



**STATE BOARD OF FORESTRY AND FIRE PROTECTION**

December 13, 2021

# 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) 2021/2022, the EMC selected XX proposed effectiveness monitoring projects to fund and support. Ongoing projects from prior years continued to be funded.

# 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 that provides an active feedback loop to policymakers, managers, agencies, and the public by soliciting robust scientific research that addresses the effectiveness of these laws at meeting resource objectives and ecological performance measures related to AB 1492.[[1]](#footnote-1)

Three formal documents guide the activities and goals of the EMC: (1) the EMC Charter,[[2]](#footnote-2) (2) the EMC Strategic Plan,[[3]](#footnote-3) which will be updated approximately every three years, and (3) the EMC Annual Report and Work Plan[[4]](#footnote-4) (i.e., this current report), which will be updated every calendar year. The longer, more static Strategic Plan and the shorter, more fluid Annual Report and Work Plan, is a linked process developed in response to Board member suggestions. 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 (Report) 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.



**Figure 1. EMC Project Submission Timeline (approximate)**

# EMC FUNDING

For FY 2021/22, the EMC has been allocated ongoing funding of $425,000 from the Timber Regulation and Forest Restoration Fund (TRFRF),[[5]](#footnote-5) established by AB 1492 (2012), of which $154,472 was allotted to support ongoing, previously awarded projects, and $270,528 remains for projects to be funded starting in the 2021/22 FY. The EMC anticipates an allocation of $425,000 in FY 2022/23 and 2023/24 as well. This funding is granted through the Board/CAL FIRE contracting process.

**Table 1. Ongoing EMC Projects with Continued Funding and/or Activity (2021/2022)**

| Project # | Title | Primary Investigator(s) | Funding Status |
| --- | --- | --- | --- |
| EMC-2015-001 | Class II Large Watercourse Study: Multiscale investigation of perennial flow and thermal influence of headwater streams into fish bearing systems | Kevin Bladon & Catalina Segura | 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, Kevin Bladon, Drew Coe, & Don Lindsay | Not applicable\*  |
| EMC-2016-003 | Road Rules Effectiveness at Reducing Mass Wasting (Repeat LiDAR Surveys to Detect Landslides) | Bill Short & Matt O'Connor | Fully allocated |
| EMC-2017-001 | Effects of Forest Stand Density Reduction on Nutrient Cycling and Nutrient Transport at the Caspar Creek Experimental Watershed | Helen Dahlke & Randy Dahlgren | $ |
| EMC-2017-006 | Tradeoffs among Riparian Buffer Zones, Fire Hazard, and Species Composition in the Sierra Nevada | Rob York | $ |
| EMC-2017-007 | The Life Cycle of Dead Trees and Implications for Management | John Battles | $ |
| EMC-2017-008 | Do Forest Practice Rules Minimize Fir Mortality from Root Disease and Bark Beetle Interactions | Richard Cobb | $ |
| EMC-2018-003 | Alternative Meadow Restoration | Christopher Surfleet | Fully allocated |
| EMC-2018-006 | Effect of Forest Practice Rules on Restoring Canopy Closure, Water Temperature, & Primary Productivity | Kevin Bladon, Catalina Segura, Matthew House, & Drew Coe | $154,472.00 |
| EMC-2019-002 | Evaluating Treatment Longevity and Maintenance Needs for Fuel Reduction Projects Implemented in the Wildland Urban Interface of Plumas County | Brad Graevs & Jason Moghaddas | $ |
| EMC-2019-003 | Fuel Treatments & Hydrologic Implications in the Sierra Nevada | Terri Hogue & Alicia Kinoshita  | $58,397.79 |
| EMC-2019-005 | Sediment Monitoring and Fish Habitat – San Vicente Accelerated Wood Recruitment | Cheryl Hayhurst | $56,200.00 |

\*EMC-supported, but not EMC-funded

# EMC ACCOMPLISHMENTS

In 2021, the EMC accomplished the following:

