CAL FIRE Demonstration State Forest Research
Fire and Resource Assessment Program (FRAP)

The CAL FIRE Fire and Resource Assessment Program (FRAP) conducts and supports scientific research and monitoring related to a variety of wildfire and forest health issues at the Demonstration State Forests (DSF's) through staff-led projects and collaborations. Additionally, FRAP administers the CAL FIRE-CCI Forest Health Research Program, which provides grants for high-level scientific research, primarily through a competitive proposal and selection process. A portion of the grant program funds are allocated to projects with study sites at the CAL FIRE-managed DSFs.

FRAP-Led Research and Monitoring Projects at DSF's

Project Title: Carbon, fire hazard, and forest regeneration dynamics following high severity wildfire in a mixed-conifer forest

Location: Boggs Mountain DSF

Principal Investigator: Dave Sapsis (dave.sapsis@fire.ca.gov)

Funding: FRAP Staff Time

Status and Duration: Active; 2016-present. Preparing for third post-harvest remeasurement.

Summary: This study aims to evaluate fire hazard, carbon dynamics, and vegetation recovery under different management options following a high severity wildfire at Boggs Mountain Demonstration Forest (BMDF). Three experimental treatments representing different post-fire reforestation approaches, plus a control treatment have been applied in approx. 10 acre units, and replicated five times. Additional studies have leveraged the experimental design to examine wildlife responses and soil carbon.

Project Title: Whitmore Fire Plantation Restoration Study

Location: LaTour DSF

Principal Investigator: Dave Sapsis (dave.sapsis@fire.ca.gov)

Funding: FRAP Staff Time

Status and Duration: Active; 2018-present. Treatments to be completed Summer 2021.

Summary: This study aims to evaluate options for restoring an area at LDSF that burned in the 1978 Whitmore Fire, and was subsequently replanted with little subsequent management actions. Densely spaced ponderosa pine with significant shrub understory and low crown contribute to high fire hazard.

Two experimental treatments representing different residual densities are being applied, plus a control. All treatment units will include mastication of understory shrub component.

Project Title: Prescribed Fire Monitoring

Location: Multiple locations around the state, including LaTour DSF and Mountain Home DSF.

Principal Investigator: Joe Restaino (joe.restaino@fire.ca.gov)

Funding: FRAP Staff Time; FY 2018-19 Forest Carbon Plan Implementation Funds (per SB 901)

Status and Duration: Ongoing program; 2019- present.

Summary: The Joint Prescribed Fire Monitoring Program gathers air quality, fuel consumption and vegetation data for prescribed fires in select locations around the state. Pre-fire, active-fire and post-fire data is taken through instrumentation, observation and long-term measurement plots. By ensuring prescribed burns are being conducted in the most effective manner possible with the least negative impacts, more prescribed fire can be used as a treatment tool for sustained resiliency.

FRAP-Funded Research and Monitoring Projects at DSF's

Project Title: Sierra Nevada Adaptive Management Experiment

Location: Mountain Home DSF, LaTour DSF, Grouse Ridge Experimental Forest (University of California), Stanislaus-Tuolomne Experimental Forest (USFS) and Eshom Forest (USFS).

Principal Investigator: Sarah Bisbing Ph.D., University of Nevada Reno (sbisbing@unr.edu); Rob York, University of California (ryork@berkeley.edu)

Funding: FRAP contract 2018; CAL FIRE-CCI Forest Health grant FY 2018-19.

Status and duration: Active; 2018-present.

Summary: The Sierra Nevada Adaptive Management Experiment (AMEX) is a large-scale, replicated experiment utilizing progressive, scientifically-supported silvicultural treatments to increase resilience, resistance, and adaptation capacity of California's Sierra Nevada mixed conifer forests. The experiment is designed to generate and track long-term changes in forest composition, structure, and function under ongoing and future climate change, and treatments represent a basic suite of plausible approaches that managers may feasibly take to address ongoing and novel stresses to forest ecosystems.

Project Title: Massive tree mortality in the Sierra Nevada: Consequences for forest health, carbon storage and wildfire hazard

Location: Eight sites across the Sierra Nevada, including Mountain Home DSF and LaTour DSF.

