

National-scale spatiotemporal patterns of vegetation fire occurrences using MODIS satellite data

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Abstract

As the risk of climate change increases, robust fire monitoring methods become critical for fire management purposes. National-scale spatiotemporal patterns of the fires and how they relate to vegetation and environmental conditions are not well understood in Zimbabwe. This paper presents a spatially explicit method combining satellite data and spatial statistics in detecting spatiotemporal patterns of fires in Zimbabwe. The Emerging Hot Spot Analysis method was utilized to detect statistically significant spatiotemporal patterns of fire occurrence between the years 2002 and 2021. Statistical analysis was done to determine the association between the spatiotemporal patterns and some environmental variables such as topography, land cover, land use, ecoregions and precipitation. The highest number of fires occurred in September, coinciding with Zimbabwe's observed fire season. The number of fires significantly varied among seasons, with the hot and dry season (August to October) recording the highest fire counts. Additionally, although June, July and November are not part of the official fire season in Zimbabwe, the fire counts recorded for these months were relatively high. This new information has therefore shown the need for revision of the fire season in Zimbabwe. The northern regions were characterized by persistent, oscillating, diminishing and historical spatiotemporal fire hotspots. Agroecological regions IIa and IIb and the Southern Miombo bushveld ecoregion were the most fire-prone areas. The research findings also revealed new critical information about the spatiotemporal fire patterns in various terrestrial ecoregions, land cover, land use, precipitation and topography and highlighted potential areas for effective fire management strategies.