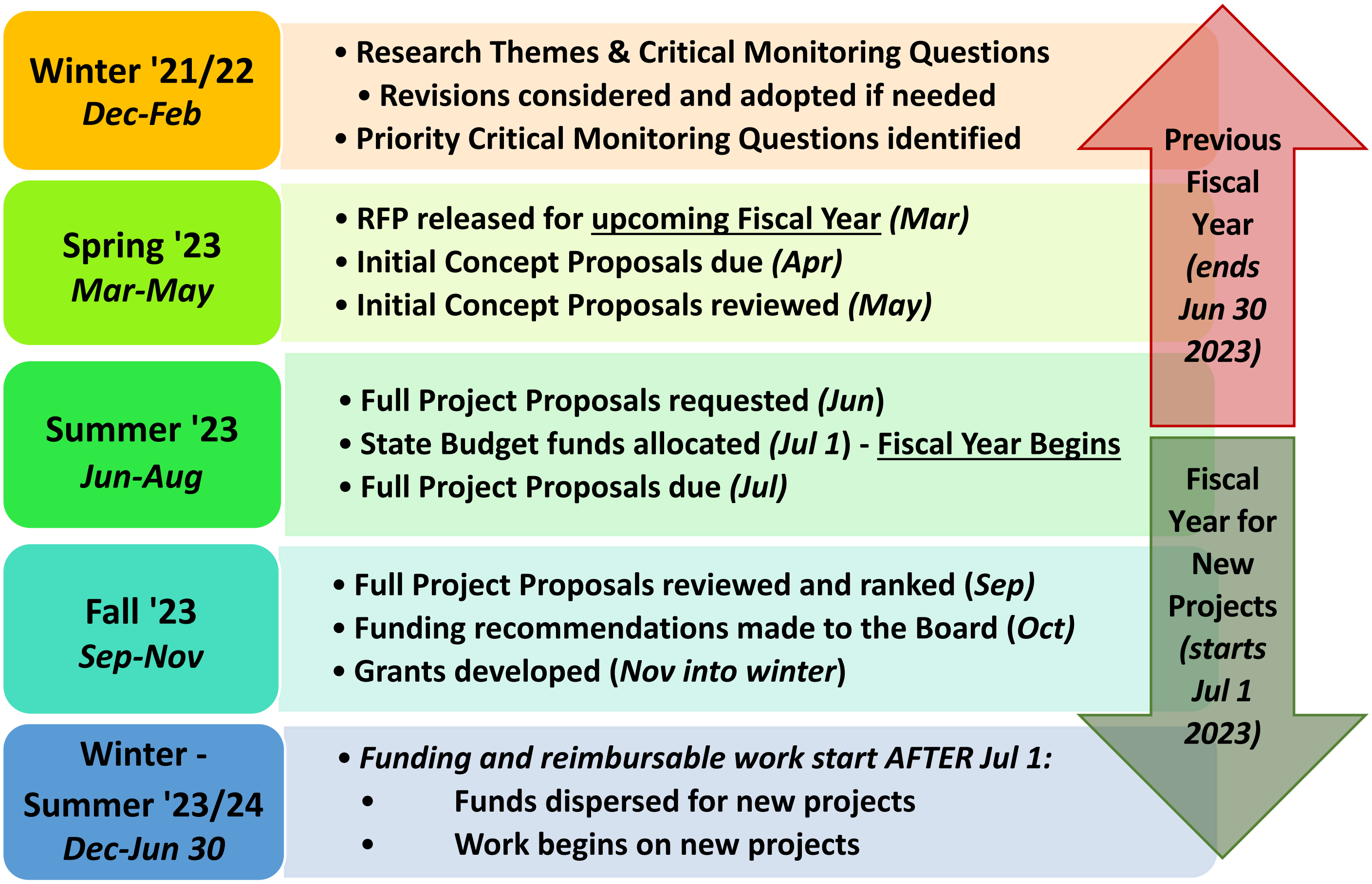

Figure 1. Sample Anticipated EMC Project Submission and Grant Processing Timeline
Key: RFP = Request for Proposals.

For FY 2022/23, the EMC was allocated ongoing funding of $425,000 from the Timber Regulation and Forest Restoration Fund (TRFRF), established by AB 1492, of which $294,909 was allotted to support ongoing, previously awarded projects and $130,091 remained for new projects starting in the current FY 2022/23 (see **Table 1** for a list of active projects and funding status). The EMC anticipates an allocation of $425,000 in FY 2023/24 and subsequent years and selected proposed projects with funding terms ending June 30, 2025 based on this anticipated funding. This funding is allocated to projects through the Board/CAL FIRE grants department.

Table 1. Ongoing EMC Projects with Continued Funding and/or Activity in Current (2022/2023) or Upcoming Fiscal Year(s)

Project #, *Award*	**Title**	**Primary Investigator(s), *Affiliation(s)***	**Project Liaison(s)**	**Project Status**	**Funding Status or Remaining Budget**
EMC-2015-001 *$ 221,271*	Class II Large Watercourse Study: Multiscale investigation of perennial flow and thermal influence of headwater streams into fish bearing systems	• Dr. Kevin Bladon, *Oregon State University* • Dr. Catalina Segura, *Oregon State University*	• Drew Coe • Loretta Moreno	• Final project deliverables and CRA received • Anadromous Salmonid Protection Rule change resulted • Additional refereed publications anticipated 2023	Fully allocated
EMC-2016-002	Post-fire Effectiveness of the Forest Practice Rules in Protecting Water Quality on Boggs Mountain Demonstration State Forest	• Joe Wagenbrenner, *Michigan Technological University* • Kevin Bladon, *Oregon State University* • Drew Coe, *CAL FIRE* • Don Lindsay, *California Geological Survey*	None[†]	• Final project deliverables received • Additional refereed publications anticipated 2023	Fully allocated
EMC-2016-003 *$ 700,000*	Road Rules Effectiveness at Reducing Mass Wasting (Repeat LiDAR Surveys to Detect Landslides)	• Bill Short, *California Geological Survey* • Matt O'Connor, *O'Connor Environmental Inc.*	• Bill Short • Matt O'Connor	• In progress and deliverables up-to-date • Final project deliverables and CRA expected 2023	Fully allocated

Project #, ***Award***	**Title**	**Primary Investigator(s),** ***Affiliation(s)***	**Project Liaison(s)**	**Project Status**	**Funding Status or Remaining Budget**
EMC-2017-001 *$ 192,251*	Effects of Forest Stand Density Reduction on Nutrient Cycling and Nutrient Transport at the Caspar Creek Experimental Watershed	• Dr. Helen Dahlke, *University of California, Davis* • Dr. Randy Dahlgren, *University of California, Davis*	Drew Coe	• In progress and deliverables up-to-date • Final project report, a refereed publication(s), and CRA expected 2023	Fully allocated
EMC-2017-002 *$ 1,200*	Boggs Mountain Demonstration State Forest (BMDSF) Post-Fire Automated Bird Recorders Study	Stacy Stanish, *CAL FIRE*	Stacy Stanish	• In progress • Project deliverables and CRA expected 2023	Fully allocated
EMC-2017-006 *$ 114,844*	Tradeoffs among Riparian Buffer Zones, Fire Hazard, and Species Composition in the Sierra Nevada	Dr. Rob York, *University of California, Berkley*	TBD	• In progress • Final project deliverables and CRA expected 2023	Fully allocated
EMC-2017-007 *$ 71,278*	The Life Cycle of Dead Trees and Implications for Management	Dr. John Battles, *University of California, Berkley*	• Loretta Moreno • Dr. Michael Jones	• Work completed and final project deliverables received • CRA expected 2023	Fully allocated
EMC-2017-008 *$ 108,986*	Do Forest Practice Rules Minimize Fir Mortality from Root Disease and Bark Beetle Interactions	Dr. Richard Cobb, *California Polytechnic State University*	• Ben Waitman • Jessica Leonard	• Final project deliverables received • CRA to be reviewed by Board in January 2023 • Additional refereed publications anticipated 2023	Fully allocated