Principal Investigator: John Battles Ph.D., UC Berkeley (jbattles@berkeley.edu); Jodi Axelson Ph.D., UC Berkeley (jodi.axelson@berkeley.edu)

Funding: FRAP contracts to University of California, 2017 and 2020

Status and Duration: Active; 2017-present. Plot re-measurements underway for summer 2021

Summary: Through two sequential agreements with CAL FIRE, this project is tracking ongoing tree mortality and causes, tree fall rates, surface fuels accumulation and shrub and conifer regeneration responses related to the severe drought of 2012-2015.

Project Title: Effects of the 2020 Castle Fire and prior management on the giant sequoia-mixed conifer forests of Mountain Home DSF

Location: Mountain Home DSF

Principal Investigator: Sarah Bisbing Ph.D., University of Nevada Reno (sbisbing@unr.edu); Rob York, University of California (ryork@berkeley.edu)

Funding and Duration: FRAP contract with UNR, May 2021.

Status: Active; May 2021-present. Post-fire plot remeasurements underway for summer 2021.

Summary: This project leverages the long-term plot network established in 2019 as part of the FRAP-funded Adaptive Management Experiment to evaluate impacts of the 2020 Castle Fire on the mixed-conifer forests of Mountain Home DSF. Additionally, the project will evaluate impacts to old-growth giant sequoia trees within the DSF and examine prior forest management activity and its impacts on outcomes of the Castle Fire.

Project Title: Fire severity in Giant Sequoia groves: comparing patterns observed in Mountain Home State Demonstration Forest to those observed in adjacent forests.

Location: Mountain Home DSF and multiple surrounding locations

Principal Investigator: Scott Stephens, Ph.D., UC Berkeley (sstephens@berkeley.edu); Brandon Collins Ph.D., UC Berkeley (bcollins@berkeley.edu)

Funding: FRAP contract with UC Berkeley, May 2021.

Status and duration: To be initiated in 2022 (under active contract/MOU for multiple studies); Contract open May 2021 – March 2024.

Summary: This analysis will examine the factors that contributed to the observed fire severity patterns within and among giant sequoia groves at Mountain Home DSF and adjacent forests. The suite of potential factors examined will include: 1) pre-fire structural and compositional characteristics, e.g., overstory tree density, ladder fuel density, proportion of drought-related tree mortality (to the extent

these data are available); 2) fire weather, linked spatially with fire progression maps; and 3) biophysical environmental characteristics, primarily moisture availability indices and topography.

Project Title: Fire Ecology and Conservation of Pygmy Forest at Jackson State Demonstration Forest

Location: Jackson DSF

Principal Investigator: Scott Stephens, Ph.D., UC Berkeley (sstephens@berkeley.edu); Brandon Collins Ph.D., UC Berkeley (bcollins@berkeley.edu)

Funding: FRAP contract with UC Berkeley, May 2021.

Status and Duration: To be initiated in 2022 (under active contract/MOU for multiple studies); contract open May 2021 – March 2024.

Summary: Pygmy forests are a unique and important forest type in California that has received little management attention. This project will implement a set of replicated prescribed fires to measure their effects on tree and understory plant regeneration. We intend to do this for two seasons, spring and fall, to investigate any potential influence of fire seasonality on regeneration.

CCI Forest Health Research Program – Grants Awarded for Study at DSF's

Project Title: Effects of dead tree removal on the resilience and successional trajectory of high-mortality forests

Location: Multiple sites across the southern and central Sierra Nevada, including Mountain Home DSF.

Principal Investigator: Rebecca Wayman, UC Davis (rbwayman@ucdavis.edu)

Funding: FY 2018-19 Forest Health Research Program Grant

Status and Duration: Active; 2019-2023

Summary: Widespread dead-tree removal has been occurring throughout areas of recent severe tree mortality in the mixed conifer forests of California's Sierra Nevada, yet the effects of such treatments on ecosystem recovery are not well understood. This observational study is examining paired treated (recent salvage) and untreated (no salvage) sites to assess forest ecosystem recovery in terms of carbon dynamics, tree regeneration, fuels, and understory plant communities.

Project Title: Using UAV's and Big Data to Map Live Trees and Predict Postfire Regeneration

Location: Multiple sites in Northern CA, including Boggs Mountain DSF

Principal Investigator: Derek Young, Ph.D., UC Davis (djyoung@ucdavis.edu); Andrew Latimer, Ph.D., UC Davis (amlatimer@ucdavis.edu)

Funding: FY 2018-19 Forest Health Research Program Grant

Status and Duration: Active; 2019-2023

Summary: This project aims to substantially improve predictions of post-fire seedling recruitment using by 1) creating a spatially extensive stem maps of seed sources (surviving trees) using UAV ("drone") imagery, and 2) applying a spatially explicit optimization model to characterize individual-tree dispersal patterns and the joint contribution of multiple seed sources (mature trees) to seed rain. We use our fitted model to make predictive maps of natural regeneration at high resolution (10 m) across large landscapes (~ 300 ha).

