Characterizing change in the yellow bush lupine, *Lupinus arboreus*, using high-resolution aerial photography

### High-Resolution Tracking of Bush Lupine Die-off

- The yellow bush lupine is a nitrogen fixing plant found on the coast of California.
- Bush lupine die-off has been associated with root-feeding parasitism by the ghost moth caterpillar, *Hepialus californicus*.
- The ghost moth caterpillar is subject to parasitism by entomopathogenic nematodes.
- If these nematodes are present in the soil around a lupine bush, ghost moth caterpillars rarely succeed in invading the roots.
- Assessing lupine health across the Bodega Marine Reserve could help keep track of lupine plots currently being analyzed and highlight new plots for further study of this trophic cascade.

### Can a bird’s-eye view detect a bush-sized change?

- Ground-based spatial analysis of large areas can be expensive and time consuming.
- Remote sensing can accomplish change detection on large scales and can be updated as frequently as data becomes available.
- Most fine-scale vegetation assessments/change detection studies make use of hyperspectral imagery to distinguish between different species and landforms.
- Our photos are limited to the visible spectrum, making it difficult to identify lupine amidst the rest of the landscape.

### Is analysis on the individual bush level still possible with the imagery we have?

- The spectral profile of the land-cover classes from both years shows that lupine may be hard to pick out from the rest of the landscape using spectral information alone.
- However, the human eye and brain can pick up on subtleties of texture and feature shapes that are generally confined to the more advanced extensions of the BML’s imaging software.
- If individual plants can be clipped from the rest of the landscape, there may be enough difference between the live and dead portions of the plant’s crown cover to give relative estimates of plant health from year to year.
- This study will assess the effectiveness of hand-based extraction and analysis of individual lupine plants in estimating the area of live vs. dead crown cover for the lupine plots set up on Mussel Point by the Strong lab.
- If this analysis method can produce enough accuracy, it may be implemented in place of extensive ground-based lupine assessments. If ineffective, it provides a reasonable rationale for the acquisition of hyperspectral imagery.

### Three Classification Methods

- Once the individual lupine bushes are extracted from the photo, I will compare two supervised and one unsupervised classification method.

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