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Digital Mapping Burn Severity in Agricultural and Forestry Land over a Half-Decade Using Sentinel Satellite Images on the Google Earth Engine Platform: A Case Study in Isparta Province

Demir, S. and Başayiğit, L.

Isparta University of Applied Sciences

Abstract

Fires have significant impacts on vegetation and ecosystems globally, with varying intensity depending on the severity and duration of the fires. The Difference Normalized Burn Ratio (dNBR) is a powerful tool for assessing burn severity in agricultural and forested areas and is commonly used to measure and predict the extent of fire-affected regions. This study utilizes the Google Earth Engine platform, enabling efficient large-scale spatial analysis. By leveraging Sentinel-2 satellite imagery and code developed on the Google Earth Engine platform, the aim is to evaluate the burn severity over five years (2018-2022) relative to 2017 and assess the fire impacts on land cover. Spatial analysis was conducted using the dNBR index calculated from images captured in August, representing the peak fire season. The burn severity is classified into four levels: "Low," "Moderate-Low," "Moderate-High," and "High" severity classes, providing insights into the changes over the five years. In the Isparta Province, the burned areas are measured as follows: 505 km², 230 km², 287 km², 409 km², and 1672 km² in the "Low" severity class; 27 km², 28 km², 32 km², 46 km², and 217 km² in the "Moderate-Low" severity class; 14 km², 13 km², 15 km², 18 km², and 36 km² in the "Moderate-High" severity class; and 7 km², 4 km², 5 km², 5 km², and 4 km² in the "High" severity class. The results indicated an increase in burn severity in the "Low," "Moderate-Low," and "Moderate-High" classes compared to 2017, while minimal changes are observed in the "High" severity class within agricultural and forested areas. These findings suggest that burn severity in agricultural and forested regions within the study area undergoes changes influenced by global climate change, variations in fire frequency, and size. Notably, agricultural areas show a more significant increase in burn severity class spatial size compared to forested areas. Assessing the long-term impact of fire-induced land cover changes is crucial for effective fire management and ecosystem preservation. This study showcases the potential of open-source platforms for swift, user-friendly, and sustainable management of fire-affected areas. Furthermore, future advancements are expected by utilizing more comprehensive data sources and developing enhanced analysis methods.

Keywords: Burn Severity Index, Sentinel-2, Google Earth Engine, Agriculture land, Forestry land

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