National Aeronautics and Space Administration

FY23 Strategic University Research Partnership (SURP)

Quantifying functional stability of California ecosystems using imaging spectroscopy after a decade of drought and fire

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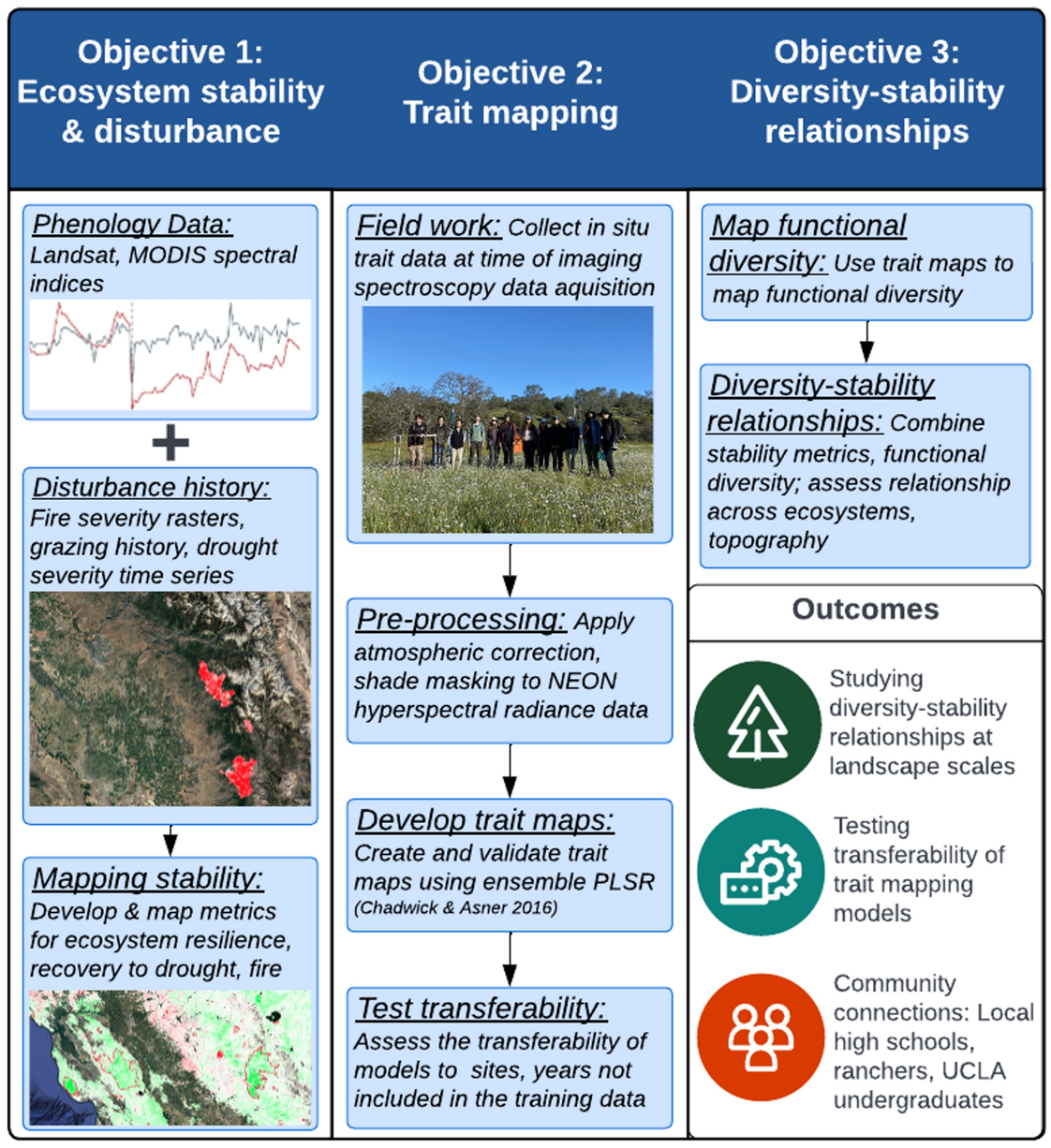
Background: This project is quantifying ecosystem responses to disturbance across California, ranging from grasslands and Mediterranean oak woodlands to high elevation closed canopy forests. Results from this project will inform the sensitivity and stability (i.e., maintenance of function over time) of terrestrial ecosystems' carbon storage and biodiversity to climate change.



Objectives:

1. Characterize decadal fire and drought disturbance histories and phenological shifts across an environmental and ecological gradient in southern California,
2. Estimate plant traits and uncertainties using imaging spectroscopy, and test the transferability of trait mapping models across study sites and years,
3. Analyze plant trait variability in space and time in relation to disturbance regimes and vegetation types.

Approach and Results for Year 1:

During the 2023 field season, we collected 256 samples across two sites (*Figure 1*). Foliar samples are currently being processed for 13 functional traits. Additional sampling will occur in Soaproot Saddle in 2024.

We also began analyzing Landsat and MODIS time series following known drought and fire events (*Figure 2*). We are working towards developing metrics for ecosystem variability, recovery, and resilience to disturbances of varying severity across California ecosystems. For our next steps, we will map these metrics over the entire study region.

