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Using NDVI to Monitor Wildfire Activity

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Healthy ecosystems exhibit dynamic relationships between a multitude of ecologic variables. One such variable with importance to current land management practices is wildfires. While wildfires are essential for ecological health, sustained increases in the severity, occurrence, and duration of wildfires can be detrimental to soil health, carbon emission, and biodiversity. The currently observed trend of sustained increases in wildfire activity have resulted in increases in property damage and associated financial costs as wildfires encroach further upon populated areas.

The increased level of wildfire consequences requires advancements in land management policies pertaining to wildfire mitigation, planning, and decision-making. One method for advancing these policies involves the use of remote sensing to support wildfire prediction models such as the National Fire Danger Rating System. Remote sensing provides the ability to measure surface geophysical properties at spatial and temporal resolutions relevant for wildfire application needs. Since fuel is one of the most important impacts on wildfire activity, the remote sensing of vegetation is of interest for wildfire activities. This is especially important due to potential impact of vegetation in all three phases of a wildfire cycle: pre-fire, active fire, and post-fire. While there are many metrics for measuring vegetation, the normalized difference vegetation index (NDVI) has proven to be a useful remotely-sensed parameter in many applications.

This study analyzes the potential for using NDVI observations to monitor all three phases of the wildfire cycle. NDVI estimates were collected by the VIIRS radiometer in the vicinity of the 2021 Caldor wildfire. Pre-fire VIIRS NDVI measurements were examined to establish baseline values that were then compared to data collected during the months of May through December of 2021 and in 2022. Pre-fire data were used to establish monthly baseline values so that monthly anomalies can be determined. These anomalies are compared to the GIS-based wildfire perimeter for the Caldor wildfire during the active and post fire periods. The analysis shows an ability to identify trends that indicate wildfire susceptibility, active fire location and severity, the presence of burn scars and vegetation recovery. The results of the investigation highlight the potential of NDVI use in land management and wildfire applications and shows the potential for further development and implementation with future missions.