Project #, ***Award***	**Title**	**Primary Investigator(s),** ***Affiliation(s)***	**Project Liaison(s)**	**Project Status**	**Funding Status or Remaining Budget**
EMC-2017-012 NA*	Assessment of Night-Flying Forest Pest Predator Communities on Demonstration State Forests – with Monitoring across Seral Stages and Silvicultural Prescriptions	Dr. Michael Baker, *California Department of Forestry & Fire Protection*	Drew Coe	• In progress and deliverables up-to-date • Final work to be completed in next two to three years, and final reported expected 2025	Fully allocated via other funding streams outside of the EMC*
EMC-2018-003 *$ 101,802*	Alternative Meadow Restoration	Dr. Christopher Surfleet, *California Polytechnic State University*	Matt O'Connor	• Final project presentation planned February 2023 • Final project deliverables and CRA expected 2023	$ 10,406.25
EMC-2018-006 *$ 694,371*	Effect of Forest Practice Rules on Restoring Canopy Closure, Water Temperature, & Primary Productivity	• Dr. Kevin Bladon, *Oregon State University* • Dr. Catalina Segura, *Oregon State University* • Matt House, *Green Diamond Resource Company* • Drew Coe, *CAL FIRE*	• Drew Coe • Mathew Nannizzi	• In progress and deliverables up-to-date • First peer-reviewed publication accepted in Dec 2022 • Final project deliverables and CRA expected 2023	$ 31,441.33
EMC-2019-002 *$ 68,168*	Evaluating Treatment Longevity and Maintenance Needs for Fuel Reduction Projects Implemented in the Wildland Urban Interface of Plumas County	• Brad Graevs, *Feather River Resource Conservation District* • Jason Moghaddas, *Spatial Informatics Group*	• Stacy Drury • Drew Coe	• Work completed and final project deliverables received • CRA expected 2023	Fully allocated

Project #, ***Award***	**Title**	**Primary Investigator(s),** ***Affiliation(s)***	**Project Liaison(s)**	**Project Status**	**Funding Status or Remaining Budget**
EMC-2019-003 *$ 156,665*	Fuel Treatments & Hydrologic Implications in the Sierra Nevada	• Dr. Terri Hogue, *Colorado School of Mines* • Dr. Alicia Kinoshita, *San Diego State University*	Drew Coe	• In progress and deliverables up-to-date • Final project deliverables and CRA expected 2023	$ 61,150.64
EMC-2019-005 *$ 56,200*	Sediment Monitoring and Fish Habitat – San Vicente Accelerated Wood Recruitment	Cheryl Hayhurst, *California Geological Society*	Bill Short	• Due to wildfire and pandemic, contract term expired and remaining funding disencumbered • Project plan revised and results to be shared in future	$ 47,244.75 *disencumbered 06/30/2022*
EMC-2021-003 *$ 448,510.00*	Evaluating the Response of Native Pollinators to Fuel-Reduction Treatments in Managed Conifer Forests	Dr. James Rivers, *Oregon State University*	Dr. Michael Jones	Funding awarded and work in progress	$ 448,510.00

Key: CAL FIRE = California Department of Forestry & Fire Protection; CRA = Completed Research Assessment; TBD = to be determined.

* EMC-supported, but not EMC-funded

† project liaisons were introduced in late 2020, and some projects were completed prior to assignment of liaisons.

II. EMC SUPPORTED MONITORING PROJECTS – 2015 to 2022

A comprehensive list of all EMC-supported monitoring projects and links to supporting materials—including completed and closed projects—can be found on the Board's EMC webpage.[1]

III. EMC ACCOMPLISHMENTS

In 2022, EMC accomplishments are summarized as follows:

- The EMC met four times virtually in open, webcast meetings to conduct business.
- The EMC continued development of a new communication system that was established in 2020, in which individual committee members were assigned as project liaisons to provide check-ins with EMC-funded Principal Investigators (PI) to ensure project progress and deliverables are on track for BOF acceptance. Project liaisons provide project updates, as appropriate, at regularly scheduled EMC meetings, and work with Board staff to facilitate communications and plan receipt of deliverables to the EMC. A new Project Liaison Guide is in development for distribution to new members and project liaisons to provide clarity around the responsibilities of project liaisons and is expected to be available for EMC use in spring 2022.
- Three members were welcomed to the EMC, and the updated Membership Roster is available online at EMC Members and Term Expirations (EMC 2022c):
    - Co-chair Dr. Elizabeth "Liz" Forsburg-Pardi filled the seat of former co-chair Sue Husari in early January and will be working with co-chair Loretta Moreno to lead the EMC. Dr. Forsburg-Pardi received her PhD from University of California, Berkeley in Forest Policy and Economics, and is the Associate Director for The Nature Conservancy.
    - Dr. Michael Jones joined the EMC's Monitoring Community when the Board approved the EMC's recommendation at the August 17 meeting. Forest Advisor for Mendocino, Lake, and Sonoma Counties, U.C. Cooperative Extension. Dr. Jones is the Forest Advisor for Mendocino, Lake, and Sonoma Counties, U.C. Cooperative Extension.
    - Matthew Nannizzi filled Matthew House's seat on the EMC's Monitoring Community when the Board approved the EMC's recommendation at the November 2 meeting. Mr. Nannizzi is an aquatic biologist with the Green Diamond Resource Company, for which Member House was also an employee.
- The Research Themes and CMQs are in the process of being revised based on the current state of the science, data gaps and information needs in the science supporting the effectiveness of the FPRs. The EMC made initial revisions based on comments received during an official public comment period in July. Additional comments and input received during public meetings were also utilized to inform further revisions, and included public comment and stakeholders from Water Quality Control Boards, the California Department of Forestry and Fire Protection (CAL FIRE), the Board, California Natural Resources Agency, the Nature Conservancy, and the University of

[1] https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/

California, Berkley and Davis. Revisions will continue through the end of 2022, with an EMC vote expected on a final version in February 2023, and the Board review and a vote is anticipated in March 2023.

- The EMC received an ongoing allocation of $425,000 from the Timber Regulation and Forest Restoration Fund, of which $294,909 was allocated to previously awarded projects (see Table 1).
- A new grant program was developed for the EMC and utilized for the first time during the July 15th release of the Request for Proposals (RFP). After consideration of previously allocated funds, funding available for newly proposed projects totaled $931,216 over three FYs, comprising $130,091 in FY 2022/23; $376,125 in FY 2023/24; and $425,000 in FY 2024/25.
- The top five CMQs prioritized for funding in the 2021/22 FY remained the same in the 2022/23 RFP,[2] based on the conclusion by the EMC that these questions remained relevant and continued to represent the EMC priorities in assessing the effectiveness of the FPRs. As in previous years, these questions were prioritized for research funding, but not to the exclusion of projects focusing on the remaining CMQs or other research needs related to the FPRs and associated regulations.
- The EMC reviewed five Initial Concept Proposals (ICPs) and requested Full Project Proposals (FPPs) from all five research teams. Ultimately, one proposal was withdrawn and four FPPs were considered for funding. Upon review and discussion, the committee voted to recommend funding for three proposals, with a request to the PIs to reallocate funding of up to $47,588 to the FY 2022/23 as feasible, although funding would not be denied if the request could not be accommodated. If any funding can be reallocated to FY 2022/23, this will be accommodated up to a total of $47,588 across the three newly funded projects, and subsequent years' budgets would be adjusted accordingly. As designated in the FPPs, newly requested funding totaled $82,503 in FY 2022/23, $164,379 in FY 2023/24, and $137,271 in FY 2024/25, for a total of $384,153 over the three FYs. This would leave an anticipated $547,063 remaining for newly proposed projects solicited during the annual RFP over the next three years, or for other research endeavors. The proposed projects selected for EMC-funding support were as follows:
    - EMC-2022-003: Santa Cruz Mountains Post-Fire Redwood Defect Study[3]
    - EMC-2022-004: A critical evaluation of Forest Practice Regulation's capacity to accommodate forest restoration and resilience targets[4]
    - EMC-2022-005: Decay rate and fire behavior of post-harvest slash in coastal redwood forests[5]

