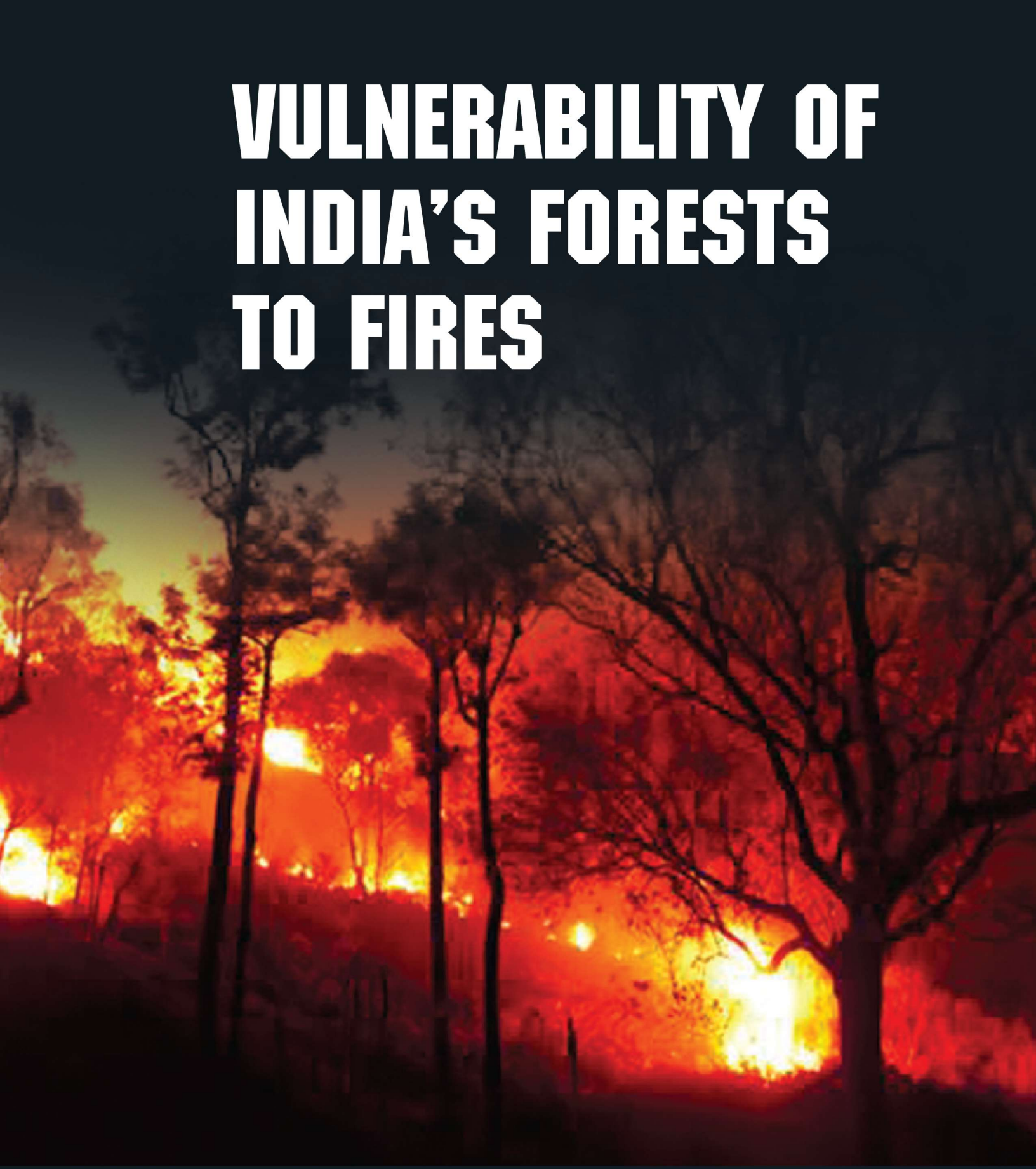
VULNERABILITY OF INDIA'S FORESTS TO FIRES

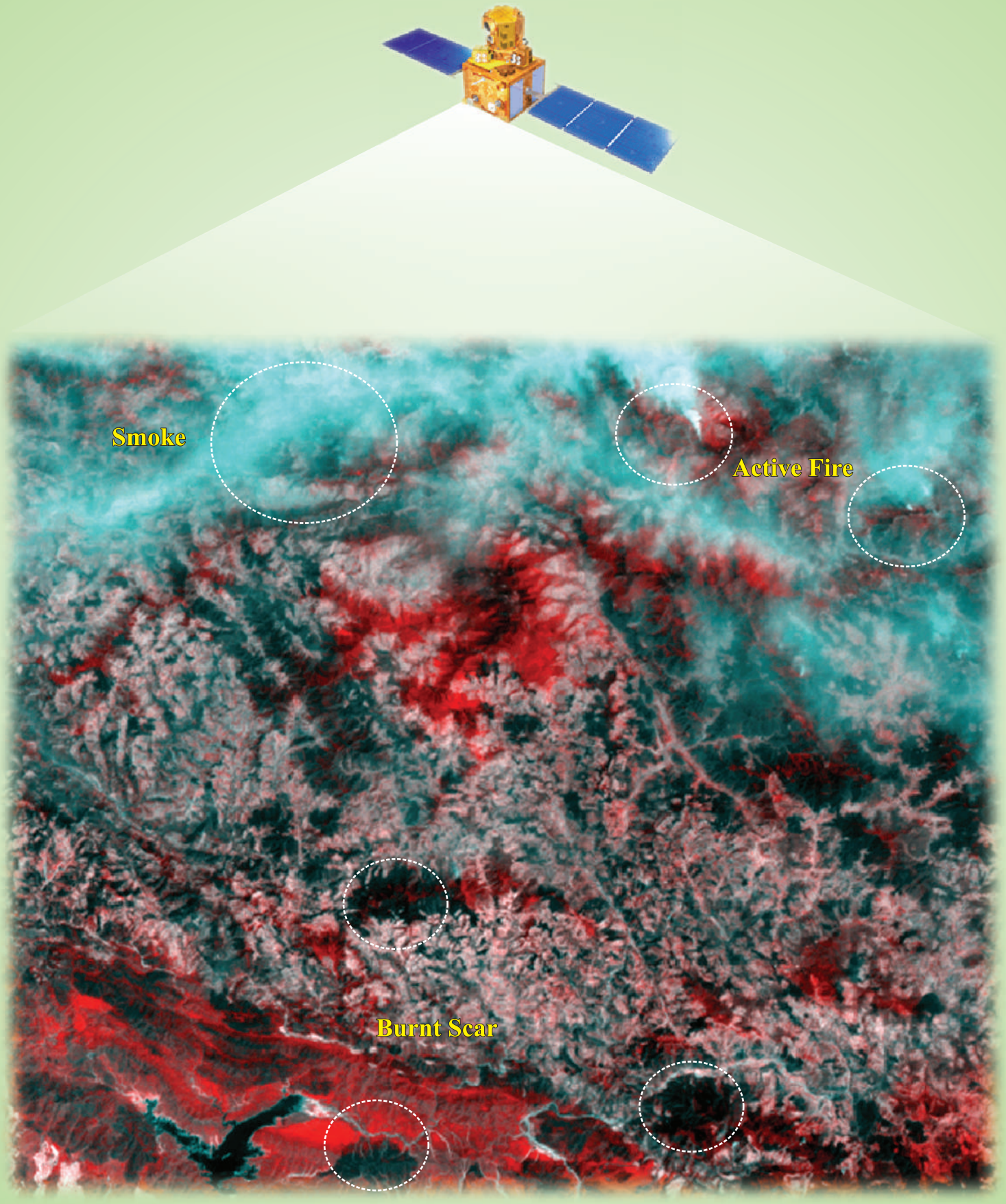


FOREST SURVEY OF INDIA

(Ministry of Environment & Forests)

Kaulagarh Road, P.O.-IPE, Dehradun – 248195 India

Fire as shown in satellite data



सत्यमेव जयते

VULNERABILITY OF INDIA'S FORESTS TO FIRES

Forest Survey of India
(Ministry of Environment & Forests)
Government of India
Dehradun

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ENVIRONMENT & FORESTS
GOVERNMENT OF INDIA
NEW DELHI-110 003

FOREWORD

It gives me great pleasure to learn that the Forest Survey of India has brought out a report projecting the fire proneness of India's forests through mapping and analysis of satellite data. The report plugs a major gap in the management of our forest resources because fire is one of the most unpredictable and devastating risks to our forests.

Millions of people in our country hold forests at the center of their existence and spiritual strength. The forests that has stood for decades and even centuries, have provided succor to generations. The sudden and cataclysmic destruction of huge tracts of forests to fires, turns the lives of people dependent on them upside down. It takes the span of almost a complete human generation for a new forest to take the place of a ravaged one. Saving our forests is, therefore, a national mission for us. We are aided in our mission by the growing potentials of technology. The valuable tool of Remote Sensing & GIS enables us to project several layers of information in a single frame thereby improving our capacity to understand and even predict the occurrences of forest fires. There will always be an element of surprise in the outbreak of a fire, but with the vast array of data organized in a usable format, we are in a position to see patterns and thereby rein in the unpredictability associated with this peril. With this report before us, foresters can now take proactive action for management of forest fire in the country.

I extend my best wishes on the release of this report and hope it shall be found useful by all stakeholders involved in and committed to the conservation and development of our forest resources.

(Jayanthi Natarajan)

तिष्यरक्षित चटर्जी
Dr. Tishya Chatterjee

सत्यमेव जयते

सचिव
भारत सरकार
पर्यावरण एवं वन मंत्रालय
SECRETARY
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT AND FORESTS

MESSAGE

The centrality of forests to human existence has long been recognized. Forests are the core of the biodiversity around which the health and vitality of the human race revolves. For a vast populace of our country and world, forests must be maintained in good health to provide the fodder, fuelwood and other products that provide them sustenance and succor. Fire is one of the most destructive threats faced by our forests. During the long dry season it takes a good toll of our forests every year thus resulting in significant loss of forest wealth and invaluable diversity of vegetation and life forms contained in them. Innumerable human lives are placed at risk of starvation with the loss of forests. To save the forests from the scourge of fire is thus a central responsibility of forest managers in this country.

The present report on the fire vulnerability of India's forests through mapping and analysis of satellite data is as timely as it is pertinent. Technologies like GIS enable us to integrate many frames of information in a seamless interplay enabling experts not only to understand temporal trends but also predict the future. This is a capability of infinite value in the management of forests. Forests are situated in inhospitable terrain making quick movement of personnel a logistical challenge. If the Forest Departments were to know which places were more vulnerable to fires, the available resources can be deployed in a way that promises the speediest response. It is a classic example of technology strengthening the capability of human hands.

The FSI is a widely acclaimed organization for its role in the assessment of forest resources in our country. The biennial 'India State of Forest Report' published by the FSI is reference material for the scale and health of our forests. The FSI is not only assessing our forests but is also actively involved in safeguarding them. Since 2004, it has been monitoring forest fires and providing invaluable alerts to the State Forest Departments. It is only proper that the present report on the assessment of fire vulnerability should emerge out of the enormous data gathered by the FSI in monitoring forest fires in our country.

I am sure this input will be seen as a quantum leap in the task of saving and managing our forests. The FSI deserves the highest praise for carrying out this exercise. The beneficiaries will be all segments of society, particularly our most vulnerable segments for whom forests are a veritable lifeline.

(Dr. T. Chatterjee)

डा. पी. जे. दिलीप कुमार
Dr. P. J. Dilip Kumar

सत्यमेव जयते

वन महानिदेशक एवं विशेष सचिव
भारत सरकार
पर्यावरण एवं वन मंत्रालय
DIRECTOR GENERAL OF FORESTS & SPL. SECY.
GOVERNMENT OF INDIA
MINISTRY OF ENVIRONMENT AND FORESTS

MESSAGE

Forests are the priceless treasures of the human race. The forests are home to a rich array of plant and animal species coexisting in the habitat. For a casual observer, it is hard to fathom the scale of miracles happening in the forests every day with the interplay of species. When the loss of forests is due to fires that could have been averted by prior knowledge and planning, the loss is nothing less than tragic. Because much of India's forests are situated in dry areas and because of the presence of humans everywhere, ground fires run through the under growth, burning the regeneration and destroying the nests and lairs of ground living species. At the same time it is to be recognised that periodic ground fires are often and integral part of the ecosystem and serve to reduced the load of combustible material thereby reducing the danger of more damaging wild fires that periodically ravage the forest areas even in developed countries like the USA and Australia.

The Forest Survey of India has been in the vanguard of forest cover assessment in our country for more than a quarter century. This distinguished organization has taken a giant leap forward in the protection of our forests by addressing the dangers of forest fires. The FSI has been carrying out forest fire monitoring since 2004, passing on crucial information to the States Forest Departments in the form of SMS alerts. These warnings have saved vast domains of our forests by enabling the Forest Departments to respond to the risks effectively.

As data has accumulated on the occurrence of forest fires, we have been able to detect patterns and measure the vulnerability of areas to this menace. The FSI has undertaken an exercise of central importance by compiling this report on fire vulnerability of India's forests through mapping and analysis of satellite data. Equipped with this knowledge, the States Forest Departments can marshal their resources to provide the most effective response to the outbreak of fire.

I am confident that the information provided in this report shall prove immeasurably useful to all stakeholders committed to the protection and conservation of forests against the hazards of fire. I congratulate DG, FSI and his team for bringing out this report in public domain.

(Dr. P. J. Dilip Kumar)

ए. के. वहल
महानिदेशक
A. K. WAHAL
Director General

सत्यमेव जयते

भारत सरकार
भारतीय वन सर्वेक्षण
पर्यावरण एवं वन मंत्रालय
GOVERNMENT OF INDIA
FOREST SURVEY OF INDIA
MINISTRY OF ENVIRONMENT AND FORESTS

PREFACE

A big chunk of forest area of the country is annually affected by forest fires leading to enormous impact on our biodiversity and ecosystems. Over the years, several areas have been under frequent threat of fires and have perceived serious physiological, hydrological, phenological and vast changes in land-use land-cover. The technology based tools are useful in generating fire alerts that help in minimizing the severity and extent of damage caused by fires. FSI has been using remote sensing and GIS techniques in near real time detection of forest fires and dissemination of information to the States Forest Departments since the year 2004. From the current fire season, system of forest fire detection and monitoring has been upgraded to reduce the time lag from earlier 24 hours to 2 hours, so as to provide near instant alerts to forest personnel for taking timely action in prevention and control of the forest fires.

This report has been prepared by consolidating data of past seven years in assessing the proneness of India's forest to fires. The forest type groups that are more susceptible to forest fire have also been identified and mapped. From planning perspective, the districts and the grids that are prone to forest fires have been listed. Time line data has also been used to correlate the incidences of occurrences of forest fire with rainfall data. Information so generated by carrying out detailed analysis of data, shall be of immense use to forest managers, policy makers and planners alike. The study shall be carried forward by making burnt area assessments thereby working out the colossal loss of valuable forest resources on annual basis.

Sincere efforts made by FSI team in generating this report of the first kind at country level, is deeply appreciated and acknowledged.

(A.K. Wahal)

Executive Summary

1. Background

Remote sensing and GIS play an important role in detecting the active forest fire locations, as well as help in assessment of the fire risk based on several factors such as topography, climate and other biological factors. In the present study, vulnerability analysis has been carried out using the existing data for forest fire outbreaks over a period of seven years and analysis of the data performed accordingly. Forest fire signals from the MODIS (Moderate-resolution Imaging Spectrometer) sensor on Terra and Aqua satellites have been used for identification of forest fire pixels. One of the key inputs for the vulnerability mapping and analysis has been drawn from the near real time forest fire monitoring exercise carried out by FSI since 2004 by using spatial information available on the website-web fire mapper of NASA and University for Maryland, USA under MODIS Rapid Response System.

The primary objective of this study has been to map the vulnerable areas based on the frequency of forest fire occurrences over an area so as to be of help to planners and forest departments in the management of forest resources at the ground level.

The specific objectives of the study are as follows :

- Study the forest fire vulnerability using time series data and other causative factors
- Study the vulnerability based on the forest types and forest density classes
- Identify and categorize the grids/districts based on the degree of severity
- Study the socio-economic parameters and relate the vulnerable area with these parameters

2. Salient Features :

- Forest fire vulnerability has been estimated in terms of forest cover, forest type, 2.5' x 2.5' grids, toposheets, time period.
- Attempt has been made to correlate the vulnerability with different factors such as socio-economic, anthropogenic, climatological etc.
- Vulnerability in terms of spatial extent has been assessed, It has been further studied to find the state level crucial period of fire occurrences.

3. Findings :

- A total of 8,645 forest fire incidences have been reported during 2004-2005; 20,567 during 2005-2006; 16,779 during 2006-2007; 17,264 during 2007-2008; 26,180 during 2008-2009; 30,892 during 2009-2010 and 13,898 during 2010-2011 respectively in the country.
- A total of 57,063 forest fire incidence were observed in moderately dense forest which is 43% of total forest fire incidences. A total of 53,779 forest fire incidences have been observed in open forest area which is 40% of the total forest fire incidences. However, only 9% fire incidences have been reported in very dense forest during the last 7 years.
- The maximum forest fire incidences have been reported in tropical dry deciduous forest followed by tropical moist deciduous forests and tropical semi-evergreen forests.

- Subtropical pine forest is the fifth dominating forest type vulnerable to forest fires. Although the percentage of this forest type group is 2.63% in the country yet total fire incidences reported in this type group during past 7 years is 2062.
- In north-eastern part of the country, a total of 1057, 1032 and 999 fire incidences have been reported following in toposheet numbers 84B09, 84A05 and 84A12 respectively, whereas in other parts of the country 702, 667 and 608 forest fire incidences have been reported in 65A15, 65E03 and 65A14 toposheets respectively during the past 7 years.
- Most of the vulnerable areas have been observed in the border districts of the states of central and south central India viz., Madhya Pradesh, Chhattisgarh, Andhra Pradesh and Odisha.
- 29 out of 35 states and UTs have been reported with the continuous forest fire in two or more consecutive years. 348 districts of the country are vulnerable to forest fires out of which 168 districts are highly vulnerable, 69 are moderately vulnerable whereas 111 are less vulnerable.
- As per the analysis carried out in every 2.5'x2.5' grid, 15% area of the country is vulnerable to forest fire.
- States such as Delhi, and in the Union Territories except Dadra and Nagar Haveli, repetition of forest fire in the same area in consecutive years has not been reported.
- In north-eastern states, main reason for the larger region being vulnerable may be attributed to the general practice of shifting cultivation.
- At country level, the state of Madhya Pradesh is having highest number of highly vulnerable districts followed by Maharashtra, Chhattisgarh and Odisha.
- Out of 348 identified vulnerable districts of the country, 83 districts are having literacy rate less than 60%
- 32 districts of central India are highly prone to forest fire with average poverty level between 41-80% (Census of India 2001). These districts comprise 35.16% forest cover area of the total geographical area of these districts.
- 51% of the highly forest fire vulnerable districts are having 31-47 percent of population living below poverty line, thereby, reflecting their dependency on forests for their livelihood and collection of minor forest produce, subsequently making forest vulnerable to fires in such regions.
- Based on the analysis of the data for rainfall, it has been observed that low and scanty rainfall has occurred in the past seven years in the regions of east Madhya Pradesh, Chhattisgarh, Maharashtra, Odisha, Bihar, Parts of Uttar Pradesh which are also identified as fire vulnerable states.
- In north-eastern states, crucial period is between first week of March to third week of April, whereas, in southern part of the country it is between first week of February to first week of April, However, in the northern and the central India, it is between last week of February to third week of June.
- The highly vulnerable districts have 4,20,071 km^2 forest cover with very dense forest (VDF) as 49,867 km^2, moderately dense forest (MDF) as 2,08,348 km^2 and open forest (OF) as 1,61,856 km^2.
- The forest cover falling under moderately vulnerable districts is 1,05,226 km^2 with very dense forests (VDF) 12,001 km^2, moderately dense forest (MDF) as 48,732 km^2 and open forest (OF) as 44,493 km^2.
- Less vulnerable districts have 90,819 km^2 forest cover with very dense forest (VDF) as 12,733 km^2, moderately dense forest (MDF) as 37,701 km^2 and open forest (OF) as 40,385 km^2

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ACRONYMS AND ABBREVIATIONS

BPL	Below Poverty Line
DIP	Digital Image Processing
FSI	Forest Survey of India
FTM	Forest Type Mapping
FCM	Forest Cover Mapping
FIRMS	Fire Information for Resource Management System
GIS	Geographic Information System
IRS	Indian Remote Sensing
IST	Indian Standard Time
ISFR	India State of Forest Report
KML	Keyhole Markup Language
LISS	Linear Imaging and Self-scanning Sensor
MDF	Moderately Dense Forest
MFP	Minor Forest Produce
MODIS	Moderate Density Imaging Spectrometer
MoEF	Ministry of Environment & Forests
NASA	National Aeronautical & Space Administration
NNRMS	National Natural Resource Management System
NF	Non-Forest
OF	Open Forest
SFR	State of Forest Report
SOI	Survey of India
SFD	State Forest Department
SMS	Short Message Service
UTC	Co-ordinated Universal Time
VDF	Very Dense Forest

1. Introduction

Over the years, forest fire occurrences across the globe have engulfed vast tracts of forest land besides resulting in soil degradation, change in climate conditions and adverse impacts on ecology. Fires are recurrent phenomena in India during the fire season. The wild fires cause incalculable loss of forest products and the biodiversity contained therein. Unlike in west, forest fire occurrence in India is more of anthropogenic in nature than natural. People in India generally burn understory vegetation and grass in forests for stimulating fresh undergrowth of fodder for their livestock. Besides, people visit forest areas for collection of fuel wood and other non timber products and inadvertently cause forest fires.

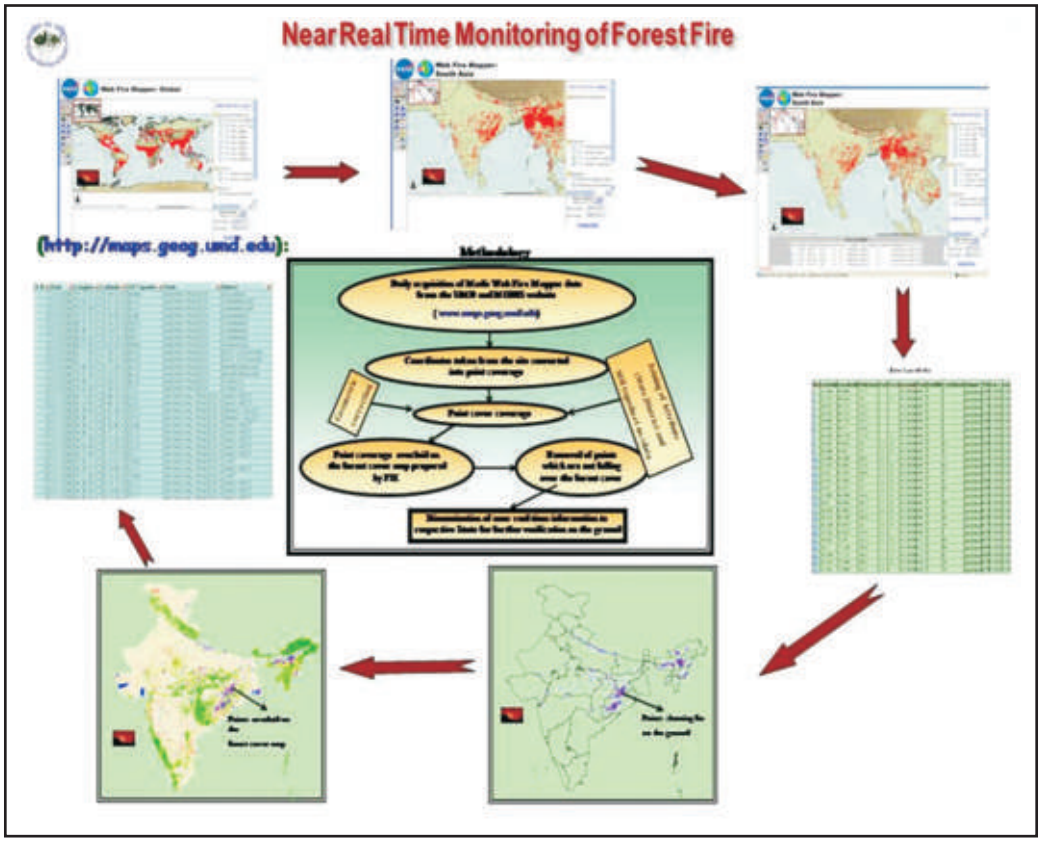
Deciduous and dry forests of the lowlands and the coniferous forests in the lower and middle elevations are regularly burnt. With a large variety of biogeographically related features and climatic conditions prevailing within a specified region, high diversity of forest ecosystems result in different fire regimes and as such set forth different parameters for estimation of vulnerability. Insufficient information and knowledge on fire vulnerable regions could make management imperatives more difficult in these areas. These conditions may lead to deferment of a comprehensive mitigation and adaptation framework. Hence, it is important to undertake vulnerability assessment studies in these areas to primarily aid the creation of an effective and efficient forest fire management plan as well as to optimize the use of available resources.

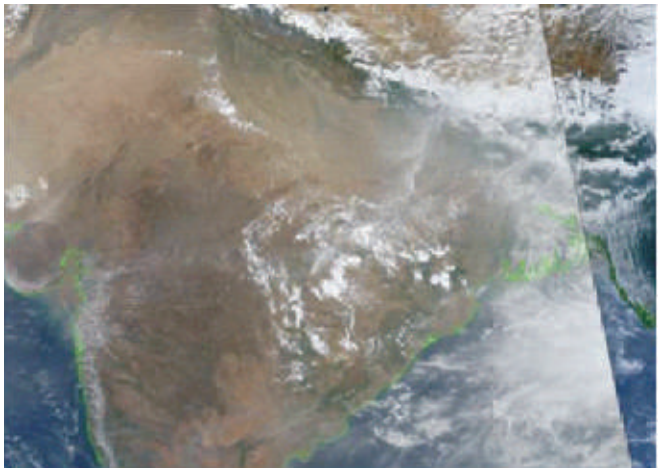
Vulnerability analysis primarily entails information on regimes and forest strata that face frequent occurrence of forest fires due to various reasons. Remote sensing and GIS play an important role not only in detecting the active forest fire locations, but also help in assessment of the fire risk based on several factors such as topography, climate and other biological factors. Fire risk evaluation is a critical part of fire prevention, since pre-fire planning resources require objective tools to monitor as to when and where fires are more likely to occur, or when it will have more negative effects. There are several methods of mapping vulnerable areas and assessment of vulnerability indices. In the present

study, vulnerability analysis has been carried out using the existing data for forest fire outbreaks over a period of seven years and analysis performed. Forest fire signals from the MODIS (Moderate-resolution Imaging Spectrometer) sensor on board Terra and Aqua satellites have been used for identification of forest fire pixels. The vulnerability map has been prepared based on the time series data of the forest fires between 2004-2011. One of the key inputs for the vulnerability mapping and analysis has been drawn from the near real time forest fire monitoring exercise carried out by FSI since 2004. The main objective of the exercise has been to deliver the positional coordinate of active fire location through SMS facility. Through this program, all registered users have been getting the forest fire alerts through SMS on their mobile sets.

2. Near Real Time Forest Fire Monitoring

Forest Survey of India (FSI) has been using spatial information available on the website web fire mapper (http://maps.geog.umd.edu) of NASA and University of Maryland, USA viz. MODIS Rapid Response System, since 2004. Web fire mapper displays active fire locations based on MODIS Rapid Response System. The detection of forest fires is made on a daily basis and uploaded on this website. After collecting coordinates of fire spots, FSI maps the forest fires through GIS analysis. The fire points, sometimes termed as hot-spots, as received from this site, are filtered for pure forest fires by using forest cover map prepared by FSI. The coordinates of all the forest fire spots are then overlaid by state boundary, district boundary and toposheets and subsequently filtered for respective states and districts. This information is then disseminated to respective State Forest Department (SFD) personnel through Fax, SMS and email for control during fire season every year. FSI monitors fire incidences from 1st November to 30th June. The process of fire signal dissemination at country level has been in operation since 2004 and has received an overwhelming response at states levels. From the feedback received from SFDs, it has





been found that the detected forest fires are correct on more than 95% points.

3. MODIS Based Web Fire Mapper

Fire Information for Resource Management System (FIRMS) integrates remote sensing and GIS technologies to deliver global MODIS hotspots/fire locations and burnt area information to natural resource managers and other stakeholders around the world. FIRMS provides MODIS hotspots / fire locations and burnt area products to natural resource managers around the world in easy to use formats. FIRMS is supported by NASA and in built on Web Fire Mapper, a web mapping interface that displays hotspots/fires detected by the MODIS Rapid Response System besides delivering near real-time hotspot/fire information and monthly burnt area information to international users.

The MODerate-resolution Imaging Spectrometer (MODIS) is an instrument that is on-board two satellite platforms owned by NASA: Terra (launched December 18th, 1999) and Aqua (launched May 4th, 2002). The MODIS instrument has 36 spectral bands available to view the earth. Each instrument has a viewing swath width of 2,330 km and views the entire surface of the earth every one to two days. The image resolution used in detecting fires is 1 km.

4. Detection of Fire Spots by MODIS

A hotspot is detected by MODIS sensor using data from the middle infrared and thermal infrared bands. The algorithm examines each pixel of the MODIS swath, and ultimately assigns it to each one of the following classes: missing data, cloud, water, non-fire, fire, or unknown. In most cases, this thermal anomaly is a fire, but sometimes it can be a volcanic eruption or the flare from a gas well. Hence the most important component of forest fire detection using satellite data is the segregation of fire points from the rest of the signals.

An active fire is displayed as a 1km pixel on the ground, the fire "location" is the center point of that pixel. This does not necessarily mean that the fire is 1km^2 in size. While it is not possible to determine the exact fire size, the system gives at least one fire if it is located within that 1km^2 pixel. If multiple fires are detected within the same 1km^2 location, the system will only display one pixel for that area. Hence, the MODIS fire representation provides information of the potential fire pixel which has a dimension of 1 km x 1 km. Even though the information is coarse, yet availability of the information at high temporal interval is of great significance. The process of detection of hotspot points or active fire locations is primarily based on a set of algorithms that detect the higher temperature pixels from the entire image. The thermal sensor (11 micrometer Channel) of the MODIS is heat sensitive, is capable of clearly visualizing the fire points on the ground and has a higher level of confidence in determining fire pixels.

5. Data Acquisition by the Base Station and Uploading the Information to Web Fire Mapper

The Terra MODIS instrument acquires data twice daily (10:30am and 10:30pm IST), as does the Aqua MODIS (2:30pm and 2:30am IST). Therefore, four daily MODIS observations are available. FIRMS delivers active fires detected using the MODIS active fire locations processed by the MODIS Rapid Response System.

The active fire locations are processed by the MODIS Rapid Response System using the standard MOD14 Fire and Thermal Anomalies Product. Each active fire location represents the centre of a 1 km pixel that is flagged by the algorithm as containing a fire within the pixel. FIRMS offers experimental Keyhole Markup Language (KML), version 2.0, to view MODIS Hotspot detections for the past 24 hours (UTC) using Google Earth. The KML files are updated every four hours, starting 1:00 a.m. eastern time (USA). Similarly text and shape files are also available on the website which is available on daily, weekly and monthly basis.