* The EMC met five times virtually in open, webcast meetings to conduct business. The January meeting was delayed from December 2020.
* The EMC received an ongoing allocation of $425,000 from the Timber Regulation and Forest Restoration Fund, of which $154,472 was allocated to previously awarded projects (see Table 1), and the remaining $270,528 will be available to projects awarded in the 2021/22 fiscal year.
* The EMC reviewed three initial concept proposals and requested full concept proposals from two research teams. Upon review and discussion, the committee voted to XXXXXX.
* Research priorities were selected from the established Priority Themes and Critical Monitoring Questions described in the Strategic Plan via anonymous vote of all EMC voting members. The top five critical monitoring questions were prioritized for funding in the 2021/22 FY, although not to the exclusion of projects focusing on the remaining critical monitoring questions.
* The EMC finalized a new framework for processing completed EMC-funded projects to better facilitate EMC reporting to the Board. This “Completed Research Assessment” (previously known as “Science to Policy Framework”) 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 work with the Principal Investigator(s) of each project to complete the required form, 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.
* A Completed Research Assessment was prepared for project EMC-2015-001: Effectiveness of Class II Watercourse and Lake Protection Zone (WLPZ) FPRs and Aquatic Habitat Conservation Plan (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.
* 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 related regulations) was provided on the Railroad Gulch BMP Evaluation Study conducted in the Elk River watershed, Humboldt County.
* Brief project updates were provided by Principal Investigators and/or Project Liaisons at EMC meetings for the following projects: EMC-2015-001 (Class II Large Watercourse Study), EMC-2016-003 (Repeat LiDAR Surveys to Detect Landslides), EMC-2017-001 (Caspar Creek Experimental Watershed), EMC-2017-008 (Forest Practice Rules and Fir Mortality), EMC-2018-003 (Alternative Meadow Restoration), EMC-2018-006 (Effect of Forest Practice Rules), EMC-2019-002 (Treatment Longevity and Maintenance Needs for Fuel Reduction Projects), and EMC-2019-005 (San Vicente Accelerated Wood Recruitment).
* The EMC implemented 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 to ensure project progress and deliverables are on track for BOF acceptance. Project liaisons provided project updates, as appropriate, at regularly scheduled EMC meetings, and worked with Board staff to facilitate communications and plan receipt of deliverables to the EMC.

A Draft Strategic Plan was updated at the end of 2021, and will be finalized in early 2022. The EMC investigated a grant program as a means of distributing funding on future projects, and continued to develop the program for implementation in FY 2021/22.

# EMC SUPPORTED MONITORING PROJECTS – 2015 to 2021

The comprehensive list of EMC-supported monitoring projects can be found on the Board’s [EMC webpage](https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/) (<https://bof.fire.ca.gov/board-committees/effectiveness-monitoring-committee/>).

# EMC PRIORITIES

EMC priorities are developed by the Committee, but as an advisory body to the Board, the Board can also request prioritization of items by the EMC. The current EMC priorities are as follows:

* Support projects related to the EMC themes and critical questions.
* Monitor progress on previously funded or supported EMC monitoring projects.
* Meet in the field at least once per year to observe active or proposed monitoring projects (this was not achieved in 2020 or 2021 due to the COVID-19 pandemic, although one virtual field tour was conducted and several comprehensive presentations were given during public meetings).

# CURRENT APPOINTED EMC MEMBERS AND STAFF

For FY 2021/2022, the Committee has two Co-Chairs; up to 16 EMC members, including eight agency representatives and seven monitoring community members (two seats were vacated during 2021 and remain open); and five support staff positions (one seat was vacated in 2021, but filled within two months).

**Table 2. Current EMC Membership and Support Staff**

| **Name** | **Specialty** | **Affiliation** | **Term End Date** |
| --- | --- | --- | --- |
| Co-Chairs |
| Loretta Moreno | Co-Chair, Forest Ecology | California Natural Resources Agency | 07/05/2023 |
| Susan Husari | Co-Chair, Forestry and Fire Management | Board of Forestry and Fire Protection | 11/06/2023 |
| Monitoring Community |
| ***OPEN SEAT***Greg Giusti | Forestry, Registered Professional Forester (RPF) 2709 | University of California Cooperative Extension Advisor Emeritus - Lake and Mendocino counties | Vacated 07/01/2021 |
| Matt House | Hydrology and Fisheries | Green Diamond Resource Company | 08/31/2024 |
| Sal Chinnici | Wildlife | Humboldt and Mendocino Redwood Companies | 07/01/2024 |
| Matt O’Connor, Ph.D. | Geology and Geomorphology | Public | 11/06/2023 |
| ***OPEN SEAT***Sarah Bisbing, Ph.D. | Forest Ecology and Forestry | Academic, University of Nevada, Reno | Resigned 09/08/2021 |
| Leander Love-Anderegg, Ph.D. | Forest Ecology and Forestry | Academic, University of California, Berkeley | 07/05/2023 |
| Peter Freer-Smith, Ph.D. | Plant Ecology and Environmental Policy | Academic, University of California, Davis | 07/05/2023 |
| Agency Representatives |
| Stacy Drury, Ph.D. | Fire Ecology | USDA Forest Service Pacific Southwest Research Station | n/a |
| Elliot Chasin (to 09/21/2021)Ben Waitman (from 09/22/2021) | Wildlife | California Department of Fish and Wildlife | n/a |
| Drew Coe | Hydrology/Forestry, RPF 2981 | CAL FIRE | n/a |
| Jessica Leonard | Watershed Management | State Water Resources Control Board | n/a |
| 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 |
| Support Staff |
| 1. Matt Dias (to 07/01/2021)
2. Edith Hannigan (from 11/03/2021)
 | 1. Forestry, RPF 2773
2. Geography and Sustainable Land Use Planning
 | Board of Forestry and Fire Protection Executive Officer | n/a |
| 1. Pete Cafferata (to 07/01/2021)
2. Andrew Lawhorn (from 12/14/2021)
 | 1. Hydrology/Forestry, RPF 2184
2. Forestry and Fire Management
 | 1. CAL FIRE
2. Board of Forestry and Fire Protection, 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 |
| * Katie Harrell (to 01/31/2021)
* Kristina Wolf, Ph.D. (from 02/01/2021)
 | 1. Forestry
2. Rangeland and Restoration Ecology
 | Board of Forestry and Fire Protection | n/a |