  Board staff began developing required documents for funding encumbrance through the grants program in December 2022, and it is anticipated that the Board will review and finalize the funding recommendations in early 2023.
- The EMC continued to utilize a new framework for processing completed EMC-funded projects—established and utilized for the first time in 2021—to better facilitate EMC reporting to the Board. This "Completed Research Assessment" (CRA; previously known as "Science to Policy Framework")

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[2] https://bof.fire.ca.gov/media/yuopheif/emc-grant-guidelines-2022-23-final.pdf
[3] https://bof.fire.ca.gov/media/wblj0qws/5d-i-emc-2022-003-full-project-proposal-redacted.pdf
[4] https://bof.fire.ca.gov/media/smvji2em/5e-emc-2022-004-full-project-proposal-redacted.pdf
[5] https://bof.fire.ca.gov/media/kvcdm2ou/5f-emc-2022-005-full-project-proposal-redacted.pdf

(EMC 2021) provides a step-by-step approach to guide EMC members in verifying scientific integrity and validity of the research, and interprets the results of the scientific research as to the implications for management and policy. Two EMC members volunteer to work with the PIs of each project to complete this document, which is then presented to the EMC and amended as necessary prior to presentation to the Board. This provides an easily understood narrative and synthesis for Board members to give context to study results and inform policy changes, if justified.

- Presentations were provided at public EMC meetings by members of research teams for the following projects:
    - EMC-2016-003: Repeat LiDAR Surveys to Detect Landslides – Project progress report (Short et al. 2022)
    - EMC-2017-001: Effects of Forest Stand Density Reduction on Nutrient Cycling and Nutrient Transport at the Caspar Creek Experimental Watershed – Final project presentation (Dahlke et al. 2022)
    - EMC-2017-007: The Life Cycle of Dead Trees and Implications for Management – Final project presentation (Battles et al. 2022)
    - EMC-2017-008: California Forest Practice Rules and relation to fir mortality - Effectiveness monitoring and evaluation: Do rules minimize fir mortality from root disease and bark beetle interactions – Final project presentation (Cobb et al. 2022) and presentation of the draft (Waitman and Leonard 2022a) and revised draft of the CRA (Waitman and Leonard 2022b)
    - EMC-2017-012: Assessment of Night-Flying Forest Pest Predator Communities on Demonstration State Forests - with Monitoring across Seral Stages and Silvicultural Prescriptions – Project progress report (Baker 2022)
    - EMC-2019-002: Evaluating Fuel Treatment Longevity and Maintenance Needs for Fuel Reduction Projects Implemented in the Wildland Urban Interface in Plumas County, California – Final project presentation (Moghaddas 2022)
    - EMC-2019-003: Fuel Treatments and Hydrologic Implications in the Sierra Nevada – Project progress report (Boden et al. 2022)
- A CRA was prepared in 2021 for project EMC-2015-001: Effectiveness of Class II WLPZ FPRs and AHCP Riparian Prescriptions at Maintaining or Restoring Canopy Closure, Stream Water Temperature, and Primary Productivity. The results and implications of this project were presented to the EMC and then forwarded to the Board for consideration by the Forest Practice Committee. Results from EMC-2015-001 were utilized to craft a draft rule revision in 2022 related to the Anadromous Salmonid Rules.
- The first peer-reviewed journal article produced from EMC-2018-006 (Effect of Forest Practice Rules [FPR] on Restoring Canopy Closure, Water Temperature, & Primary Productivity) was published in December 2022, entitled "Characterizing stream temperature hysteresis in forested headwater streams" (Miralha et al. 2022).
- While not an EMC-funded project, a final project presentation on a project that is relevant to EMC-funded research (i.e., related to the FPRs and associated regulations) was provided by Dr. Lee MacDonald of Colorado State University on the Management-related and Long-term Erosion Rates

in Two Intensively-managed Forested Watersheds in Northwestern California (McDonald et al. 2022); also see the Little River Report, McDonald 2021). Member Matthew O'Connor of O'Connor Environmental, Inc. also provided a research presentation on Stand Age & Forest Evapotranspiration: Implications for Forest Management, Streamflow and Salmonid Recovery.[6]

IV. EMC PRIORITIES

Annual priorities are developed by the EMC and the Board as needs arise. The 2022 EMC priorities that were fulfilled are as follows:

- Support projects that relate to the EMC Themes and CMQs, including funding new projects where knowledge gaps exist, and monitoring progress of EMC-funded or EMC-supported monitoring projects.
- Revise the EMC's 2018 Strategic Plan to meet the 3-year revision cycle identify in the EMC Charter.
- Separate the Research Themes and CMQs from the Strategic Plan to accommodate differing revision cycles and begin revision process on this new standalone guiding document.

In 2023, the EMC priorities are as follows:

- Support projects related to the EMC Themes and CMQs, including funding new projects where knowledge gaps exist, and monitor progress of EMC-funded or EMC-supported monitoring projects.
- Monitor progress on EMC-funded or EMC-supported monitoring projects.
- Meet in the field at least once in 2023 to observe active or proposed monitoring projects.
- Identify and begin process to secure funding sources to support EMC member travel to public meetings.
- Finalize and adopt 2023 Research Themes and CMQs and identify up to five themes/CMQs for priority research funding in the 2023/24 RFP.
- Finalize and adopt new Project Liaison Guidance.
- Revisit the EMC's 2014 Charter to assess need for changes, and begin process of revision, if needed.
- Fill currently open and pending open EMC seats, as well as any seats for which terms expire in 2023, filling gaps in expertise and agency representation as needed.

V. EMC MEMBERSHIP AND STAFF

The EMC has 17 mandated seats, including two co-chairs (one from the Board), eight agency representatives and seven monitoring community members. Additional staff support positions are provided by the Board, CAL FIRE, and other related agencies. In 2022, three seats were vacated and filled in 2022, two remain open, and four will be vacated once appropriate representatives are identified, nominated, and confirmed) (**Table 2**; currently open seats and terms expiring in 2023 are shown in **bold**; seats to be back-filled once an appropriate candidate is confirmed are in ***bold italic***).

[6] https://bof.fire.ca.gov/media/djsdd2wk/4-stand-age-m-o-connor-presentation_ada.pdf

Table 2. Current EMC Membership and Support Staff.

Name	Specialty	Affiliation	Term End Date
Co-Chairs			
Loretta Moreno	Forest Ecology	California Natural Resources Agency	**07/05/2023**
Elizabeth (“Liz”) Forsburg-Pardi, Ph.D.	Forest and Water Policy	Board of Forestry and Fire Protection, The Nature Conservancy	01/15/2025
Monitoring Community			
Michael Jones, Ph.D.	Forest Health and Disturbance Ecology	Forest Advisor Mendocino, Lake, and Sonoma Counties University of California Cooperative Extension	08/17/2026
Mathew Nannizzi	Aquatic Biology	Green Diamond Resource Company	11/02/2026
Sal Chinnici	Wildlife	Humboldt and Mendocino Redwood Companies	07/01/2024
Matt O’Connor, Ph.D.	Geology and Geomorphology	Public, O’Connor Environmental	**11/06/2023**
Open Seat Formerly Sarah Bisbing, Ph.D.	Forest Ecology and Forestry	University of Nevada, Reno	Resigned **09/08/2021**
Leander Love-Anderegg, Ph.D.	Forest Ecology and Forestry	University of California, Santa Barbara	**07/05/2023**
Peter Freer-Smith, Ph.D.	Plant Ecology and Environmental Policy	University of California, Davis	**07/05/2023**
Agency Representatives			
Pending Open Seat Stacy Drury, Ph.D.	Fire Ecology	USDA Forest Service Pacific Southwest Research Station	n/a
Ben Waitman	Wildlife	California Department of Fish and Wildlife	n/a
Pending Open Seat Drew Coe	Hydrology/Forestry	RPF, CAL FIRE	n/a
Pending Open Seat Jessica Leonard	Watershed Management	State Water Resources Control Board	n/a
Open Seat Formerly Justin LaNier	Geology, Hydrology, and Water Quality	Central Valley Regional Water Quality Control Board	n/a
Clarence Hostler	Fisheries	National Oceanic & Atmospheric Administration National Marine Fisheries Service	n/a
Bill Short	Engineering Geology and Hydrogeology	California Geological Survey	n/a
Jim Burke	Geology and Water Quality	North Coast Regional Water Quality Control Board	n/a

Table 2, *continued on next page.*

Table 2. Current EMC Membership and Support Staff, *continued from previous page.*

Name	Specialty	Affiliation	Term End Date
Support Staff			
Edith Hannigan	Forestry and Fire Protection, Land Use Planning	Executive Officer, Board of Forestry and Fire Protection	n/a
Andrew Lawhorn	Forestry and Fire Management	CAL FIRE	n/a
Stacy Stanish	Biology and Fisheries, RPF 3000	CAL FIRE	n/a
Dave Fowler	Geology and Water Quality	North Coast Regional Water Quality Control Board	n/a
Kristina Wolf, Ph.D.	Rangeland and Restoration Ecology	Environmental Scientist, Board of Forestry and Fire Protection	n/a

Key: CAL FIRE = California Department of Forestry & Fire Protection; RPF = Registered Professional Forester.