6. Forest Fire Monitoring Undertaken by FSI

FSI has developed an indigenous methodology to detect forest fires from the given fire spots (including within and outside forest regions) from Web Fire Mapper under a project named Forest Fire Monitoring in India. In this exercise, the coordinates of active fire locations are daily downloaded from Web Fire Mapper. The active fire spots are the location of fire irrespective of forest or non-forest land. The downloaded positional coordinates for the total fire locations, are projected on the forest cover map of India prepared by Forest Survey of India to select active fire locations within forest cover. The active forest fire location is further validated using other reference information available with FSI. This is primarily carried out to avoid false alarms being disseminated to State Forest Departments. Overall, the objective is to disseminate only those signals where higher level of confidence is observed. The information is then disseminated through SMS and emailed to the State Forest Department's registered users. The same is also available on the website of FSI (www.fsi.nic.in). One of the objectives of the project have been to find and report forest fires in the nascent stage and to provide quick and reliable information to SFDs to initiate preventive measures at their end. This information has been further utilized for identification of vulnerable areas in context of forest fire.

7. Review of the Past Studies

The scientific literature has been able to isolate both biophysical and anthropogenic variables which both enhance and decrease forest fire vulnerability, such as temperature, precipitation, topography, vegetation type and density, soil moisture and human presence. However, the integration of these many variables into a single model is not always simple (Arienti *et al.*, 2006; Cyr *et al.*, 2007; Gonzalez *et al.*, 2007; Lavorel *et al.*, 2007; Podur *et al.*, 2002; Wotton and Martell, 2005). Problems arise when data is unavailable, of poor quality, or out of date for an area of concern. To accurately determine fire vulnerability models, one would require a combination of multi-scale and interdisciplinary regional data (Lavorel *et al.*, 2007).

Kazanis *et al.*, 2007 carried out a study to characterize and map fire vulnerable areas. They revealed that resilience to fire may differ among the various patches of the forested landscape, slowing the ability of several key plant species to regenerate after fire under the specific biotic and abiotic interactions developed within the various patches. Differences in fire and land use history increase this diverse response to fire.

8. Objective of the Study

Based on the review of the past studies on forest fires, very few studies have been observed to be carried out in the field of forest fire vulnerability. Though different approaches for assessment of forest fire vulnerability have been used, no such study has been reported to be using the data on forest fire occurrences in a region. This may be attributed firstly to non-availability of continuous and periodic forest fire records and secondly to the availability of the spatial information for the forest fire incidences as point attributes. In the light of this, the broad objective of this study has been to map the vulnerable areas based on the frequency of occurrence over an area so that the ultimate outcomes can be of help to planners and forest department in management of forest resources at the ground level.

8.1 Specific Objectives

The specific objectives of the above study are as follows:

- Study the forest fire vulnerability using time series data and other causitive factors
- Study the vulnerability based on the forest types and forest density classes
- Identify and categorize the Grids/Districts based on the degree of severity
- Study the socio -economic parameters & relate the vulnerable area with the parameters

9. Data, Material and the Software Used

Data relevant to each forest fire location for the past 7 years has been taken in the GIS framework as point coverage attached with the attributes like latitude, longitude, date of fire occurrence, State, District and SOI toposheet number (Figure1). Forest Cover Map, Forest Type Map and Census 2011 data has also being used in the analysis. ERDAS Imagine 2010 Digital Image Processing (DIP) and ArcGIS 9.2 GIS Software respectively have been used to perform image processing and GIS related analysis. The hardware component used in the study consists of a fast processing computer workstation and a plotter.

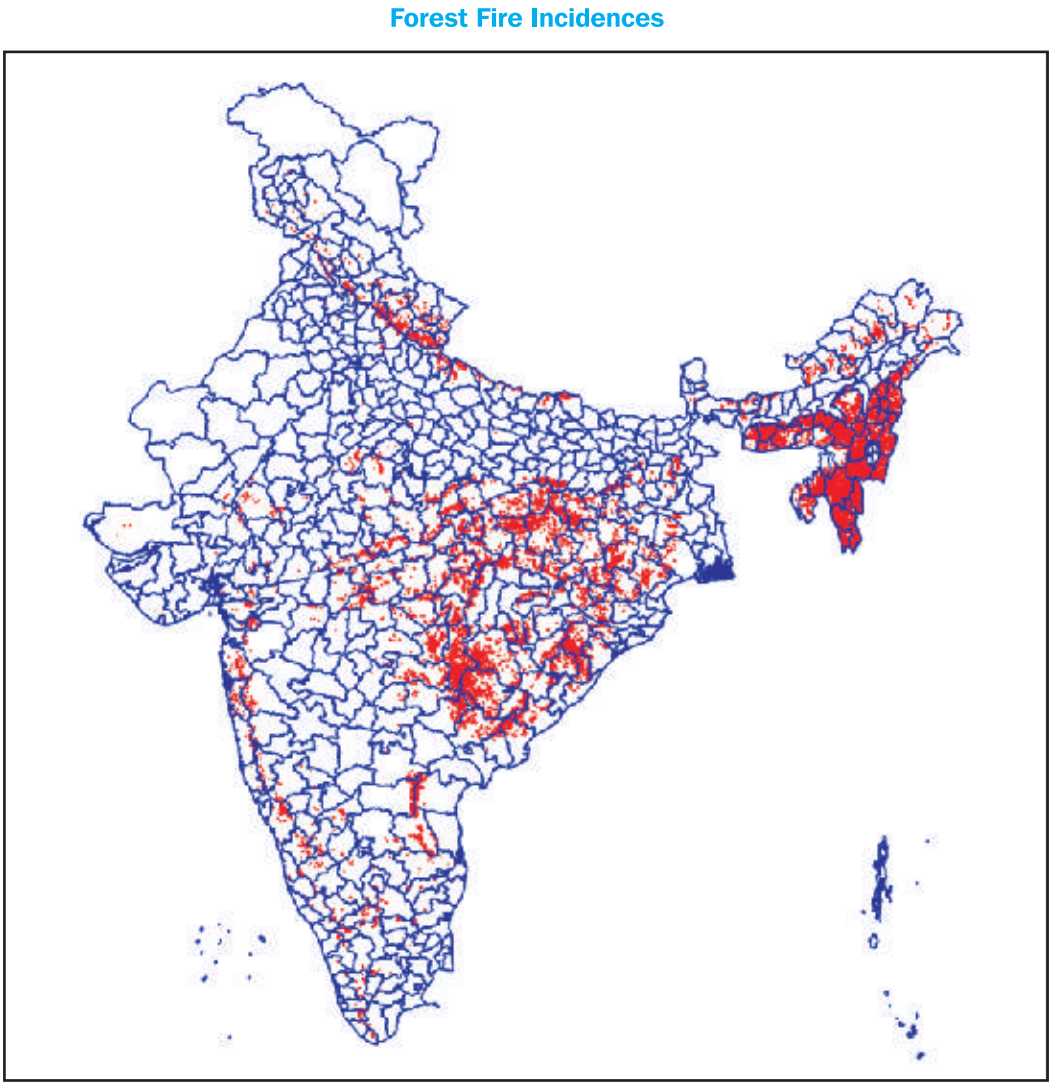


Figure 1: Map showing fire points overlaid on district boundary

Methodology

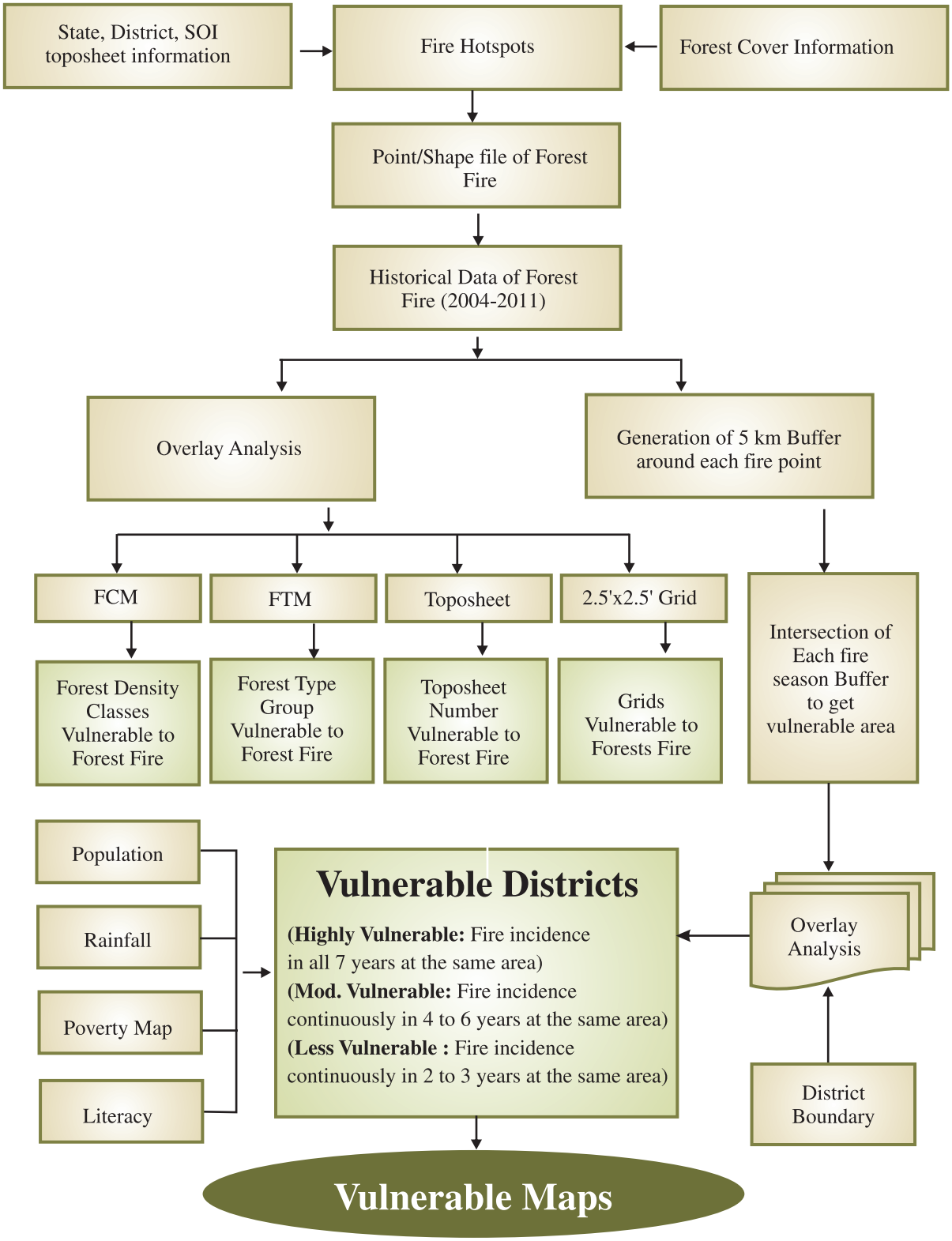


Figure 2: Flow chart showing basic approach of generating fire vulnerability map

10. Methodology

Vulnerability assessment has been carried out by people using different approaches. However, no such work has been reported that is based on vulnerability assessment based on forest fire frequency in specific regions. The regions facing frequent occurrences of forest fires may affect forest strata, cause soil erosion, land degradation, variation in temperature and climate conditions, affect wildlife and cause other serious impacts. Considering the role of forest fire occurrences as the major cause of forest degradation and other changes, the present study went into studying fire occurrences between the period 2004-2011 using MODIS satellite sensor. The satellite, which has a high level of periodicity (data four times a day), has proved to be of immense value in real time assessment and monitoring of forest fires. It is also of prime importance that fire signals detected using remote sensing data carry high confidence value so that false alarms for forest fires are not generated. For that grid based (2.5'x2.5') reference information has been being generated to filter forest fire signals. The grid based information comprises multi-source data for layers including-forest cover, forest types, soil, altitude, aspect, slope, rainfall (average of last ten years), temperature (average of last ten years), and inventory data. The forest fire signals so received as fire incidences or commonly termed as *hot-spot* is overlaid on the forest cover to filter out non-forest fire points. All the available information on forest fires has been compiled for the respective years. The frequency of occurrence of fire depends on many spatial parameters such as fuel type, fuel load, temperature, topographical, moisture conditions and the biotic influence in the area. It is also dependent on non-spatial parameters such as population density, socio-economic conditions prevailing in the area and other such parameters. On the basis of this information, the vulnerability index, fire risk zonation or the fire behavior can be modeled to some extent. In the present assessment, limited information was available for forest fire incidences gathered from the ground. Apart from this the information of the forest fire incidences occurred as point data. Accordingly, buffers have been created around each cluster of fire-points to extrapolate the fire area of influence in the vicinity of core area. The study utilized past forest fire data (as stated in section 6) for assessment of vulnerable areas based on the frequency of occurrences of fires over a specific region. The approach followed to map the vulnerable area is shown in the figure 2.

11. Generation of Forest Fire Points

An important component of forest fire vulnerability mapping is to generate forest fire points for the country on near real time basis. For this the data for fire points have been downloaded from Web Fire Mapper service. A filtering exercise has been carried out to separate out the pure forest fire signals. In order to perform value addition to each of the forest fire location, attributes such as state name, district name, toposheets number, date of fire incidence and the geographical location of the fire incidences have been attached. As such, each of the fire location occurring in a GIS compatible format (point coverage/ shape file) entails a complete information for further analysis.

12. Historical Data of Forest Fires

An increase in dryness period due to low rainfall leads to an increase in the dryness of the vegetation. The drier the vegetation, the greater the fire risk due to increased susceptibility of biomass to catch fire. The regular dissemination of forest fire spots using MODIS sensor was carried by FSI between the periods of 2004-2011. A total of *8,645* forest fire incidences were reported to the State Forest Departments (SFD) during 2004-2005, *20,567* during 2005-2006, *16,779* during 2006-2007, *17,264* during 2007-2008, *26,180* during 2008-2009, *30,892* during 2009-2010 and *13,898* during 2010-2011 respectively. State wise, communication regarding forest fire is shown in Table 1.

Table 1: Forest fire incidences communicated to state forest department during different fire seasons.

State	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
Andaman & Nicobar	0	1	6	0	1	7	0	15
Andhra Pradesh	1108	1569	1931	1454	2442	1837	1119	11460
Arunachal Pradesh	97	514	627	349	786	576	485	3434
Assam	210	1369	902	1020	1901	2511	1321	9234
Bihar	67	126	84	84	143	397	81	982
Chandigarh	0	0	0	0	0	0	0	0
Chhattisgarh	784	848	1762	1389	2849	2835	1074	11541
Dadra & Nagar Haveli	0	0	1	3	0	0	0	4
Daman & Diu	0	0	0	0	0	0	0	0
Delhi	0	0	0	0	0	0	1	1
Goa	6	9	1	0	2	0	3	21
Gujarat	140	208	100	131	182	179	101	1041
Haryana	7	11	14	75	21	29	5	162
Himachal Pradesh	9	12	48	104	168	125	6	472
Jammu & Kashmir	29	81	92	54	117	30	7	410
Jharkhand	151	548	140	394	430	1314	192	3169
Karnataka	417	631	414	275	604	428	370	3139
Kerala	90	51	130	19	166	106	10	572
Lakshadweep	0	0	0	0	0	0	0	0
Madhya Pradesh	900	1101	871	2705	2894	2386	1451	12308
Maharashtra	534	1009	1243	1426	2257	1789	882	9141
Manipur	295	1666	1223	1415	1477	2487	1275	9838
Meghalaya	69	1285	504	699	1010	1743	879	6189
Mizoram	1513	4479	2733	2095	3434	4675	1691	20620
Nagaland	131	1200	851	568	984	1645	919	6307
Odisha	1127	1646	1587	1184	2080	2515	7820	10919
Puducherry	0	0	0	0	0	0	0	0
Punjab	21	33	18	147	41	56	10	326
Rajasthan	14	47	53	118	96	117	87	532
Sikkim	0	7	0	0	1	5	1	14
Tamil Nadu	193	109	123	40	276	148	34	923
Tripura	324	1421	788	358	717	1127	634	5369
Uttar Pradesh	235	253	305	379	370	737	198	2477
Uttarakhand	143	165	222	717	631	855	85	2818
West Bengal	31	168	6	62	100	224	197	788
Total	**8645**	**20567**	**16779**	**17264**	**26180**	**30892**	**13898**	**134225**

An analysis of figure 3 indicates that the forest fire incidences have been highest in 2009-2010 fire season whereas it has been least during 2004-2005. In 2009-10 States like Andhra Pradesh, Assam, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Manipur, Odisha, Uttarakhand, Tripura, Mizoram have significantly faced higher number of fire incidences. The reason for this variation has been studied further and analyzed with the rainfall and temperature data for the particular season. The coordinates of fire incidences has been communicated to state forest departments during the past seven years. Of them, the states of Chhattisgarh, Madhya Pradesh, Andhra Pradesh and Odisha, have reported more than 10,000 forest fire incidences during these periods. In case of north eastern states, Mizoram is having the highest number of forest fire incidences followed by Manipur and Assam.

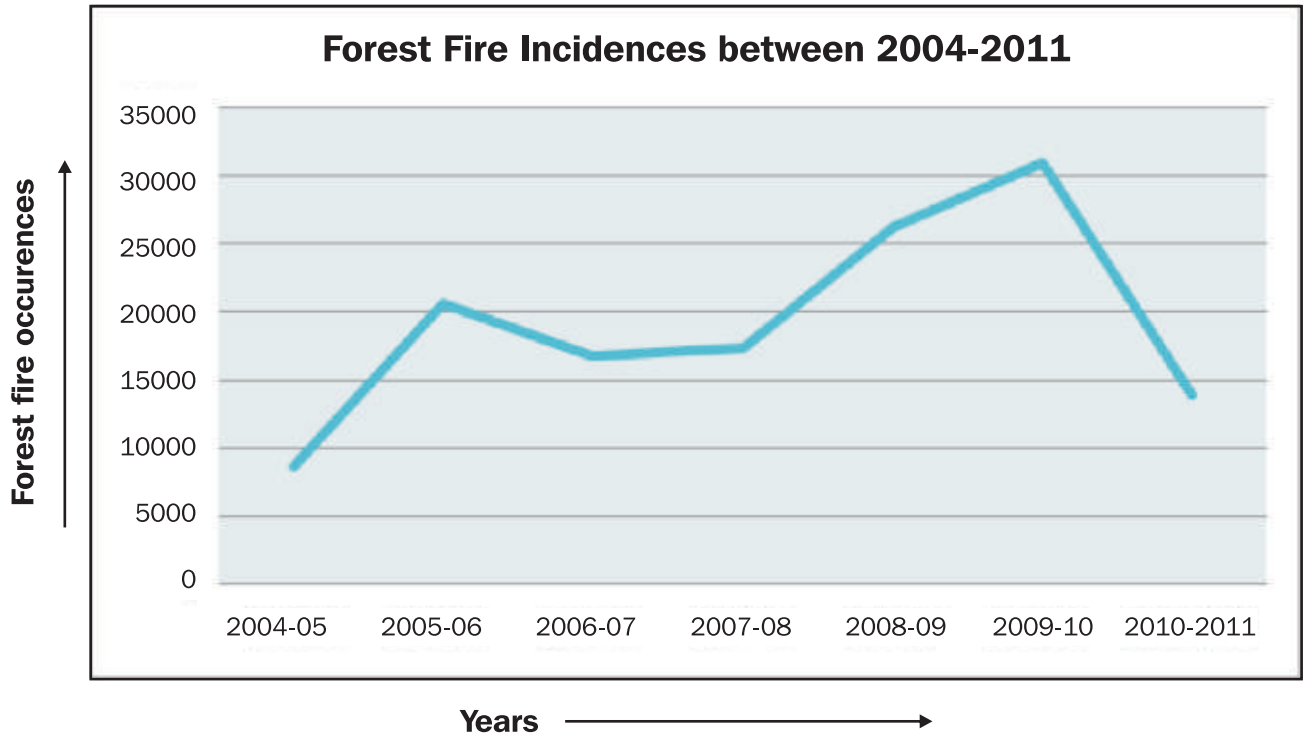


Figure 3: Graph showing forest fire incidences between 2004-2011

All the forest fire points so generated were geo-coded so that positional accuracy vis a vis to their occurrence over a region could be ascertained. The historical data has many applications in the study of the following:

- Burnt area assessment
- Fire risk zonation mapping
- Hazard modeling
- Vulnerability mapping

Overlay Analysis: Once the database (layers and attribute data) is created based on the integration of different layers, it can be analyzed and new information extracted in a GIS platform. General information can be deciphered simply by looking at the layers and visually comparing them to other layers. However, new information can be retrieved by combining and comparing layers using overlay analysis.

In this regard, overlay analysis has been performed between the forest fire point coverage layer, and the forest cover map, forest type map, toposheets as well as 2.5'x2.5' grid of the country.

Basic requirement in layers overlay is that all the layers must have same projection, scale and datum.

13. Forest Density Classes Vulnerable to Forest Fire

FSI has been regularly assessing the forest cover of the country in every two years cycle. As per ISFR 2011, the forest cover of the country is classified into three canopy density classes: Very Dense Forest with canopy density more than 70%, Moderately Dense Forest with canopy density between 40-70% and Open Forest with canopy density between 10-40%. Scrub is a degraded forest land with canopy density less than 10%.

An overlay analysis has been done using forest cover of the country with forest fire incidences since 2004 to find the vulnerable forest density classes. Detailed statistics has been given year wise in Table 2 for all the forest cover densities to find the vulnerable forest density class.

Table 2: Forest fire incidences in different forest density classes of forest cover map

Forest Density	Year 2004-05	Year 2005-06	Year 2006-07	Year 2007-08	Year 2008-09	Year 2009-10	Year 2010-11	Total
Very Dense Forest	827	1139	1456	1563	2574	2804	1105	**11468**
Moderately Dense Forest	3646	8140	7173	7570	11497	13196	5841	**57063**
Open Forest	3032	8910	6675	6758	10008	12711	5685	**53779**
Scrub	82	137	77	61	84	100	39	**580**
Non Forest	1058	2241	1398	1312	2017	2081	1228	**11335**
Total	**8645**	**20567**	**16779**	**17264**	**26180**	**30892**	**13898**	**134225**

The study reveals that the moderately dense forests are more prone to forest fire followed by open forests and very dense forests. It has been observed that a total of *57,063* forest fire incidence were observed in moderately dense forests which accounts for 43% of the total forest fire incidences during the past seven years. As per ISFR 2011, moderately dense forests (MDF) of the country is 3,20,736 km^2, which indicates that every 6 km^2 of moderately dense forest has been subjected to atleast one forest fire incidences during past 7 years. A total *of* 53,779 forest fire incidences have been observed in open forest area which accounts for 40% of the total forest fire incidences in the country. As per ISFR 2011, open density forests (OF) of the country is 2,87,820 km^2, which indicates that every 5 km^2 of open forest has been subjected to atleast one forest fire incidences. On the other hand only 9% fire incidences were reported in very dense forest during the last 7 years.

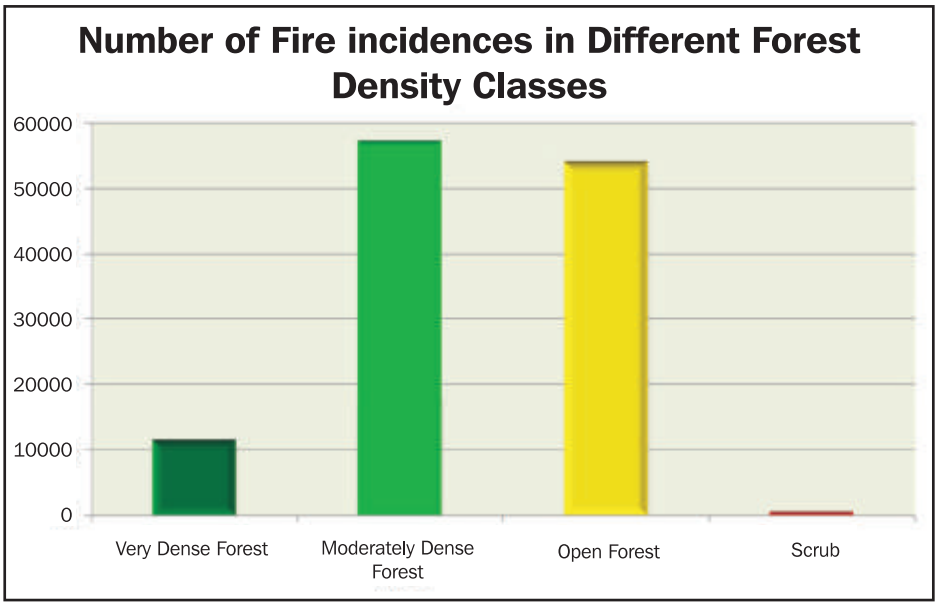


Figure 4: Variation of forest fire incidences in different forest density classes

14. Forest Type Groups Vulnerable to Forest Fire

Information on forest types carries valuable importance for wide range of applications related to any forest region, like forest management, silvicultural practices, scientific research, resource assessment, environment impact assessment, wildlife management, forest fire management etc. In 1968 Champion and Seth categorized the forests of India into different groups and subgroups, which has been considered as the most accepted classification till date. Based on climate conditions, India's forests have been classified into six major groups. These major groups have been further divided into 16 type groups based on temperature and moisture conditions. They have been further divided based on southern and northern forms. Finally, the forest type groups have been classified into 200 forest types and subtypes including variations based on location specific climate factors and vegetation formation of the country.

The National forest type mapping exercise for India under the NNRMS, MoEF, sponsored program was taken up by Forest Survey of India (FSI) in 2004, which has been the first ever effort for wall-to-wall mapping of forest types of India. The mapping used Champion & Seth forest classification system as the basis for forest types identification. In this exercise, FSI made an attempt to map 178 forest types using Indian Remote Sensing Setellite Data (IRS-LISS-3) and using supportive ancillary information and field data.

For the present study on vulnerability, forest type group map (Figure 5) showing 16 forest type group has been taken into consideration as forest types have been observed to play a major role in occurrence and rate of spread of forest fire. The forest types and forest density generate fuel load that could be a major causative factor in initiation and spread of fire across a region. A study carried out in the past have observed that high resin content in sub-tropical pine region and dry conditions in the tropical region have been a major cause of fire spreads in India (Chandra, 2005). In order to estimate forest fire vulnerable regions, an overlay analysis has been performed using forest type group map and forest fire incidence of each year so as to find the occurrence of forest fires in particular forest type group of the country (Table 3).

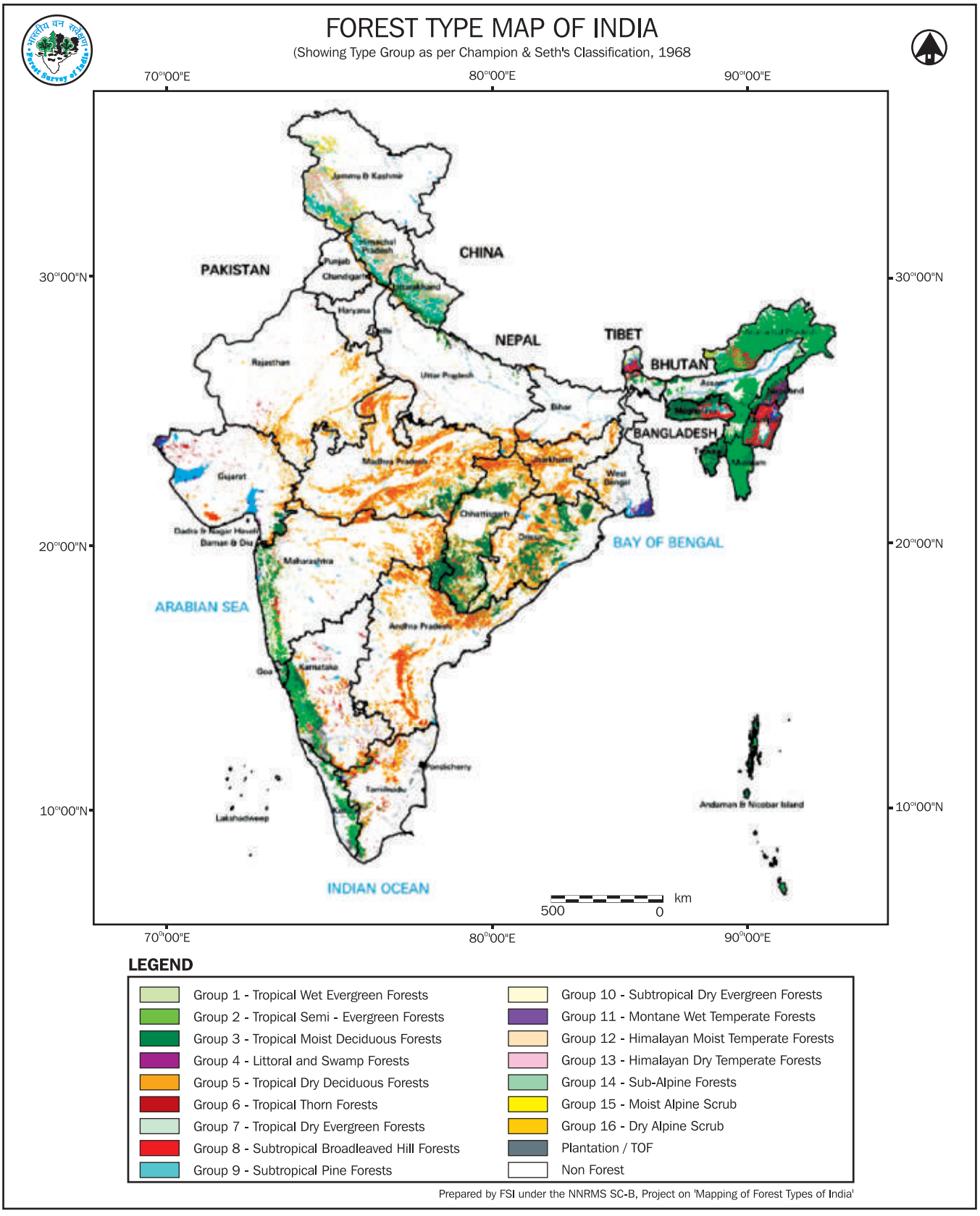


Figure 5: Forest type group map of India

Table 3: Forest fire incidences in different forest type groups during period 2004-11 (year wise) as per Champion and Seth's classification

Sl. No.	Type Group	No of fire incidence							
		04-05	05-06	06-07	07-08	08-09	09-10	10-11	Total
1	Tropical Wet Evergreen Forests	32	144	93	50	182	184	107	**792**
2	Tropical Semi-Evergreen Forests	1447	5274	3705	3007	5121	6324	2999	**27877**
3	Tropical Moist Deciduous Forests	2316	6079	5239	4367	7113	9514	3997	**38625**
4	Littoral & Swamp Forests	8	9	3	11	18	16	1	**66**
5	Tropical Dry Deciduous Forests	3281	5111	5116	6700	9120	9583	4260	**43171**
6	Tropical Thorn Forests	70	109	96	75	90	81	71	**592**
7	Tropical Dry Evergreen Forests	5	6	10	2	9	7	0	**39**
8	Subtropical Broadleaved Hill Forests	167	1093	773	822	987	1633	780	**6255**
9	Subtropical Pine Forests	64	272	247	325	479	531	144	**2062**
10	Subtropical Dry Evergreen Forests	0	0	0	0	0	0	0	**0**
11	Montane Wet Temperate Forests	8	139	79	96	132	227	109	**790**
12	Himalayan Moist Temperate Forests	53	48	113	136	410	156	64	**980**
13	Himalayan Dry Temperate Forests	0	0	1	13	12	4	1	**31**
14	Sub-Alpine Forests	0	18	16	14	35	23	17	**123**
15	Moist Alpine Scrub	0	2	0	3	6	3	0	**14**
16	Dry Alpine Scrub	0	0	1	3	1	0	0	**5**
	Plantation/ToF	28	50	35	64	64	93	30	**364**
	Non Forest	1166	2213	1252	1576	2401	2513	1318	**12439**
	Total	**8645**	**20567**	**16779**	**17264**	**26180**	**30892**	**13898**	**134225**

An analysis of the data of table 3 reveals that maximum forest fire incidences have been reported in tropical dry deciduous forest followed by tropical moist deciduous forests and tropical semi-evergreen forests. States like Andhra Pradesh, Madhya Pradesh, Maharashtra, Chhattisgarh, Odisha, Karnataka, have been observed to be dominated by both moist as well as dry deciduous forests where as the north eastern states of the country consitutute mainly of tropical semi-evergreen forests. The major cause of fire incidences in deciduous forests may be attributed to long spells of dry season, scanty rainfall and other human induced factors. Tropical semi-evergreen forest and sub-tropical broadleaved hill forest are mainly dominating in north-eastern states where it is a socio-cultural practice of harvesting forest crops thereby going for clear felling of trees to raise agriculture crop in the cleared area. Hence the major cause of forest fire incidences in this part of the country is mainly anthropogenic in nature. Subtropical pine forests is the fifth dominating forest type vulnerable to forest fires. Although the percentage of the forest type group is just 2.63% in the country yet the total fire incidences reported during the past 7 years is 2062. This indicates a higher vulnerability of this forest type group towards forest fire occurence. Based on the analysis, it emerged that every 9 km^2 of the area has a probability of fire incidence.

