Forest Fire Risk Zonation Mapping

The most common hazard in forests is forests fire. Forests fires are as old as the forests themselves. They pose a threat not only to the forest wealth but also to the entire regime to fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region. During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twinges, which could burst into flames ignited by the slightest spark. The tropical forests, particularly, dry deciduous forests of the state have been burning regularly during the last few summers.

Classification of Forest Fire

Forest fire can broadly be classified into three categories;

- Natural or controlled forest fire.
- Forest fires caused by heat generated in the litter and other biomes in summer through carelessness of people (incendiary habits of people) and
- Forest fires purposely caused by local inhabitants.

What is Forest Fire Risk Zonation Mapping ?

Forest fire risk zonation mapping for the entire forest area of the state is prerequisite for preparing e forest fire management plan for each district. Such zonation can be done by taking various factors that are influencing fire into consideration viz., the fuel (forest type and density) , the topography (slope and aspect) , the proximity (roads and villages) , the environmental factors (wind, temperature, rainfall etc) for the entire forest area of the state. These maps are useful in delineating most to least vulnerable areas to fire and helpful in creating fire lines and combating the fire hazards. The fire risk zonation output in the form of maps can be compared with real time MODIS fire location data of the past.

Objectives of the Study

1. Identify fire prone areas of the entire forest area of the state by using multi-criteria spatial analysis
2. Analysis of parameters and weights contributed by the different physical and climatic attributes and vegetational cover types.
3. Propose suitable forest fire control measures in scientific manner
4. Suggest suitable budgeting methodology for distribution of funds for fire management

Methodology : The methodology applied for this study consisted of the following steps:

1. Identification of factors of forest fire ,
2. Generation of thematic maps ,
3. Assignment of weightage to different factors ,
4. Preparing fire risk index for each factors and
5. Aggregating those index values for each map units and assigning each such map units to different category of fire risk zones .

The initial process is generation of different thematic maps. The major influencing factors of fire were identified. They were vegetation types, density, slopes, terrain, roads proximity of villages to forests, and real fire incidences in the past five years. Maps were prepared for each influencing factors by using geographic information system. The source of information for factors such as slopes, terrains , proximity

of village and roads to forests and forests types (Fuel type maps) is secondary geo-database of the forest department. The source of density cover information was the LISS-III classified vegetation cover data procured from Forest Survey of India , Dehradun. This data pertained to the year 2006. The source of real fire incidences data was the geo-location MODIS data collected from Forest Fire Mapper.

Spatial multi-criteria decision analysis is a process that combines and transforms geographical data (input) into a resultant (output) data. The procedure involves the utilisation of geographical data , the decision makers preferences in terms of weights for each influencing factors and aggregating into an unidimensional values of alternative decisions. A weight can be defined as a value assigned to an evaluation criterion that indicates its importance relative to other criteria under consideration .the larger the weight , the more important is the criterion is the overall utility . The weight value is dependent on the range of criteria values, that is the difference between the minimum and a maximum value for a given criterion. The criterion weight was generally decided on the basis of location (of forest fire incidences occurred in the forest area in the last five years) that fell on the areas of influencing factors of fire , by consulting field officers depending upon the gravity of forest fire in their respective areas .

In total six influencing factors were under consideration. Each factor was allotted some weights in the overall index. Again fire risk index for all the six factors was prepared. Weightage assigned to each influencing factors of fire is presented in the table below:

SN	**Influencing Factor of Fire**	**Weightage**
1	Vegetation type	10
2	Vegetation density	3
3	Slope & Terrain	4
4	Proximity to Roads	3
5	Proximity to villages	3
6	Real fire incidences	2
	Total	25

1. **Fire risk index for each aforesaid factor was prepared based on real fire location data and past experiences. Afterwards index values of all factors for a map unit (25 hectares) were aggregated and the total value of fire risks for that unit was found out . Based on that five zones were prepared . They are extreme, high, moderate, low and very low. Fire risk zones and fire risk criteria is presented in the table below.**

SN	**Fire Risk Zones**	**Criteria (Fire Risk Points)**
1	Extreme	>80
2	high	60-80
3	Moderate	41-60
4	Low	21-40
5	Very Low	<20

All analysis for fire zonation was done in the GIS environment and output with respect to map units of 25 hectares was classified into one of the five fire risk zones . Maps and statistics for each forest division was generated.

Results and Discussion

After integration of the above themes viz., vegetation type , forest types , slope , road and settlements buffers through GIS based multicriteria spatial modelling , a final integrated map was obtained. This study reveals the following salient features:

1. The entire forest areas have been classified into five categories of zones based on vulnerability to fire.
2. High fire risk categories areas are those in high slopes with dry deciduous forests.
3. Miscellaneous forests are more prone to forest fire than sal forests.
4. Forests situated in moderate slopes or flat areas have shown moderate proneness to fire.

Use of Forest Fire Risk Zonation Mapping

Forest fire risk zonation mapping has the following uses.

1. It helps to prepare forest fire management plan for a division.
2. It helps to redesigning the forest fire lines.
3. It helps to select suitable location for constructing fire watch towers
4. It helps to develop strategy for deploying fire waters in the fire season.
5. It helps to utilise the funds for forest fire prevention , mitigation and suppressions rationally.

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