# EMC PROJECT UPDATES

The following section provides more information on reported project activities in 2021, or prior if applicable:

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

At the January 13, 2021 EMC meeting, Member Coe announced that OSU PhD student Austin Wissler had analyzed the thermistor data for EMC-2015-001: Class II-Large Monitoring from Caspar Creek and LaTour Demonstration State Forest as the first part of his dissertation research. This portion of his research has been submitted for publication to the journal Hydrological Processes in January 2021. A paper was accepted and published in the journal *Authorea* in January 2021.

As part of a California Fire Science Seminar Series, Dr. Kevin Bladon provided a presentation titled “Wildfire and Post-Fire Management Effects on Water Resources” on April 13, 2021 (recorded and posted at <https://www.youtube.com/watch?v=yI199ixy_SI&list=PLvPofWzmi8889iiaMSPtzUD0VLqxyo-fz&index=29>).

**At the April 21, 2021 EMC meeting, Member Coe presented on longitudinal trends in stream temperature from work conducted in the Caspar Creek Experimental Watersheds and on LaTour Demonstration State Forest (contrasting lithologies). Data were collected in five Caspar watersheds and three LaTour basins in 2017 and 2018. Drainage areas ranged from 57 to 773 acres. Air and stream temperatures tracked much more closely for the coastal basins compared to the inland LaTour basins. Input of coldwater springs decreased water temperature at entry points in the Cascade Range, providing cooling in a downstream direction, while four out of five Coast Ranges streams had a warming trend downstream. Spring inputs were found to lower the relationship between air and water temperatures. This study showed that not all streams meet the assumptions of uniform downstream warming utilized with the Class II-Large** Anadromous Salmonid Protection (ASP) **rules. The general pattern of complex instead of assumed asymptotic downstream warming makes implications for the California Forest Practice Rules difficult. This conclusion validates the concepts included in 916.9[936.9, 956.8](v), allowing RPFs to develop site-specific riparian zone measures where they are appropriate.**

Adam Pate’s earlier work conducting a regional assessment of parameters for determining Class II flow permanence and network connectivity was also briefly described (Pate et al. 2020). Approximately 100 streams were studied, with channel characteristics and surface water conditions measured in mostly ASP watersheds. The most important variable for connectivity was winter precipitation. Drainage area was found to be more important than bankfull channel width, and width was found to work in the opposite direction than expected (decreased flow with wider channels). For connected streams, the rule requirement of 100 or 150 acres depending on forest practice district came reasonably close to the mid-values measured in this field study. The rule mandated drainage areas did not work as well for flow permanence, but they were still tracking appropriately (larger watersheds had more flow permanence). In general, this study provides evidence that channel width is not a good predictor for higher water temperatures being transmitted downstream, while drainage area is a good parameter for use in the CA Forest Practice Rules.

Member Coe also reported that the manuscript previously submitted to the journal *Hydrological Processes* was rejected, and that modifications would be made to the discussion section and the paper would be resubmitted over the summer.

The EMC determined that the completed project EMC-2015-001 would provide a good beta test for the draft Science to Policy Framework (i.e., the precursor to the Completed Research Assessment). It was found that the study (1) did fulfill the funding requirements and informed a FPR; (2) was scientifically sound (one published paper to date); (3) scalable: clear differences in warming patterns were documented in different lithologies, with complex patterns observed in the Cascade Range; a key limitation was that only temperature was studied, while the ASP rules were also developed to address the transport of sediment, large wood, and nutrients; (4) additional research needed: it is appropriate to determine findings from EMC-2018-006 prior to initiating new research; and (5) scientific application: our understanding of controls for perennial/connectivity flow for headwater streams in California has been substantially increased.