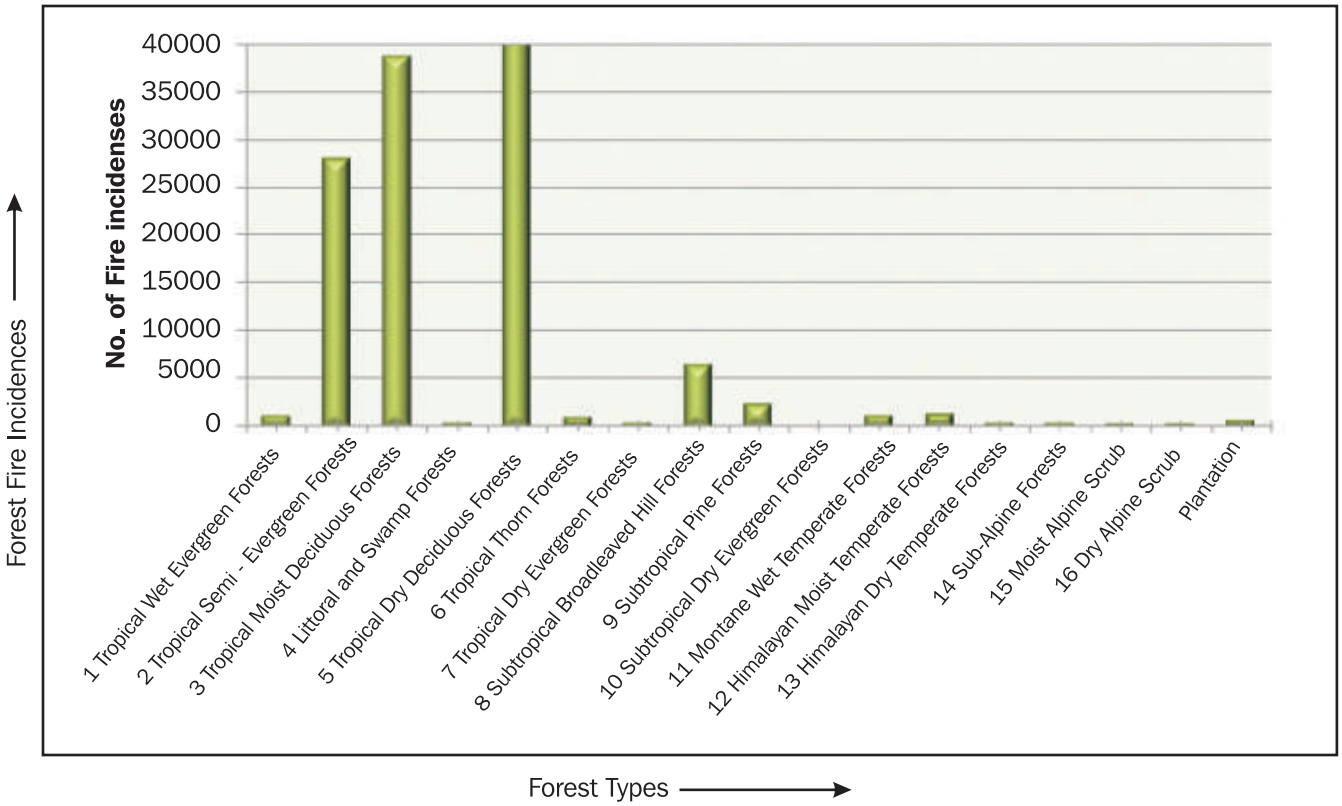


Figure 6: Forest fire incidences in different forest types from 2004 to 2011

15. Forest Fire Vulnerable Toposheets Based on Forest Fire Occurrences

Forest fire incidences communicated to the State Forest Department consists of the information for several parameter including toposheet number. With the help of this information total number of forest fire incidences in a particular toposheet of 1:50,000 has been calculated. The detailed list of the toposheets having more than 100 forest fire incidences during the past 7 years has been given in annexure 1.5. With the help of the above analysis it has been observed that the most vulnerable areas are falling in the toposheet number 84B09 followed by 84A05 and 84A12 with the number of reported forest fire incidences as 1057,1032 and 999 respectively. The sheets correspond to the north eastern states. In addition to the above, toposheet numbers 65A15, 65E03 and 65A14 have also been reported to have the higher number of forest fire incidences in the region during the past 7 years with number of fire incidences as 702, 667 and 608 respectively. A total of 129 toposheets in the scale of 1:50,000 have reported fire incidences at more than 250 locations were as 1366 toposheets have reported fire incidences at more than 10 locations during the past 7 years. There are 562 toposheets where fire incidences has been reported in all the 7 years since 2004.

16. Identification of Vulnerable Grids

Vector coverage of 2.5' x 2.5' grids has been created for the entire country using *ArcGIS* software. Total number of grids for the country comes out to be 1,71,028. The area covered by the grid polygons is approximately between 18 to 20 km^2. A grid receiving forest fire incidences in a three cycle period on

continuous basis has been described as less vulnerable, where as occurrence of fires for 4-6 years in a grid has been classified as moderately vulnerable grids. The grids where incidences of fire have been reported in all the seven years have been classed as highly forest fire vulnerable grids (Figure 8). Table 4 shows the total number of grids vulnerable to forest fire.

Table 4: Total number of grids vulnerable to forest fire

Vulnerability	No of Grids	Percentage
Highly Vulnerable	353	0.21
Moderately Vulnerable	6114	3.57
Less Vulnerable	19298	11.28
Total	**25765**	**15.06**

With the above statistics, highly vulnerable area amounts to 6,707 km^2 approx., where as moderately vulnerable and less vulnerable area amounts to 1,16,166 km^2 and 3,66,662 km^2 approx. respectively. It has been found that a total of 15% area of the country is vulnerable to forest fire based on this analysis.

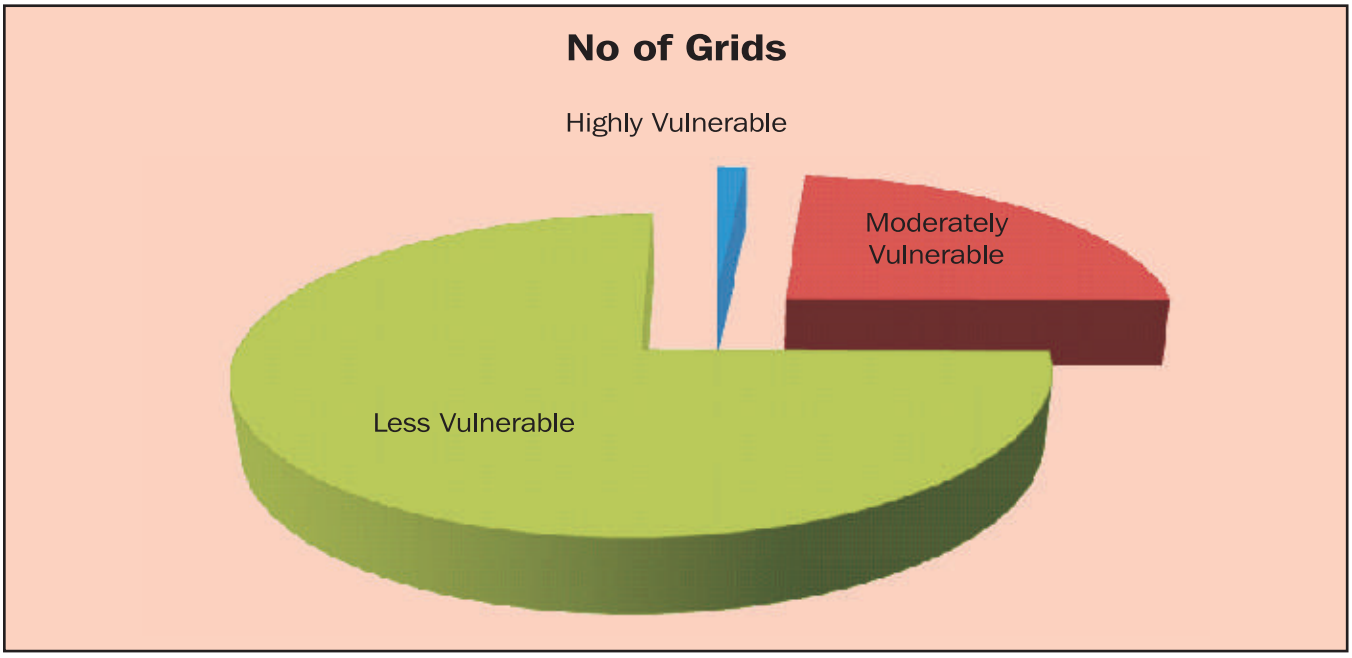


Figure 7: Number of vulnerable grids

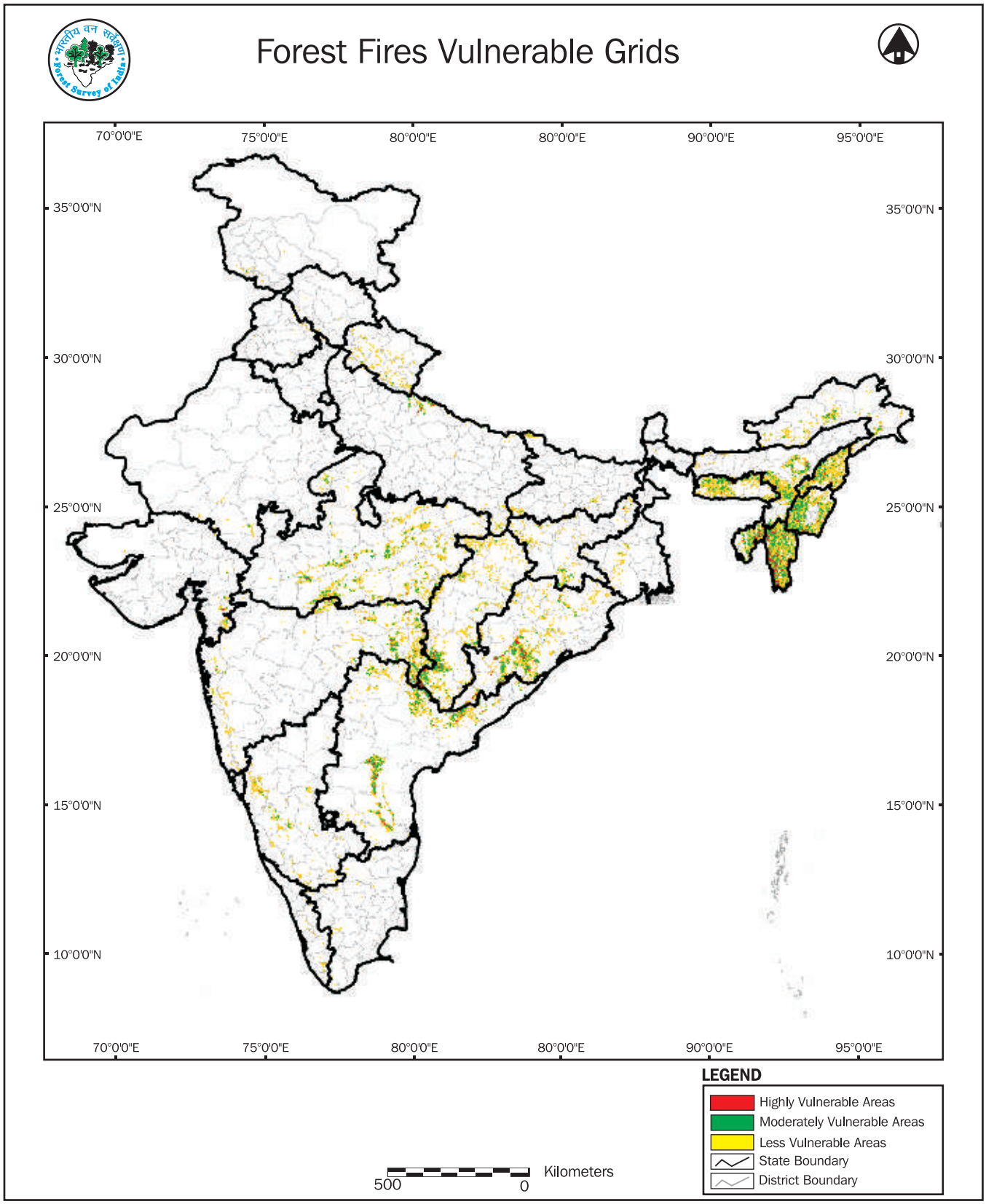


Figure 8: Forest Fire vulnerable grids

17. Creation of the 5 km Buffer around Each Fire Point

Since the point information derived from MODIS sensor for each of the fire clusters has to be spatially correlated, a region of 5 km areal distance has been created and has been identified as the area affected by the impact of forest fires in each year separately. The areal distance of 5 km has been obtained after several trial and errors performed on the dataset (Annexure 1.3).

The cluster of buffers so formed for each of the years based on the above has been used to identify the region for forest fire vulnerbality. Areas common in continuous three year period has been termed as less vulnerable area, where as occurrence of fires for 4-6 years has been classified as moderately vulnerable area. In regions where incidences have been reported in all the seven years have been classed as highly vulnerable areas.

18. Generation of the Vulnerable Map

Areas vulnerable to forest fire are categorized into highly vulnerable, moderately vulnerable and less vulnerable area. The district and state boundary have been added to get the vulnerable areas at country level in the form of a map (Figure 9). Vulnerable districts with high, moderate and less vulnerable areas have been mapped to get the forest fire vulnerable map of the county at district level (Figure 10).

19. Identification of Vulnerable Districts

The common buffer (vulnerable area) is overlaid with the state boundary and the respective district boundaries to identify the districts constituting the vulnerable areas (Annexure 1.1). An analysis of the vulnerable areas indicate that the most vulnerable areas have been mostly observed in the border district of the states of central and south central India viz., Madhya Pradesh, Maharashtra Chhattisgarh, Andhra Pradesh and Odisha. In order to further explore the relationship between fire incidences and anthropogenic pressure, a further analysis of population density and poverty index has been carried out using census of India, 2011 information. An analysis of the most vulnerable regions with the highest poverty affected districts indicated that a total of 46 districts falling under most vulnerable areas are from the states having larger number of people living below poverty line. The reasons may be many. But the most likely reason may be the frequent visits of the people residing in the periphery of the forest areas for firewood, fodder, and collection of minor forest produce (MFP). Some states are facing the threat of left wing extremism such as Madhya Pradesh, Maharastra, Chhattisgarh, Odisha and Andhra Pradesh making it vulnerable to forest fires due to reduced mobility by forest staff in the affected areas thereby largely affecting the forest fire protection and management measures. Figure 10 shows the map showing forest fire vulnerable disticts.

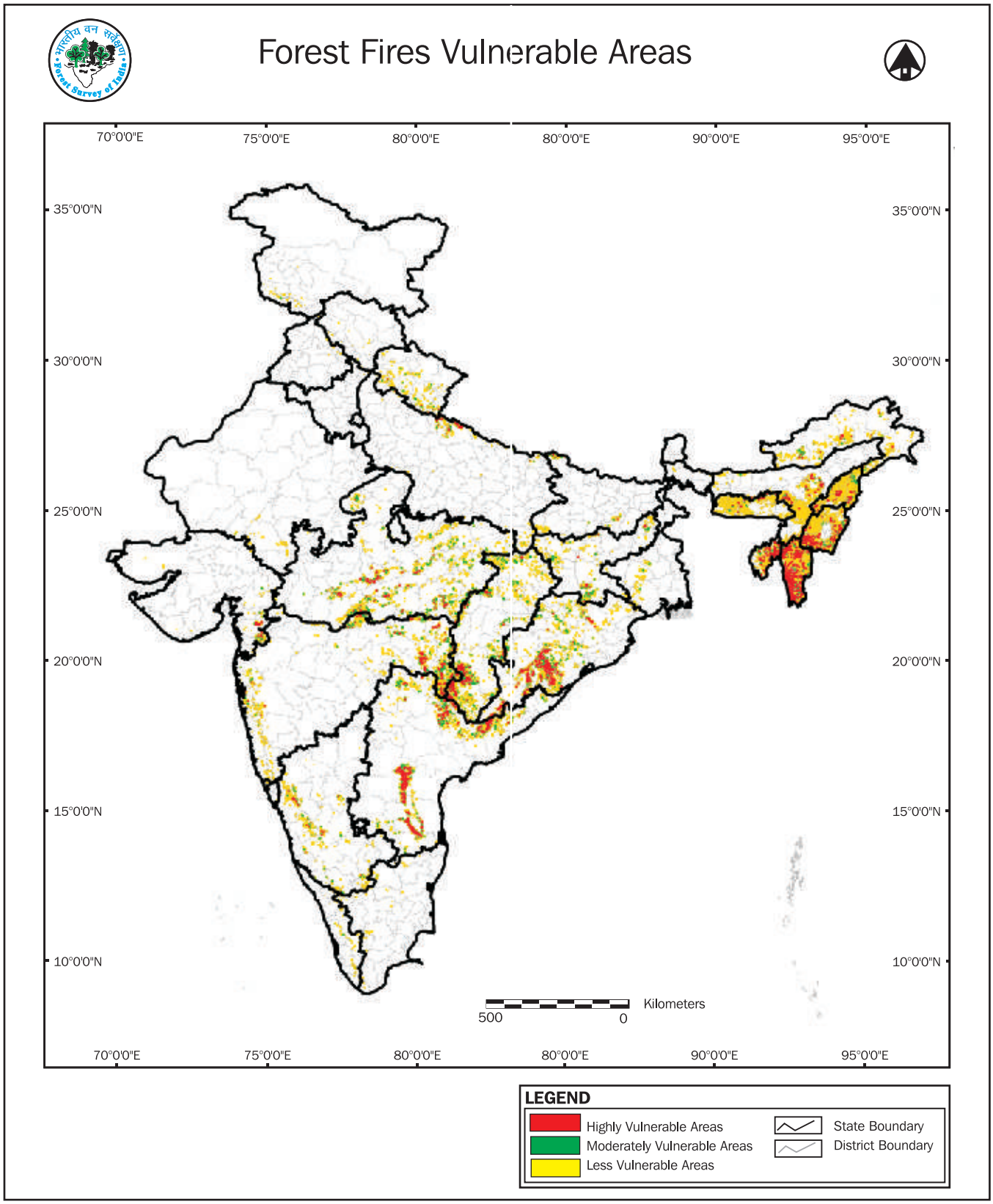


Figure 9: Forest Fire vulnerable areas

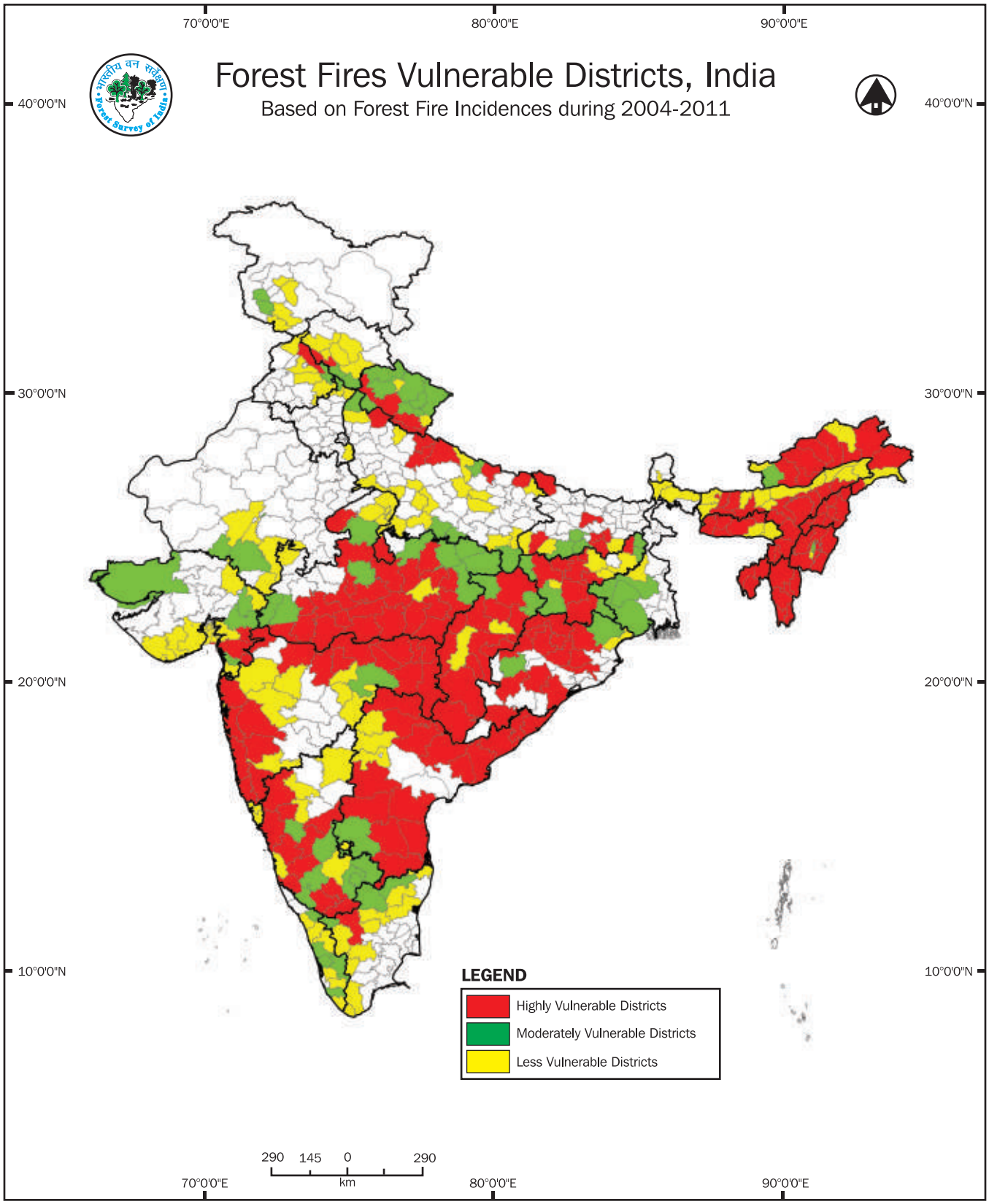


Figure 10: Map showing forest fire vulnerable districts

20. Result & Discussions

An analysis of the forest fire incidences with different factors have been carried out in the present work to find the forest types, forest density classes, toposheet number and ultimately the vulnerable area along with the districts.

Based on the analysis of the figures at annexure 1.1, it has been observed that the very high vulnerable states are congregated in the central and southern part of India, which is primarily dominated by dry and moist deciduous forests. The north-eastern part of India has also been identified as vulnerable to forest fire, owing largely to the socio cultural practice of clearing the forest through burning of trees to be ultimately being used for practising agriculture. The number of districts in each of the states falling in different vulnerable zones are shown in Table 5.

Table 5: States with No. of districts under different vulnerability zones.

Sl. No.	State	No. of Highly Vulnerable District	No. of Moderately Vulnerable District	No. of Less Vulnerable District	Total No. of Vulnerable District
1.	Andhra Pradesh	15	1	3	19
2.	Arunachal Pradesh	9	1	3	13
3.	Assam	12	0	9	21
4.	Bihar	5	3	3	11
5.	Chhattisgarh	11	2	2	15
6.	Gujarat	3	4	7	14
7.	Goa	0	0	2	2
9.	Haryana	0	1	1	2
10.	Himachal Pradesh	1	2	5	8
11.	Jammu & Kashmir	0	2	4	6
12.	Jharkhand	8	5	4	17
13.	Karnataka	11	7	5	23
14.	Kerala	0	5	6	11
15.	Madhya Pradesh	24	9	5	38
16.	Maharashtra	18	1	7	26
17.	Manipur	7	1	1	9
18.	Meghalaya	5	0	2	7
19.	Mizoram	6	0	0	6
20.	Nagaland	8	0	0	8
22	Odisha	9	3	1	13
23	Punjab	1	1	4	6
24.	Rajasthan	0	2	4	6
25.	Sikkim	0	0	1	1

Sl. No.	State	No. of Highly Vulnerable District	No. of Moderately Vulnerable District	No. of Less Vulnerable District	Total No. of Vulnerable District
26.	Tamil Nadu	1	3	10	14
27.	Tripura	3	0	0	3
28.	Uttar Pradesh	7	5	16	28
29.	Uttarakhand	4	7	2	13
30.	West Bengal	0	4	3	7
31	Dadra & Nagar Haveli	0	0	1	1
	Total	**168**	**69**	**111**	**348**

An analysis of the above table reveals that highest vulnerability has been observed in the states of Arunachal Pradesh, Goa, Manipur, Meghalaya, Nagaland, Uttarakhand followed by Jharkhand, Chhattisgarh, Assam where maximum number of districts out of the total districts in the state are prone to forest fires. 29 out of 35 states and UTs have been reported with the continuous forest fire in two or more consecutive years. A total of 348 districts of across the country are vulnerable to forest fires.

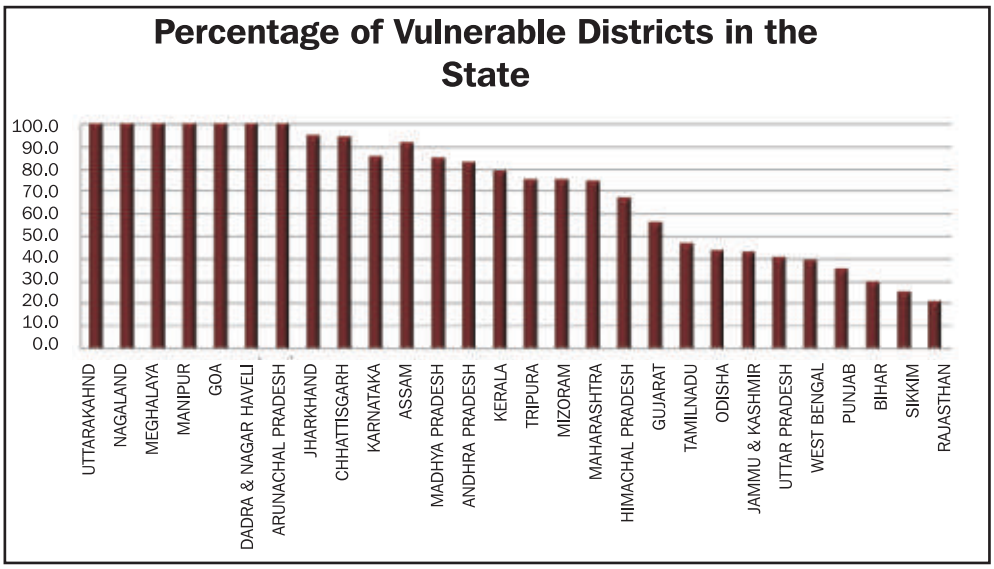


Figure 11: Chart representing the number of vulnerable districts in each of the states

In Delhi, and in all the Union Territories except Dadra and Nagar Haveli, repetition of forest fire in the same area in consecutive years is negligible.

The anthropogenic reasons behind the vulnerability categorization may be attributed to the biotic pressure and dependency of the people on forest. Apart from the above, forest types that has been the major source of dry fuel for ignition and spread of fire have been a major factor. Higher temperature condition during summers, other weather conditions, poverty and illiteracy have been some of the other reasons indentified for the forest fire occurrence in the areas.

An analysis of the census 2011 statistics on population and other data indicates that vulnerable districts categorized on the basis of fire occurrences in general have a large population or comparatively low

literacy rate. District wise population and literacy rate has been given in Annexure 1.2. On the basis of the above analysis it has been observed that of the 15 highly vulnerable districts of Andhra Pradesh, 9 districts are having literacy rate below 60%. At national level, of the 348 identified vulnerable districts 83 districts are having literacy rate less than 60%.

In north eastern states although the literacy rate is high, yet the main reason for the larger area being vulnerable may be attributed to the general practice of shifting cultivation, where large chunks of forest land is being burnt for practicing agriculture.

In central part of the country where the vulnerable districts are comparatively higher, one of the reasons may be the insurgency activities in the certain parts of the states. It has been found that the bordering region of the two or more states have been more vulnerable to forest fire, among the likely reasons could be the management issues in the bordering areas. In Uttarakhand state the dominating forest type other than temperate forests is subtropical pine forest (29% of the total forests of the state) which is much prone to forest fires in the fire season. Steep slope and topographic features of the state is also favorable to forest fire occurrences and spread. In Uttar Pradesh and Bihar some of the districts bordering Nepal are also vulnerable to forest fire. A further analysis of the poverty map created using data from Planning Commission , Govt. of India, for the Uniform Recall Period 2004-05 (Annexure 1.4) in case of the highly fire vulnerable districts has also been carried out. The results indicates that 51% of the highly forest fire vulnerable districts are falling under eight states of the country having 31-47 percentage of population below poverty line (Figure 14). The states are-Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Uttar Pradesh and Uttarakhand. The likely reasons for the occurrence of major fire incidences in this part of the country may be attributed to the maximum pressure on forest areas by the people living in the fringe forest areas for collection of fire wood, fodder, grazing of cattle and collection of minor forest produce.

