Forest Fires in the Himalayan Foothills: A Major Source of Emissions of Greenhouse Gases and Air Pollutants

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Abstract

Forest fires stand as a central aspect of the triple crisis confronting us today: climate change, air pollution, and biodiversity loss. Despite this, our knowledge on details of the forest fires and their emissions remains insufficient. Of particular concern is the escalating forest fires in the southern side of the Himalayas in recent years, which have emerged as major source of greenhouse gases and air pollutants. Consequently, they profoundly affect air quality and climate change not only within their vicinity but also downwind regions like the Tibetan Plateau. This study analysed forest fires in Nepal and their estimated emissions from 2001 to 2022 using satellite observations (MODIS data), GIS technology, and statistical tools to thoroughly analyse their complex nature. During this period, close to 50,000 forest fires were identified, applying a 50% confidence level threshold in MODIS data. The burned area consistently showed an upward trend, emphasizing their growing significance. Southern Nepal characterized by tropical forests, larger number of fire hotspots and burned areas compared to the northern hilly and mountainous regions. In terms of CO2 emissions, evergreen broadleaf (EBL) forests emitted the most, followed by mixed forests, with the grasslands having the lowest emissions. The spatial distribution of the burned area demonstrated strong correlation with total national emissions of greenhouse gases (CO2, CH4), trace gases (CO, NOx), and aerosols (BC, PM2.5) across different forest types from 2001 to 2022. The year 2016 had exceptionally high number of forest fires and subsequent emissions, especially for CO2 and CH4. The implications of the findings of this study extend beyond scientific comprehension to designing targeted actionable strategies, especially crucial during emergencies and disasters, to tackle forest fires and mitigate their impacts in the vast Himalayan region, which is home to sensitive ecosystems of global significance and vulnerable populations.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

GEIA: Global Emissions Initiative, BBURNED: Biomass Burning Uncertainty: ReactioNs, Emissions and Dynamics

IGAC Regional Working Groups

MANGO: Monsoon Asia and Oceania Networking Group