As of December 2022, nominations are being accepted for up to 6 seats that could be filled on the EMC. Of these, two seats are currently vacant, and the remaining four are filled by members that will vacate them once an appropriate candidate can be identified and confirmed. The seats include the following:

1. **Monitoring Community:** one open seat
    - One open seat previously filled by an academic with forest ecology and forestry expertise from University of Nevada, Reno; this seat was vacated in September 2021.
2. **Agency Representatives:** up to five open/pending open seats
    - Central Valley Regional Water Quality Control Board (CVRWQCB) – previously filled by Justin LaNier, whose background is in geology, hydrology, and water quality; vacated after the 11/18/2022 meeting and the CVRWQCB is expected to recommend a nominee.
    - State Water Resources Quality Control Board (SWRQWB) – currently filled by Jessica Leonard, whose background is in watershed management; seat expected to open after February 16th, 2023 meeting and the SWRQWB is expected to recommend a nominee.
    - CAL FIRE – currently filled by Drew Coe, a Registered Professional Forester (RPF), whose background is in hydrology and forestry. Member Coe will vacate this seat once an appropriate candidate is appointed.
    - US Fish and Wildlife Service (USFWS) – one open seat; the USFWS is expected to recommend a nominee.
    - US Forest Service (USFS) – currently filled by Dr. Stacy Drury with the Pacific Southwest Research Station, whose background is in fire ecology. While not a mandated seat, the USFS has had agency representation on the EMC for some time, and there is strong EMC support for continued representation. Member Drury will vacate this seat once an appropriate candidate is appointed.

3. **Term Expirations:** Four upcoming in 2023; if members are unable to remain in their seats a call for applications for those seats will be advertised on the EMC webpage, Board webpage, and via listservs.

VI. EMC PROJECT UPDATES AND PRODUCTS

The following project summaries provides more information on reported activities in 2022, including details on project deliverables provided in 2022 or that are anticipated in future years.

EMC-2015-001: Class II Large Watercourse Study: Multiscale investigation of perennial flow and thermal influence of headwater streams into fish bearing systems

Final project deliverables and a CRA were submitted and presented in 2021 (see EMC 2022b for detailed information on project work and products produced resulting from this research). While the project work has been completed and all final deliverables, project reports, and the CRA have been received, additional products and peer-refereed publications are anticipated in 2023. At the August 2, 2022 EMC meeting Member Coe reported that proposed rule revisions based on findings of this project were passed. Results from this project were utilized to craft a draft rule revision related to the Anadromous Salmonid Protection Rules. The draft plea was passed, resulting in a simplification of the rule language used to identify Class II Large (II-L) watercourses (i.e., 14 CCR § 916.9 [936.9, 956.9] (g)(1)(A)(2) was removed], as well as a removal of the sunset language in 14 CCR § 916.9 [936.9, 956.9] (g)(1)(C)] which mandated an assessment of the effectiveness of the various Class II-L identification methods.

EMC-2016-002: Post-fire Effectiveness of the Forest Practice Rules in Protecting Water Quality on Boggs Mountain Demonstration State Forest

Final project deliverables were submitted from 2016 through 2021, with one additional presentation in 2021. A CRA was not developed for this project as it was closed prior to the development of this requirement for EMC projects. While the project work has been completed and all final deliverables and project reports have been received, additional peer-refereed publications related to this work are anticipated in subsequent years.

EMC-2016-003: Road Rules Effectiveness at Reducing Mass Wasting (Repeat LiDAR Surveys to Detect Landslides)

Member Dr. Bill Short introduced Michael Fuller, who provided an in-depth project status update at the August 2, 2022 EMC meeting entitled LiDAR Differencing Eldorado National Forest and Nearby Private Lands (Short et al. 2022). Results shared in the April progress report were limited, as most of the work started only recently due to delays from fires, inability to fly safely due to smoke cover, and other stochastic events that introduced difficulties into acquiring the LiDAR dataset, including the pandemic. Moreover, additional quality control and assurance processes delayed analysis by years longer than originally anticipated.

LiDAR is a tool that researchers hope will facilitate understanding differences in mass wasting before and after stochastic events in managed and unmanaged forests at a landscape scale at improved resolutions, and how different factors and outcomes relate to the FPRs. LiDAR may be an efficient tool compared to site visits which may have safety and liability concerns. The CGS desired to leverage available datasets in a LiDAR differencing study, and utilizing funds provided by the EMC and other funding partners, CGS arranged for the USGS to manage a new LiDAR survey conducted in late 2019 with products delivered in late 2021.

Postfire LiDAR data were collected consequent to the Bagley Fire in 2014, the Power Fire in 2004, and the Freds Fire in 2004. Data were collected by the USFS in 2015 on 4 sites in the Placerville and Amador Ranger Districts. These locations were chosen based on the availability of recent LiDAR datasets, the presence of recent mass wasting events, the presence of both public and private timberland, and their representative nature of Sierra timberlands. In 2017, a series of storms stimulated landslide activity that could be evaluated using the before-and-after lidar data. Precipitation from the 2017 storm damage set a record, with four atmospheric storms converging in the El Dorado National Forest. Storm damage was recorded well beyond the forest to the entire western slope of the Sierra Nevada up into the Klamath Mountains and into the Modoc Plateau. Precipitation was 215% and 185% higher than average in the American River and Cosumnes River Basins, respectively, with 114 USFS reports of storm damage.

LiDAR differences identified three suspected landslides stemming from 2017 storm-damage in three distinct generations of burn scars from past fires: the 2014 King Fire, the 2004 Fred's and Power's Fires, and the 1992 Cleveland Fire. This preliminary work revealed an estimated vertical resolution of 2 feet, which will inform future LiDAR differencing projects. Ultimately, the researchers intend to determine detection limits, accuracy, and reliability. The LiDAR method utilized here may help with future mitigation efforts by providing better projections around mass wasting using 3-D modeling, as opposed to 2-D photographs from aerial photography methods. The lower detection limits are of special interest as they may provide an early warning system for hazards to the public and public resources.

Mr. Fuller provided a summary of next steps, which included additional data processing, field work, and overlays of analyses with other variables (e.g., ownership, topography, vegetation types, fire history, geology, and forest management). Future work may include comparison of point clouds to improve model resolution, selection of new sites to improve the modeling, and inclusion of other datasets to account for factors such as vegetation and harvesting methods.

A small subset of this information was presented at the October 2022 California Geological Survey (CGS) conference in a presentation titled "Storm Induced Mass Wasting on Disturbed Slopes Across a Thirty-Four Year Timeline" (Fuller et al. 2022). The goal of this portion of the study is to improve understanding of potential long-range effects of climate change, drought, forest health, and increased wildfire severity on mass wasting rates on managed timberlands; to investigate the relationship between forest health and slope instability including relationships between soil moisture and triggering events; and to better understand potential site-specific protection measures (as indicated in the FPRs) in burned areas that may be increasingly prone to landslides in order to protect slop stability, reduce sediment delivery to channels, and promote Large Woody Debris (LWD) delivery to channels.