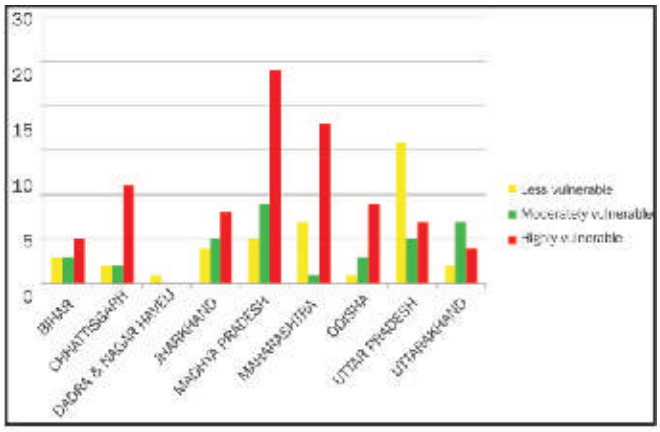


Figure 12: Chart representing the number of forest fire vulnerable districts in states at national level having 31-47% of population below poverty line

An analysis of the results reveal that at country level, the state of Madhya Pradesh is having highest number of highly vulnerable districts followed by Maharashtra, Chhattisgarh and Odisha (Figure 12). A further analysis into the number of districts identified as highly vulnerable compared with the total number of districts in the respective state, has also been carried out. It has been found that Chhattisgarh is having the highest percentage of highly vulnerable districts in the state, followed by Maharashtra and Madhya Pradesh(Figure 13).

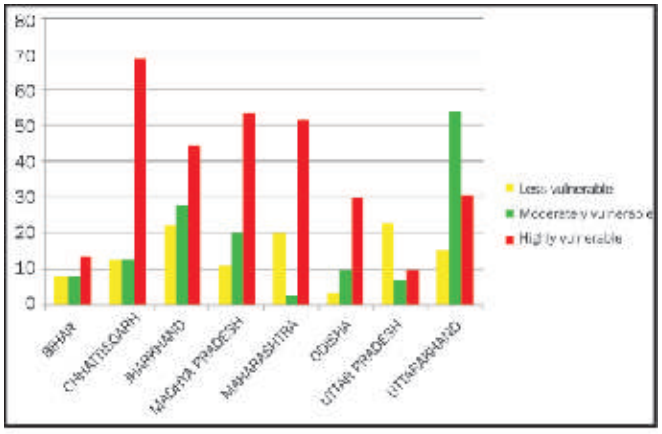


Figure 13: Chart representing the number of forest fire vulnerable districts in states having 31-47% of population below poverty line

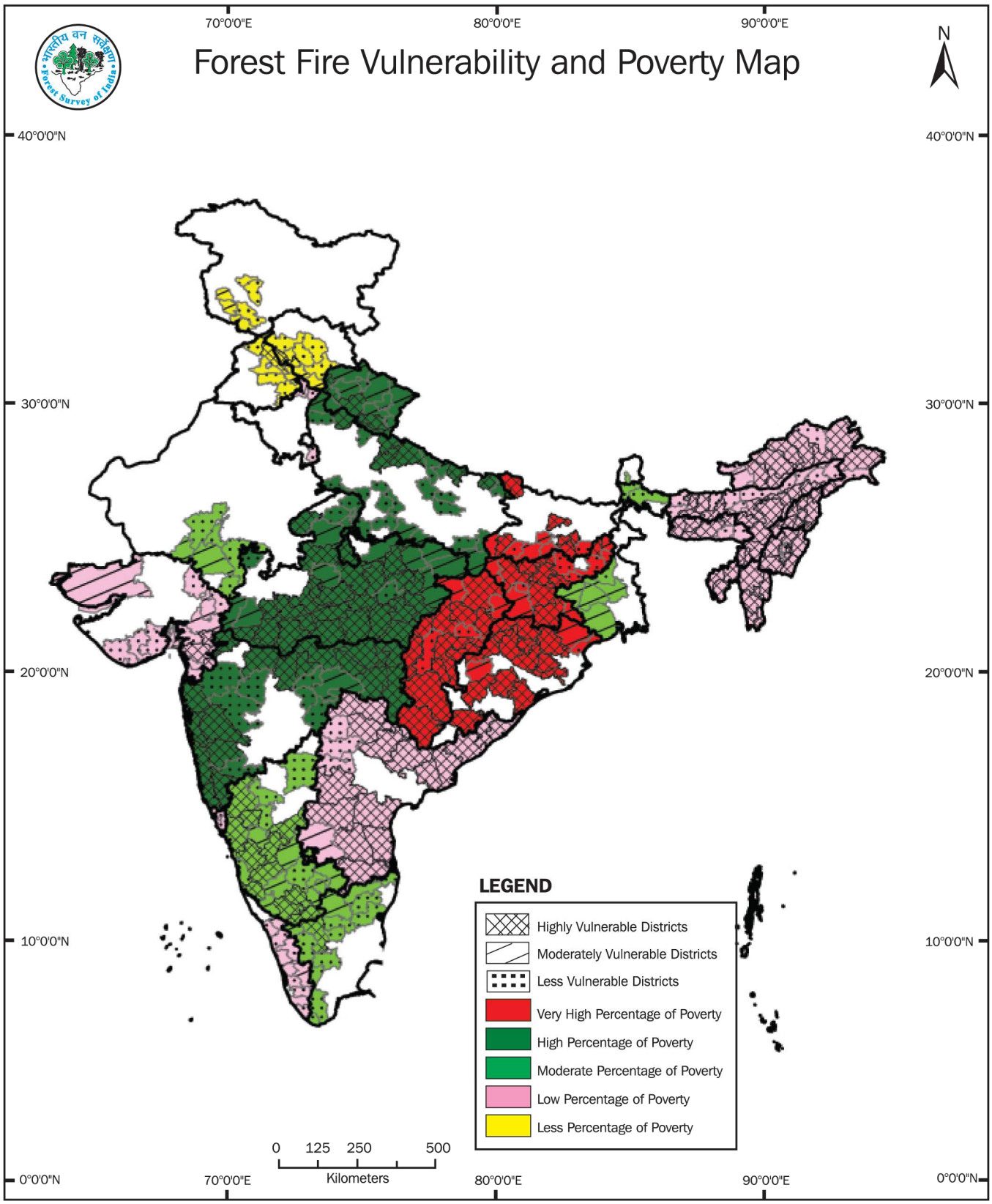


Figure 14: Map showing forest fire vulnerable districts overlaid with Poverty affected districts

Correlating Forest Fires with Rainfall Data

A further study into the pre-monsoon rainfall condition, in the 36 meteorological stations across the county was carried out to study the rainfall conditions that may affect plant health, leaf stress conditions, soil moisture and ultimately affect forest fire occurrences. An analysis of the pre-monsoon rainfall data up to April 2012 indicate that of the total meteorological divisions, 17 in year 2007, 12 in year 2008, 27 in year 2009, 28 in year 2010, 15 in year 2011 and 23 in year 2012 received rainfall below normal. A further analysis was carried out for the rainfall regions where rainfall deviation has been observed below -59% to as low as -99%. A total of 6 divisions in 2007, 6 in 2008, 19 in 2009, 19 in 2010, 5 in 2011 and 9 in 2012 have been observed to receive scanty rainfall. One division in 2010 and 2011 each did not receive any rainfall during pre-monsoon period up to April of the respective years. The figure 15 below indicates the departure from normal rainfall at different meteorological stations across the country. Analysis of the figure below indicates that the low and scanty rainfall has been reported in the regions of east Madhya Pradesh, Chhattisgarh, Maharashtra, Odisha, Bihar, parts of Uttar Pradesh which have also been identified as forest fire vulnerable areas in the present study.

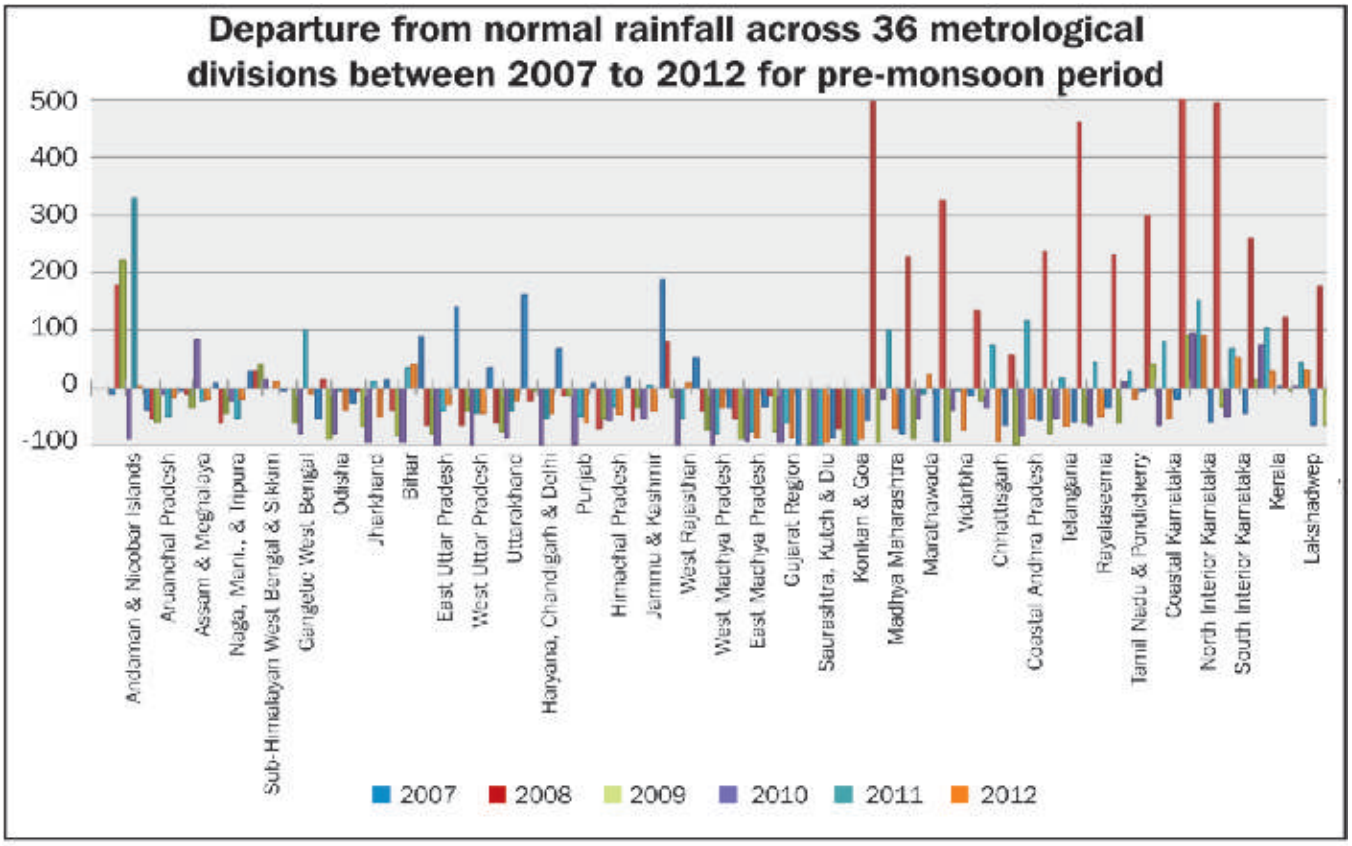


Figure 15: Chart representing the rainfall conditions at 36 Meteorological divisions

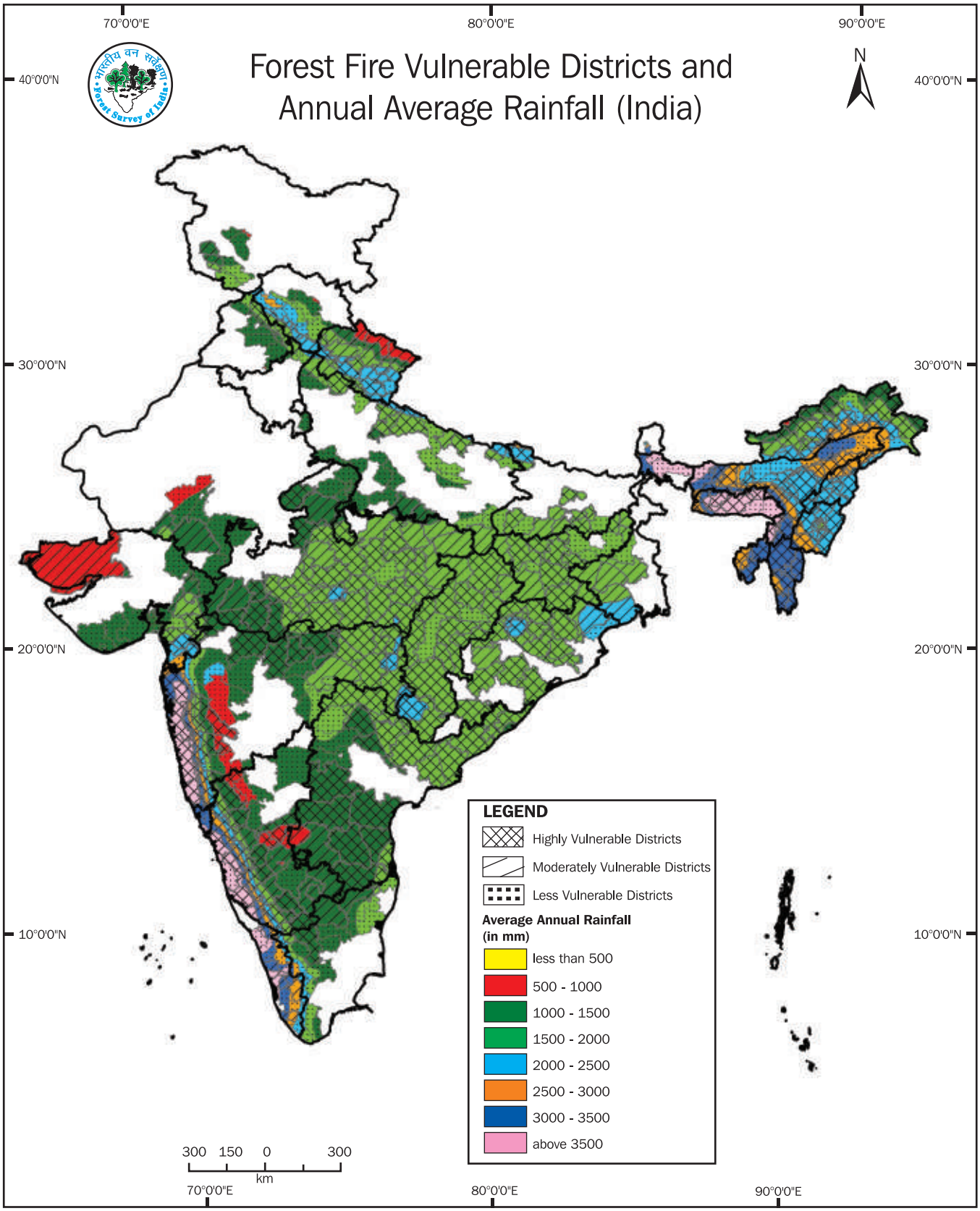


Figure 16: Map showing forest fire vulnerable districts under different annual average rainfall

21. Vulnerability in Terms of Time Period: State wise Crucial Time for Forest Fire

In this report, vulnerability in terms of spatial extent has been estimated. It has been further observed that the duration time for the maximum forest fire occurrences in a state could provide the information for crucial period of fire occurrences. The study further looked into such periods of fire occurrences when the frequency of occurrences of forest fires have been maximum. The estimation of the crucial time period have been carried out by averaging out the day-wise frequency of total fire points of all the studied years. Scatter plot of the average forest fire frequencies have been generated for each state. After the generation of the scattered plot of each year, 1/3rd from the peak value has been calculated to get the crucial period of forest fires for each state. The crucial period of the states under analysis has been given in Table 6.

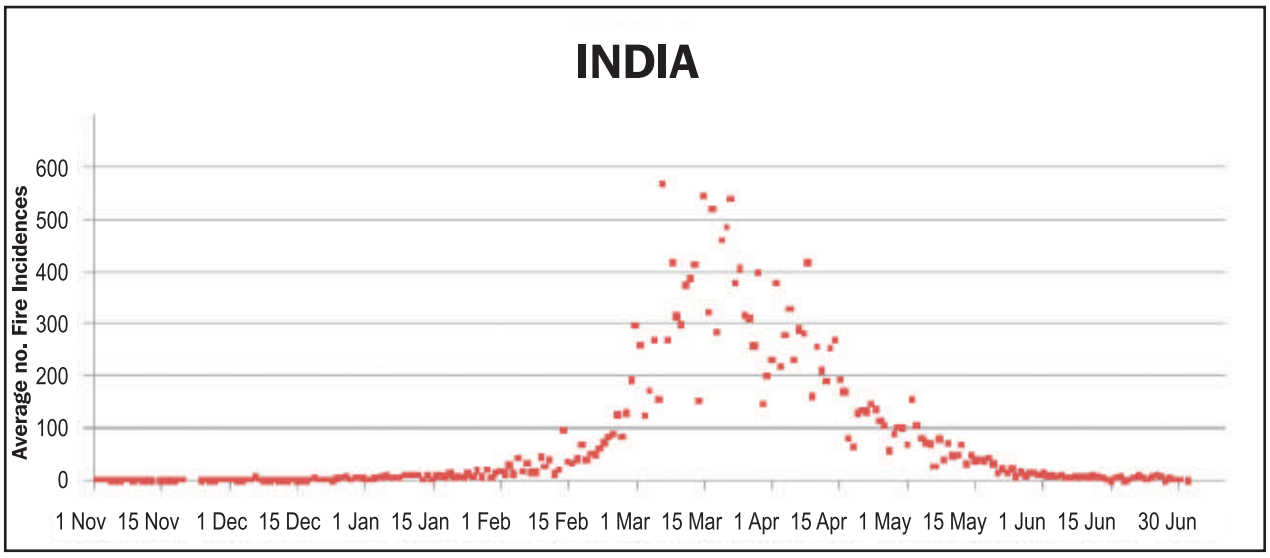
Table 6: Crucial period for the states.

Sl. No.	State	Crucial Period of Forest Fire	
		From	To
1	Andaman & Nicobar	1st week of Apr	1st week of May
2	Andhra Pradesh	2nd week of Feb	1st week of Apr
3	Arunachal Pradesh	3rd week of Feb	4th week of Apr
4	Assam	1st week of Mar	3rd week of Apr
5	Bihar	2nd week of Mar	3rd week of Apr
6	Chhattisgarh	4th week of Feb	3rd week of Apr
7	Gujarat	4th week of Feb	3rd week of Apr
8	Haryana	3rd week of Mar	1st week of Jun
9	Himachal Pradesh	2nd week of Apr	1st week of Jun
10	Jammu & Kashmir	2nd week of May	3rd week of Jun
11	Jharkhand	1st week of Mar	3rd week of Apr
12	Karnataka	2nd week of Feb	1st week of Apr
13	Kerala	1st week of Feb	4th week of Mar
14	Madhya Pradesh	1st week of Mar	4th week of Apr
15	Maharashtra	4th week of Feb	3rd week of Apr
16	Manipur	1st week of Mar	1st week of Apr
17	Meghalaya	1st week of Mar	1st week of Apr
18	Mizoram	1st week of Mar	1st week of Apr
19	Nagaland	4th week of Feb	4th week of Mar

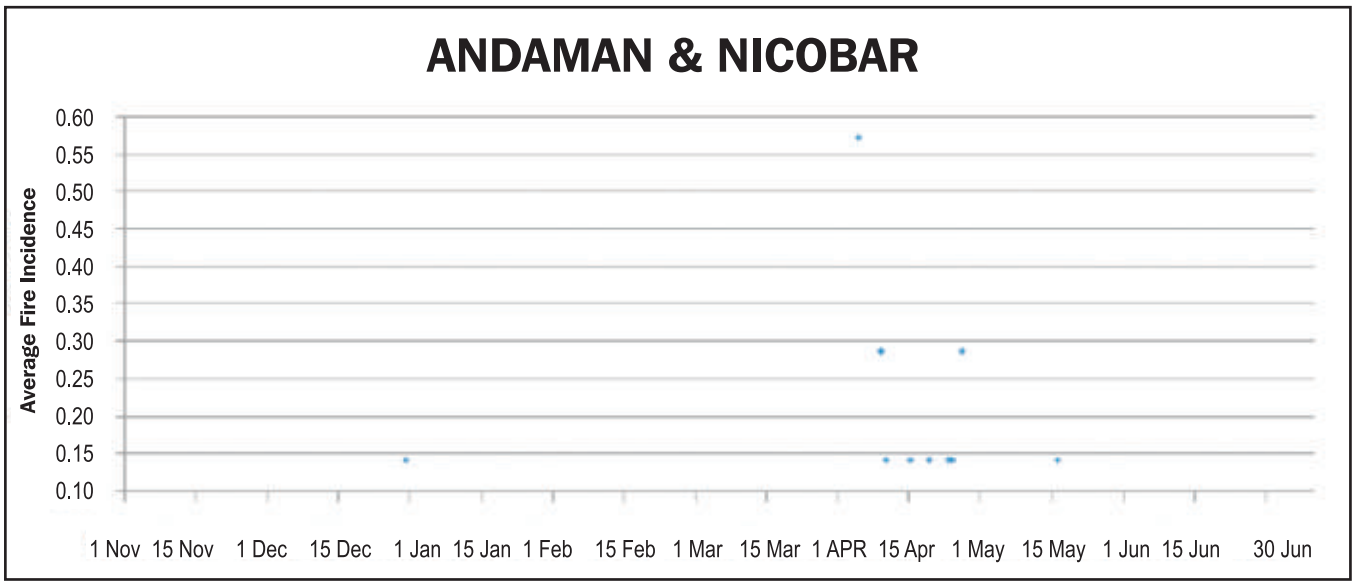
Sl. No.	State	Crucial Period of Forest Fire	
		From	To
20	Odisha	3rd week of Feb	4th week of Apr
21	Punjab	3rd week of Mar	Ist week of Jun
22	Rajasthan	2nd week of Feb	Ist week of May
23	Tamil Nadu	Ist week of Feb	3rd week of Mar
24	Tripura	2nd week of Mar	2nd week of Apr
25	Uttar Pradesh	3rd week of Mar	3rd week of Apr
26	Uttarakhand	Ist week of Apr	4th week of Apr
27	West Bengal	2nd week of Feb	3rd week of Mar

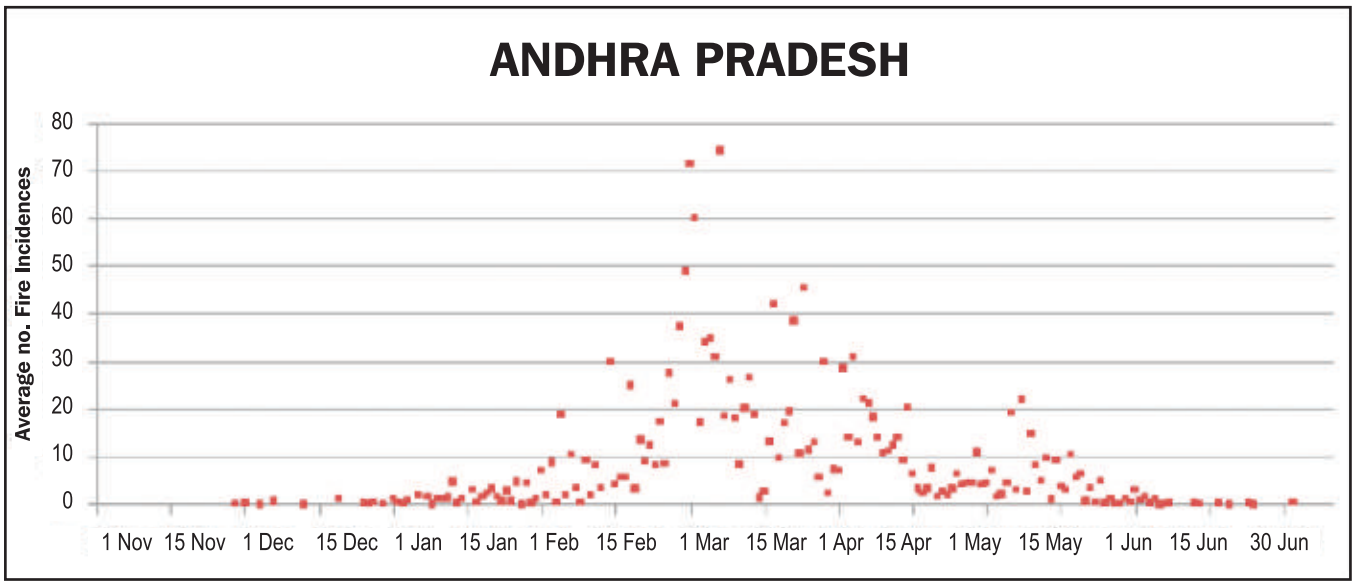
From the table it is discernibly observed that there is a clear cut pattern for the crucial period of the forest fire in different parts of the country. In north-eastern states crucial period is between the first week of March to third week of April, whereas, in southern part of the country crucial period is between first week of February to first week of April. However in the northern and the central part of the country, the crucial period is between fourth week of February to third week of June.

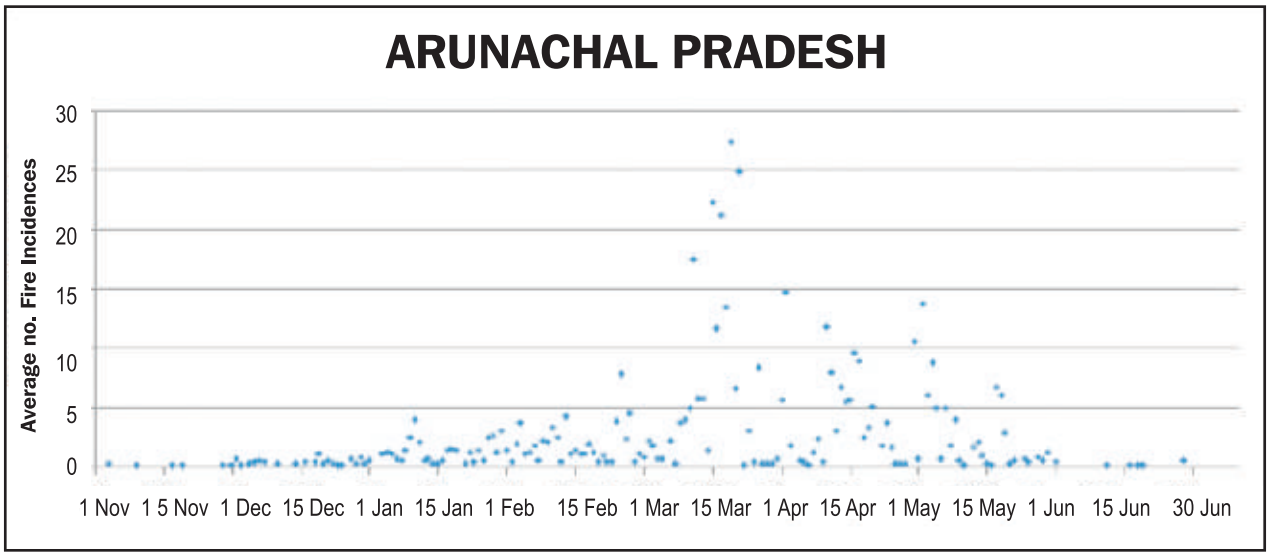
An analysis of the results indicate that the crucial period in general for forest fires in country is between third week of February to first week of May. The scatter plot of the average forest fire frequencies for the country is given below.

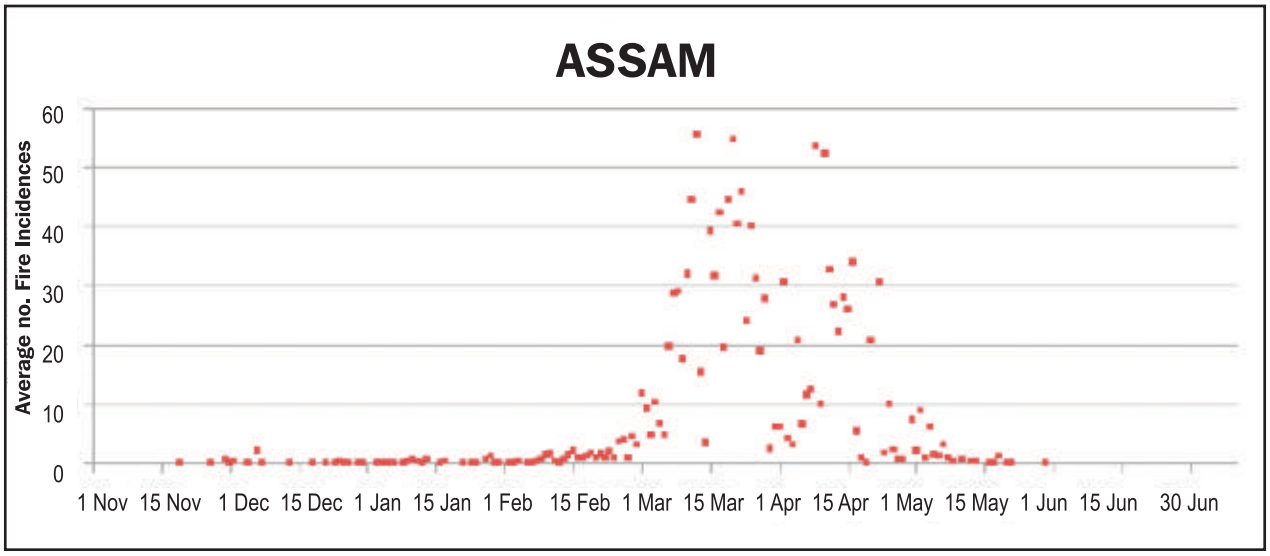


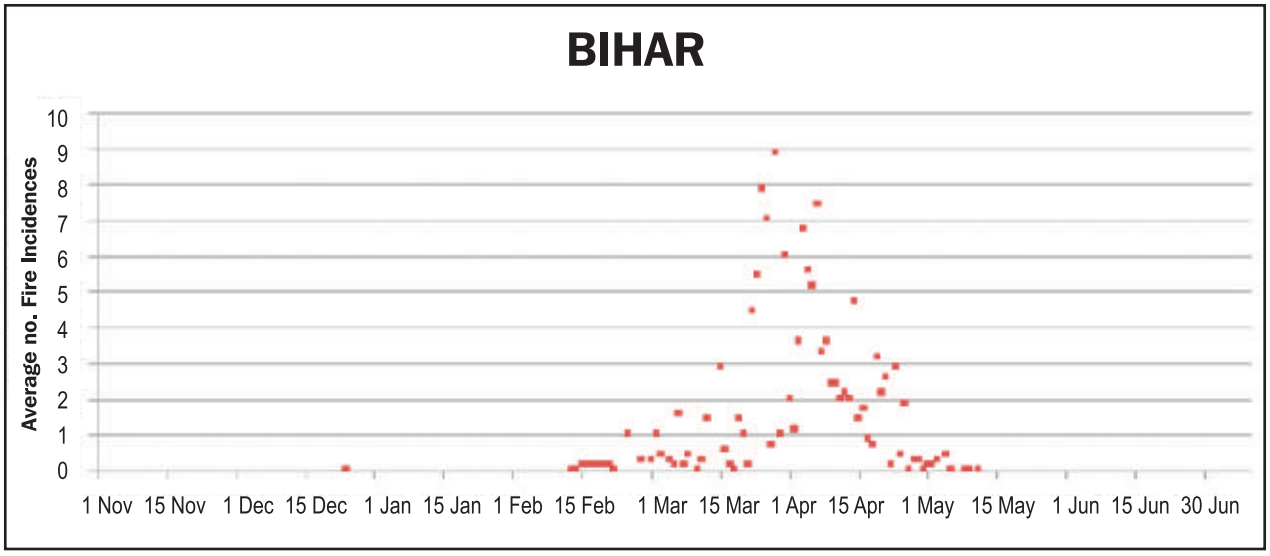
State wise Scatter plots of average forest fire frequencies are given below. Although the scatter plot of Dadra & Nagar Haveli, Delhi, Goa and Sikkim has been generated based on the fire incidences in the state but the crucial period from the data could not be derived as no pattern has been observed for these states and UTs.