At the July 21, 2021 EMC Meeting, Member Coe summarized the revised Completed Research Assessment that he and Member Matt House completed for this project. The project determined that drainage area is considerably more important than the active channel width for determining both Class II flow connectivity and flow permanence. The document suggested that simplifying the FPRs by removing channel width as a criterion for classifying Class II-Large watercourses was merited. Revisions were suggested to the document prior to its presentation to the Board’s Forest Practice Committee.

The final project results were presented to the Board by Member Coe on XX. The Completed Research Assessment was also presented to the Forest Practice Committee at the September 10, 2021 Board meeting, including potential implications for policy. In response, the Board proposed some rule changes, and the item will be discussed at a future Board meeting. Updated presentations were presented to the Board at the Forest Practice Committee meeting on November 3, 2021, and again on December 8, 2021.

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

At the January 13, 2021 EMC Meeting, Member Coe summarized a published poster presented online at the Fall 2020 AGU (American Geophysical Union) meeting titled “Alternative methods for reducing sediment delivery from skid trails used for post-fire logging”. This component of the study was included to develop and demonstrate alternative best management practices (BMPs) for post-fire salvage operations. Rainfall simulation was used to test post-fire treatments on skid trails in an area that burned with high severity in the 2015 Valley Fire. Runoff experiments were conducted to compare changes in runoff and sediment outputs among five mitigation techniques. The treatments were:

* Control: standard waterbar spacing with the FPRs (100 feet with moderate EHR; 30-40% slopes).
* Double-drainage: waterbar spacing set to ½ the prescribed FPR spacing (50 feet).
* Slash-covered: skid trail covered with logging slash at a rate of 50%.
* Slash-packed waterbar outlets: outlets covered with logging slash (70%) and machine packed.
* Walked-in slash: both skid trail and waterbar outlet covered by slash (50% and 70%, respectively), and machine packed.

A licensed timber operator made four round trips on each skid trail. There were six plots randomly assigned for each treatment. Plot test sections were ½ the distance between waterbars and the full skid trail width. The application rate for the runoff simulator was 28 mm/hr (1.1 in/hr) for 30 minutes, which corresponded to the runoff rate from rainfall simulations with an applied rainfall rate of 71 mm/hr (>100-year recurrence interval; Prats et al. 2021). Variables included surface cover, surface roughness, runoff velocity (using a pulsed saline injection tracer), runoff rate, and sediment concentration. Results were as follows:

* Cover: There was no difference in wood cover between the Control and Double-drainage plots or outlets. Plot wood cover was greater for the Slash-covered and Walked-in treatments, which included addition of wood on the skid trail surface. Outlet wood cover was greater for Slash-covered, slashpacked, and Walked-in treatments.
* Surface roughness: Surface roughness showed no differences in the plots. Roughness in the outlets was more variable within each treatment than in the plots, and none of the treatments appeared to affect surface roughness.
* Runoff velocity: The plot runoff velocities were lower for the treatments where slash was added to the skid trails (Slash-covered and Walked-in). All treatments had lower runoff velocities in the outlets than the Controls, particularly where slash was added to the waterbar outlets.
* Runoff rate: Runoff rates across all treatments were highly variable. Runoff rates in the Double-drainage treatment were lower than the Controls because of the higher frequency of waterbars and shorter plot lengths. Runoff rates in the Slash-covered and Walked-in treatments were lower than the Controls.
* Sediment concentration: Sediment concentrations were similar at the plot sample location across treatments except for the Slash-covered, which was slightly lower. At the outlets, there was no difference in sediment concentration between the Controls and Double-drainage treatments, and the Slash-covered, Slash-packed, and Walked-in treatments had lower concentrations. Sediment rating curves still need to be constructed to allow sediment yields to be calculated.

Additional characterizations of hydraulic roughness and erosion may also be generated using structure for motion photogrammetry. The main conclusions to date from this study are that (1) reducing the distance between waterbars has little effect on sediment delivery, and (2) the addition of slash to waterbar outlets has a greater influence on sediment delivery than slash added to the skid trails. The value of slash packing the outlets of skid trails following salvage logging operations validates the existing FPRs, which state that, “Where waterbreaks cannot effectively disperse surface runoff, including where waterbreaks on roads and skid trail cause surface runoff to be concentrated on downslopes, roads or skid trails, other erosion controls shall be installed as needed…(914.6 [934.6, 954.6](f)).” Since roads and skid trails share similar properties and similar rule requirements (e.g., 914.6, 934.6, 954.6), results from this study may also apply to elements of the “Road Rules”, specifically to elements of 923.5, 943.5, 963.5.