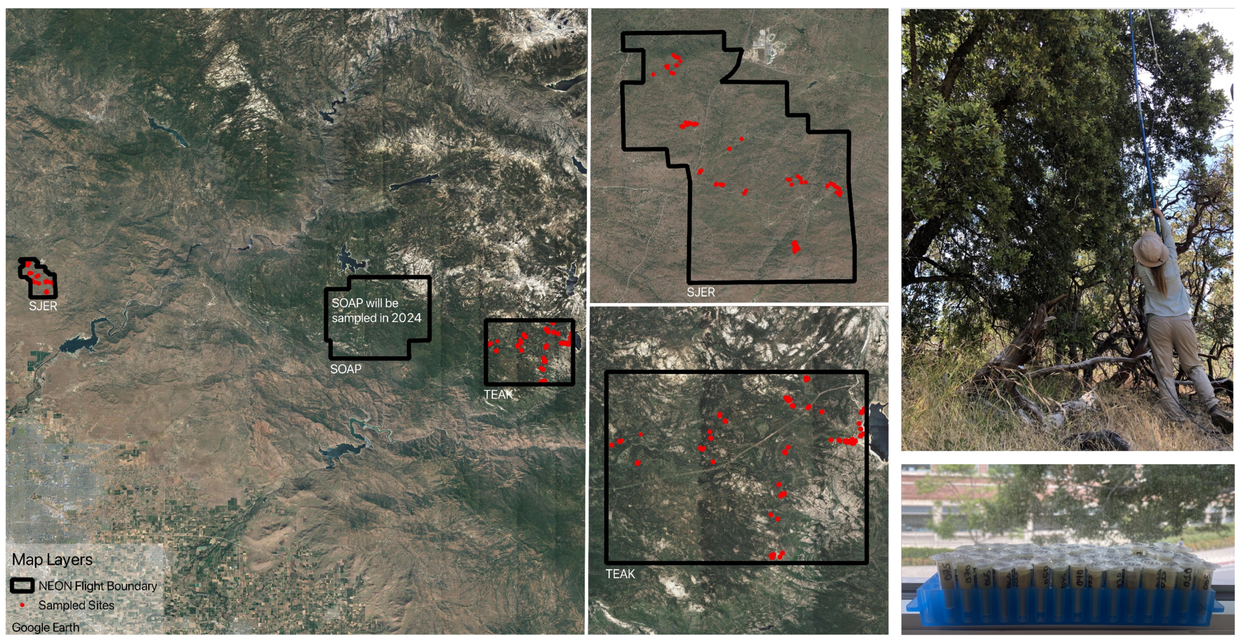


Figure 1. 2023 Sampling locations for San Joaquin Experimental Range (SJER) and Lower Teakettle (TEAK). The NEON flightbox for each site is outlined in black. Sampled locations are shown in red. The right photos show sample collection from a tree canopy and and ground foliar samples.

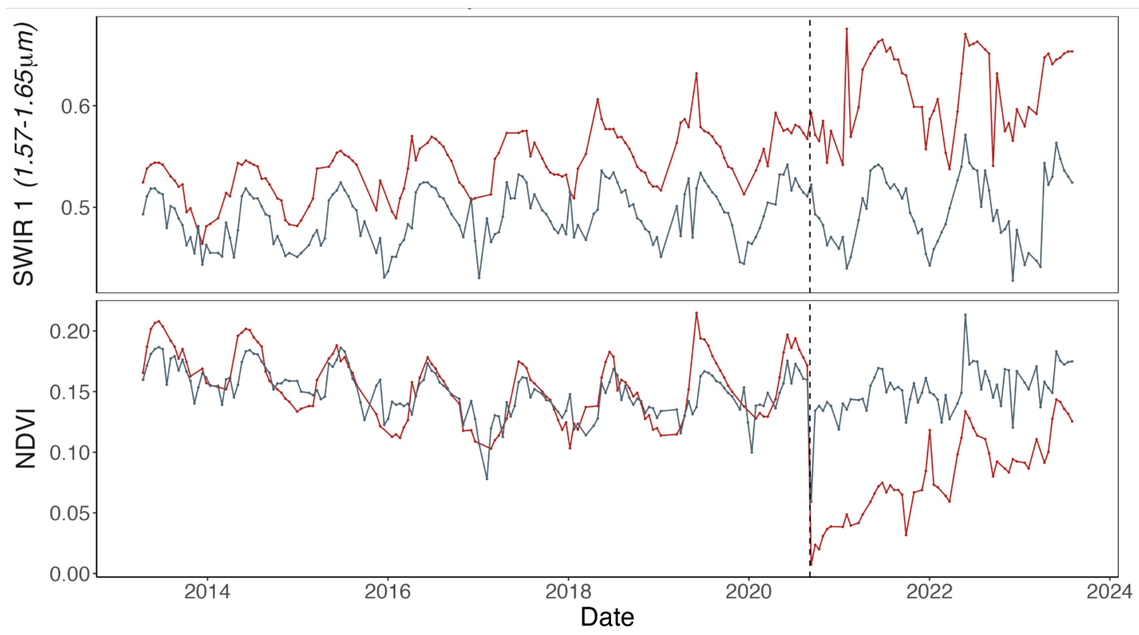


Figure 2. Time series of median values for Landsat short-wave infrared (SWIR) band 1 and normalized difference vegetation index (NDVI) for an unburned (blue line) and high severity burn (red line) region. The Creek Fire began in September 2020, as indicated by the dashed grey line.

Significance/Benefits to JPL and NASA:

- Leverage data and plant functional trait models produced for SHIFT, testing their consistency, transferability and usefulness to quantify functional stability of California ecosystems
- Provide early use cases for data and workflows as they will become available from JPL-led EMIT and SBG missions.
- Utilize the SHIFT and NEON data to study the relationships between biodiversity and ecosystem stability following fire and drought across an elevational gradient in California ecosystems

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