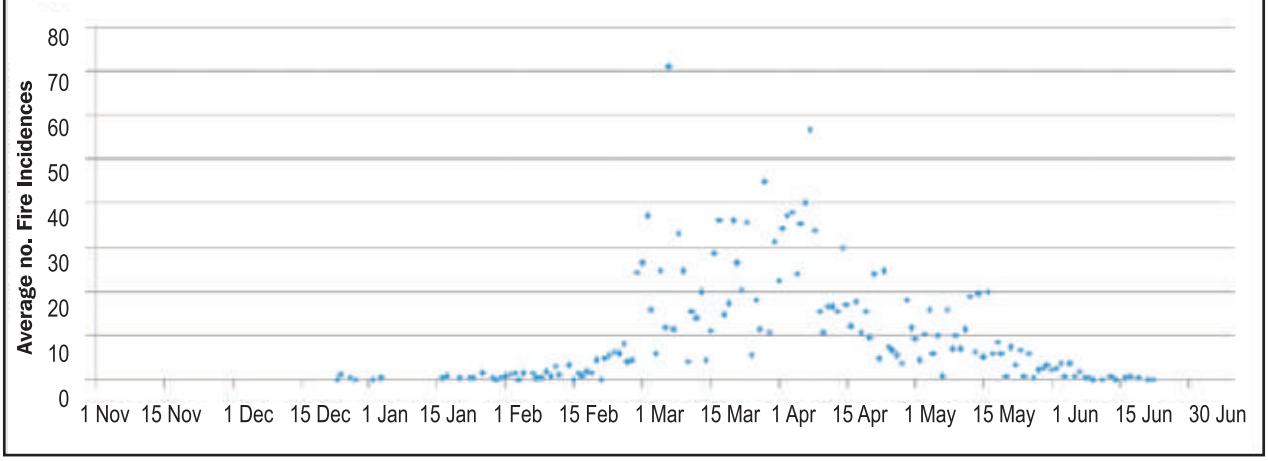



ARUNACHAL PRADESH
Average no. Fire Incidences
30
25
20
15
10
5
0
1 Nov
1 5 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun

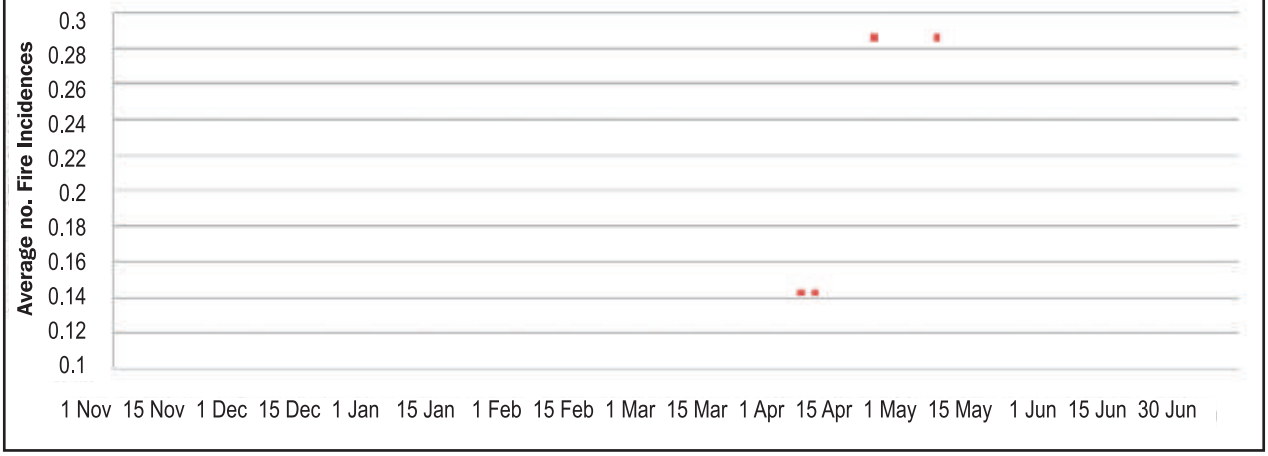

ASSAM
Average no. Fire Incidences
60
50
40
30
20
10
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun


BIHAR
Average no. Fire Incidences
10
9
8
7
6
5
4
3
2
1
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun

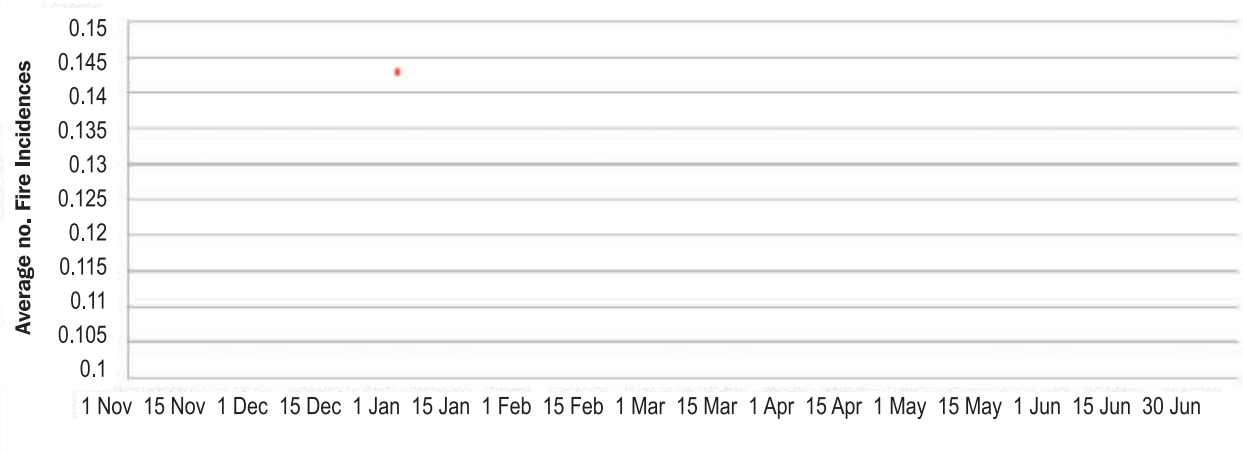
CHHATTISGARH

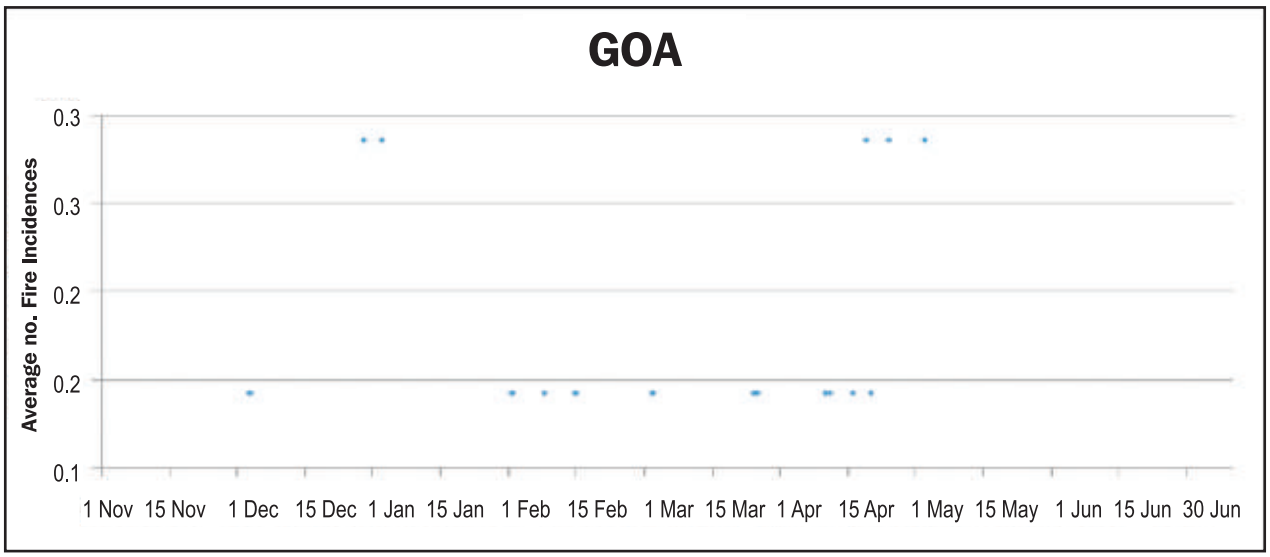


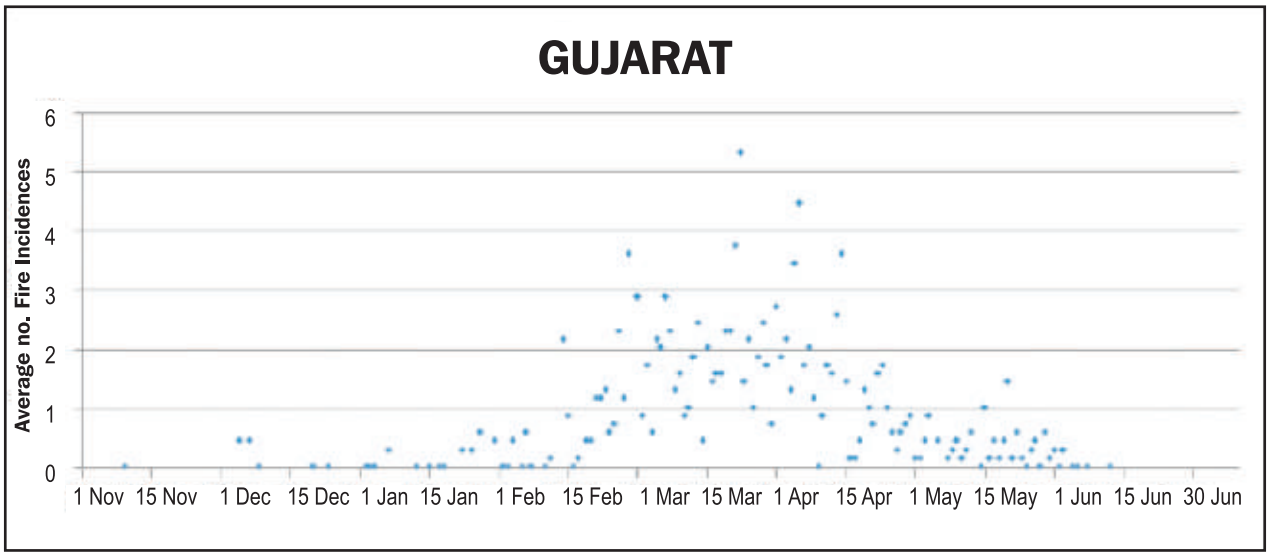
DADRA & NAGAR HAVELI

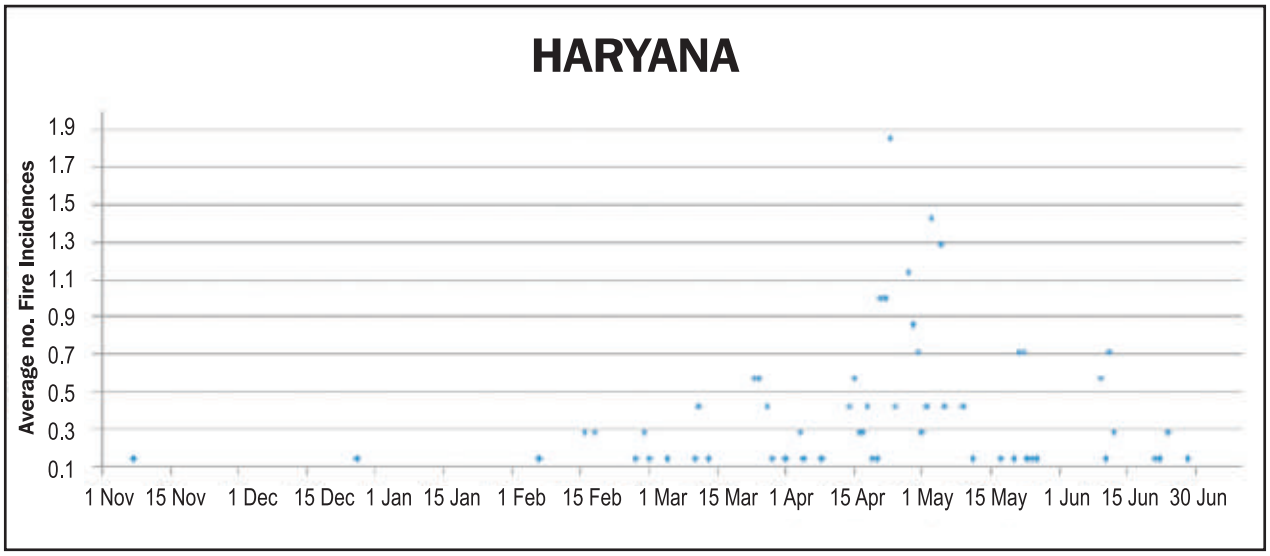


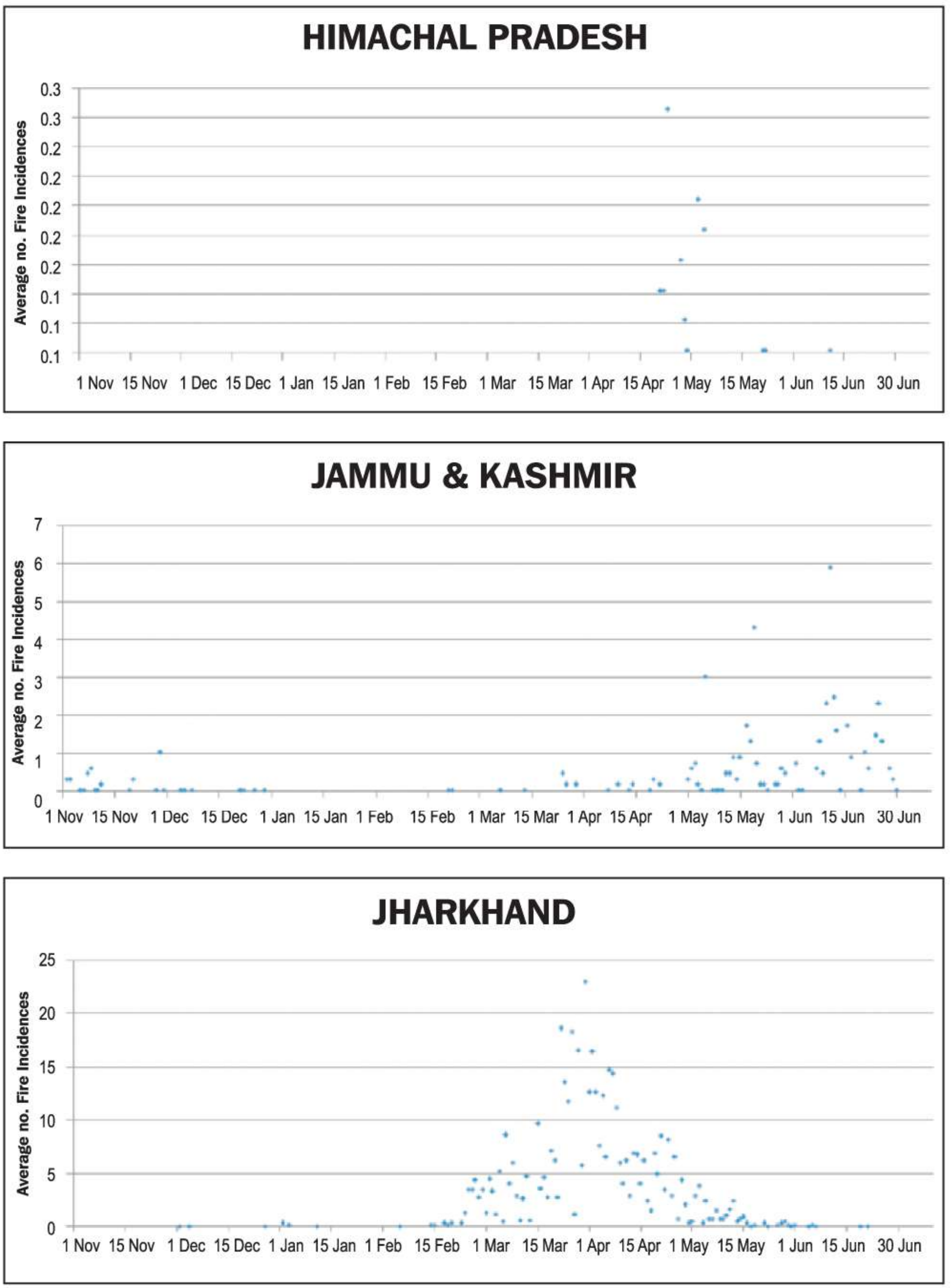
DELHI

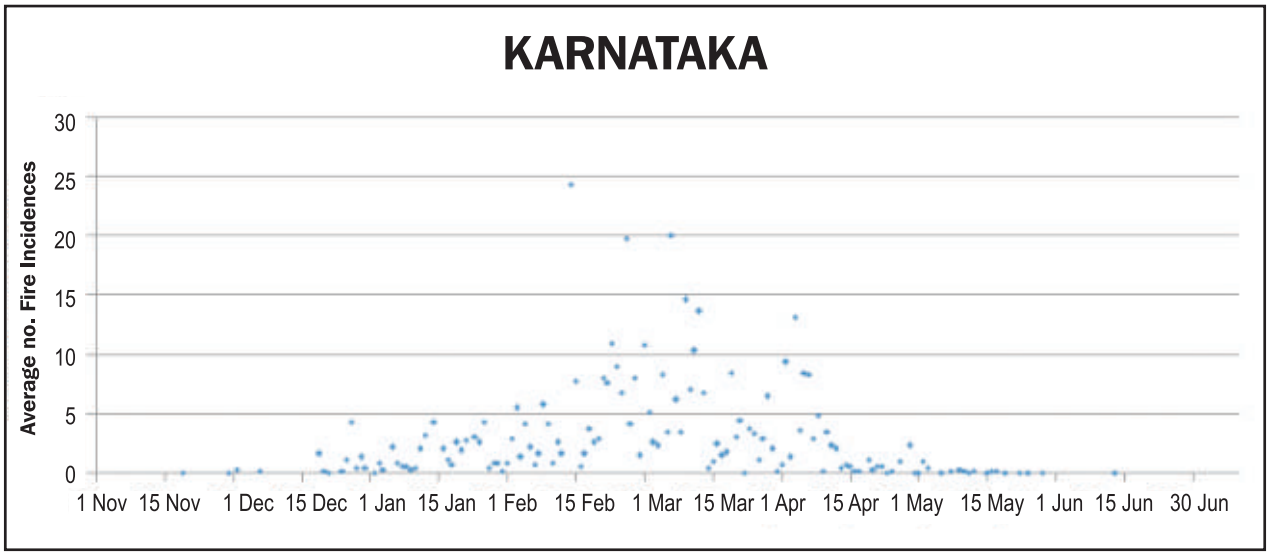


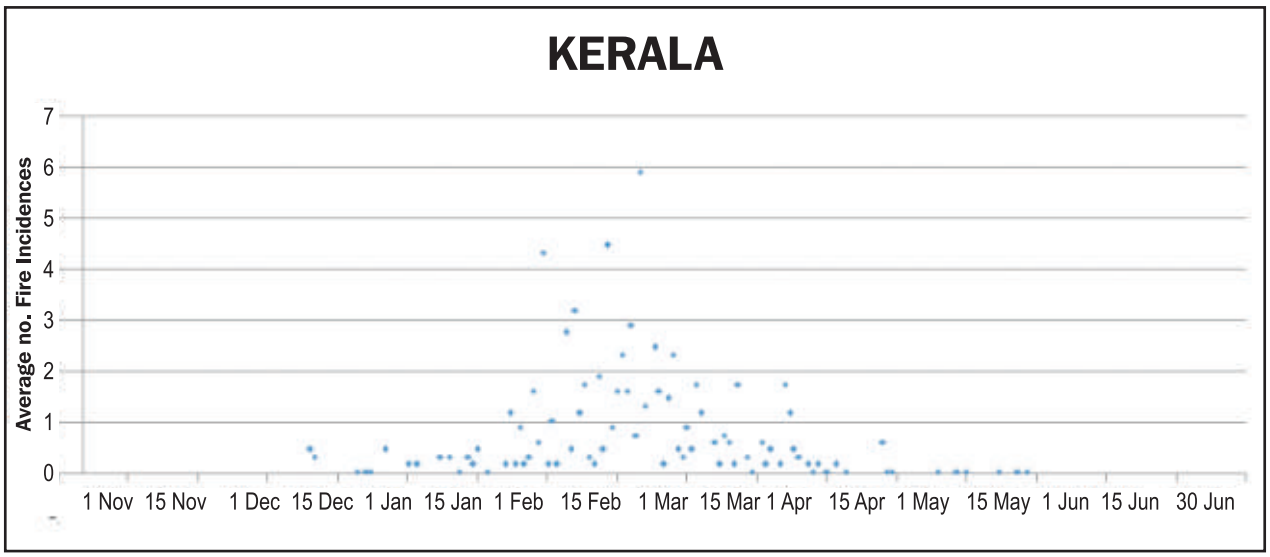

GOA
Average no. Fire Incidences
0.3
0.3
0.2
0.2
0.1
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

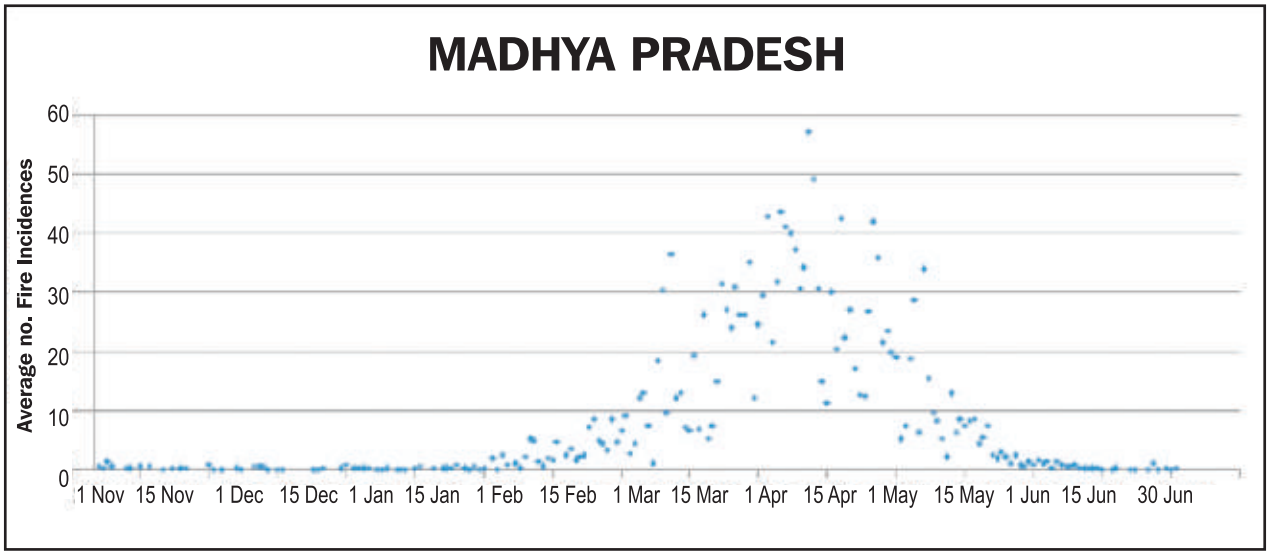

GUJARAT
Average no. Fire Incidences
6
5
4
3
2
1
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

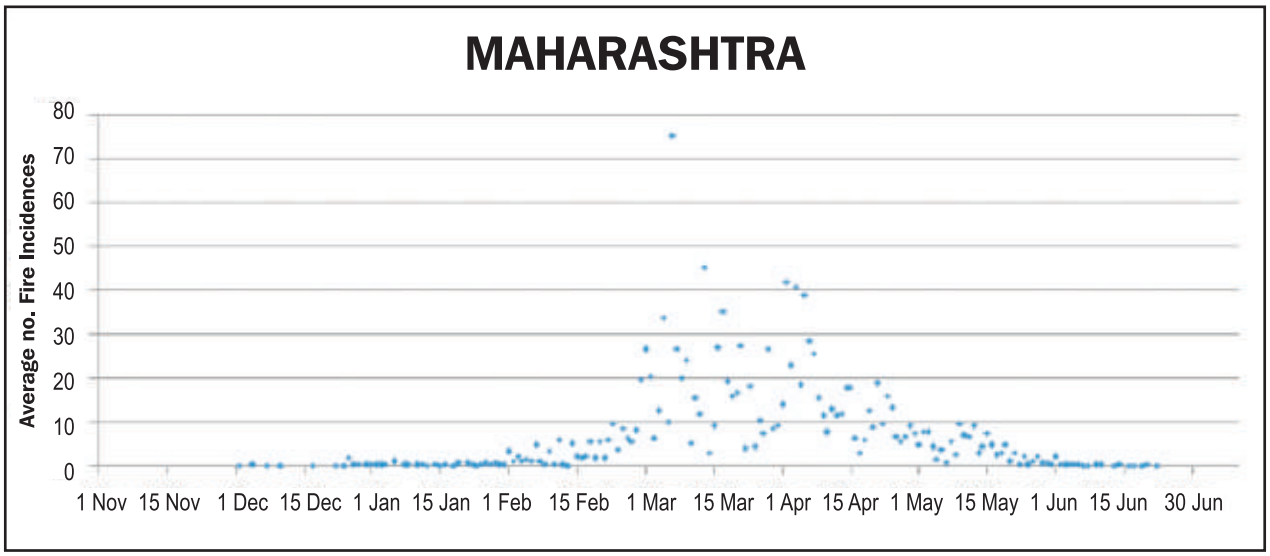

HARYANA
Average no. Fire Incidences
1.9
1.7
1.5
1.3
1.1
0.9
0.7
0.5
0.3
0.1
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

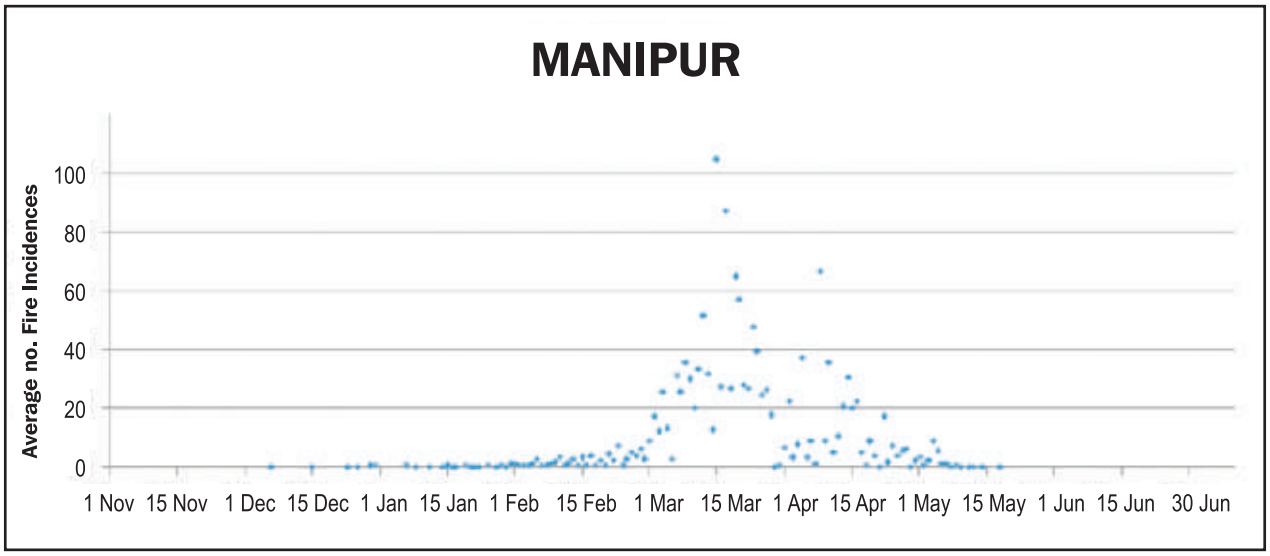

HIMACHAL PRADESH
Average no. Fire Incidences
0.3
0.3
0.2
0.2
0.2
0.2
0.1
0.1
0.1
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun
JAMMU & KASHMIR
Average no. Fire Incidences
7
6
5
4
3
2
1
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun
JHARKHAND
Average no. Fire Incidences
25
20
15
10
5
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

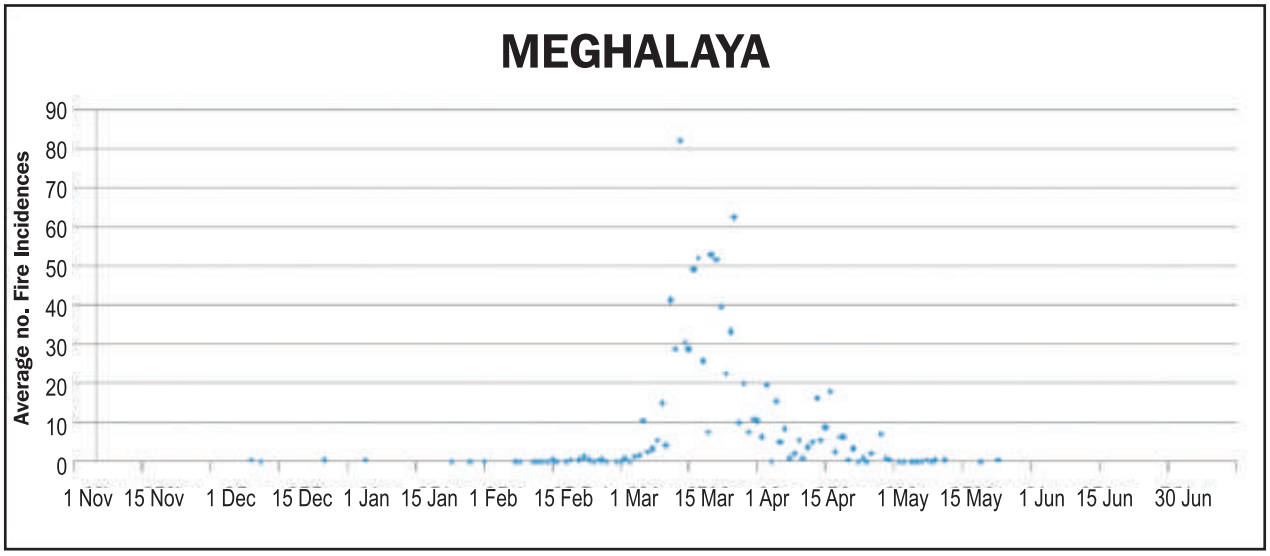

KARNATAKA
Average no. Fire Incidences
30
25
20
15
10
5
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