Member Short provided a brief update at the September 28, 2022 EMC meeting, informing the Committee that work had begun proceeding at a good pace. An additional update was given at the November 18, 2022 EMC meeting, when Member Short reported that difficulties with obtaining US Geological Survey (USGS) LiDAR results were overcome and the LiDAR differencing analysis was underway. More than 500 areas showing differences were identified between various LiDAR datasets, and the team was evaluating those detections to determine if they exhibit or are caused by mass wasting. Final results on this project are expected in mid-2023, with final project deliverables and a CRA anticipated in 2023.

EMC-2017-001: Effects of Forest Stand Density Reduction on Nutrient Cycling and Nutrient Transport at the Caspar Creek Experimental Watershed

At the August 2, 2022 EMC meeting, Member Coe reported that PI Dr. Helen Dahlke presented research findings at the Casper Creek annual meeting in May 2022, and the report is available on the Casper Creek website under publications. Member Coe reported at the September 28, 2022 EMC meeting that a final report was delivered with the goal of producing a publishable manuscript.

Dr. Dahlke provided a final project presentation entitled Effects of forest stand density reduction on nutrient transport at the Caspar Creek Watershed (Dahlke et al. 2022) at the November 18, 2022 EMC meeting. Member Coe provided an introduction fir the context of this particular experiment, which is the third in a series of experiments led by Dr. Randy Dahlgren (U.C. Davis) and Dr. Dahlke. This third Caspar Creek experiment investigated the effects of stand density reduction on a variety of watershed products. The first experiment was in the South Fork in the 1960's and '70's which compared a control site to a selectively logged catchment (i.e., essentially a comparison of the north and south forks). The second experiment investigated the effects of clear-cut harvesting on sediment hydrology and nutrients. This third experiment explores variable rates of stand reduction and the subsequent impacts on nutrients, hydrology, and sediment transport. Much of the larger experiment was funded by CAL FIRE, with additional funding support from the EMC. Dr. Dahlke gave a presentation on the experimental findings in 2021 at the Annual Caspar Creek meeting, and this 2022 presentation is the final deliverable for the EMC's contract. However, this presentation does not represent the full suite of products that are likely to come out of these experiments, as next steps are planned to develop a publishable article out of this work, if not more, in the next year or two.

Dr. Dahlke explained that this third project was an extension of Dr. Dahlgren's previous work and examines the effects of different percentages of stand density reduction on the mass balance of water quality parameters, including electrical conductivity (EC), pH, turbidity, Dissolved Organic Carbon (DOC), nitrate, ammonium, Dissolved Organic Nitrogen (DON), Total Nitrogen (TN), total phosphorus (TP), and phosphate, with research questions focusing on:

- Temporal variations and patterns of nutrient and base cation/anion fluxes from coast redwood forests; and,
- Impacts on patters, concentrations, and fluxes of nutrients and base cations and anions compared to pre-harvest conditions.

At this point, cation and anion values had not yet been evaluated due to temporarily limited access to necessary equipment, but they will be evaluated once reliable equipment access is re-established.

Water samples were collected over a four-year period from 07/2016 to 06/2020 at four sub-watersheds in Caspar Creek. The four treatments for reduction in basal area were:

- WIL – 0% reduction, control watershed, no harvest conducted
- TRE – 35% reduction
- UQL – 55% reduction
- ZIE – 75% reduction
- Note: Other samples were taken from other watersheds but to a lesser degree (SFC)

Most water samples were collected in the summer with auto-samplers placed near the gauges which were placed in each of the watershed outlets. They were programmed to take hourly samples during storm events, and they were cleaned out every 24 hours. Two samples each were taken on the rising and falling limbs, and one sample was taken near the peak, for a total of over 2,000 samples taken in the four-year monitoring period. Concentrations were converted to nutrient loads to estimate nutrient fluxes leaving the watersheds. ANOVA and Tukey's HSD tests were performed at a significance level of alpha = 0.05; across all comparisons (10 tests), the threshold for significance was p = 0.005.

Comparisons for the nutrient analysis were mainly based on yarding periods, because yarding actually represents most of the disturbance on the forest floor, relative to felling. Felling dates were the basis of the hydrologic analysis, however, because felling constitutes the point at which trees no longer have access to moisture, and therefore a change in hydrologic conditions would be expected. Post-harvest to pre-harvest comparisons were made for the nutrient analysis in each watershed. Hydrologic year was operationally defined as August 1, which was based on a previous study that examined the water year in Caspar Creek; years were also compared, as were seasonal dynamics (fall, winter, spring, summer) and wet to dry years (2 years for each).

The experiment assumes the watersheds are "paired", so to investigate this assumption, they compared discharge across watersheds prior to harvest to determine if the watersheds behaved similarly. They found that watersheds TRE, UQL, and ZIE had higher discharge than watershed WIL (the control watershed) by about 6.4%, 18%, and 20%, respectively. For the most part, discharge was therefore greater in the experimental treatment watersheds than in the control watershed but they were still relatively well-aligned. These differences could not be explained by watershed slope or area, so differences were likely related to differences between the watersheds in factors such as aspect, precipitation, and storage.

Results

- ***Daily water yield/runoff and flow*** increased in all experimental watersheds in the post-felling season. The largest increase in water yield was in the treatment with the greatest stand density reduction (ZIE).
- ***Turbidity*** was highest after large rainfall events, as expected; Post-harvest winter turbidity was significantly higher in the greatest reduction stand (ZIE)
- ***EC*** is expected to increase in dry flow summer months and decrease during winter storm events. In the pre-harvest period, EC was consistently higher in the control watershed than in the treatment watersheds, and therefore likely has deeper flow pathways and longer residence times in the soil and contact with the bedrock in the control watershed.
- ***pH*** generally declined over the study period, ranging from 6–9.2, possibly indicating higher amounts of organic-rich runoff contributing to the streamflow. pH was lower in winter when runoff has more time in contact with the organic-rich soil and humic acids.
- ***DOC*** was highest in the fall, typically after a wetting period. It was also higher post-harvest, which is also expected. Also, very high in dry years when not diluted by higher precipitation.
- ***TN*** was high during storm events in wet years and during the fall flush of dry years, as expected due to increased mineralization and nitrification. TN was also significantly higher in the two watersheds with the two highest stand reductions (UQL, ZIE).
- ***Nitrate*** was relatively low throughout the monitoring period; but, was relatively higher in the largest reduction watershed (ZIE) treatment post-harvest as expected.

- ***Ammonium*** behaved similarly to nitrate; mainly highest during storm events and late in the rainy season (spring), which is expected since microbial activity begins to pick back up again in the spring with warmer temperatures.
- ***DON*** is the dominant form of TN, calculated as the residual of the TN minus Inorganic N. DON was elevated during storm events and peaked late in the rainy season (spring) in wet years, and the peak occurred earlier in dry years.
- ***TP:*** very low (near the MDL) most of the time, but spiked during storm events, and was clearly related to flow and geogenic sources such as mineral weathering. There was no trend in soluble P.

In summary, there was a clear increase in water yield from harvested watersheds following harvest; a clear increase in carbon and TP flux from the watersheds post-harvest; greatest TN and DON in the wettest year; increased DON, nitrate, and ammonium with increasing percent timber removed; and N, P, and C fluxes were 1.3 to 9 times higher than in the control watershed.

An additional peer-refereed publication and CRA are anticipated in 2023.

EMC-2017-002: Boggs Mountain Demonstration State Forest (BMDSF) Post-Fire Automated Bird Recorders Study

Principal Investigator Stacy Stanish worked with a statistician at the California Department of Fish and Wildlife to analyze the data in 2022. A final project presentation is planned for February 2023, and project deliverables and a CRA are anticipated in 2023.

EMC-2017-006: Tradeoffs among Riparian Buffer Zones, Fire Hazard, and Species Composition in the Sierra Nevada

This project was significantly affected by COVID-19, and a contract amendment extended the project to June 30, 2022. As described in the original proposal, Phase 1 is now complete. Burning was completed in spring 2022. Analyses will focus on treatment effects on through-canopy light penetration at WLPZ edges and directly above watercourses. Treatment effects on timber revenue will also be a focus within the context of economic sustainability from potentially increased revenue. Case studies will be conducted to evaluate tradeoffs between forest structure changes and water quality impacts. Opportunities for continuing the study will occur from replication at other sites and through long-term monitoring of these study sites.

