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Monitoring post-fire recovery of shrublands in Mediterranean-type ecosystems using MODIS and TM/ETM+ data

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Wildland fires in Mediterranean-Type Ecosystems (MTEs) are episodic events that dramatically alter land-cover conditions. Monitoring post-fire vegetation recovery is important for land management applications such as the scheduling of prescribed burns, post-fire resource management and soil erosion control. Full recovery of MTE shrublands may take many years and have a prolonged effect on water, energy and carbon fluxes in these ecosystems. Comparative studies of fynbos ecosystems in the Cape Floristic Region of South Africa (Western Cape Region) and chaparral ecosystems of California have demonstrated that there is a considerable degree of convergence in some aspects of post-fire vegetation regeneration and marked differences in other aspects. Since these MTEs have contrasting rainfall and soil nutrient conditions, an obvious question arises as to the similarity or dissimilarity in remotely sensed post-fire recovery pathways of vegetation stands in these two regions and the extent to which fire severity and drought impact the rate of vegetation recovery. Post-fire recovery pathways of chaparral and fynbos vegetation stands were characterized using the normalized difference vegetation index (NDVI) based on TM/ETM+ and MODIS (250 m) data. Procedures based on stands of unburned vegetation (control) were implemented to normalize the NDVI for variations associated with inter-annual differences in rainfall. Only vegetation stands that had not burned for 20 years were examined in this study to eliminate potential effects of variable fire histories on the recovery pathways.
Post-fire recovery patterns of vegetation in both regions and across different vegetation types were found to be very similar. Post-fire stand age was the primary control over vegetation recovery and the NDVI returned to pre-fire values within seven to 10 years of the fires. Droughts were shown to cause slight interruptions in recovery rates while fire severity had no discernable effect. Intra-stand variability in the NDVI (pixel-scale) also returned to pre-fire values within the same time frame but increased with water stress associated with droughts. While these studies indicated that the NDVI of fynbos and chaparral stands recovered to pre-fire values within 10 years, it is recognized that other ecosystem characteristics may take considerably longer to recover. Despite the larger pixel size, MODIS data were found to be more suitable for monitoring vegetation post-fire recovery than TM/ETM+ data, requiring considerably less pre-processing and providing substantially more information regarding phenological characteristics of recovery pathways. Future studies will include consideration of fire history in the post-fire recovery characteristics of vegetation in these two MTEs.