In related research, Dr. Joe Wagenbrenner provided a presentation titled, “Post-Fire Salvage Logging Effects on Soils, Runoff, and Sediment Production in Western Watersheds,” posted at [https://www.youtube.com/watch?v=MakVum6U\_vE&list=PL-u4XN2GJZIgtKEmz0WxPWpwfUtchxvV\_&index=3](https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DMakVum6U_vE%26list%3DPL-u4XN2GJZIgtKEmz0WxPWpwfUtchxvV_%26index%3D3&data=04%7C01%7CPete.Cafferata%40fire.ca.gov%7C802cd95710d64dbda45208d90383f1ef%7C447a4ca05405454dad68c98a520261f8%7C1%7C0%7C637544687501304283%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=2RQj8sMDGwjjR8LO0U0puVeSO9z9Rzivd8lHSEIMJeE%3D&reserved=0). The presentation was recorded on April 5, 2021 and was part of a Salvage Webinar series co-hosted by the Rocky Mountain Research Station, Northern Rockies Fire Science Network, Southern Rockies Fire Science Network, and the Northwest Fire Science Consortium.

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

The processing of the LiDAR data by the USGS and its contractors was delayed due to COVID-19 response and by prioritizing processing of LiDAR data from areas affected by wildfires. At the April 21, 2021 meeting, Member Short reported that LiDAR delivery from the USGS was still delated. At the July 21, 2021 EMC meeting, Member Short informed the EMC that LiDAR data for Amador and El Dorado counties has been accepted, and that California Geological Society (CGS) should be getting the data in the next few weeks, and would be uploaded to the national USGS site (<https://www.usgs.gov/core-science-systems/ngp/tnm-delivery/gis-data-download>).

At the Oct 21, 2021 EMC Meeting, Member O’Connor and Member Bill Short provided a project update. They reported that allocated project funds were expended in support of LiDAR acquisition to implement the project, and CGS was still awaiting the LiDAR data. Once received, CGS would implement an investigation of sequential LiDAR as a tool for identifying and tracking landslides; the analysis is expected to occur in early 2022.

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

At the April 21, 2021 meeting, Pete Cafferata reported that the pandemic imposed major restrictions on laboratory access for cation-anion analysis on 1,600 remaining water samples, but that Seanna McLaughlin’s master’s thesis was expected by June and a final report by the end of the calendar year. No project deliverables were provided in 2021.

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

The third and final year of bird recordings were made in the late spring of 2019 and the bird call interpreter completed the recording analysis in January 2020. Stacy Stanish is working with a CDFW statistician to analyze the data. No project updates or deliverables were provided in 2021.

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

At the January 13, 2021 EMC Meeting, Katie Harrell, Board staff, reported that this project was significantly affected by COVID-19, and a contract amendment extended the project to June 30, 2022. An emailed project update was provided in September 2021, which reported that this project is near its conclusion in terms of implementation. All treatments were implemented, while piles remain to be burned, and the principal investigator planned to burn in the fall, weather permitting. Once burning is completed, post-treatment sampling will commence. A progress report and results will be provided in the late spring of summer of 2022.

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

This project is in a 24-ha stand at Blodgett Forest (identified as Compartment 160) where snags have been tracked for almost four decades. Dr. John Battles developed a new annual snag tracking protocol at Blodgett Forest Research Station. The first annual inventory using the new monitoring protocol was completed in 2020. A retrospective study of log decay was also completed to complement the long-term study of downed wood decay rates. This project is complete, and results are expected in spring of 2022.

## EMC-2017-008: FPRs to Minimize Fir Mortality from Root Diseases

At the October 21, 2021 EMC Meeting, Richard Cobb reported that several publications were in development, recently submitted, or in review, and a final project presentation would be provided to the EMC in early 2022.

## EMC-2018-003: Alternative Meadow Restoration

At the April 21, 2021 meeting, Member O’Connor reported that due to extremely low winter precipitation, no meadow streamflow was recorded, greatly complicating measurement of treatment effects. Field work continued during the pandemic, however. The last funds were allocated in August of 2021, and analyses were ongoing and expected to be completed in spring 2022.

A Master of Science (MS) thesis will be completed analyzing the pre-treatment lodgepole pine sap flow and pre-treatment statistical analysis of the hydrologic instruments in June 2021. An MS thesis on the Rock Creek vegetation response and Rock Creek and Marian Meadow post-treatment hydrologic response of 1-year and 6-years post treatment, respectively, will be completed by spring 2022. Additionally, an MS project on the soil disturbance and stream habitat response the first year following alternative treatment at Rock Creek will be completed in September 2021.

