National Aeronautics and Space Administration

FY24 Strategic University Research Partnership (SURP)

Scaling the remote sensing of invasive species in California (CalWeeds)

Principal Investigator: Kerry-Anne Cawse-Nicholson (329)**; Co-Investigators:** Roberta Martin (Arizona State University), Amy Mainzer (University of California Los Angeles), Nicoletta Stork (Arizona State University)

Objectives: The objective of this study is to develop a standardized framework for detecting invasive plant species at multiple spatial scales. To do this, we will define species-level classifications of non-native plants in Southern California parklands using NASA's Airborne Visible/Infrared Imaging Spectrometer (AVIRIS; both the classic and Next Generation instruments), and upscale these measurements to determine the accuracy and precision of the detection of invasive species at the spectral and spatial resolution of NASA satellite data.

Background: Non-native species invasions are identified as a significant driver of global biodiversity loss and are causing widespread ecosystem degradation, often with irreparable consequences. Non-native plant species are naturally spreading in vulnerable areas and disturbance events such as wildfires are exacerbating invasions while native communities recover [A].

Approach and Results: A species classification model was built using high spatial and spectral resolution imagery data within the Santa Monica Mountains National Recreation Area. Five target invasive plant species (IPS; Figure 1) were targeted because of their pervasive growth after disturbance and their significant contributions to ecosystem degradation.

Significance/Benefits to JPL and NASA: The development of spatial scaling frameworks will benefit NASA's Decadal Survey objectives and future missions such as the Surface Biology and Geology (SBG). Invasive species maps will provide decision support to Southern California land managers by supplying accurate measurements of terrestrial vegetation distributions and will support global conservation efforts through the optimization of contemporary imaging spectroscopy technology.

