The broad goal of our research is to assess the need for multi-temporal, hyperspectral satellite imagery for improved land cover mapping across a range of environmental and anthropogenic gradients. Here we present results of mapping 20 Land Cover Classification System (LCCS) classes over 30,000 km^2 in San Francisco Bay Area using multi-temporal, HyspIRI imagery simulated from the AVIRIS sensor. HyspIRI is a proposed VSWIR hyperspectral satellite sensor being considered by NASA. The Random Forests (RF) classifier was applied to surface reflectance, hyperspectral metrics, and minimum noise fraction (MNF) variable bundles derived from HyspIRI-like data at 30- and 60-m pixel scales, including summer and spring-summer-fall collections from 2013. The final LCCS maps were mosaicked using the class with maximum RF confidence in areas of scene overlap.

In terms of overall accuracy, the best predictor variables were hyperspectral metrics bands, followed by reflectance, then MNF. With hyperspectral metrics, there was a 3.6% and 14.5% improvement in overall accuracy when using multi-season versus summer-only data for 30-m and 60-m maps, respectively. When comparing spatial resolution, we found a 10.6% improvement in accuracy in 30-m over 60-m maps using summer imagery, but a very small difference in accuracy between scales with multi-temporal imagery. We compared maps based on multi-temporal, hyperspectral metrics to those based on multi-temporal, simulated Landsat 8 OLI bands. There was an improvement of 7.6% increase in accuracy using hyperspectral imagery relative to Landsat, both at 30-m resolution. HyspIRI-like data produced maps with less visible seams across runs. All LCCS maps were weakest when discriminating different forest life-form types, such as mixed conifer and broadleaf forests and open- and closed-canopy forests.