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

At the April 21, 2021 EMC meeting, Member Matt House announced that harvesting occurred in 2020, and 2021 post-harvest data were being collected. Green Diamond Resource Company staff had supplemented Oregon State University staff due to field limitations related to the pandemic. Austin Wissler scaled back his study to a master’s project, and Drs. Bladon and Segura were pursuing a post-doc to continue the project.

At the July 21, 2021 EMC meeting, Dr. Kevin Bladon provided a recorded video (see the EMC webpage link: <https://bof.fire.ca.gov/media/5uie1e1g/bladonsegura_emcupdate_2021-07-21.mp4>) and progress presentation on this project being conducted on Green Diamond Resource Company (GDRC) timberlands in Humboldt County. There are 18 watersheds included in the study—six reference watersheds and four of each of the three riparian treatments. Treatment watersheds were all harvested in 2020 with one of the three treatments: (a) Coastal Anadromy Zone ASP Class II-L Prescription (30-ft core zone, 70-ft inner zone with 80% overstory canopy cover), (b) GDRC Habitat Conservation Plan Prescription (30-ft inner zone with 85% overstory canopy, 70-ft outer zone with 70% overstory canopy cover), or (c) an alternative prescription resembling pre-ASP (& Threatened or Impaired Watersheds (T/I) Rule Package) requirements (100-ft zone with 50% overstory canopy).

There are six circular 1/10 acre fixed-area plots in the riparian area of each watershed to quantify pre- and post-harvest tree condition, species, diameter at breast height (DBH), basal area, and canopy closure from hemispherical photographs. Stream discharge is being measured with salt solution gaging, and dissolved oxygen (DO) and photosynthetically active radiation (PAR) (radiation reaching the stream) data are also being recorded. Longitudinally along each of the 18 stream reaches (1,000 feet) there are four air temperature sensors and 12 stream temperature sensors (288 total sensors). Two centrally located meteorological stations are also maintained to quantify precipitation, air temperature, wind speed, soil moisture, and relative humidity. Additionally, 27 groundwater wells have been installed to document how water is routed to stream channels. All automated sensors have been set up to collect data at 15-minute intervals.

Pre-harvest mensuration data presented show that the three treatment sites and the controls are generally comparable when considering the mean number of trees per acre, basal area, canopy closure, and leaf area index (LAI). Annual precipitation was only approximately 50% of the long-term average during the winter of 2019–2020, but air temperatures were close to average. Stream discharge was similar in the reference and pre-ASP watersheds, but considerably lower in the ASP basins. Very limited flow response is expected due to the very low WLPZ harvest rates.

Preliminary stream temperature data show little evidence of discrete locations of groundwater discharge or spring inputs (i.e., stable temperature moving in a downstream direction). Plots of stream temperature for reference watersheds vs. ASP and HCP basins show no effect, while pre-ASP basins show a harvest effect, with increases of ~0.3°C (0.5°F). Photosynthetically active radiation data show no treatment differences, except for pre-ASP basins, where increases of 244% have been documented. Mean chlorophyll-a concentrations are slightly elevated for all the treatment basins and the reference watersheds. Monthly water chemistry grab samples for nitrogen, phosphorus, and dissolved organic carbon (DOC) do not reveal large changes to date. Next steps include continued data collection and sampling, application of Quality Assurance and Control protocols, post-harvest data analyses, and publishing a stream temperature paper in early 2022 (Wissler) and a streamflow response paper in late 2022 (Nicholas). A post-doctoral researcher started on the project in October 2021 to conduct longer term data analyses. Final results are expected 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

An online geodatabase of completed Fire Safe Council Projects is being completed with review by the Plumas County Fire Safe Council (PCFSC). Using these data, and in coordination with PCFSC, six parcels were examined for the quality and condition of a previously treated parcel in the La Porte Road area. Several of the parcels burned and were used during Claremont Fire firefighting operations, giving a unique opportunity to assess treatment effectiveness in terms of burn severity and facilitation of fire suppression actions. Measurements were taken of crown cover, diameter at breast height, basal area, species composition, and fire effects, when applicable. Photographs of the treatment were taken in the four cardinal directions with a GPS point taken at the sampling point. Planning is underway to visit parcels in Whitehawk, East Quincy, and Clio, weather permitting. All subsequent visits will incorporate drone flights and 360° photographs. When possible, older pre- and post-treatment photographs taken at the time of treatment will be repeated in the exact location.