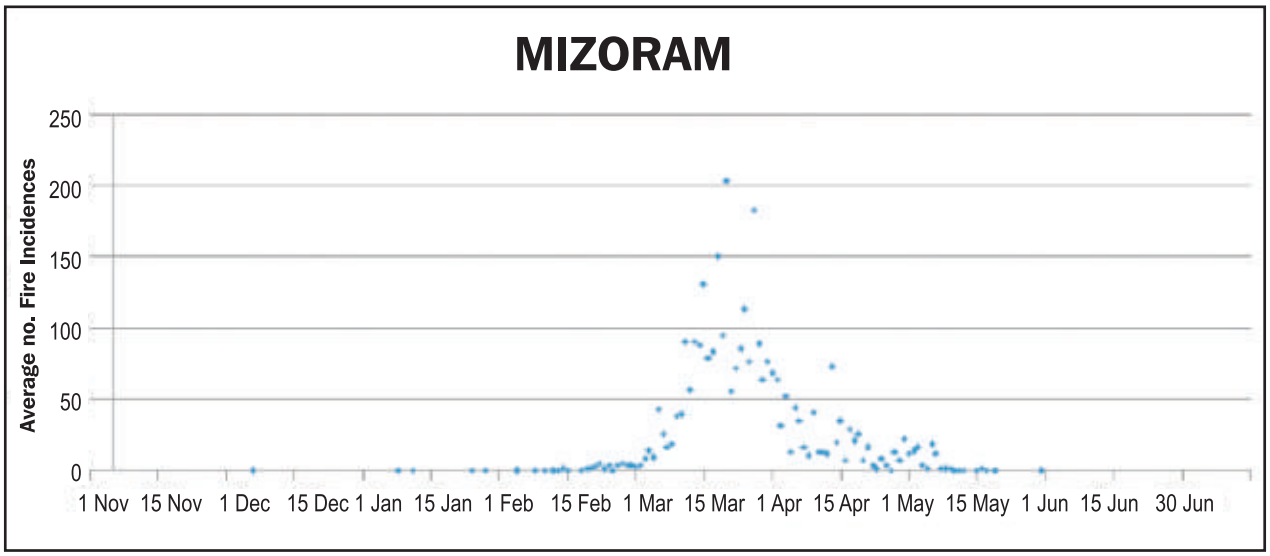

KERALA
Average no. Fire Incidences
7
6
5
4
3
2
1
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

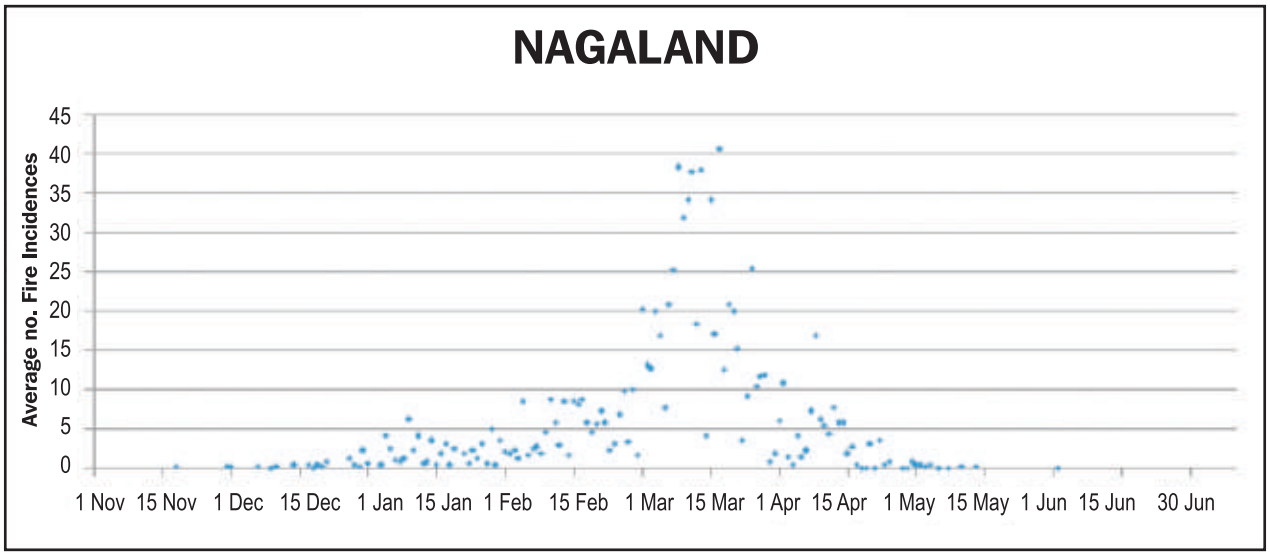

MADHYA PRADESH
Average no. Fire Incidences
60
50
40
30
20
10
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

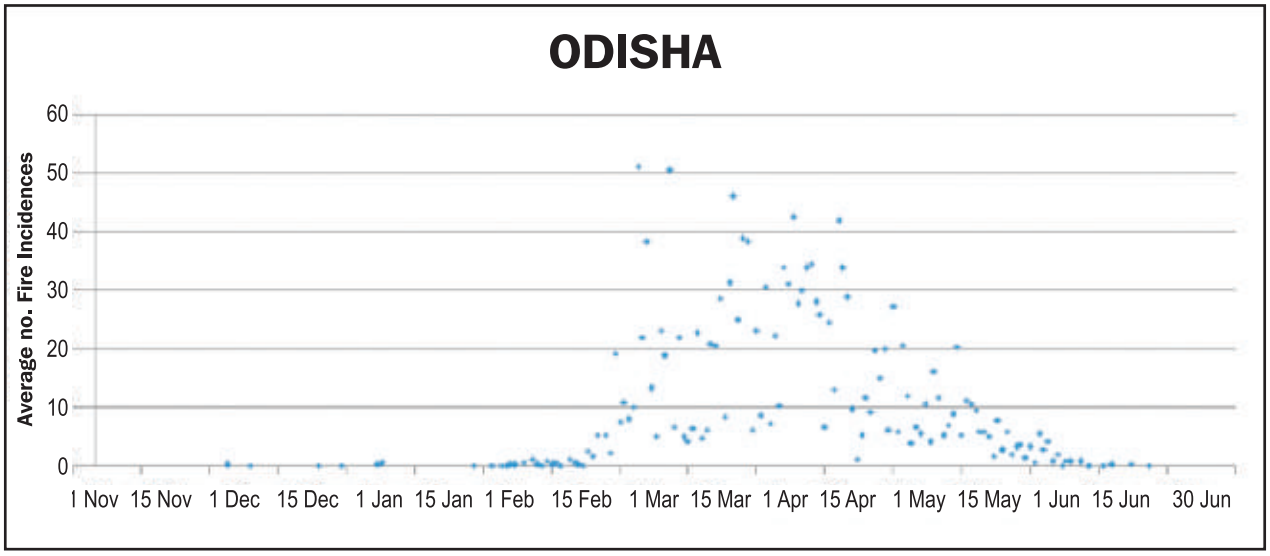

MAHARASHTRA
Average no. Fire Incidences
80
70
60
50
40
30
20
10
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

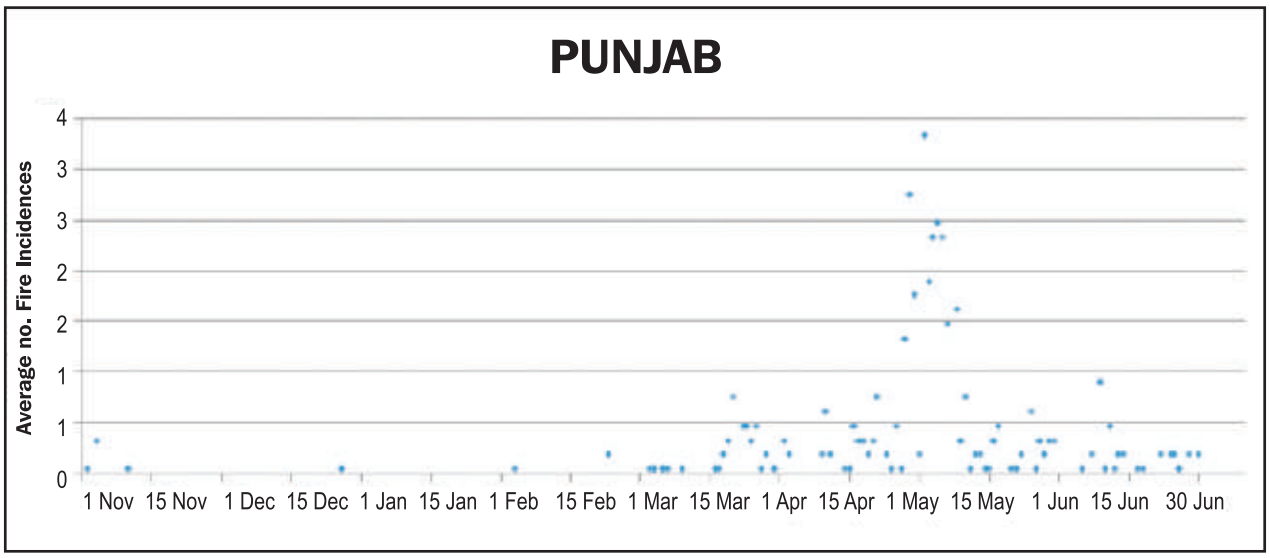

MANIPUR
Average no. Fire Incidences
100
80
60
40
20
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

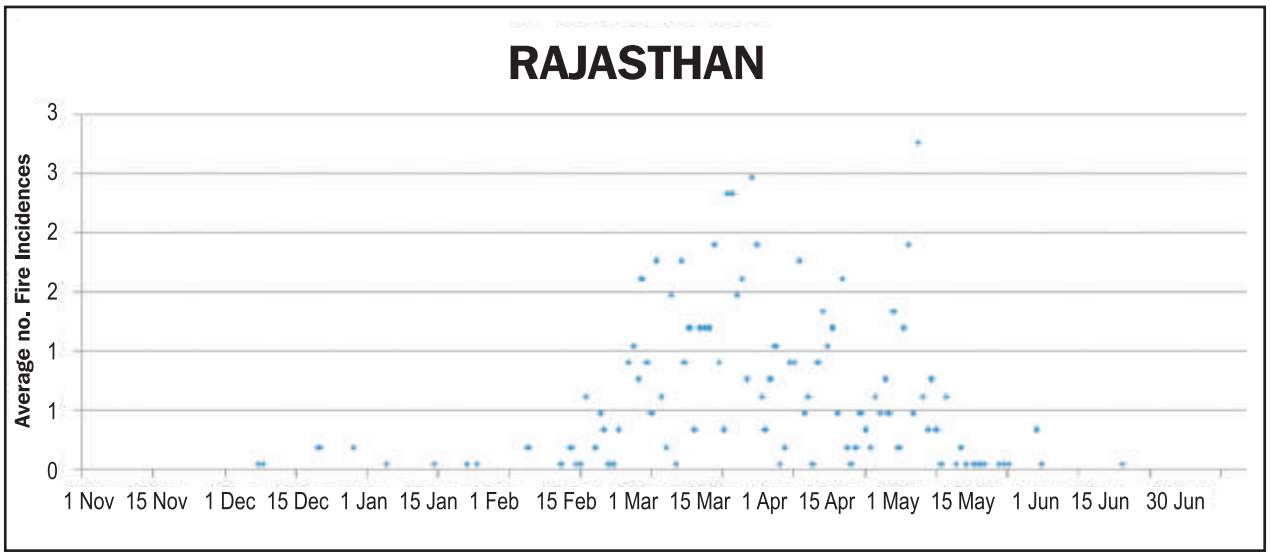

MEGHALAYA
Average no. Fire Incidences
90
80
70
60
50
40
30
20
10
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

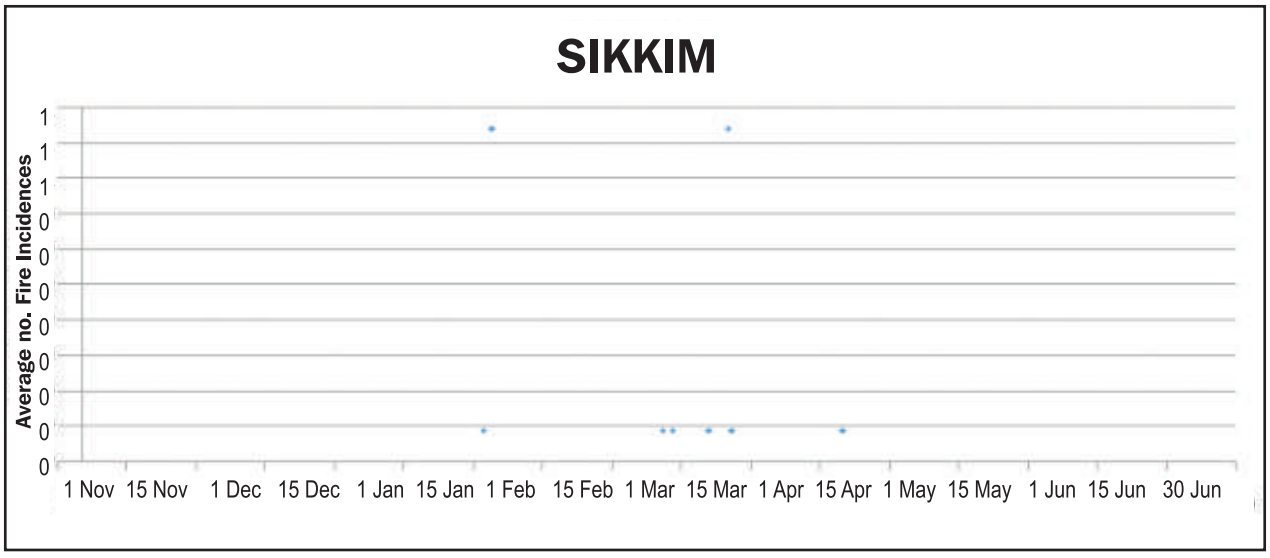

MIZORAM
Average no. Fire Incidences
250
200
150
100
50
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

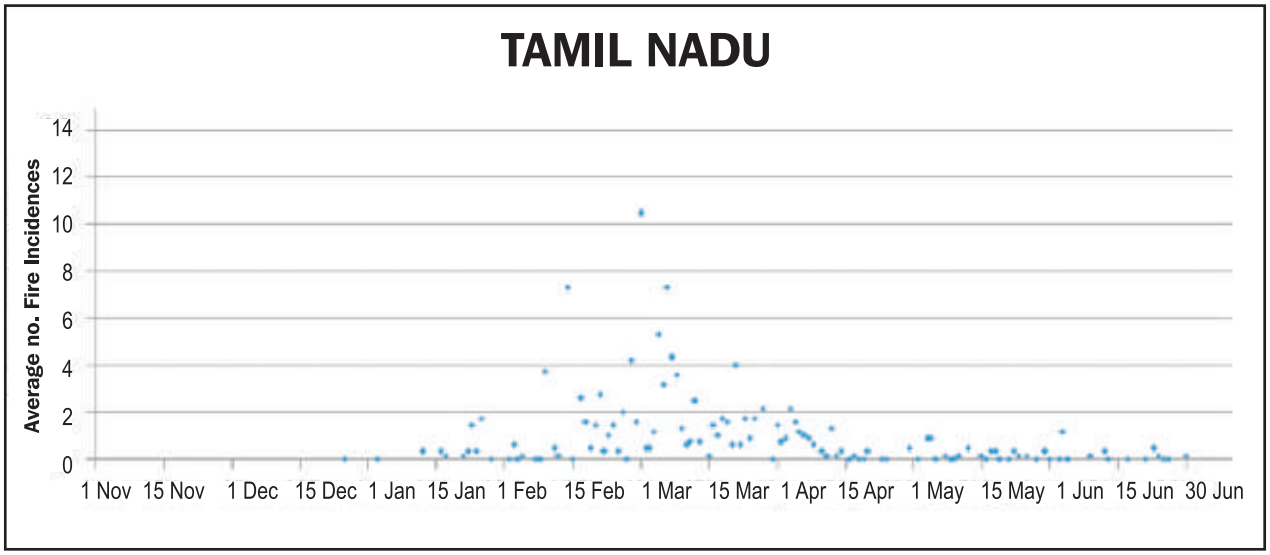

NAGALAND
Average no. Fire Incidences
45
40
35
30
25
20
15
10
5
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

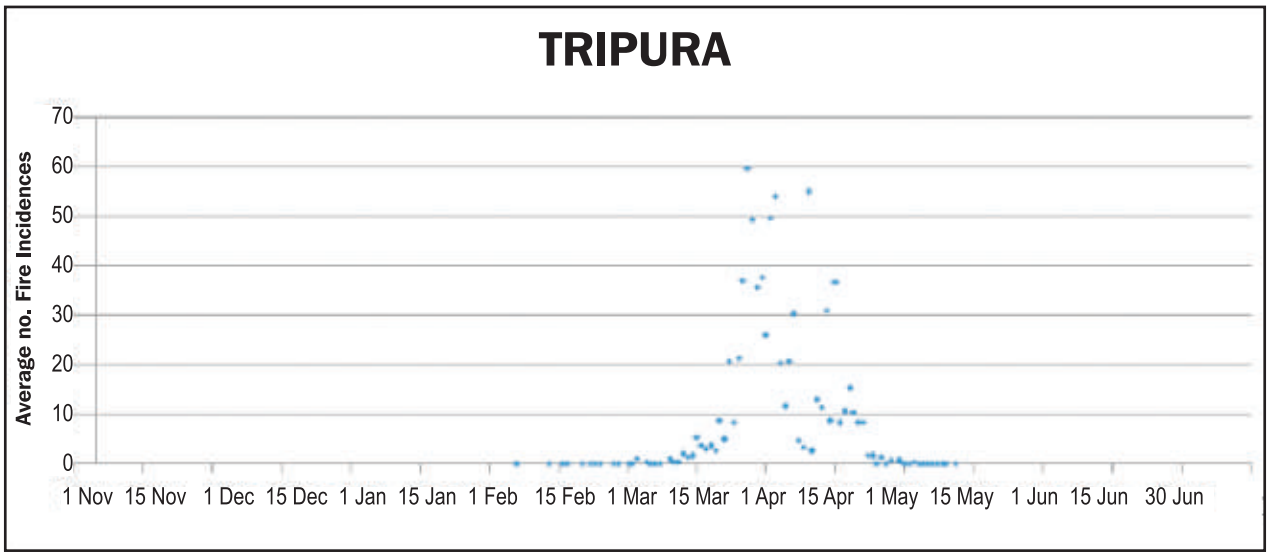

ODISHA
Average no. Fire Incidences
60
50
40
30
20
10
0
1 Nov 15 Nov 1 Dec 15 Dec 1 Jan 15 Jan 1 Feb 15 Feb 1 Mar 15 Mar 1 Apr 15 Apr 1 May 15 May 1 Jun 15 Jun 30 Jun

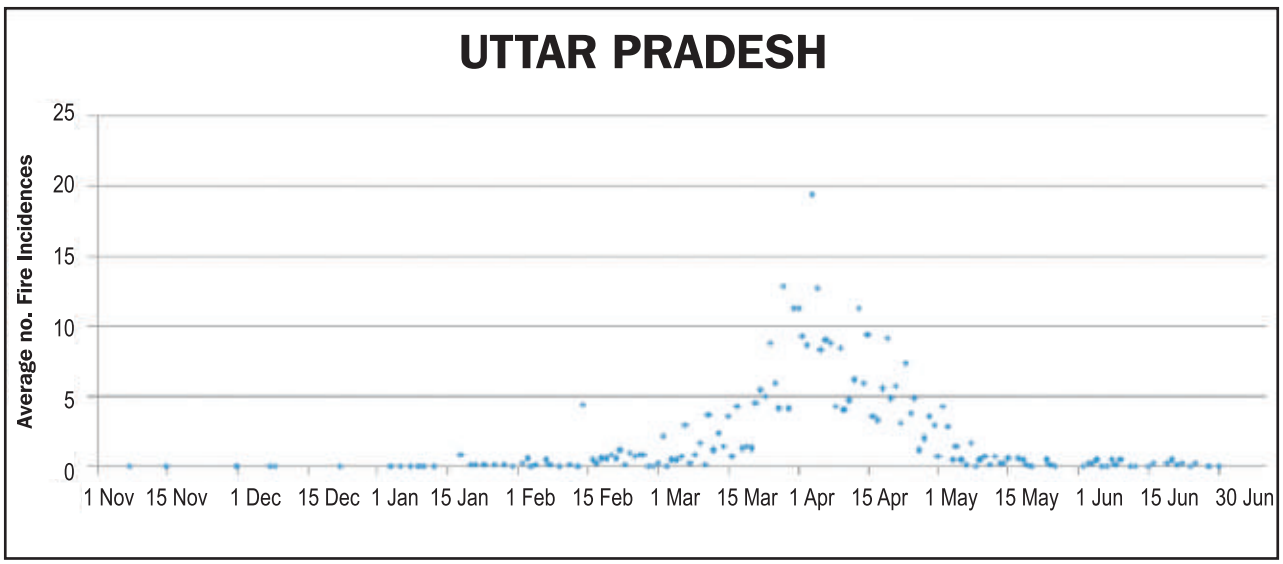

PUNJAB
Average no. Fire Incidences
4
3
3
2
2
1
1
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun

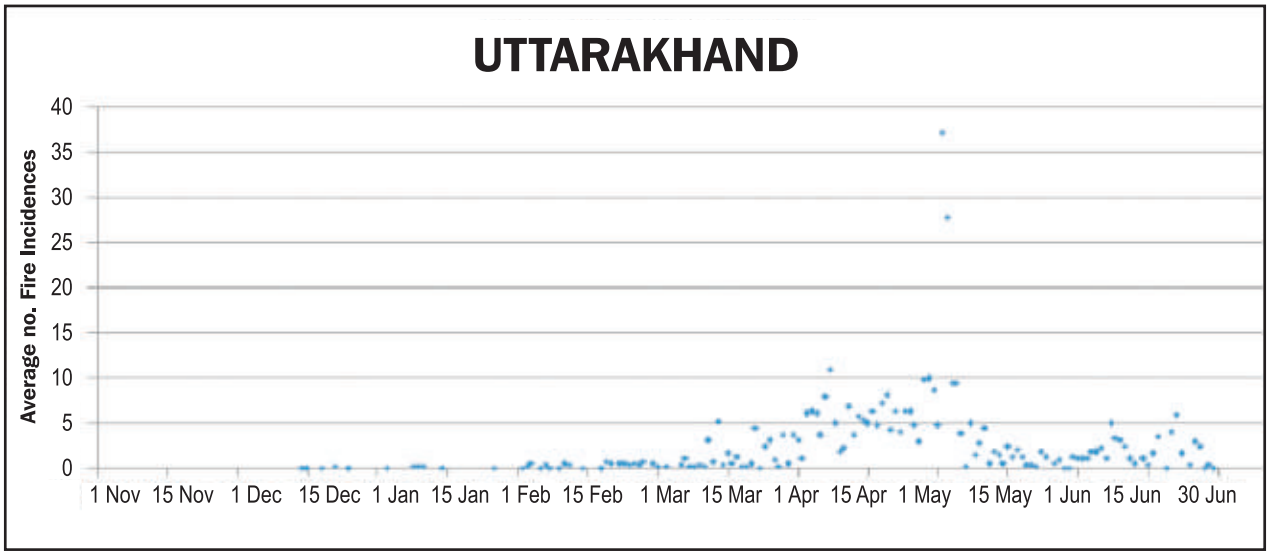

RAJASTHAN
Average no. Fire Incidences
3
3
2
2
1
1
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun

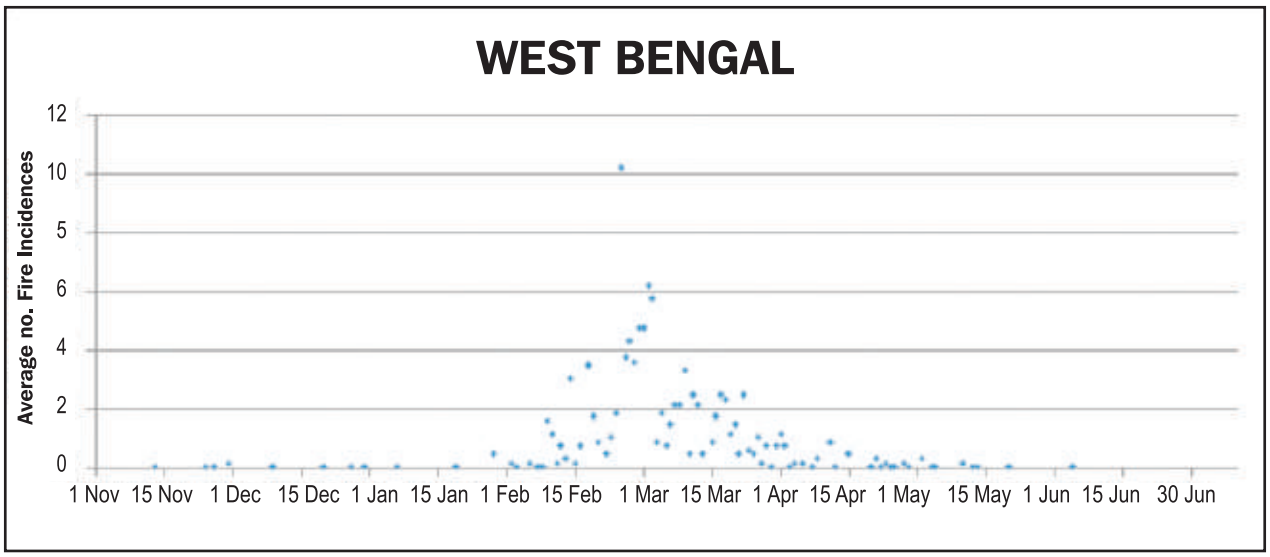

SIKKIM
Average no. Fire Incidences
1
1
1
0
0
0
0
0
0
0
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun


TAMIL NADU
Average no. Fire Incidences
0
2
4
6
8
10
12
14
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun


TRIPURA
Average no. Fire Incidences
0
10
20
30
40
50
60
70
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun


UTTAR PRADESH
Average no. Fire Incidences
0
5
10
15
20
25
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun


UTTARAKHAND
Average no. Fire Incidences
40
35
30
25
20
15
10
5
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun


WEST BENGAL
Average no. Fire Incidences
12
10
5
6
4
2
0
1 Nov
15 Nov
1 Dec
15 Dec
1 Jan
15 Jan
1 Feb
15 Feb
1 Mar
15 Mar
1 Apr
15 Apr
1 May
15 May
1 Jun
15 Jun
30 Jun

22. Conclusion

It has been observed that total forest cover in the highly vulnerable districts is 4,20,071 km^2 with very dense forest (VDF) as 49,867 km^2, moderately dense forest (MDF) as 2,08,348 km^2 and open forest (OF) as 1,61,856 km^2. The forest cover falling under moderately vulnerable districts is 1,05,226 km^2 with very dense forest (VDF) as 12,001 km^2, moderately dense forest (MDF) as 48,732 km^2 and open forest (OF) as 44,493 km^2. For low vulnerable districts total forest cover is 90,819 km^2 with very dense forest (VDF) as 12,733 km^2, moderately dense forest (MDF) as 37,701 km^2 and open forest (OF) as 40,385 km^2. Based on the analysis, it has been observed that a total of 32 districts of central India are highly prone to forest fire. These 32 districts have been further observed to be highly poverty affected districts(Figure 14), with average poverty level between 41-80% (Census of India 2001). These districts comprise a forest area of 95131 km^2 which constitutes 35.16% of the total geographical area of these districts. These districts have highest percentage of forest cover in the moderately dense forest category (crown cover between 40-70%) constituting 17.58%, followed by open density forest (crown cover between 10-40%) constituting 13.26%, and very dense forest (crown cover >70%) constituting 4.32% of the area of the districts.

An analysis of the data further revealed that third week of Feburary till first week of May has been the general crucial period of forest fire across the country.

Annexure 1.1 gives the detail of categories of vulnerable districts along with the forest cover density classes.

23. Scope of futher study and analysis

The present report is an effort to present a holistic view of the forest fire occurrences and their consideration in creation of a vulnerbility index. As described in detail in the present report, the facts and figures present in the study is a compilation of the near real time data from satellite sensors, overlaying of other independent datasets and the analysis of multisource dataset for forest fire vulnerability. Over the years forest fires have been a subject of debate both at state and at the central government level. Although, state managers have developed their own methods to handle the forest fires, yet at central level, the minsitry of environment and forest has been responsible for policy making for forest fires management. The information related to fire vulnerability as presented in the report supported with ground data from SFDs, data on rainfall, poverty and temperature, would act as the base information for managers at state level in preparation of their management plans for measures such as forest protection, identification of vulnerable species based on the vulnerability maps, creation of protected zones, buffer creation around vulnerable areas and several other issues. The states and the agencies at district level may use this information for further overlaying their spatial information up to block, compartment and village level so as to prepare their operational plan at cadestral scale. As fires are reported to be directly influenced by human behavior and population living in the fringe areas, the census data may be integrated and correlated with the vulnerability map. The outcomes using suitable criteria building methods that would be based on the local conditions may be used to prepare suitable strategies for managing fires on scientific basis. For effective managment of forest areas, suitable integration of connectivity functions including proximity analysis, network analysis, spread functions, and three dimensional surface analysis such as visibility and perspective viewing along with the vulnerability maps could be used. Besides, the fuel load estimation, that forms the primary cause for initiation and spread of fire could be critically carried out. An important aspect of fire management has been the response time to this event. In regions of Western Himalays, North East and Western Ghats,

inaccessibility has been a major cause for unnoticed small fires culminating into major fires. Hence in regions indentified as high and moderately vulnerable, response time to reach the effected regions could be minimized by properly mapping suitable routes in advance.

Besides the information provided by fire vulnerability mapping supported by ground data could be suitably utilized in fire risk zonation and in fire burnt severity assessment. As of now no concrete methodology has evolved in our country for burnt areas assessment, as the signatures for burnt scars often gets diluted with time. In case, we have burnt scars reported for vulnerable area, the same could be validated with the ancillary information available for vulnerable regions. Besides, the gird-wise assessment of fire vulnerable areas, that entail information related to forest types, temperature, rainfall, soil types could help in deriving exact cause of fires. Thus the information so available in the report including that for vulnerable grids could be effectively utilized by state officers in developing better management practices. Fire may alter the properties of soil which come in contact with the forest fire frequently. Hence, the extent and severity of surface area burnt by fires can also be used to map the extent of loss caused to soil. Vulnerability analysis can help in predicting the change in soil characteristics from less vulnerable to high vulnerable areas which may help the management in further planning. Similarly, forest fire may alter the forest types of the region. Therefore, sustainability of forest in the adverse conditions can be analyzed and further forest type management issues can be handled separately for the vulnerable areas.

The idea of developing Forest Fire Decision Support System (FFDSS) is well construed. The functions of forest fire management are pre-suppression planning, fire danger assessment, fire detection, fire behavior prediction, operational fire suppression (including dispatching), fire effects assessment and mitigation. All these functions can be performed using FFDSS. It is, therefore also suggested that a centrally sponsored forest fire decision support system could come in to existence to do all the above mentioned work in a GIS based system.