Project Title: Evaluating plot-level remote sensing tools to increase accuracy and efficiency of fuels management approaches

Location: Multiple sites in northern California, including LaTour DSF, Jackson DSF, and Pepperwood Preserve

Principal Investigator: Lisa Bentley Ph.D., Sonoma State University (lisa.bentley@sonoma.edu)

Funding: FY 2018-19 Forest Health Research Program grant

Status and Duration: Active; 2019-2023

Summary: This study aims to evaluate the use of innovative remote sensing techniques, including terrestrial laser scanners (TLS) and low-cost unmanned aerial systems (UAS), combined with modern data processing techniques, to acquire detailed measurements of 3-dimensional forest structure in coastal and southern Cascade forests of northern California. Estimates of above-ground biomass (AGB) are related to tree properties (e.g., DBH, height) for a range of species, and used estimate crucial fuels parameters to help validate or refine behavior models across diverse California forests.

Project Title: Decentralized biomass torrefaction to reduce cost and improve utilization of woody biomass

Location: Jackson DSF

Principal Investigator: Daniel Sanchez, Ph.D., UC Berkeley (sanchezd@berkeley.edu)

Funding: FY 2018-19 Forest Health Research Program grant

Status and Duration: Active; 2019-2023

Summary: One of the biggest challenges related to forest treatment is the management of the treated biomass residues in a way that minimizes their costs and maximizes carbon emissions reductions. This study aims to evaluate decentralized biomass torrefaction of unmerchantable tanoak in Jackson Demonstration State Forest as a possible approach to reduce the logistical costs of transporting biomass residues, and to increase the amount of carbon that can be mitigated.

Project Title: Simulating the heterogeneous consequences of widespread forest health treatments for California mixed conifer forest resilience to climate change and wildfire

Location: Forest inventory data from multiple sources, including LaTour DSF, Boggs Mountain DSF, and Mountain Home DSF are used to parameterize and benchmark the models.

Principal Investigator: Lara Kueppers, Ph.D., UC Berkeley (lmkueppers@berkeley.edu)

Funding: FY 2019-20 Forest Health Research Program grant

Status and Duration: Active; 2020-2024

Summary: This study uses data-constrained, process-based vegetation modeling to examine the long-term consequences of forest health treatments, specifically thinning and prescribed burning, on future forest CO2 emissions and resilience to drought and wildfire in a changing climate. It supports implementation of the CA Forest Carbon Plan by providing stakeholder-informed projections that vary in assumptions regarding management, future climate, and existing stand conditions across California's mixed conifer forest.

Project Title: Sierra Nevada-wide provenance trials to support climate-based seed zones and reforestation efforts

Location: Multiple Sites across the Sierra Nevada, including LaTour DSF and Mountain Home DSF.

Principal Investigator: Sarah Bisbing, Ph.D., University of Nevada Reno (sbisbing@unr.edu)

Funding: FY 2019-20 Forest Health Research Program grant

Status and Duration: Active; 2020-2024

Summary: Use of locally-adapted seed is the foundation of reforestation, but unprecedented megafires and rapid climate change are likely to drive regeneration failures under a business-as-usual reforestation policy. This study pairs Sierra Nevada-wide provenance (seed origin) trials with landscape genomics to quantify seedling success and local adaptation to climate in five economically and ecologically important conifers. Our objective is to identify provenances with high tolerance for climatic variability to guide seed and species selection in reforestation.

Project Title: Coast Range Dry Forest Restoration

Location: Multiple sites across northern California, including Jackson DSF

Principal Investigator: Pascal Berrill, Ph.D., Humboldt State University (pberrill@humboldt.edu)

Funding: FY 2014-15 Forest Health Program grant

Status and Duration: Completed; 2016-2020

Summary: This replicated field experiment is aimed at demonstrating and quantifying greenhouse gas (GHG) reductions achieved by forest restoration. We test different combinations of restoration

treatment options that enhance carbon sequestration by favoring fast-growing conifers over hardwoods, and remove or modify the arrangement of flammable harvest residues (surface fuels).