Framework for eForest fire management in the shifting cultivation-dominated landscape of Meghalaya, North East India, using remote sensing and GIS

Kasturi Chakraborty[1,*], Dhruval Bhavsar[1], Suraj Kumar Swain[1], Siddharth Bhuyan[1], Harish Chaudhary[2], Jakesh Mohapatra[3], Praveen Kumar[1], Balajied Lyngdoh[1], Joydeep Dey[1], Brandon Rynjah[1], Nilay Nishant[1] and K. K. Sarma[1]

[1]North Eastern Space Applications Centre, Umiam 793 103, India
[2]Forests and Environment Department, Government of Meghalaya, Shillong 793 103, India
[3]Department of Botany, College of Basic Science and Humanities, Odisha University of Agriculture and Technology, Bhubaneswar 751 003, India

Meghalaya, 'the abode of clouds' is one of the states of North East India. The state witnesses several forest fire incidents every year. In this study, MODIS-based forest fire counts from 2003 to 2023 have been used for the generation of forest fire-prone and vulnerability maps. The forest fire vulnerability map has been generated at 1 : 10 k for the entire state and at 1 : 5 k for Reserve Forests, Community Reserve Forests and other Protected Areas. Ri Bhoi and West Khasi Hills districts witness high forest fire incidents compared to all the other districts. Maximum number of forest fire occurs in moderately dense and very dense forests. The eForest Fire Information System, viz. 'Meghalaya Forest Fire Information System' has a dashboard with geospatial forest fire information and a forest fire incident reporting android based app developed for fire managers both at Government and community level. Shifting cultivation (jhum) is a predominant land-use pattern; therefore the framework has embedded jhum area information for improving forest fire management strategies to match the local scenario.

Keywords: Forest fire, mitigation measures, remote sensing, shifting cultivation, vulnerability maps.

According to Tyukavina *et al.*[9], 26–29% of the global 2001–2019 forest loss was due to fire, which is higher than previous estimates of 21–25% for 2001–2015 (ref. 10) and 12–18% for 2003–2014 (ref. 11). At least half of the global forest losses caused by natural and anthropogenic drivers is associated with fire[10].

The forests of North East (NE) and central India have more fire-prone areas in the country (Forest Survey of India (FSI), 2019). Forest fire studies in Meghalaya have raised concerns over their frequent occurrence due to shifting cultivation and other human activities, and the need for scientific forest fire management strategies[12–14].

Increased incidences of forest fire have prompted Government intervention and schemes aimed at preventing and controlling them[15]. Meghalaya in NE India, has constituted State Crisis Management Groups (SCGs) and a Crisis Management Cell to involve the local communities in forest fire protection by setting-up a Village Forest Fire Control Committee. The Joint Forest Management Committees also help combat forest fires, especially in the plantation areas. Forest fire control is an essential part of forest management[16].

This study aims to present an eForest Fire Information System using remote sensing and GIS-based information platform, namely 'Meghalaya Forest