Annexure 1.1

Table 7: Districts identified as forest fire vulnerable along with forest cover as per ISFR 2011 are listed below:

(in Km^2)

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
1	Highly Vulnerable	Andhra Pradesh	Adilabad	127	3643	2296	6066	101
2	Moderately Vulnerable	Andhra Pradesh	Anantapur	0	143	543	686	758
3	Highly Vulnerable	Andhra Pradesh	Chittoor	0	1253	1318	2571	1680
4	Highly Vulnerable	Andhra Pradesh	Coddapah	8	2450	1641	4099	1210
5	Highly Vulnerable	Andhra Pradesh	East Godawari	72	2513	964	3549	166
6	Highly Vulnerable	Andhra Pradesh	Karimnagar	0	979	699	1678	365
7	Highly Vulnerable	Andhra Pradesh	Khammam	28	5120	1782	6930	42
8	Highly Vulnerable	Andhra Pradesh	Kurnool	72	1488	549	2109	644
9	Highly Vulnerable	Andhra Pradesh	Mahboobnagar	329	537	1076	1942	325
10	Less Vulnerable	Andhra Pradesh	Medak	0	81	504	585	141
11	Highly Vulnerable	Andhra Pradesh	Nellore	4	429	760	1193	772
12	Less Vulnerable	Andhra Pradesh	Nizamabad	0	217	979	1196	140
13	Highly Vulnerable	Andhra Pradesh	Prakasam	198	1691	1418	3307	1148
14	Less Vulnerable	Andhra Pradesh	Rangareddy	0	47	344	391	253
15	Highly Vulnerable	Andhra Pradesh	Srikakulam	0	108	508	616	471
16	Highly Vulnerable	Andhra Pradesh	Vijianagaram	0	145	602	747	340
17	Highly Vulnerable	Andhra Pradesh	Vishakhapatnam	0	2053	1386	3439	1066
18	Highly Vulnerable	Andhra Pradesh	Warangal	0	2426	642	3068	155
19	Highly Vulnerable	Andhra Pradesh	West Godawari	12	605	269	886	27
20	Less Vulnerable	Arunachal Pradesh	Changlang	1864	1455	922	4241	2
21	Highly Vulnerable	Arunachal Pradesh	Dibang Valley	1696	4981	1644	8321	5
22	Highly Vulnerable	Arunachal Pradesh	Kameng East	3432	4681	2146	10259	35
23	Moderately Vulnerable	Arunachal Pradesh	Kameng West	3432	4681	2146	10259	35
24	Highly Vulnerable	Arunachal Pradesh	Lohit	1965	4033	1609	7607	8

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
25	Highly Vulnerable	Arunachal Pradesh	Papum Pare	991	1555	701	3247	0
26	Highly Vulnerable	Arunachal Pradesh	Siang East	883	1269	669	2821	0
27	Less Vulnerable	Arunachal Pradesh	Siang Upper	1638	2630	1359	5627	2
28	Highly Vulnerable	Arunachal Pradesh	Siang West	2476	2726	1582	6784	0
29	Highly Vulnerable	Arunachal Pradesh	Subansiri Lesser	3004	4248	1421	8673	28
30	Highly Vulnerable	Arunachal Pradesh	Subansiri Upper	1876	2753	1192	5821	25
31	Less Vulnerable	Arunachal Pradesh	Tawang	366	486	374	1226	17
32	Highly Vulnerable	Arunachal Pradesh	Tirap	677	702	404	1783	0
33	Highly Vulnerable	Assam	Barpeta	35	179	183	397	2
34	Highly Vulnerable	Assam	Bongaigoan	33	267	221	521	3
35	Highly Vulnerable	Assam	Cachar	81	975	1180	2236	18
36	Less Vulnerable	Assam	Darrang	12	91	367	470	2
37	Less Vulnerable	Assam	Dhemaji	7	124	160	291	10
38	Less Vulnerable	Assam	Dhubari	21	201	196	418	10
39	Less Vulnerable	Assam	Dibrugarh	29	165	564	758	0
40	Highly Vulnerable	Assam	Goalpara	1	71	265	337	8
41	Highly Vulnerable	Assam	Golaghat	6	122	397	525	0
42	Highly Vulnerable	Assam	Hailakandi	13	373	400	786	5
43	Highly Vulnerable	Assam	Jorhat	2	113	498	613	0
44	Highly Vulnerable	Assam	Kamrup	68	612	753	1433	26
45	Highly Vulnerable	Assam	Karbi Anglong	566	3819	3554	7939	24
46	Highly Vulnerable	Assam	Karimganj	3	318	539	860	48
47	Less Vulnerable	Assam	Kokrajhar	208	716	220	1144	2
48	Less Vulnerable	Assam	Lakhimpur	4	118	171	293	6
49	Less Vulnerable	Assam	Morigoan	6	41	86	133	4
50	Less Vulnerable	Assam	Nalbari	4	70	208	282	0

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
51	Highly Vulnerable	Assam	Naogoan	40	353	403	796	8
52	Highly Vulnerable	Assam	North Cachar Hills	135	1553	2562	4250	1
53	Highly Vulnerable	Assam	Sibsagar	8	144	543	695	1
54	Less Vulnerable	Assam	Sonitpur	56	280	624	960	0
55	Less Vulnerable	Assam	Tinshukia	106	699	731	1536	4
56	Less Vulnerable	Bihar	Aurangabad	0	54	97	151	13
57	Less Vulnerable	Bihar	Banka	0	111	110	221	12
58	Moderately Vulnerable	Bihar	Gaya	0	124	506	630	46
59	Highly Vulnerable	Bihar	Jamui	0	383	249	632	2
60	Highly Vulnerable	Bihar	Lakhisarai	0	180	14	194	2
61	Highly Vulnerable	Bihar	Munger	0	251	14	265	7
62	Moderately Vulnerable	Bihar	Nalanda	0	5	23	28	6
63	Moderately Vulnerable	Bihar	Nawada	0	187	323	510	10
64	Highly Vulnerable	Bihar	Pashchimi Champaran	231	524	166	921	0
65	Highly Vulnerable	Bihar	Rohtas	0	321	385	706	11
66	Highly Vulnerable	Chhattisgarh	Baster	1349	4333	2329	8011	11
67	Highly Vulnerable	Chhattisgarh	Bilaspur	338	1623	533	2494	6
68	Highly Vulnerable	Chhattisgarh	Dantewara	1082	6167	4079	11328	22
69	Less Vulnerable	Chhattisgarh	Durg	44	521	202	767	4
70	Less Vulnerable	Chhattisgarh	Janjgir Champa	4	26	125	155	2
71	Moderately Vulnerable	Chhattisgarh	Jashpur	111	1485	668	2264	11
72	Highly Vulnerable	Chhattisgarh	Kawardha	70	1126	389	1585	4
73	Highly Vulnerable	Chhattisgarh	Korba	203	2306	840	3349	6
74	Moderately Vulnerable	Chhattisgarh	Korea	79	2605	1423	4107	3
75	Highly Vulnerable	Chhattisgarh	Mahasamund	4	534	422	960	8
76	Highly Vulnerable	Chhattisgarh	Raigarh	126	1697	723	2546	13

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
77	Highly Vulnerable	Chhattisgarh	Raipur/Dhamtari	189	3837	1435	5461	7
78	Highly Vulnerable	Chhattisgarh	Raj Nandgaon	29	1771	720	2520	4
79	Highly Vulnerable	Chhattisgarh	Sarguja	320	4836	1977	7133	16
80	Less Vulnerable	Dadra & Nagar Haveli	Dadra & Nagar Haveli	0	114	97	211	1
81	Less Vulnerable	Goa	North Goa	128	236	559	923	0
82	Less Vulnerable	Goa	South Goa	415	349	532	1296	0
83	Less Vulnerable	Gujarat	Amreli	0	63	167	230	36
84	Less Vulnerable	Gujarat	Bharuch	0	81	227	308	5
85	Less Vulnerable	Gujarat	Bhavnagar	0	52	235	287	79
86	Less Vulnerable	Gujarat	Dahod	1	163	540	704	36
87	Less Vulnerable	Gujarat	Junagarh	15	952	641	1608	23
88	Moderately Vulnerable	Gujarat	Kuchchh	0	304	1995	2299	564
89	Highly Vulnerable	Gujarat	Narmada	20	465	474	959	21
90	Moderately Vulnerable	Gujarat	Navsari	18	125	145	288	8
91	Moderately Vulnerable	Gujarat	Panch Mahals	0	176	394	570	35
92	Less Vulnerable	Gujarat	Sabar Kantha	29	305	470	804	91
93	Highly Vulnerable	Gujarat	Surat	84	778	454	1316	32
94	Highly Vulnerable	Gujarat	The Dangs	209	745	414	1368	3
95	Moderately Vulnerable	Gujarat	Vadodara	0	144	479	623	27
96	Less Vulnerable	Gujarat	Valsad	0	345	590	935	14
97	Less Vulnerable	Haryana	Ambala	0	16	29	45	0
98	Moderately Vulnerable	Haryana	Panchkula	6	151	243	400	25
99	Less Vulnerable	Himachal Pradesh	Hamirpur	39	91	114	244	0
100	Less Vulnerable	Himachal Pradesh	Kangara	310	1221	533	2064	11
101	Less Vulnerable	Himachal Pradesh	Kullu	586	785	588	1959	23
102	Less Vulnerable	Himachal Pradesh	Mandi	373	735	567	1675	29

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
103	Less Vulnerable	Himachal Pradesh	Shimla	739	1037	610	2386	32
104	Moderately Vulnerable	Himachal Pradesh	Sirmaur	130	568	687	1385	56
105	Moderately Vulnerable	Himachal Pradesh	Solan	55	404	391	850	38
106	Highly Vulnerable	Himachal Pradesh	Una	18	302	203	523	0
107	Less Vulnerable	Jammu & Kashmir	Jammu	0	210	672	882	43
108	Moderately Vulnerable	Jammu & Kashmir	Poonch	187	300	242	729	9
109	Moderately Vulnerable	Jammu & Kashmir	Rajouri	49	439	752	1240	8
110	Less Vulnerable	Jammu & Kashmir	Anantnag	196	664	578	1438	23
111	Less Vulnerable	Jammu & Kashmir	Srinagar	196	307	249	752	1
112	Less Vulnerable	Jammu & Kashmir	Udhampur	349	1129	1211	2689	47
113	Highly Vulnerable	Jharkhand	Bokaro	64	244	252	560	48
114	Highly Vulnerable	Jharkhand	Chatra	251	863	663	1777	15
115	Less Vulnerable	Jharkhand	Dhanbad	0	50	155	205	17
116	Less Vulnerable	Jharkhand	Dumka	0	314	323	637	58
117	Moderately Vulnerable	Jharkhand	Garhwa	124	406	835	1365	55
118	Less Vulnerable	Jharkhand	Giridih	98	422	344	864	8
119	Highly Vulnerable	Jharkhand	Godda	15	268	116	399	25
120	Moderately Vulnerable	Jharkhand	Gumla	324	919	1414	2657	33
121	Highly Vulnerable	Jharkhand	Hazaribagh	272	626	1164	2062	44
122	Highly Vulnerable	Jharkhand	Koderma	68	321	207	596	0
123	Less Vulnerable	Jharkhand	Lohardaga	174	219	110	503	10
124	Moderately Vulnerable	Jharkhand	Pakur	3	172	108	283	19
125	Highly Vulnerable	Jharkhand	Palamu	529	1809	1189	3527	88
126	Highly Vulnerable	Jharkhand	Pashchimi Singhbhum	453	1559	1829	3841	81
127	Moderately Vulnerable	Jharkhand	Purbi Singhbhum	53	621	404	1078	67

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
128	Highly Vulnerable	Jharkhand	Ranchi	141	684	1079	1904	67
129	Moderately Vulnerable	Jharkhand	Sahebganj	21	336	193	550	72
130	Less Vulnerable	Karnataka	Bagalkot	0	11	189	200	233
131	Moderately Vulnerable	Karnataka	Bangalore City	0	39	111	150	253
132	Moderately Vulnerable	Karnataka	Bangalore Rural	6	133	673	812	253
133	Highly Vulnerable	Karnataka	Belgaum	17	757	320	1094	465
134	Highly Vulnerable	Karnataka	Bellary	0	110	662	772	252
135	Highly Vulnerable	Karnataka	Chamrajanagar	45	1043	1548	2636	179
136	Highly Vulnerable	Karnataka	Chikmagalur	587	2428	666	3681	17
137	Moderately Vulnerable	Karnataka	Chitradurg	0	56	362	418	435
138	Highly Vulnerable	Karnataka	Dakshin Kannad	253	1009	1598	2860	0
139	Highly Vulnerable	Karnataka	Davangere	4	339	399	742	269
140	Highly Vulnerable	Karnataka	Dharwar	0	232	153	385	5
141	Less Vulnerable	Karnataka	Gadag	0	0	122	122	64
142	Less Vulnerable	Karnataka	Gulbarga	0	87	209	296	46
143	Moderately Vulnerable	Karnataka	Hassan	67	752	511	1330	91
144	Moderately Vulnerable	Karnataka	Haveri	0	154	245	399	53
145	Moderately Vulnerable	Karnataka	Kodagu	246	2142	951	3339	0
146	Moderately Vulnerable	Karnataka	Kolar	1	98	209	308	135
147	Highly Vulnerable	Karnataka	Mandya	4	648	417	1069	38
148	Highly Vulnerable	Karnataka	Mysore	205	2808	1394	4407	23
149	Highly Vulnerable	Karnataka	Shimoga	205	2808	1394	4407	23
150	Less Vulnerable	Karnataka	Tumkur	0	62	490	552	219
151	Less Vulnerable	Karnataka	Udipi	158	1415	617	2190	0
152	Highly Vulnerable	Karnataka	Uttar Kannad	184	5776	1859	7819	1
153	Moderately Vulnerable	Kerala	Ernakulam	12	298	385	695	1

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
154	Moderately Vulnerable	Kerala	Idukki	350	2159	1421	3930	
155	Moderately Vulnerable	Kerala	Kollam	75	632	623	1330	0
156	Less Vulnerable	Kerala	Kottayam	12	542	335	889	1
157	Less Vulnerable	Kerala	Kozhikode	32	288	271	591	0
158	Less Vulnerable	Kerala	Malappuram	144	406	659	1209	9
159	Less Vulnerable	Kerala	Palakkad	276	693	606	1575	35
160	Less Vulnerable	Kerala	Pathanamthitta	144	1147	464	1755	0
161	Moderately Vulnerable	Kerala	Thrissur	181	388	362	931	5
162	Less Vulnerable	Kerala	Thrivanantapuram	55	824	470	1349	0
163	Moderately Vulnerable	Kerala	Wayanad	140	1347	288	1775	1
164	Highly Vulnerable	Madhya Pradesh	Balaghat	1334	2705	958	4997	54
165	Highly Vulnerable	Madhya Pradesh	Barwani	0	189	802	991	42
166	Highly Vulnerable	Madhya Pradesh	Betul	201	1967	1404	3572	114
167	Less Vulnerable	Madhya Pradesh	Bhind	0	29	69	98	395
168	Highly Vulnerable	Madhya Pradesh	Bhopal	0	128	238	366	129
169	Moderately Vulnerable	Madhya Pradesh	Chhatarpur	184	822	743	1749	279
170	Highly Vulnerable	Madhya Pradesh	Chhindwara	575	2044	1922	4541	240
171	Highly Vulnerable	Madhya Pradesh	Damoh	2	862	1742	2606	76
172	Less Vulnerable	Madhya Pradesh	Datia	0	78	79	157	101
173	Highly Vulnerable	Madhya Pradesh	Dewas	13	955	930	1898	112
174	Moderately Vulnerable	Madhya Pradesh	Dhar	0	137	597	734	120
175	Highly Vulnerable	Madhya Pradesh	Dindori	1033	1175	559	2767	132
176	Highly Vulnerable	Madhya Pradesh	East Nimar	200	1830	1381	3411	51
177	Highly Vulnerable	Madhya Pradesh	Guna	2	699	1410	2111	355
178	Less Vulnerable	Madhya Pradesh	Gwalior	1	327	865	1193	208
179	Highly Vulnerable	Madhya Pradesh	Harda	19	546	463	1028	8

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
180	Highly Vulnerable	Madhya Pradesh	Hoshangabad	274	1373	777	2424	35
181	Highly Vulnerable	Madhya Pradesh	Indore	0	370	336	706	27
182	Less Vulnerable	Madhya Pradesh	Jabalpur	36	514	620	1170	154
183	Moderately Vulnerable	Madhya Pradesh	Jhabua	0	255	682	937	194
184	Highly Vulnerable	Madhya Pradesh	Katni	102	607	573	1282	52
185	Highly Vulnerable	Madhya Pradesh	Mandla	751	1204	857	2812	55
186	Highly Vulnerable	Madhya Pradesh	Narsimhapur	60	665	632	1357	135
187	Less Vulnerable	Madhya Pradesh	Neemach	0	121	706	827	395
188	Highly Vulnerable	Madhya Pradesh	Panna	85	1501	1072	2658	189
189	Highly Vulnerable	Madhya Pradesh	Raisen	22	1331	1382	2735	183
190	Moderately Vulnerable	Madhya Pradesh	Rewa	65	398	314	777	115
191	Highly Vulnerable	Madhya Pradesh	Sagar	2	1178	1726	2906	135
192	Moderately Vulnerable	Madhya Pradesh	Satna	13	942	794	1749	204
193	Highly Vulnerable	Madhya Pradesh	Sehore	25	654	703	1382	124
194	Highly Vulnerable	Madhya Pradesh	Seoni	240	1806	1037	3083	62
195	Moderately Vulnerable	Madhya Pradesh	Shahdol	245	1255	1224	2724	73
196	Highly Vulnerable	Madhya Pradesh	Sheopur	6	1394	2121	3521	127
197	Moderately Vulnerable	Madhya Pradesh	Shivpuri	19	786	1645	2450	376
198	Moderately Vulnerable	Madhya Pradesh	Sidhi	717	1935	1447	4099	101
199	Highly Vulnerable	Madhya Pradesh	Umaria	411	1086	537	2034	29
200	Moderately Vulnerable	Madhya Pradesh	Vidisha	1	363	505	869	97
201	Highly Vulnerable	Madhya Pradesh	West Nimar	1	472	825	1298	48
202	Less Vulnerable	Maharashtra	Ahmadnagar	0	69	217	286	555
203	Highly Vulnerable	Maharashtra	Akola	11	96	215	322	8
204	Highly Vulnerable	Maharashtra	Amravati	655	1455	1077	3187	116
205	Highly Vulnerable	Maharashtra	Bhandara	130	544	215	889	21

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
206	Less Vulnerable	Maharashtra	Bombay Suburban	0	62	58	120	0
207	Highly Vulnerable	Maharashtra	Buldana	23	137	430	590	163
208	Highly Vulnerable	Maharashtra	Chandrapur	1340	1588	1150	4078	56
209	Highly Vulnerable	Maharashtra	Garhchiroli	4733	3392	1969	10094	20
210	Highly Vulnerable	Maharashtra	Gondiya	884	824	303	2011	37
211	Less Vulnerable	Maharashtra	Hingoli	0	10	104	114	47
212	Highly Vulnerable	Maharashtra	Jalgaon	52	363	770	1185	69
213	Highly Vulnerable	Maharashtra	Kolhapur	65	1038	672	1775	88
214	Highly Vulnerable	Maharashtra	Nagpur	372	953	698	2023	77
215	Less Vulnerable	Maharashtra	Nanded	60	434	420	914	128
216	Highly Vulnerable	Maharashtra	Nandurbar	0	418	796	1214	30
217	Less Vulnerable	Maharashtra	Nashik	0	351	738	1089	319
218	Highly Vulnerable	Maharashtra	Pune	0	757	975	1732	493
219	Highly Vulnerable	Maharashtra	Ratnagiri	33	1910	2255	4198	2
220	Highly Vulnerable	Maharashtra	Raygad	13	1248	1603	2864	70
221	Less Vulnerable	Maharashtra	Sangli	0	95	49	144	156
222	Highly Vulnerable	Maharashtra	Satara	119	569	588	1276	365
223	Highly Vulnerable	Maharashtra	Sindhudurg	88	1364	1116	2568	47
224	Highly Vulnerable	Maharashtra	Thane	0	1281	1631	2912	222
225	Highly Vulnerable	Maharashtra	Wardha	10	419	430	859	62
226	Less Vulnerable	Maharashtra	Washim	5	113	214	332	28
227	Moderately Vulnerable	Maharashtra	Yavatmal	123	1110	1372	2605	97
228	Less Vulnerable	Manipur	Bishnupur	0	1	20	21	0
229	Highly Vulnerable	Manipur	Chandel	0	744	2085	2829	0
230	Highly Vulnerable	Manipur	Churachandpur	37	1683	2555	4275	0
231	Highly Vulnerable	Manipur	Imphal East	0	53	167	220	0

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
232	Moderately Vulnerable	Manipur	Imphal West	0	24	31	55	0
233	Highly Vulnerable	Manipur	Senapati	233	870	1080	2183	0
234	Highly Vulnerable	Manipur	Tamenglong	279	1784	1839	3902	0
235	Highly Vulnerable	Manipur	Thoubal	0	4	52	56	0
236	Highly Vulnerable	Manipur	Ukhrul	181	988	2380	3549	1
237	Highly Vulnerable	Meghalaya	East Garo Hills	68	1104	1045	2217	92
238	Less Vulnerable	Meghalaya	East Khasi Hills	0	1084	716	1800	110
239	Less Vulnerable	Meghalaya	Jaintia Hills	99	1578	839	2516	53
240	Highly Vulnerable	Meghalaya	Ri Bhoi	131	1092	898	2121	10
241	Highly Vulnerable	Meghalaya	South Garo Hills	44	1005	590	1639	27
242	Highly Vulnerable	Meghalaya	West Garo Hills	0	1361	1613	2974	129
243	Highly Vulnerable	Meghalaya	West Khasi Hills	91	2551	1366	4008	64
244	Highly Vulnerable	Mizoram	Aizawl	26	1205	2034	3265	0
245	Highly Vulnerable	Mizoram	Champhai	57	1096	1632	2785	0
246	Highly Vulnerable	Mizoram	Lawngtlai	0	704	1664	2368	0
247	Highly Vulnerable	Mizoram	Lunglei	1	1233	2972	4206	1
248	Highly Vulnerable	Mizoram	Saiha	0	568	723	1291	0
249	Highly Vulnerable	Mizoram	Serchhip	5	408	794	1207	0
250	Highly Vulnerable	Nagaland	Dimapur	0	75	317	392	0
251	Highly Vulnerable	Nagaland	Kohima	288	1146	1489	2923	0
252	Highly Vulnerable	Nagaland	Mokokchung	3	521	825	1349	0
253	Highly Vulnerable	Nagaland	Mon	33	482	724	1239	1
254	Highly Vulnerable	Nagaland	Phek	279	675	813	1767	0
255	Highly Vulnerable	Nagaland	Tuensang	603	1112	1517	3232	2
256	Highly Vulnerable	Nagaland	Wokha	1	504	873	1378	0
257	Highly Vulnerable	Nagaland	Zunheboto	86	416	536	1038	0

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
258	Moderately Vulnerable	Odisha	Balangir	72	221	644	937	232
259	Less Vulnerable	Odisha	Baleshwar	23	126	155	304	51
260	Highly Vulnerable	Odisha	Cuttack	46	216	405	667	119
261	Highly Vulnerable	Odisha	Dhenkanal	172	343	827	1342	153
262	Highly Vulnerable	Odisha	Ganjam	156	1037	800	1993	672
263	Highly Vulnerable	Odisha	Kalahandi	369	749	1213	2331	454
264	Highly Vulnerable	Odisha	Kendujhar	308	1401	1507	3216	55
265	Highly Vulnerable	Odisha	Koraput	101	719	874	1694	612
266	Moderately Vulnerable	Odisha	Mayurbhanj	1340	1711	941	3992	33
267	Highly Vulnerable	Odisha	Phulabani	660	2642	2167	5469	358
268	Moderately Vulnerable	Odisha	Puri	0	56	44	100	44
269	Highly Vulnerable	Odisha	Sambalpur	533	1735	1041	3309	49
270	Highly Vulnerable	Odisha	Sundargarh	1046	1771	1235	4052	144
271	Less Vulnerable	Punjab	Gurdaspur	0	343	344	687	4
272	Highly Vulnerable	Punjab	Hoshiarpur	0	343	344	687	4
273	Less Vulnerable	Punjab	Jalandhar	0	1	9	10	0
274	Less Vulnerable	Punjab	Ludhiana	0	33	31	64	0
275	Less Vulnerable	Punjab	Patiala	0	38	53	91	2
276	Moderately Vulnerable	Punjab	Rupnagar	0	146	244	390	4
277	Less Vulnerable	Rajasthan	Banswara	0	83	293	376	85
278	Less Vulnerable	Rajasthan	Chittaurgarh	0	595	1092	1687	159
279	Less Vulnerable	Rajasthan	Pali	0	216	446	662	268
280	Less Vulnerable	Rajasthan	Rajsamand	0	131	293	424	51
281	Moderately Vulnerable	Rajasthan	Sirohi	0	300	616	916	198
282	Moderately Vulnerable	Rajasthan	Udaipur	0	1420	1698	3118	457
283	Less Vulnerable	Sikkim	South	93	371	107	571	3

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
284	Less Vulnerable	Tamil Nadu	Anna	351	551	587	1489	60
285	Less Vulnerable	Tamil Nadu	Coimbatore	0	218	222	440	10
286	Moderately Vulnerable	Tamil Nadu	Dharmapuri	241	1078	1715	3034	201
287	Less Vulnerable	Tamil Nadu	Kanniyakumari	40	417	195	652	31
288	Less Vulnerable	Tamil Nadu	Namakkal	55	189	300	544	22
289	Moderately Vulnerable	Tamil Nadu	Nilgiri	240	978	868	2086	0
290	Highly Vulnerable	Tamil Nadu	Periyar	468	1371	366	2205	40
291	Less Vulnerable	Tamil Nadu	Salem	139	422	669	1230	68
292	Less Vulnerable	Tamil Nadu	South Arcot	70	370	569	1009	21
293	Less Vulnerable	Tamil Nadu	Theni	199	491	271	961	63
294	Less Vulnerable	Tamil Nadu	Thiruvallur	0	59	155	214	76
295	Less Vulnerable	Tamil Nadu	Tirunelveli Kattabom	278	760	179	1217	44
296	Less Vulnerable	Tamil Nadu	Tiruvanamalai	169	523	695	1387	57
297	Moderately Vulnerable	Tamil Nadu	Vellore	172	628	939	1739	184
298	Highly Vulnerable	Tripura	North Tripura	10	963	541	1514	36
299	Highly Vulnerable	Tripura	South Tripura	73	1387	1013	2473	22
300	Highly Vulnerable	Tripura	West Tripura	23	1074	981	2078	5
301	Less Vulnerable	Uttar Pradesh	Agra	0	67	209	276	74
302	Less Vulnerable	Uttar Pradesh	Bahraich & Shrawasti	290	315	243	848	4
303	Highly Vulnerable	Uttar Pradesh	Balrampur	225	188	116	529	3
304	Moderately Vulnerable	Uttar Pradesh	Banda	0	26	77	103	29
305	Less Vulnerable	Uttar Pradesh	Bara Banki	0	4	79	83	2
306	Highly Vulnerable	Uttar Pradesh	Bijnor	45	235	142	422	3
307	Less Vulnerable	Uttar Pradesh	Chandauli	6	194	365	565	11
308	Moderately Vulnerable	Uttar Pradesh	Chitrakoot	0	358	203	561	15
309	Less Vulnerable	Uttar Pradesh	Etawah	0	44	142	186	42

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
310	Less Vulnerable	Uttar Pradesh	Faizabad	0	5	50	55	0
311	Less Vulnerable	Uttar Pradesh	Firozabad	0	4	43	47	26
312	Less Vulnerable	Uttar Pradesh	Jhansi	0	33	167	200	121
313	Less Vulnerable	Uttar Pradesh	Kannauj	0	0	28	28	0
314	Less Vulnerable	Uttar Pradesh	Kanpur Nagar & Dehat	0	12	97	109	37
315	Highly Vulnerable	Uttar Pradesh	Kheri	409	475	435	1319	1
316	Less Vulnerable	Uttar Pradesh	Kushinagar	0	3	32	35	0
317	Highly Vulnerable	Uttar Pradesh	Lalitpur	0	128	442	570	41
318	Highly Vulnerable	Uttar Pradesh	Maharajganj	239	113	109	461	2
319	Less Vulnerable	Uttar Pradesh	Mirzapur	0	323	543	866	44
320	Less Vulnerable	Uttar Pradesh	Muzaffarnagar	0	14	27	41	0
321	Highly Vulnerable	Uttar Pradesh	Pilibhit	340	157	200	697	0
322	Less Vulnerable	Uttar Pradesh	Rampur	4	26	47	77	0
323	Moderately Vulnerable	Uttar Pradesh	Saharanpur	0	175	200	375	0
324	Highly Vulnerable	Uttar Pradesh	Shahjahanpur	23	63	36	122	0
325	Moderately Vulnerable	Uttar Pradesh	Sonbhadra	45	870	1626	2541	38
326	Less Vulnerable	Uttar Pradesh	Sultanpur	0	15	162	177	0
327	Moderately Vulnerable	Uttarakhand	Almora	222	928	427	1577	10
328	Moderately Vulnerable	Uttarakhand	Bageshwar	194	883	304	1381	4
329	Moderately Vulnerable	Uttarakhand	Chamoli	427	1586	682	2695	6
330	Less Vulnerable	Uttarakhand	Champawat	336	571	274	1181	8
331	Highly Vulnerable	Uttarakhand	Dehra Dun	584	695	328	1607	24
332	Moderately Vulnerable	Uttarakhand	Haridwar	26	353	240	619	0
333	Highly Vulnerable	Uttarakhand	Naini Tal	601	1923	566	3090	13
334	Highly Vulnerable	Uttarakhand	Pauri Garhwal	523	2094	672	3289	59
335	Moderately Vulnerable	Uttarakhand	Pithoragarh	567	1115	412	2094	32

Sl. No.	Vulnerability	State	District	VDF	MDF	OF	Total	Scrub
336	Less Vulnerable	Uttarakhand	Rudraprayag	246	581	298	1125	5
337	Moderately Vulnerable	Uttarakhand	Tehri Garhwal	298	1232	617	2147	89
338	Highly Vulnerable	Uttarakhand	Udham Singh Nagar	171	247	128	546	0
339	Moderately Vulnerable	Uttarakhand	Uttarkashi	567	1959	619	3145	21
340	Moderately Vulnerable	West Bengal	Bankura	213	510	333	1056	4
341	Moderately Vulnerable	West Bengal	Barddhaman	44	135	82	261	1
342	Less Vulnerable	West Bengal	Birbhum	0	42	63	105	2
343	Less Vulnerable	West Bengal	Darjiling	714	663	912	2289	0
344	Less Vulnerable	West Bengal	Jalpaiguri	681	514	1309	2504	8
345	Moderately Vulnerable	West Bengal	Medinipur	253	1171	1172	2596	0
346	Moderately Vulnerable	West Bengal	Puruliya	43	373	381	797	13