At the July 21, 2021 EMC Meeting, Member Stacy Drury provided a project update. Member Drury was in contact with the Feather River Resource Conservation District (RCD), which had moved forward with the project, COVID had put the project behind schedule. Some experimental sites burned in 2020, and fires in the summer had encroached on some of the plots, but the project was still on track to provide the contracted deliverables.

At the October 21, 2021 meeting, Member Drury provided an additional update, stating that the project was wrapping up. The Dixie Fire burned most of the experimental sites, and many could no longer be evaluated, resulting in a delay in the final report, so the project investigators would re-evaluate the next steps and timeline.

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

Streamflow data were acquired and reset on November 12-14, 2020. These data will be quality controlled and added to the existing long-term dataset. Leaf Area Index and MODIS FPAR 4-day global datasets have been acquired using Google Earth Engine. Ongoing work includes acquisition of additional remote sensing products: fractional snow-covered area, evapotranspiration, and NDVI. Statistical evaluation will begin in late December to early January. LiDAR data available for Sagehen will be acquired in spring 2021 and interpreted to quantify canopy change at a high resolution. COVID-19 delayed the start date of the project by several months and the proposed timeline. No project updates or deliverables were provided in 2021.

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

At the April 21, 2021 EMC meeting, Member Bill Short reported that the two watersheds to be studied in Santa Cruz County had burned in the CZU Lightning Complex and the Sempervirens Fund was not going to continue with the Timber Harvest Plan (THP). Project investigators met with Board staff to discuss alternatives that might be available, including changing the project to a post-fire large wood study. However, RPF Nadia Hamey was planning to go forward with the project. The California Geological Society had installed monitoring equipment in the stream channels, and data were being collected. They observed significant sediment delivery to the channels.

At the October 21, 2021 meeting, Member Short reported that a modified plan for the project would be submitted. At that time, the project was still on hold, but Member Short anticipated that the plan would go through as modified and work to fly the LiDAR for pre-project analyses was planned for winter, and some streamflow surveys had been conducted.

# EMC PROJECT RESULTS AND PRODUCTS

The following section provides more information on reported project deliverables in 2021, or prior if applicable:

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

This project is complete, and additional publications and presentations are expected. The following items were published or presented in 2021:

* + Wissler, A., C. Segura, and K. Bladon. 2021. Comparing headwater stream thermal sensitivity across two contrasting lithologies in Northern California. *Authorea* 1–42. DOI: 10.22541/au.160993267.74556159/v1
	+ Member Coe provided a project update at the January 13, 2021 EMC meeting.
	+ A presentation on the final project results was given to the EMC at the meeting on April, 21, 2021.
* Co-Chair Husari provided the Board with a project update at the July 2, 2021 Board Meeting.
* Final project results and a Completed Research Assessment were presented at the EMC meeting on July 21, 2021, and following revisions, was presented to the Board at the Forest Practice Committee meeting on September 10, 2021.
* A presentation on policy implications and an additional project update were presented to the Board at the Forest Practice Committee meeting on November 3, 2021, and again on December 8, 2021.

## EMC-2016-002: Post-fire effectiveness of the Forest Practice Rules in protecting water quality on Boggs Mountain Demonstration State Forest

This project is complete, and additional publications and presentations are expected. The following items were published or presented in 2021:

* At the January 13, 2021 EMC meeting, Member Coe summarized a published poster that was presented online at the Fall 2020 AGU meeting titled “Alternative methods for reducing sediment delivery from skid trails used for post-fire logging”.
* Dr. Joe Wagenbrenner gave a presentation on April 5, 2021 at the Salvage Webinar series co-hosted by the Rocky Mountain Research Station, Northern Rockies Fire Science Network, Southern Rockies Fire Science Network, and the Northwest Fire Science Consortium titled, “Post-Fire Salvage Logging Effects on Soils, Runoff, and Sediment Production in Western Watersheds,” posted at [https://www.youtube.com/watch?v=MakVum6U\_vE&list=PL-u4XN2GJZIgtKEmz0WxPWpwfUtchxvV\_&index=3](https://gcc02.safelinks.protection.outlook.com/?url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DMakVum6U_vE%26list%3DPL-u4XN2GJZIgtKEmz0WxPWpwfUtchxvV_%26index%3D3&data=04%7C01%7CPete.Cafferata%40fire.ca.gov%7C802cd95710d64dbda45208d90383f1ef%7C447a4ca05405454dad68c98a520261f8%7C1%7C0%7C637544687501304283%7CUnknown%7CTWFpbGZsb3d8eyJWIjoiMC4wLjAwMDAiLCJQIjoiV2luMzIiLCJBTiI6Ik1haWwiLCJXVCI6Mn0%3D%7C1000&sdata=2RQj8sMDGwjjR8LO0U0puVeSO9z9Rzivd8lHSEIMJeE%3D&reserved=0).