Several field tours of the study sites occurred in 2022, including tours for California legislative staff and journalists. A final project presentation is planned for February 2023, and project deliverables and a CRA are anticipated in 2023.

EMC-2017-007: The Life Cycle of Dead Trees and Implications for Management

Dr. John Battles of University of California, Berkeley, provided a final project presentation entitled The Life Cycle of Dead Trees and Implications for Management (Battles et al. 2022) at the April 12, 2022 EMC meeting. The primary goal of this project is to provide the necessary scientific basis to develop snag retention guidelines, with an emphasis to quantify the life cycle of standing dead trees to inform forest management and policy development. However, there are multiple exceptions to the retention stipulation and there is no established practice for managing snag density. To address this data gap, a long-term snag inventory and monitoring study was conducted at Blodgett Forest Research Station.

In 1983, all snags (≥ 5" diameter at breast height, [DBH]) in a 59-acre (ac) stand at Blodgett were evaluated and tagged. The evaluation included several measures of decay (e.g., wood strength, presence of bark) as well as a detailed assessment of habitat elements (e.g., woodpecker holes, cavities). The inventory has been repeated at irregular intervals: 1989, 1994/95, 2005, and 2012. There are currently 1,163 snags being tracked and the study has recorded 680 tree falls. This study has proven valuable for estimating fall rates and for quantifying wildlife habitat value. While current carbon impact assessments of timber harvest plans may account for carbon in snags to some degree, better information on carbon dynamics in snags can make these assessments more accurate. Thus, the secondary goal of this proposal is to improve understanding of the contribution of snags to carbon storage in the Sierran mixed conifer forest.

A brief progress report was provided by Board staff Dr. Kristina Wolf at the November 18, 2022 meeting, and the Committee was informed that a final project report was provided to the project liaison in October and is in revision. A second EMC member was needed to partner with Co-chair Moreno to develop the CRA, and ultimately Member Dr. Michael Jones took on this role. The final research report and CRA are expected in 2023.

EMC-2017-008: Forest Practice Rules to Minimize Fir Mortality from Root Diseases

Dr. Richard Cobb, California Polytechnic State University, San Luis Obispo provided a final project presentation at the April 12, 2022 EMC meeting entitled Do forest practice rules minimize fir mortality from root disease and bark beetle interactions? – a final report (Cobb et al. 2022). This project sought to evaluate several sections of the FPRs for their effectiveness in controlling fuel accumulations in the face of devastating bark beetle outbreaks in true fir stands. The study focused on true fir forests because these stands have yet to reach crisis mortality levels when viewed at the state scale, but the frequency of *Heterobasidion* infections, and the distribution of both biological agents of mortality across the Sierra Nevada, suggests the potential for a highly damaging outbreak. This study showed that several post-harvest stump treatments including borax, urea, and application of *Phlebiopsis* inoculant were effective in reducing *Heterobasidion* colonization of recently cut stumps. The study also followed the expansion of *Heterobasidion* disease centers over a period greater than 50 years and found that the rate of disease expansion declined dramatically after an initial period of expansion and that tree mortality was best predicted by this initial rate of expansion.

A draft CRA (Waitman and Leonard 2022a) was presented by Members Ben Waitman and Jessica Leonard at the September 28, 2022 EMC meeting. After minor revisions, Member Waitman presented a revised draft of the CRA (Waitman and Leonard 2022b) to the Committee at the November 18, 2022 EMC meeting, when the EMC voted to forward the CRA to the Board. The Board is expected to review the CRA in early 2023, although no rule changes are expected to result from this research. Though the results of these studies do not directly address specific rule FPR targets or prescriptions, this work addressed an important disease affecting commercial timber species and identified important practices that can aid the timber industry in predicting maintaining susceptible stands. Two additional publications are in preparation are anticipated in 2023.

EMC-2017-012: Assessment of Night-Flying Forest Pest Predator Communities on Demonstration State Forests – with Monitoring across Seral Stages and Silvicultural Prescriptions

Dr. Michael Baker of CAL FIRE provided a detailed project report to the EMC at the September 28, 2022 meeting entitled, Assessment of Night-Flying Forest Pest Predator Communities on Demonstration State Forests (Baker 2022). This study focuses on forest stands where bats would be foraging for insects (avoiding travel routes or watering sites) and explores bat communities in 50+ year old stands at Jackson Demonstration State Forest (JSDF). The main research question is, "Are the FPRs effective in promoting habitats suitable for bat survival?" which is related to the following regulations: 14 California Code of Regulations (CCR) § 897, 14 CCR § 912.9 (932.9, 952.9), 14 CCR § 913.4 (939.4, 959.4), and 14 CCR § 919 (939, 959). This research relates to EMC Research Theme 7 (Wildlife Habitat: Species and Nest Sites), Theme 8 (Wildlife Habitat: Seral Stages), and Theme 10 (Wildlife Habitat: Structures).

Acoustic sampling sites were located in mature stands (greater than 50-year-old stands, and old growth redwood) in two drainages (James Creek and Chamberlain Creek) on the eastern edge of JDSF about 15 miles from the coast to avoid coastal fog influence. Monitoring included five full nights of acoustic sampling from dusk to dawn, along with insect traps for availability data and bat detectors. Bat detectors were placed mid-canopy in areas of less foliage to improve quality of recordings. Ancillary bat capture efforts were also included to inform selection of capture sites for demonstration. It takes intense, recurrent sampling over many nights to determine best sampling areas, and as such sampling occurred over 166 nights, creating over 72,000 sound files, and occurred in 8 acoustic sampling sites over the two creek drainages. Of the 72,000 sound files collected, 66.5% contained likely "bat tonal information". Bats that call at frequencies (generally smaller, shorter, broader-winged species) of about 30kHz (i.e., "Hi-F species") were detected over four times more often than "Lo-F species" (generally larger, more narrow-winged species), which aligns with the sampling occurring within forest canopies. Hi-F species are better adapted at foraging in more "cluttered" airspace than Lo-F bats, as they can maneuver more effectively. Bat calls for both types were detected from an hour after sunset to an hour before sunrise. Most activity occurred in August, followed by June, July, September, and October.

Bat calls were conservatively classified almost 13,000 recordings to species levels for 7 species. Another 439 calls were likely other species, but required more manual vetting, while less than 4% of calls were not classified. The most common species (10x more common than other species) was California myotis (*Myotis californicus*), a Hi-F species, which was heard on 98.8% of nights, and on average was detected over 60 times (i.e., calls) per night per site. The second most commonly detected bat was the silver-haired bat (*Lasionycteris noctivagans*), a Lo-F species, which was detected 5.8 times per site per night. Even the least frequently detected species—the big brown bat (*Eptesicus fuscus*) was detected more than 50% of the time and was detected at all sites. All but one species was detected at all sites: the fringed myotis (*Myotis thsanodes*) was absent at only one of the 8 sample sites. Manual vetting on less-confident classifications had less certain IDs, but they were likely from 6 additional species. Of these, two were confidently identified as the Yuma myotis (*Myotis yumanensis*) and the little brown myotis (*Myotis lucifugus*), so they were added to the list of bats at JDSF, bringing the "confirmed" total to 9 species. Mist netting was relatively unsuccessful, with captures attempted at 3 sits over 4 nights from May to July, and only 2 bats captured on 1 night, both of which were non-reproductive males. While capture success was low, effort was low as well. There are plans to conduct more intensive capture efforts in the future in reliable sites on Demonstration State Forests (DSFs), including JDSF. Finally, twelve moth families were captured. Insect families were primarily forest tree pests and were found at all 8 sites. Quite a few tree pest beetles were also collected. The majority of forest tree pests belonged to the Orders Lepidoptera and Coleoptera.

