National Aeronautics and Space Administration

Evaluating RADAR-Imaging spectrometer fusion approach to map post-fire vegetation structure

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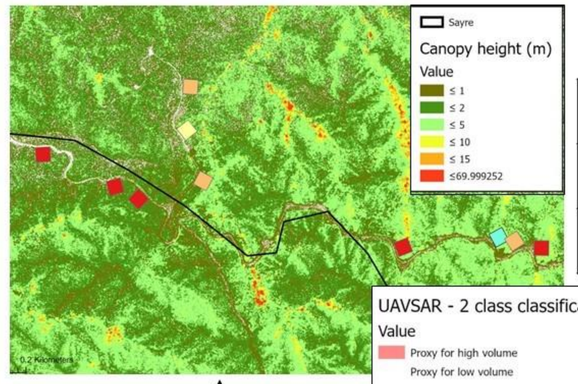
Objective: The overall objective was to study the potential application of combining SAR with spectroscopic data for vegetation composition mapping. We focused our analysis on post-fire vegetation over the Sayre fire scar (burnt in 2008) in the Angeles National Forest, California. The specific objectives were to a) Map structural vegetation classes over Sayre using UAVSAR data and b) Quantify the improvement in vegetation classification accuracy by combining UAVSAR-derived structural vegetation classes with AVIRIS data.

Background: Imaging spectroscopy data, such as AVIRIS, can help differentiate vegetation based on the chemical properties, but it does not differentiate vegetation structural characteristics, which makes identifying vegetation communities difficult. RADAR data, though primarily collected to monitor ground movement and subsidence, can be used to make inferences on vegetation structural characteristics. Unmanned Aerial Vehicle Synthetic Aperture Radar (UAVSAR) data are routinely collected over Southern California to monitor earthquakes and movement over the San Andreas Fault. These data sources are largely underutilized for vegetation monitoring, but can be a powerful resource, especially when used in combination with imaging spectrometer data.

Approach and Result: Using data from L-Band UAVSAR we classified ‘high volume’ and ‘low volume’ vegetation classes in the study region. We compared these volume classes with vegetation height from lidar and field data collected in 2018. 77% of the grass-dominant plots were classified as ‘low-volume’ vegetation. 72% of the oak-dominated plots were classified as ‘high-volume’. 53% of the shrubs were classified as ‘low-volume’.

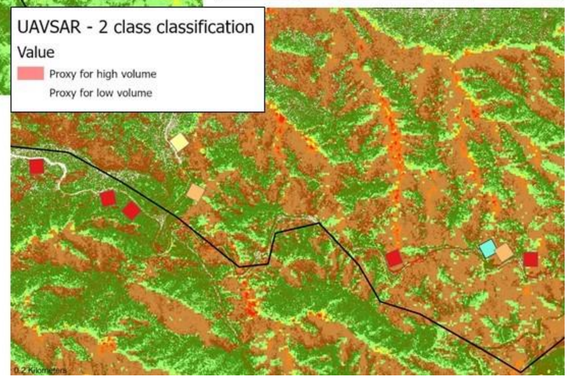
The UAVSAR-derived high-low volume classification was used as a first stage in a decision tree to partition AVIRIS data. We then used Multiple Endmember Spectral Mixture Analysis to identify dominant vegetation communities. Using field data we performed a classification accuracy assessment. Overall, we found that using UAVSAR along with AVIRIS improved the classification accuracy for vegetation communities (53% for UAVSAR+AVIRIS; <40% for AVIRIS only). Although using lidar data provided a better improvement in accuracy (59%for Lidar+AVIRIS), UAVSAR shows considerable potential to improve and enhance vegetation classification from AVIRIS data.



Canopy height	<1 m	<2m	<5m	<10 m	<15 m	<70 m
Low Volume	41.04	36.59	16.29	4.78	1.06	0.24
High Volume	9.77	26.70	35.53	19.51	6.73	1.76

Canopy height from Lidar (2016)

2-class classification from UAVSAR overlaid on canopy height.



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Significance/Benefits to JPL and NASA: This project demonstrated the potential in using SAR data along with imaging spectrometer data and is directly relevant for JPL to build synergy between the upcoming Surface Biology and Geology (SBG) designated Observable, and the NISAR mission to advance science and applications.

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