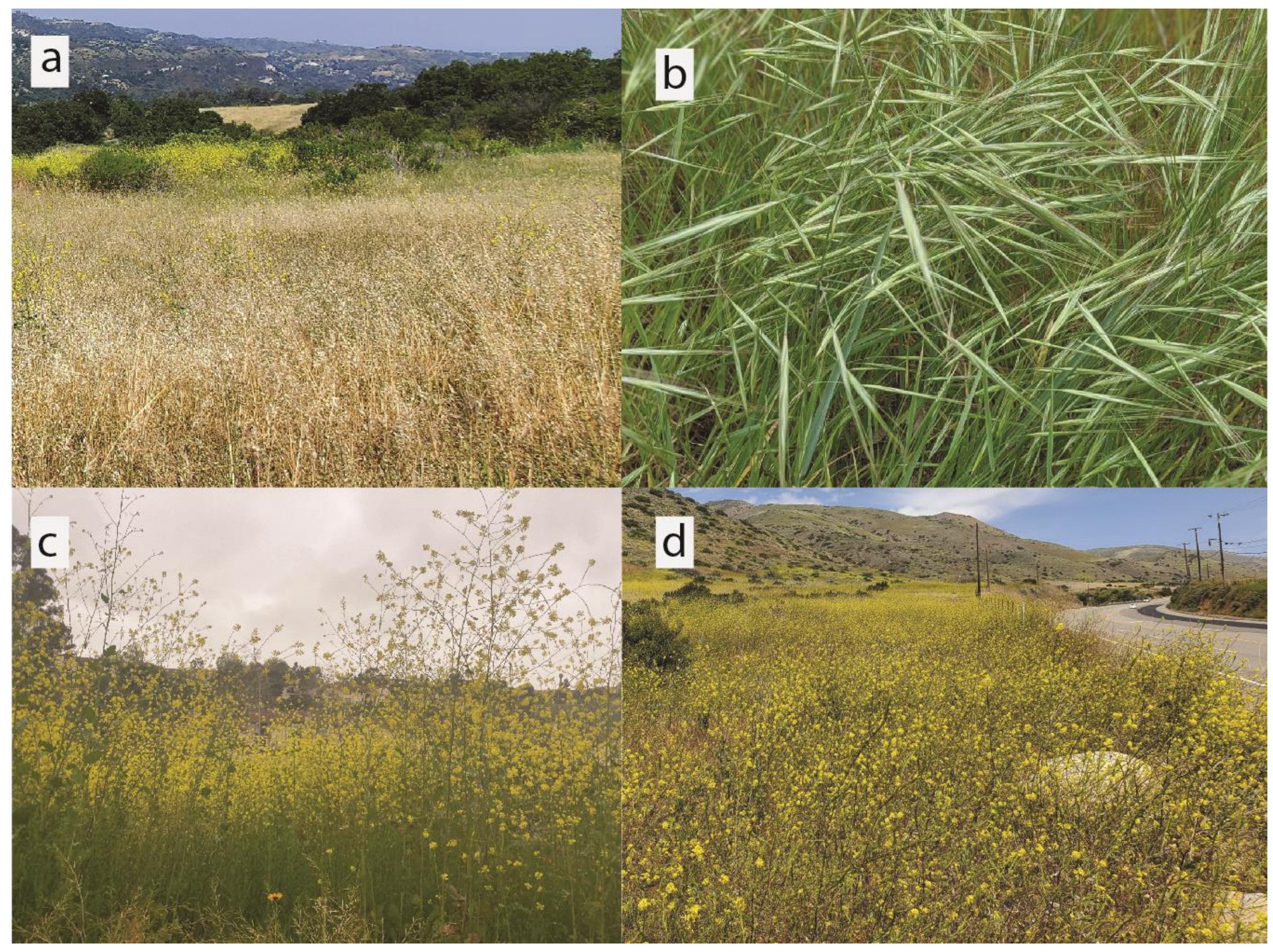

Figure 1. Images of sample invasive target species; (a) *Avena spp*. (wild oat grass), (b) *Bromus diandrus* (ripgut brome grass), (c) *Brassica nigra* (black mustard), (d) *Hirschfeldia incana* (shortpod mustard).

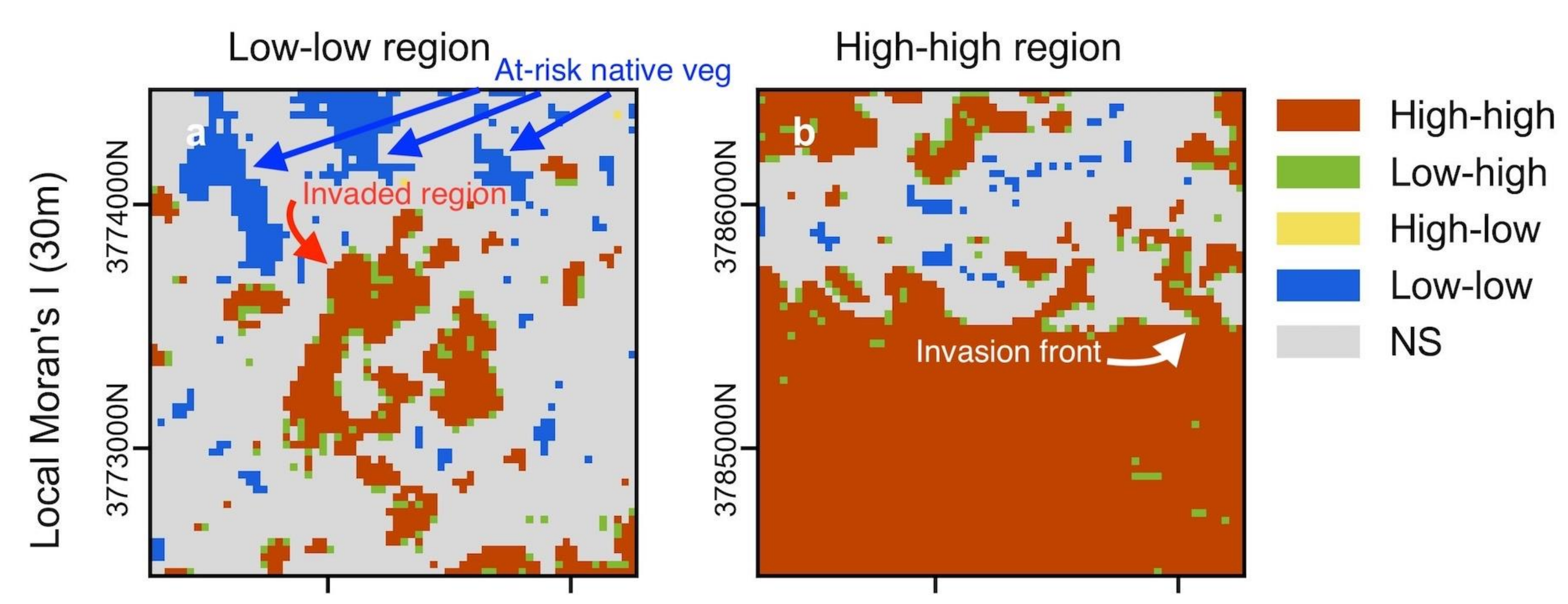

Figure 2. Species characterization maps, where "high-high" indicates regions with high invasion, surrounded by other areas that also have high invasion (land managers should target the "invasion front"). "Low-low" indicates regions with low invasion. "High-low" indicates regions with high invasion surrounded by regions with low invasion (greatest risk).

Publications:

[A] Nicoletta Stork, Amy Mainzer, & Roberta Martin, "Native and non-native plant regrowth in the Santa Monica Mountains National Recreation Area after the 2018 Woolsey Fire," Ecosphere, 14(6), e4567, 2023. https://doi.org/10.1002/ecs2.4567

[B] Nicoletta Stork, Amy Mainzer, Brooke Carruthers, Mark Mendelsohn, Gregory Asner & Roberta Martin, "Mapping distribution patterns of invasive alien species in the Santa Monica Mountains using airborne imaging spectroscopy and line-point transect data," *GIScience and Remote Sensing*, **In review**.

PI/Task Mgr. Contact Information:
Kerry-Anne.Cawse-Nicholson@jpl.nasa.gov

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

RPD-077 Clearance Number: CL#24-5184