Results of this research pertain only to low canopy mature coastal redwood-dominated mixed conifer stands on the eastern portion of the JDSF, and results should not be extrapolated beyond this context. Other habitat types and canopy strata would likely reveal different species compositions and potentially more or different species. Unlike with birds, bats call for navigation and prey-finding, and species identification based on bat calls should be conducted conservatively. Bats can adjust their calls to the situation, and uncommon or quiet species may remain undetected. Major findings include the enormous amount of bat activity between May and November at JDSF: there are at least 9 bat species foraging in the canopy of mature stands at JDSF. There are also at least 6 insect orders and 13 moth families on JDSF, with at least 66 known insect tree pest species from California. Time limits (soon after sunset until just before sunrise) indicate that roosting is occurring in or near the stands that were sampled.

Therefore, the FPRs are effective in promoting habitats suitable to forest bat communities that prey on forest insects, as feeding and roosting sites are present at JDSF. Regarding Theme 7 (Wildlife Habitat: Species and Nest (Roost) Sites), a minimum of 9 species were documented, and roosting sites were inferred based on the timing of calls. Theme 8 (Wildlife Habitat: Seral Stages) will be covered in a final report for all the DSFs sampled. In regards to Theme 10 (Wildlife Habitat: Structures), bat activity within 1 hour of sunset through 1 hour of sunrise indicates nearby roost structures.

The next steps involve moving project sampling to Mountain Home DSF, then to Soquel DSF in summer 2023, and Latour DSF in summer 2024, with the goal of producing a final report in 2025. The final report will ultimately aggregate results from all four DSFs and analyze habitat measures, silvicultural history, and local and landscape measurements. Future projects will mirror the current format for data reporting for each demonstration state DSF and will incorporate background information.

EMC-2018-003: Alternative Meadow Restoration

A project update was provided at the April 12, 2022 EMC meeting, with Board staff Dr. Wolf reporting that a one-year time extension due to the Dixie Fire was in process with the State Department of General Services (DGS). This extension was approved with an end date of June 30, 2023. Dr. Wolf also reported that a minor budget change was made by reallocating funds from the wages budget to equipment to replace damaged probes. Project PI Dr. Christopher Surfleet provided the following updated timeline: 1) hydrological meadow measurement (completed summer 2022); 2) soil disturbance surveys (completed June 2022); 3) final report drafted with one Master's thesis and one Master's project report (provided end summer 2022); and 4) final report presentation to EMC and Board of Forestry and Fire Protection (summer 2023).

Low precipitation years in 2020 and 2021 in combination with the Dixie Fire delayed data analysis so the timeline for completion was shifted and a final project presentation is anticipated in summer of 2023. Final project deliverables and a CRA are also expected in 2023.

EMC-2018-006: Class II Watercourse and Lake Protection Zone

Member Matthew House provided an update at the April 12, 2022 EMC meeting, with information that the research team was still processing data collection on treatments, which would continue through fall 2022. At the September 28, 2022 meeting, Member House reported that data collection for the summer had been completed, and equipment was ready for winter data collection. He also reported that Master's student Jonah Nicolas of the College of Forestry at Oregon State University would be defending his thesis via Zoom on November 29th, under the title Riparian harvest effects on headwater streams: Changing volume of summer flow after harvests in coastal Northern California (Nicolas 2022). Moreover, the project PI will continue working with post-doctoral scholar Dr. Lorrayne Miralha on data analysis with the goal of producing a final report in the following year. Member Mathew Nannizzi officially took over Member House's seat on the Monitoring Community at the EMC meeting on November 18, 2022, and will fill the role of project liaison for this project in partnership with Member Coe. A peer-reviewed publication was accepted on December 26, 2022, entitled "Characterizing stream temperature hysteresis in forested headwater streams" (Miralha et al. 2022). Receipt of final project deliverables and a CRA are anticipated in 2023.

EMC-2019-002: Evaluating Treatment Longevity and Maintenance Needs for Fuel Reduction Projects Implemented in the Wildland Urban Interface of Plumas County, CA

Member Dr. Stacy Drury informed the EMC at the April 12, 2022 meeting that a final presentation could be expected at the summer EMC meeting. This presentation was given by Jason Moghaddas of the Spatial Informatics Group at the August 2, 2022 EMC meeting, entitled Evaluating Treatment Longevity and Maintenance Needs for Fuel Reduction Projects Implemented in the Wildland Urban Interface of Plumas County, CA (Moghaddas 2022). The presentation provided information on treatments designed to reduce immediate fire risk to structures, reduce fire severity, and over time, improve overall community fire resilience. Treatment categories included treatments of slash and stand density on projects the Plumas County Fire Safe Council (FSC) has implemented over several decades.

The Plumas County FSC has been active since about 1999 and has conducted a lot of fuels treatments over several years, including mechanical treatments, hand thinning, prescribed, fire, and whole-tree harvesting. Methods for this research were developed from numerous state data sources: researchers compiled treatment locations and history using digital and paper files and built a single treatment map for the entire treatment dataset. Two locations were emphasized: the Genesee Valley, which was burned in the Dixie Fire; and a treatment area along La Porte Road, which was on the eastern edge of the North Complex Fire. Treatment areas were ultimately used by landowners during wildfire to defend property in Indian Valley.

Projects were completed using whole tree harvest, with post treatment slash generally minimized or removed compared with traditional lop and scatter. The researchers also tried to look at differences between treatment types for mastication versus hand thinning, but that was challenging to distinguish. Fire severity and flame length were utilized as criteria to monitor effectiveness of fuel treatments. The researchers investigated the relationship of distance from treatment area to treatment effectiveness, and found that fire severity was higher as distance increased from fuels treatments. In terms of logging slash and hazard reduction, all treatments met or exceeded standards described for 14 CCR § 917), and all treatments met minimum stocking standards (14 CCR 932.7) after completion.

Dr. Moghaddas also demonstrated use of an online tool with data imported from GoPro images collected using a drone. This method can be used to better visualize impacts than aerial photographs (https://gsal.sig-gis.com/mapURL/PCFSC_Treatments.html) and that outreach to landowners occur to tout the benefits of utilizing 360-degree images from a GoPRO for planning wildfire defense, which can be more helpful to visualizing impacts than aerial photography. In the North Complex Fire, an entire neighborhood survived, and the residents actively protected it using fuels treatment areas. Therefore, researchers recommended investments be made in maintenance of existing treatments to improve defensibility. Dr. Moghaddas also recommended more extensive slash treatment requirements, at least in the wildland-urban interface (WUI) with agencies managing lands adjacent to landowners.

A final project report was submitted in December 2021, so all project deliverables have been received. At the September 28, 2022 EMC meeting, Member Coe volunteered to work with Member Dr. Drury to develop the CRA in 2023.

EMC-2019-003: Fuel Treatments and Hydrologic Implications in the Sierra Nevada

At the August 2, 2022 EMC meeting, Kate Boden provided a progress report presentation entitled Fuel Treatments and Hydrologic Implications in the Sierra Nevada (Boden et al. 2022), and discussed the impact of forest treatment on water yield in a Sierra Nevada watershed. Past research established the potential for an increase in water yield after a large disturbance, leaving questions about impacts of forest treatments on water yield. In the context of the Sagehen experimental watershed in the Sierra Nevada, researchers in this project aimed to answer the following questions:

1. Do forest treatments impact annual runoff (water yield), and if so, at what spatial scales?
2. Do forest treatments impact annual evapotranspiration (ET), and if so, at what spatial scales?

The Sagehen Watershed is located outside of Truckee, California, and is a relatively small, 30-km^2 snow-dominated watershed, with elevations varying from roughly 1900 m to 2700 m. Peak flows are in May on average, and minimum flow is after the summer in September. Sagehen has a conifer forest of Jeffrey pine (*Pinus jeffreyi*) and lodgepole pine (*P. contorta*) at lower elevations, and white pine (*P. monticola*) and red fir (*Abies magnifica*) at higher elevations. Annual precipitation is 800mm, 80% of which falls as snow. Proposed treatment areas were selected in 9 nested sub-basins, and treatments were confirmed with LiDAR and photo datasets that documented the timing and type of treatment. The main treatment at Sagehen was thinning, which included both variable thinning and plantation thinning. Sub-basin 2 had the most treatment at 56%, followed by sub-basin 10 with 41%. Stream gauges were placed throughout to measure flow.

