

Assessment of vegetation regeneration after fire through multitemporal analysis of AVIRIS images in the Santa Monica Mountains

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Abstract

Spectral mixture analysis (SMA) from Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) was used to understand regeneration patterns after fire in two semiarid shrub communities of the Santa Monica Mountains, California: northern mixed chaparral and coastal sage scrub. Two fires were analyzed: the Malibu Topanga fire (3 November 1993) and the Calabasas fire (21 October 1996). SMA was compared to the results of the Normalized Difference Vegetation Index (NDVI) to assess vegetation recovery. An unburned control plot (within the past 20 years), having similar environmental features, was used to generate two relative fire regeneration indices, Regeneration Index (RI) and Normalized Regeneration Index (NRI). Indices were calculated using the Green Vegetation (GV) endmember and the NDVI. These indices were determined to be largely independent of AVIRIS radiometric calibration uncertainty, minor errors in the atmospheric correction, topographic distortions, and differences in the phenological state of the vegetation because of interannual or seasonal differences. The temporal evolution of the two fires were combined to produce a longer observation period and used to fit a logarithmic regression model for each Mediterranean shrub community. The NRI developed from the GV endmember (NRIGV) produced the closest estimate for the time of recovery in both communities based on recovery times in the literature. The use of NDVI worked very well for recovery in the northern mixed chaparral, but was less successful in the coastal sage scrub, mainly because of extensive herbaceous cover during the first years of the regeneration process. Endmembers generated from hyperspectral images were more accurate because they are tuned to capture the greenness of the shrub type of vegetation. Use of matching plots having similar environmental features, but which were burned in different years were demonstrated to improve estimates of the recovery within each community.