Proposal overview

Problem Statement: Fuel reduction treatments are implemented to reduce crown fire activity, flame lengths, burn severity and tree mortality. However, there is a lot of uncertainty around how long treatments remain effective and robust long term datasets are extremely rare. Here, we propose to collect and analyze an unprecedented dataset of 316 plots that were previously measured immediately before and after treatment, by completing vegetation and fuel surveys now, 10-14 years after treatment. From these data we will characterize how different fuel types accumulate over time, and how this affects potential fire behavior, to improve understanding of treatment effectiveness, longevity, and retreatment requirements.

Objectives: The three primary objectives of the proposed work are to 1) complete long-term monitoring at 316 sites that have had fuel treatments in the past 10-14 years by measuring post-treatment patterns of fuel accumulation and vegetation change over time, 2) define treatment effectiveness thresholds and longevity estimates by quantifying vegetation change and simulating fire behavior, and 3) improve understanding of treatment longevity and how it may change in the future, in order to inform the frequency and type of treatments needed to maintain treatment effectiveness

Benefits: The proposed work will provide a large unique dataset and analysis that will benefit operations agencies through improved understanding of the longevity of past treatments, improving their ability to plan for re-treatments where needed. We will also publish a web application and maps of treatment longevity into the future to provide guidance for current and future treatments. Finally the broader fire science and ecology fields will benefit from a comprehensive analysis of vegetation change and long term treatment effectiveness that will fill a wide knowledge gap.

Task Statement Relevancy: The proposed work will directly address: **Research Need 1**, *"Improved understanding of vegetation change and fuel accumulation for different fuel types (e.g., grasses, tree seedlings, shrubs, canopy fuels) following fuel treatments and how rates of change vary with site characteristics (e.g., productivity, disturbance history), fuel treatment characteristics (e.g., type, season, frequency), and climate regimes.",* through our first objective, where we will use repeated measurements (pre-, 1 year post- and 10 year post-treatment) at 316 sites to model the response of different fuel types to environmental filters while accounting for inter-fuel type interaction. **Research need 2**, *"Improved understanding of the longevity of fuel treatment effectiveness and long-term maintenance needs from the perspective of change over time in potential fire behavior (e.g., flame lengths, rate of spread) and other ecological attributes that are incorporated into fuel treatment objectives."*, will be addressed through our second and third objectives, where we use fire behavior modeling to understand how potential fire behavior is changing in response to the treatments over time. **Research need 3**, *" Incorporation of additional collected data into existing models and decision support tools that predict ecosystem change over time under different climate change scenarios and use of such models to project trends in fuel treatment effectiveness in the future."*, will be addressed in objective three by incorporating future climate projections into the models developed in the first two objectives to estimate treatment longevity for current and future treatments, and in addition by creating a web application that stakeholders can use to input site characteristics and estimate retreatment frequency, using either R shiny or Google Earth Engine platform.