Annual water budgets were extracted at the basin and sub-basin scale, and linear regressions were performed for precipitation and water yield at both scales. In the pre-treatment scenario, runoff and evapotranspiration (ET) were generally evenly balanced; in the post-treatment scenario many trees had been removed leading to a decrease in ET and an increase in runoff. This is the theoretical framework for this research. A pixel analysis conducted at a 100 m x 100 m scale was conducted to compare the change in forest density pixel data to the change in ET pixel data from 2014–2018. Pixels were grouped into treated and untreated categories, and linear regressions were performed to investigate the relationship between changes in forest density and changes in ET within each treatment group.

Data for yearly total precipitation, runoff depth, and ET for Water Years (WY) 2001–2020 at Sagehen showed that precipitation and runoff depth covaried, which was consistent with the linear regression. Despite variability in precipitation, ET was relatively constant, and the trend was consistent even after treatment began in 2014. Finally, ET exceeded precipitation for 9 of the 20 years , leading the researchers to conclude that there is likely another source of water that ET drew from.

Regressions of precipitation axis and runoff depth in each sub-basin revealed that 90% of the variability in runoff was explained by variability in precipitation, and there was no measurable increase in water yield due to forest treatment. This was consistent with basin scale analysis of the last 67 years. To understand how forest treatments may lead to a possible change in ET, which may impact runoff, the researchers investigated what was not predicted by precipitation; that is, the residual from the regressions. Runoff attribution analysis revealed assisted in this analysis, comparing relative forest density change to relative ET change. At pixel scale, forest treatment reduced ET across ~50% of sub-basin SGH 02 but only 10% of the overall Sagehen watershed. The largest treatment, covering 56% of total sub-basin area, did correspond with a 15% reduction in sub-basin ET; however, this did not translate into an increase in water yield and the decrease in ET was not observed at the basin scale. Thus, the scale of treatment impact was too small to measurably influence water yield.

Ongoing work will evaluate the diel (i.e., 24-hour) cycle. Researchers will use hourly stream stage data to understand watershed scale behavior and quantify daily stream stage variability using the Diel Cycle Index (DCI) to see how climate change may influence this variable. This ongoing work will focus on hourly time scale, and the magnitude and timing of cycle changes with season. In the melt season (Mar–May) the amplitude of the diel cycle is large with peak water level in the evening; in the growing season (June–August), the amplitude of the diel cycle is small with peak amplitude in the morning. Key differences between seasons include whether there is rapid rise or rapid loss of stream stage and sources and sinks of water. In the melt season it is likely that increased stream stage comes from overland flow (after soil saturation) and aquifer recharge. In the growing season water exchange seems to occur entirely between the stream bed and the near surface aquifer, the hyporheic zone. However, the researchers want to know if water is moving laterally in the melt season, which would provide information about whether the daily water balance in the watershed is controlled by snowmelt (addition of water) or ET loss, which is useful because DCI can be compared across space and time. In the melt season the fluctuation in stream stage is on average larger (up to 250 mm) than in the growing season, when the fluctuation in stream stage is lower (~50 mm) and consistent through time.

Future research will investigate how the DCI signal varies across space and time, which may inform scientists and managers about watershed hydrology. Additionally, high-resolution models will be developed to represent a range of fuel treatment options to investigate the interactions of vegetation with the hydrologic process. The researchers would like to determine how much of the forest needs to be treated to before the system begins to cause hydrologic changes, which could impact on runoff. At Sagehen, the focus is on runoff and ET as the dominant hydro-processes.

Several unexpected setbacks, including the pandemic, resulted in delays with completing the work, and a time extension was processed on April 25, 2022, allowing the PIs up to one additional year (to June 30, 2023) to develop the final deliverables. Thus, final project deliverables and a CRA are expected in 2023.

EMC-2019-005: Sediment Monitoring and Fish Habitat – San Vicente Accelerated Wood Recruitment

Member Short gave a brief project update at the August 2, 2022 EMC meeting. This project has been impacted at several points by wildfire, the pandemic, and other factors outside of the researchers' control. Two watersheds to be studied in Santa Cruz County burned in the CZU Lightning Complex and the Timber Harvest Plan (THP), a critical component of the research, could no longer be efficiently pursued. After several discussions with Board staff, EMC members, and the PIs, it was determined that the project could not be completed within the timeframe allowed by the contract. Board staff Dr. Wolf reported at the September 28, 2022 EMC meeting that approximately $9000 was distributed for equipment, but that the remaining funds reverted on June 30, 2022, and had to be disencumbered.

Member Short reported that CGS would continue with a modified study. While no longer be a formal EMC project, a revised THP has been approved and is being operated on now, and the researchers will provide more results to the EMC in the future on this new research endeavor. To date, the Accelerated Wood Recruitment (AWR) component of the approved THP was implemented and completed in Big Creek in phases from summer through late fall 2022. Pre-project implementation cross-section and long profile surveys were completed within three select monitoring reaches within the project area and within two selected control reaches within Deadman Gulch. Various hydrologic monitoring instruments have been installed within the project area including a rain gauge and multiple pressure transducers in Big Creek and Deadman Gulch. Photo monitoring locations have been set along with time-lapse game cameras at project monitoring reach and control locations. Post-AWR implementation, a large wood inventory was completed. During spring and summer 2022 the drone LiDAR and photogrammetry surveys were completed prior to the AWR tree felling. The drone LiDAR contractor is working with CGS on data quality, reporting, and final delivery of pertinent datasets. A series of significant winter storm events have and continue to impact the project area. Post-storm impacts will be evaluated when possible and the standard AWR project monitoring survey activities, along with sub-canopy drone-based photogrammetry are planned for summer 2023.

EMC-2021-003: Evaluating Response of Native Pollinators

Funding was encumbered on this project on June 30, 2022, and work started on this project thereafter; as such, no publications of presentations occurred in 2022. Member Dr. Michael Jones volunteered to act as project liaison at the September 28, 2022 meeting. Principal Investigator Dr. James Rivers reported that graduate student Megan Sampognaro joined the research team and this project will serve as the basis for her as a Master's of Science thesis in the College of Forestry at Oregon State University.

VII. POTENTIAL EMC PROJECT IMPACTS TO REGULATIONS

The EMC provides valuable insight to the Board on testing the effectiveness of the FPRs and associated regulations by way of science-based research projects. EMC-funded studies may show that regulatory modifications, either minor or major, need to occur to ensure the effectiveness of the FPRs (14 CCR § 895 et seq.). The EMC moved findings from EMC-2015-001 (Class II Large Watercourse Study) to the Board for consideration in 2021, and a revision resulted in 2022 to the Anadromous Salmonid Protection Rules. The EMC expects to share findings for the following EMC-supported studies with the Board for consideration in 2023 or early 2024:

- EMC-2016-003 (Road Rules Effectiveness at Reducing Mass Wasting (Repeat LiDAR Surveys to Detect Landslides)
- EMC-2017-001 (Effects of Forest Stand Density Reduction on Nutrient Cycling and Nutrient Transport at the Caspar Creek Experimental Watershed)
- EMC-2017-002 (Boggs Mountain Demonstration State Forest (BMDSF) Post-Fire Automated Bird Recorders Study)
- EMC-2017-006 (Tradeoffs among Riparian Buffer Zones, Fire Hazard, and Species Composition in the Sierra Nevada)
- EMC-2017-007 (The Life Cycle of Dead Trees and Implications for Management)
- EMC-2017-008 (Forest Practice Rules to Minimize Fir Mortality from Root Diseases), EMC-2018-003 (Alternative Meadow Restoration)
- EMC-2018-006 (Class II Watercourse and Lake Protection Zone)
- EMC-2019-002 (Evaluating Treatment Longevity and Maintenance Needs for Fuel Reduction Projects Implemented in the Wildland Urban Interface of Plumas County, CA)
- EMC-2019-003 (Fuel Treatments and Hydrologic Implications in the Sierra Nevada)

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