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

Results for this project are expected in mid-2022, and as such, no publications or presentations occurred in 2021. Project updates were provided at the April 21, July 21, and October 21, 2021 EMC meetings.

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

UC Davis MS student Seanna McLaughlin and Drs. Helen Dahlke and Randy Dahlgren prepared a [final report for pre-harvest biogeochemical analysis](https://bof.fire.ca.gov/media/9332/emc-2017-001-uc-davis-nutrient-study-progress-report_ada.pdf) of four Caspar Creek sub-watersheds for the Save the Redwoods League, one of the project funders.

Results for this project are expected in 2022, and as such, no publications or presentations occurred in 2021. A project update was provided at the April 21, 2021 EMC meeting.

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

Results for this project are expected in spring 2022, and as such, no publications or presentations occurred in 2021. No project updates or deliverables were provided in 2021.

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

Results for this project are expected in late spring or summer of 2022, and as such, no publications or presentations occurred in 2021. A project update was provided at the January 13, 2021 EMC meeting, and an email update was provided in September 2021.

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

Results for this project are expected in spring 2022, and as such, no publications or presentations occurred in 2021. A project update was provided at the January 13, 2021 EMC meeting.

## EMC-2017-008: FPRs to Minimize Fir Mortality from Root Diseases.

Results for this project are expected in 2022, and as such, no publications or presentations occurred in 2021. A project update was provided at the October 21, 2021 meeting, and Mr. Cobb reported that at least three publications were either in development, recently submitted, or in review, and a final project presentation would be provided to the EMC in early 2022. Mr. Cobb provided information on the articles as follows:

* An article titled, “Efficacy of Chemical and Biological Stump Treatments for the Control of *Heterobasidion occidentale* Infection of California *Abies concolor*” is in review with the journal *Pathogens.*
* A second article titled, “Heterobasidion effects on stand composition over fifty years of root disease in California fir and pine forests” will be submitted to a journal soon.
* A third article titled, “Interactions between forest structure, host community, and pathogen identity during 50 years of Heterobasidion root disease in the Sierra Nevada - Southern Cascade Mountains” is being prepared.

## EMC-2018-003: Alternative Meadow Restoration

Results for this project are expected in 2022, and as such, no publications or presentations occurred in 2021. A project update was provided at the April 21, 2021 meeting.

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

A project update was provided at the April 21, 2021 EMC meeting. A recorded project presentation, virtual field tour, and project status update were provided at the July 21, 2021 EMC meeting. Final results for this project are expected 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

Project updates were provided at the July 21 and October 21, 2021 EMC meetings, and results are expected in 2022.

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

No project updates or deliverables were provided in 2021.

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

Results for this project are expected in 2022, and as such, no publications or presentations occurred in 2021. Project updates were provided at the April 21 and October 21, 2021 meetings.

# POTENTIAL EMC PROJECT IMPACTS TO REGULATIONS

The EMC provides valuable insight to the Board on testing the effectiveness of their rules and 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 Forest Practice Rules (14 CCR § 895 et seq.). The EMC moved findings from EMC-2015-001 (Class II Large Watercourse Study) and EMC-2016-002 (Post-fire Effectiveness of the Forest Practice Rules) to the Board for consideration in 2021, and expects to move findings from EMC-2016-003 (Repeat LiDAR Surveys to Detect Landslides), EMC-2017-006 (Tradeoffs among Riparian Buffer Zones, Fire Hazard, and Species Composition in the Sierra Nevada), and EMC-2017-008 (FPRs to Minimize Fir Mortality from Root Diseases) to the Board for consideration in 2022.

# REFERENCES CITED

Pate, A.A., C. Segura, and K.D. Bladon. 2020. Streamflow permanence in headwater streams across four geomorphic provinces in Northern California. *Hydrological Processes* 34(23):4487–4504. DOI: <https://doi.org/10.1002/hyp.13889>

1. 1 AB-1492 Forest resource management (2011-2012), Health & Safety Code 13009.2; see <https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB1492> [↑](#footnote-ref-1)
2. 2 https://bof.fire.ca.gov/media/10115/effectiveness-monitoring-committee-charter-7120\_ada.pdf [↑](#footnote-ref-2)
3. https://bof.fire.ca.gov/media/9122/2018-emc-strategic-plan-ada.pdf [↑](#footnote-ref-3)
4. https://bof.fire.ca.gov/media/gijnn1q0/2020-emc-annual-report-and-workplan.pdf [↑](#footnote-ref-4)
5. <http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201120120AB1492>. [↑](#footnote-ref-5)