Forest Fire Susceptibility and Risk Mapping Using Geographical Information Systems (GIS) and Remote Sensing (RS) for Protected Areas: Case of Horton Plains National Park, Sri Lanka

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Horton Plains National Park is a protected Area in the central highlands of Sri Lanka and is covered by montane grassland and cloud forest. This plateau is rich in biodiversity and many species found here are endemic to the region. Horton Plains National Park is the headwater of the three major rivers in Sri Lanka, Mahaweli, Kelani and Walawe. It is one of the main tourist attraction areas of the country. Hence it is utmost important to protect this National Park, considering it's ecological, hydrological, and economic significance to the country.

It has been experiencing number of conservation issues including man-made forest fires from the past to the present. Though the occurrence of forest fires fairly low they lead to considerable damages to ecosystem along with number of other negative consequences. In the event of a prolonged spell without rain, and a lowering of the water table in the peat swamp forest, the National Park is very prone to fire. Therefore a precise evaluation of forest fire problems and the understanding of the areas at fire risks need to be closer concentration. Decisions on forest fire management can only be satisfactory when a fire hazard zone mapping is available. Geospatial technology, including Remote Sensing *(RS)* and Geographical Information Systems (GIS), provides the information and the tools necessary to develop a forest fire susceptibility map in order to indentify, classify and map fire hazard area.

The objectives of this research study were to identify environmental and human induced factors for forest fire hazards in Horton Plains National Park and to identify susceptible areas for fire hazard and finally to prepare susceptibility and risk map in order to facilitate decision making for fire hazard control. Data, such as soil type, topography, and other environmental factors were collected and were converted into a spatial database using *GIS*. Parameters to reflect the factors that influence fire occurrence, such as fuel type, vegetation cover, temperature, wetness, etc were extracted

from Landsat-7 *ETM* and *IRS* imagery. Slope and aspect of topography were generated from the digital terrain data of Survey Department. Soil type data was digitized from the soil map of the Irrigation Department. Forest fire susceptibility was analyzed using the factors causing forest fires by likelihood ratio method and the spatial relationships between hotspot-occurrence location and each factors contribution in hotspot occurrence were derived using the frequency ratio model.

The results derived in this study can help the concerned authorities for forest fire management and mitigation in protected areas in Sri Lanka. The models used in the study are valid for awareness so that necessary prevention measures can be taken during the time of forest fire. In this paper, forest fire susceptibility map was developed in order to determine the level of severity of forest fire hazards in terms of susceptibility to fire by assessing the relative importance of fire factors and location of fire ignition.

Key words: *GIS modeling of fire, Protected area management, Fire ecology*