Annexure 1.2

Table 8: District wise population and literacy rate as per census 2011

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
1	Highly Vulnerable	Andhra Pradesh	Adilabad	2,737,738	53
2	Moderately Vulnerable	Andhra Pradesh	Anantapur	4,083,315	56
3	Highly Vulnerable	Andhra Pradesh	Chittoor	4,170,468	67
4	Highly Vulnerable	Andhra Pradesh	Coddapah	3,745,875	67
5	Highly Vulnerable	Andhra Pradesh	East Godawari	5,151,549	65
6	Highly Vulnerable	Andhra Pradesh	Karimnagar	3,811,738	55
7	Highly Vulnerable	Andhra Pradesh	Khammam	2,798,214	57
8	Highly Vulnerable	Andhra Pradesh	Kurnool	4,046,601	53
9	Highly Vulnerable	Andhra Pradesh	Mahboobnagar	4,042,191	44
10	Less Vulnerable	Andhra Pradesh	Medak	3,031,877	63
11	Highly Vulnerable	Andhra Pradesh	Nellore	2,668,564	65
12	Less Vulnerable	Andhra Pradesh	Nizamabad	2,552,073	52
13	Highly Vulnerable	Andhra Pradesh	Prakasam	3,392,764	57
14	Less Vulnerable	Andhra Pradesh	Rangareddy	5,296,396	66
15	Highly Vulnerable	Andhra Pradesh	Srikakulam	2,699,471	55
16	Highly Vulnerable	Andhra Pradesh	Vijianagaram	2,342,868	57
17	Highly Vulnerable	Andhra Pradesh	Vishakhapatnam	4,288,113	60
18	Highly Vulnerable	Andhra Pradesh	Warangal	3,522,644	57
19	Highly Vulnerable	Andhra Pradesh	West Godawari	3,934,782	74
20	Less Vulnerable	Arunachal Pradesh	Changlang	147,951	51
21	Highly Vulnerable	Arunachal Pradesh	Dibang Valley	7,948	59
22	Highly Vulnerable	Arunachal Pradesh	Kameng East	78,413	412
23	Moderately Vulnerable	Arunachal Pradesh	Kameng West	87,,013	69
24	Highly Vulnerable	Arunachal Pradesh	Lohit	145,538	56
25	Highly Vulnerable	Arunachal Pradesh	Papum Pare	176,385	69
26	Highly Vulnerable	Arunachal Pradesh	Siang East	99,019	61
27	Less Vulnerable	Arunachal Pradesh	Siang Upper	35,289	50
28	Highly Vulnerable	Arunachal Pradesh	Siang West	112,272	59
29	Highly Vulnerable	Arunachal Pradesh	Subansiri Lesser	82,839	45
30	Highly Vulnerable	Arunachal Pradesh	Subansiri Upper	83,205	50
31	Less Vulnerable	Arunachal Pradesh	Tawang	49,950	47

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
32	Highly Vulnerable	Arunachal Pradesh	Tirap	111,997	42
33	Highly Vulnerable	Assam	Barpeta	1,693,190	56
34	Highly Vulnerable	Assam	Bongaigoan	732,639	54
35	Highly Vulnerable	Assam	Cachar	1,736,319	68
36	Less Vulnerable	Assam	Darrang	908,090	65
37	Less Vulnerable	Assam	Dhemaji	688,077	69
38	Less Vulnerable	Assam	Dhubari	1,948,632	59
39	Less Vulnerable	Assam	Dibrugarh	1,327,748	76
40	Highly Vulnerable	Assam	Goalpara	1,008,959	78
41	Highly Vulnerable	Assam	Golaghat	1,058,674	69
42	Highly Vulnerable	Assam	Hailakandi	659,260	60
43	Highly Vulnerable	Assam	Jorhat	1,091,295	76
44	Highly Vulnerable	Assam	Kamrup	1,517,202	74
45	Highly Vulnerable	Assam	Karbi Anglong	965,280	58
46	Highly Vulnerable	Assam	Karimganj	1,217,002	66
47	Less Vulnerable	Assam	Kokrajhar	886,999	67
48	Less Vulnerable	Assam	Lakhimpur	1,040,644	78
49	Less Vulnerable	Assam	Morigoan	2,826,006	62
50	Less Vulnerable	Assam	Nalbari	769,919	80
51	Highly Vulnerable	Assam	Naogoan	2,826,006	74
52	Highly Vulnerable	Assam	North Cachar Hills	188,079	68
53	Highly Vulnerable	Assam	Sibsagar	1,150,253	74
54	Less Vulnerable	Assam	Sonitpur	1,925,975	59
55	Less Vulnerable	Assam	Tinshukia	1,316,948	71
56	Less Vulnerable	Bihar	Aurangabad	2,511,243	73
57	Less Vulnerable	Bihar	Banka	2,029,339	60
58	Moderately Vulnerable	Bihar	Gaya	4,379,383	66
59	Highly Vulnerable	Bihar	Jamui	1,756,078	42
60	Highly Vulnerable	Bihar	Lakhisarai	1,000,717	48
61	Highly Vulnerable	Bihar	Munger	1,359,054	59
62	Moderately Vulnerable	Bihar	Nalanda	2,872,523	66
63	Moderately Vulnerable	Bihar	Nawada	2,216,653	62
64	Highly Vulnerable	Bihar	Pashchimi Champaran	3,922,780	39
65	Highly Vulnerable	Bihar	Rohtas	2,962,593	61

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
66	Highly Vulnerable	Chhattisgarh	Baster	1,411,644	44
67	Highly Vulnerable	Chhattisgarh	Bilaspur	2,662,077	64
68	Highly Vulnerable	Chhattisgarh	Dantewara	532,791	30
69	Less Vulnerable	Chhattisgarh	Durg	3,343,,079	80
70	Less Vulnerable	Chhattisgarh	Janjgir Champa	1,620,632	74
71	Moderately Vulnerable	Chhattisgarh	Jashpur	852,043	69
72	Highly Vulnerable	Chhattisgarh	Kawardha	584,552	55
73	Highly Vulnerable	Chhattisgarh	Korba	1,206,563	62
74	Moderately Vulnerable	Chhattisgarh	Korea	659,039	63
75	Highly Vulnerable	Chhatisgarh	Mahasamund	1,032,275	67
76	Highly Vulnerable	Chhattisgarh	Raigarh	1,493,627	70
77	Highly Vulnerable	Chhattisgarh	Raipur/Dhamtari	4,062,160	69
78	Highly Vulnerable	Chhattisgarh	Raj Nandgaon	1,537,520	77
79	Highly Vulnerable	Chhattisgarh	Sarguja	2,361,329	55
80	Less Vulnerable	Dadra & Nagar Haveli	Dadra & Nagar Haveli	342,853	78
81	Less Vulnerable	Goa	North Goa	817,761	89
82	Less Vulnerable	Goa	South Goa	639,962	86
83	Less Vulnerable	Gujarat	Amreli	1,513,614	74
84	Less Vulnerable	Gujarat	Bharuch	1,550,822	83
85	Less Vulnerable	Gujarat	Bhavnagar	2,877,961	77
86	Less Vulnerable	Gujarat	Dahod	2,126,558	61
87	Less Vulnerable	Gujarat	Junagarh	2,742,291	77
88	Moderately Vulnerable	Gujarat	Kuchchh	2,090,313	72
89	Highly Vulnerable	Gujarat	Narmada	590,379	60
90	Moderately Vulnerable	Gujarat	Navsari	1,330,711	76
91	Moderately Vulnerable	Gujarat	Panch Mahals	2,388,267	72
92	Less Vulnerable	Gujarat	Sabar Kantha	2,427,346	67
93	Highly Vulnerable	Gujarat	Surat	6,079,231	75
94	Highly Vulnerable	Gujarat	The Dangs	226,769	60
95	Moderately Vulnerable	Gujarat	Vadodara	4,157,568	81
96	Less Vulnerable	Gujarat	Valsad	1,703,068	69
97	Less Vulnerable	Haryana	Ambala	1,136,784	83
98	Moderately Vulnerable	Haryana	Panchkula	558,890	74
99	Less Vulnerable	Himachal Pradesh	Hamirpur	454,293	89

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
100	Less Vulnerable	Himachal Pradesh	Kangara	1,507,223	86
101	Less Vulnerable	Himachal Pradesh	Kullu	437,474	80
102	Less Vulnerable	Himachal Pradesh	Mandi	999,518	83
103	Less Vulnerable	Himachal Pradesh	Shimla	813,384	85
104	Moderately Vulnerable	Himachal Pradesh	Sirmaur	530,164	80
105	Moderately Vulnerable	Himachal Pradesh	Solan	576,670	85
106	Highly Vulnerable	Himachal Pradesh	Una	521057	80
107	Less Vulnerable	Jammu & Kashmir	Jammu	1,526,406	84
108	Moderately Vulnerable	Jammu & Kashmir	Rajouri	619,266	69
109	Moderately Vulnerable	Jammu & Kashmir	Poonch	476,820	69
110	Less Vulnerable	Jammu & Kashmir	Anantnag	10,70,144	64
111	Less Vulnerable	Jammu & Kashmir	Srinagar	1,269,751	71
112	Less Vulnerable	Jammu & Kashmir	Udhampur	555,357	70
113	Highly Vulnerable	Jharkhand	Bokaro	2061918	62
114	Highly Vulnerable	Jharkhand	Chatra	1042304	43
115	Less Vulnerable	Jharkhand	Dhanbad	2,682,662	76
116	Less Vulnerable	Jharkhand	Dumka	1321096	48
117	Moderately Vulnerable	Jharkhand	Garhwa	1,322,387	62
118	Less Vulnerable	Jharkhand	Giridih	1311382	43
119	Highly Vulnerable	Jharkhand	Godda	1,311,382	58
120	Moderately Vulnerable	Jharkhand	Gumla	1,025,656	67
121	Highly Vulnerable	Jharkhand	Hazaribagh	1,734,005	70
122	Highly Vulnerable	Jharkhand	Koderma	717169	52
123	Less Vulnerable	Jharkhand	Lohardaga	461,738	68
124	Moderately Vulnerable	Jharkhand	Pakur	899,200	50
125	Highly Vulnerable	Jharkhand	Palamu	1936319	45
126	Highly Vulnerable	Jharkhand	Pashchimi Singhbhum	1501619	50
127	Moderately Vulnerable	Jharkhand	Purbi Singhbhum	1,501,619	76
128	Highly Vulnerable	Jharkhand	Ranchi	2912022	65
129	Moderately Vulnerable	Jharkhand	Sahebganj	1150038	38
130	Less Vulnerable	Karnataka	Bagalkot	1,890,826	69
131	Moderately Vulnerable	Karnataka	Bangalore City	9,588,910	88
132	Moderately Vulnerable	Karnataka	Bangalore Rural	987257	65
133	Highly Vulnerable	Karnataka	Belgaum	4778439	64

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
134	Highly Vulnerable	Karnataka	Bellary	2532383	57
135	Highly Vulnerable	Karnataka	Chamrajanagar	1020962	51
136	Highly Vulnerable	Karnataka	Chikmagalur	1137753	72
137	Moderately Vulnerable	Karnataka	Chitradurg	1660378	64
138	Highly Vulnerable	Karnataka	Dakshin Kannad	2083625	83
139	Highly Vulnerable	Karnataka	Davangere	1946905	67
140	Highly Vulnerable	Karnataka	Dharwar	1846993	72
141	Less Vulnerable	Karnataka	Gadag	1,065,235	75
142	Less Vulnerable	Karnataka	Gulbarga	2,564,892	66
143	Moderately Vulnerable	Karnataka	Hassan	1,776,221	76
144	Moderately Vulnerable	Karnataka	Haveri	1598506	68
145	Moderately Vulnerable	Karnataka	Kodagu	554762	7
146	Moderately Vulnerable	Karnataka	Kolar	1,540,231	74
147	Highly Vulnerable	Karnataka	Mandya	1808680	61
148	Highly Vulnerable	Karnataka	Mysore	2994744	63
149	Highly Vulnerable	Karnataka	Shimoga	1755512	75
150	Less Vulnerable	Karnataka	Tumkur	2,681,449	74
151	Less Vulnerable	Karnataka	Udipi	1,177,908	86
152	Highly Vulnerable	Karnataka	Uttar Kannad	1436847	77
153	Moderately Vulnerable	Kerala	Ernakulam	3279860	93
154	Moderately Vulnerable	Kerala	Idukki	1107453	89
155	Moderately Vulnerable	Kerala	Kollam	2585208	91
156	Less Vulnerable	Kerala	Kottayam	1,979,384	96
157	Less Vulnerable	Kerala	Kozhikode	3,089,543	95
158	Less Vulnerable	Kerala	Malappuram	4,110,956	94
159	Less Vulnerable	Kerala	Palakkad	2,810,892	88
160	Less Vulnerable	Kerala	Pathanamthitta	1,195,537	97
161	Moderately Vulnerable	Kerala	Thrissur	3110327	92
162	Less Vulnerable	Kerala	Thrivanantapuram	3,307,284	93
163	Moderately Vulnerable	Kerala	Wayanad	816558	85
164	Highly Vulnerable	Madhya Pradesh	Balaghat	1701156	69
165	Highly Vulnerable	Madhya Pradesh	Barwani	1385659	42
166	Highly Vulnerable	Madhya Pradesh	Betul	1575247	66
167	Less Vulnerable	Madhya Pradesh	Bhind	1,703,562	77

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
168	Highly Vulnerable	Madhya Pradesh	Bhopal	2,368,145	75
169	Moderately Vulnerable	Madhya Pradesh	Chhatarpur	1,762,857	65
170	Highly Vulnerable	Madhya Pradesh	Chhindwara	2,090,306	66
171	Highly Vulnerable	Madhya Pradesh	Damoh	1,263,703	62
172	Less Vulnerable	Madhya Pradesh	Datia	1,563,107	61
173	Highly Vulnerable	Madhya Pradesh	Dewas	1,563,107	71
174	Moderately Vulnerable	Madhya Pradesh	Dhar	2,184,672	61
175	Highly Vulnerable	Madhya Pradesh	Dindori	704,218	54
176	Highly Vulnerable	Madhya Pradesh	East Nimar	1,309,443	62
177	Highly Vulnerable	Madhya Pradesh	Guna	1,240,938	60
178	Less Vulnerable	Madhya Pradesh	Gwalior	570,302	67
179	Highly Vulnerable	Madhya Pradesh	Harda	1,240,975	70
180	Highly Vulnerable	Madhya Pradesh	Hoshangabad	3,272,335	75
181	Highly Vulnerable	Madhya Pradesh	Indore	2,460,714	76
182	Less Vulnerable	Madhya Pradesh	Jabalpur	2,460,714	82
183	Moderately Vulnerable	Madhya Pradesh	Jhabua	1,024,091	44
184	Highly Vulnerable	Madhya Pradesh	Katni	1,291,684	64
185	Highly Vulnerable	Madhya Pradesh	Mandla	1,053,522	60
186	Highly Vulnerable	Madhya Pradesh	Narsimhapur	1,092,141	78
187	Less Vulnerable	Madhya Pradesh	Neemach	825,958	72
188	Highly Vulnerable	Madhya Pradesh	Panna	1,016,028	61
189	Highly Vulnerable	Madhya Pradesh	Raisen	1,331,699	72
190	Moderately Vulnerable	Madhya Pradesh	Rewa	2,363,744	73
191	Highly Vulnerable	Madhya Pradesh	Sagar	2,378,295	68
192	Moderately Vulnerable	Madhya Pradesh	Satna	2,228,619	74
193	Highly Vulnerable	Madhya Pradesh	Sehore	1,311,008	63
194	Highly Vulnerable	Madhya Pradesh	Seoni	1,378,876	66
195	Moderately Vulnerable	Madhya Pradesh	Shahdol	1,064,989	68
196	Highly Vulnerable	Madhya Pradesh	Sheopur	687,952	46
197	Moderately Vulnerable	Madhya Pradesh	Shivpuri	1,725,818	59
198	Moderately Vulnerable	Madhya Pradesh	Sidhi	1,126,515	52
199	Highly Vulnerable	Madhya Pradesh	Umaria	643,579	59
200	Moderately Vulnerable	Madhya Pradesh	Vidisha	1,872,413	63
201	Highly Vulnerable	Madhya Pradesh	West Nimar	1,872,413	64

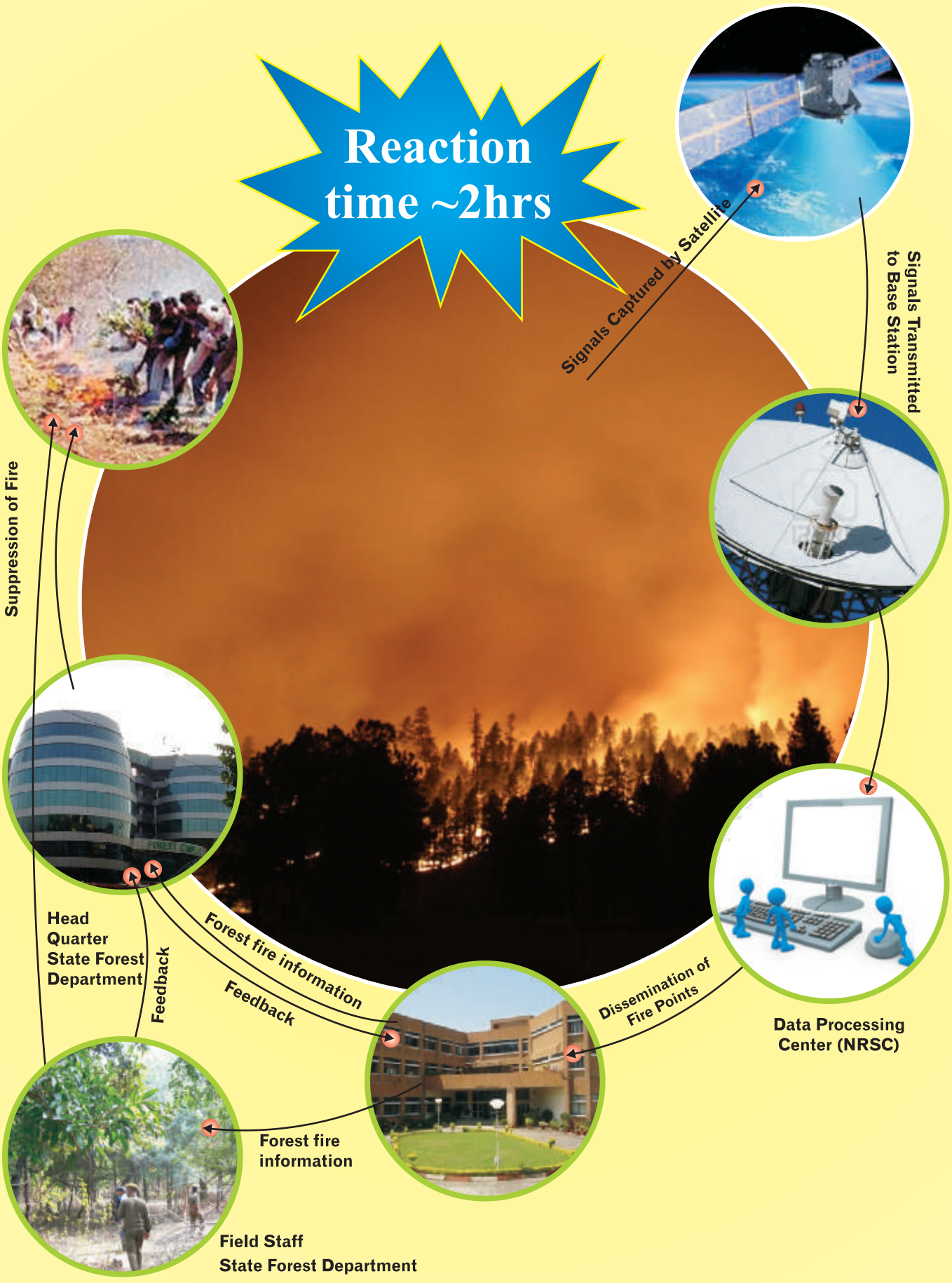
Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
202	Less Vulnerable	Maharashtra	Ahmadnagar	4,543,083	80
203	Highly Vulnerable	Maharashtra	Akola	1,818,617	81
204	Highly Vulnerable	Maharashtra	Amravati	2,887,826	83
205	Highly Vulnerable	Maharashtra	Bhandara	1,198,810	78
206	Less Vulnerable	Maharashtra	Bombay Suburban	9,332,481	91
207	Highly Vulnerable	Maharashtra	Buldana	2,588,039	76
208	Highly Vulnerable	Maharashtra	Chandrapur	2,194,262	73
209	Highly Vulnerable	Maharashtra	Garhchiroli	1,071,795	60
210	Highly Vulnerable	Maharashtra	Gondiya	1,322,331	79
211	Less Vulnerable	Maharashtra	Hingoli	1,178,973	76
212	Highly Vulnerable	Maharashtra	Jalgaon	4,224,442	75
213	Highly Vulnerable	Maharashtra	Kolhapur	3,874,015	77
214	Highly Vulnerable	Maharashtra	Nagpur	4,653,171	84
215	Less Vulnerable	Maharashtra	Nanded	3,356,566	68
216	Highly Vulnerable	Maharashtra	Nandurbar	1,646,177	56
217	Less Vulnerable	Maharashtra	Nashik	6,109,052	74
218	Highly Vulnerable	Maharashtra	Pune	9,426,959	80
219	Highly Vulnerable	Maharashtra	Ratnagiri	1,612,672	75
220	Highly Vulnerable	Maharashtra	Raygad	2,635,394	84
221	Less Vulnerable	Maharashtra	Sangli	2,820,575	83
222	Highly Vulnerable	Maharashtra	Satara	3,003,922	78
223	Highly Vulnerable	Maharashtra	Sindhudurg	848,868	80
224	Highly Vulnerable	Maharashtra	Thane	11,054,131	81
225	Highly Vulnerable	Maharashtra	Wardha	1,296,157	80
226	Less Vulnerable	Maharashtra	Washim	1,196,714	82
227	Moderately Vulnerable	Maharashtra	Yavatmal	2,775,457	74
228	Less Vulnerable	Manipur	Bishnupur	240,363	68
229	Highly Vulnerable	Manipur	Chandel	144,028	56
230	Highly Vulnerable	Manipur	Churachandpur	271,274	71
231	Highly Vulnerable	Manipur	Imphal East	452,661	75
232	Moderately Vulnerable	Manipur	Imphal West	514,683	80
233	Highly Vulnerable	Manipur	Senapati	354,972	60
234	Highly Vulnerable	Manipur	Tamenglong	140,143	59
235	Highly Vulnerable	Manipur	Thoubal	420,517	66

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
236	Highly Vulnerable	Manipur	Ukhrul	183,115	73
237	Highly Vulnerable	Meghalaya	East Garo Hills	317,618	61
238	Less Vulnerable	Meghalaya	East Khasi Hills	824,059	85
239	Less Vulnerable	Meghalaya	Jaintia Hills	392,852	52
240	Highly Vulnerable	Meghalaya	Ri Bhoi	258,380	66
241	Highly Vulnerable	Meghalaya	South Garo Hills	142,574	55
242	Highly Vulnerable	Meghalaya	West Garo Hills	642,923	51
243	Highly Vulnerable	Meghalaya	West Khasi Hills	385,601	65
244	Highly Vulnerable	Mizoram	Aizawl	404,054	97
245	Highly Vulnerable	Mizoram	Champhai	125,370	91
246	Highly Vulnerable	Mizoram	Lawngtlai	117,444	65
247	Highly Vulnerable	Mizoram	Lunglei	154,094	84
248	Highly Vulnerable	Mizoram	Saiha	56,366	82
249	Highly Vulnerable	Mizoram	Serchhip	64,875	95
250	Highly Vulnerable	Nagaland	Dimapur	379,769	77
251	Highly Vulnerable	Nagaland	Kohima	270,063	75
252	Highly Vulnerable	Nagaland	Mokokchung	193,171	84
253	Highly Vulnerable	Nagaland	Mon	250,671	42
254	Highly Vulnerable	Nagaland	Phek	163,294	71
255	Highly Vulnerable	Nagaland	Tuensang	196,801	51
256	Highly Vulnerable	Nagaland	Wokha	166,239	81
257	Highly Vulnerable	Nagaland	Zunheboto	141,014	69
258	Moderately Vulnerable	Odisha	Balangir	1648,574	56
259	Less Vulnerable	Odisha	Baleshwar	2,317,419	81
260	Highly Vulnerable	Odisha	Cuttack	2,618,708	77
261	Highly Vulnerable	Odisha	Dhenkanal	1,192,948	69
262	Highly Vulnerable	Odisha	Ganjam	3,520,151	61
263	Highly Vulnerable	Odisha	Kalahandi	1,573,054	46
264	Highly Vulnerable	Odisha	Kendujhar	1,802,777	59
265	Highly Vulnerable	Odisha	Koraput	1,376,934	36
266	Moderately Vulnerable	Odisha	Mayurbhanj	2,513,895	52
267	Highly Vulnerable	Odisha	Phulabani	648,201	53
268	Moderately Vulnerable	Odisha	Puri	1,697,983	78
269	Highly Vulnerable	Odisha	Sambalpur	1,044,410	67

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
270	Highly Vulnerable	Odisha	Sundargarh	2,080,664	65
271	Less Vulnerable	Punjab	Gurdaspur	2,299,026	81
272	Highly Vulnerable	Punjab	Hoshiarpur	1,582,793	81
273	Less Vulnerable	Punjab	Jalandhar	2,181,753	82
274	Less Vulnerable	Punjab	Ludhiana	3,487,882	83
275	Less Vulnerable	Punjab	Patiala	1,892,282	76
276	Moderately Vulnerable	Punjab	Rupnagar	683,349	83
277	Less Vulnerable	Rajasthan	Banswara	1,798,194	57
278	Less Vulnerable	Rajasthan	Chittaurgarh	1,544,392	54
279	Less Vulnerable	Rajasthan	Pali	2,038,533	54
280	Less Vulnerable	Rajasthan	Rajsamand	1,158,283	56
281	Moderately Vulnerable	Rajasthan	Sirohi	1,037,185	56
282	Moderately Vulnerable	Rajasthan	Udaipur	3,067,549	59
283	Less Vulnerable	Sikkim	South	146,742	82
284	Less Vulnerable	Tamil Nadu	Anna/ Dindigul	2,161,367	77
285	Less Vulnerable	Tamil Nadu	Coimbatore	3,472,578	84
286	Moderately Vulnerable	Tamil Nadu	Dharmapuri	1,502,900	65
287	Less Vulnerable	Tamil Nadu	Kanniyakumari	1,863,174	92
288	Less Vulnerable	Tamil Nadu	Namakkal	1,721,179	75
289	Moderately Vulnerable	Tamil Nadu	Nilgiri	735,071	80
290	Highly Vulnerable	Tamil Nadu	Periyar	2,581,500	65
291	Less Vulnerable	Tamil Nadu	Salem	3,480,008	73
292	Less Vulnerable	Tamil Nadu	South Arcot/Viluppuram	3,463,284	72
293	Less Vulnerable	Tamil Nadu	Theni	1,243,684	72
294	Less Vulnerable	Tamil Nadu	Thiruvallur	3,725,697	84
295	Less Vulnerable	Tamil Nadu	Tirunelveli	3,072,880	83
296	Less Vulnerable	Tamil Nadu	Tiruvanamalai	2,468,965	75
297	Moderately Vulnerable	Tamil Nadu	Vellore	3,928,106	80
298	Highly Vulnerable	Tripura	North Tripura	693,281	73
299	Highly Vulnerable	Tripura	South Tripura	875,144	70
300	Highly Vulnerable	Tripura	West Tripura	1,724,619	77
301	Less Vulnerable	Uttar Pradesh	Agra	4,380,793	69
302	Less Vulnerable	Uttar Pradesh	Bahraich & Shrawasti	3,478,257	51
303	Highly Vulnerable	Uttar Pradesh	Balrampur	2,149,066	35

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
304	Moderately Vulnerable	Uttar Pradesh	Banda	1,799,541	68\
305	Less Vulnerable	Uttar Pradesh	Bara Banki	3,257,983	64
306	Highly Vulnerable	Uttar Pradesh	Bijnor	3,683,896	58
307	Less Vulnerable	Uttar Pradesh	Chandauli	1,952,713	74
308	Moderately Vulnerable	Uttar Pradesh	Chitrakoot	990,626	67
309	Less Vulnerable	Uttar Pradesh	Etawah	1,579,160	80
310	Less Vulnerable	Uttar Pradesh	Faizabad	2,468,371	71
311	Less Vulnerable	Uttar Pradesh	Firozabad	2,496,761	75
312	Less Vulnerable	Uttar Pradesh	Jhansi	2,000,755	76
313	Less Vulnerable	Uttar Pradesh	Kannauj	1,658,005	74
314	Less Vulnerable	Uttar Pradesh	Kanpur Nagar & Dehat	4,572,951	62
315	Highly Vulnerable	Uttar Pradesh	Kheri	4,013,634	48
316	Less Vulnerable	Uttar Pradesh	Kushinagar	3,560,830	68
317	Highly Vulnerable	Uttar Pradesh	Lalitpur	1,218,002	49
318	Highly Vulnerable	Uttar Pradesh	Maharajganj	2,665,292	47
319	Less Vulnerable	Uttar Pradesh	Mirzapur	2,494,533	70
320	Less Vulnerable	Uttar Pradesh	Muzaffarnagar	4,138,605	70
321	Highly Vulnerable	Uttar Pradesh	Pilibhit	2,037,225	50
322	Less Vulnerable	Uttar Pradesh	Rampur	2,335,398	55
323	Moderately Vulnerable	Uttar Pradesh	Saharanpur	3,464,228	61
324	Highly Vulnerable	Uttar Pradesh	Shahjahanpur	3,002,376	49
325	Moderately Vulnerable	Uttar Pradesh	Sonbhadra	1,862,612	49
326	Less Vulnerable	Uttar Pradesh	Sultanpur	3,790,922	71
327	Moderately Vulnerable	Uttarakhand	Almora	621,927	74
328	Moderately Vulnerable	Uttarakhand	Bageshwar	259,840	81
329	Moderately Vulnerable	Uttarakhand	Chamoli	391,114	75
330	Less Vulnerable	Uttarakhand	Champawat	259,315	70
331	Highly Vulnerable	Uttarakhand	Dehra Dun	1,698,560	79
332	Moderately Vulnerable	Uttarakhand	Haridwar	1,927,029	64
333	Highly Vulnerable	Uttarakhand	Naini Tal	955,128	78
334	Highly Vulnerable	Uttarakhand	Pauri Garhwal	686,527	77
335	Moderately Vulnerable	Uttarakhand	Pithoragarh	616,409	67
336	Less Vulnerable	Uttarakhand	Rudraprayag	1,648,367	65
337	Moderately Vulnerable	Uttarakhand	Tehri Garhwal	616,409	75

Sl. No.	Vulnerability	State	District	Population	Literacy Rate (in %)
338	Highly Vulnerable	Uttarakhand	Udham Singh Nagar	1,648,367	74
339	Moderately Vulnerable	Uttarakhand	Uttarkashi	329,686	76
340	Moderately Vulnerable	West Bengal	Bankura	3,596,292	71
341	Moderately Vulnerable	West Bengal	Barddhaman	7,723,663	77
342	Less Vulnerable	West Bengal	Birbhum	3,502,387	71
343	Less Vulnerable	West Bengal	Darjiling	1,842,034	80
344	Less Vulnerable	West Bengal	Jalpaiguri	3,869,675	74
345	Moderately Vulnerable	West Bengal	Medinipur	1,103,738	83
346	Moderately Vulnerable	West Bengal	Puruliya	2,927,965	65



Box-1 : Forest fire monitoring at national level from 2012

Annexure 1.3

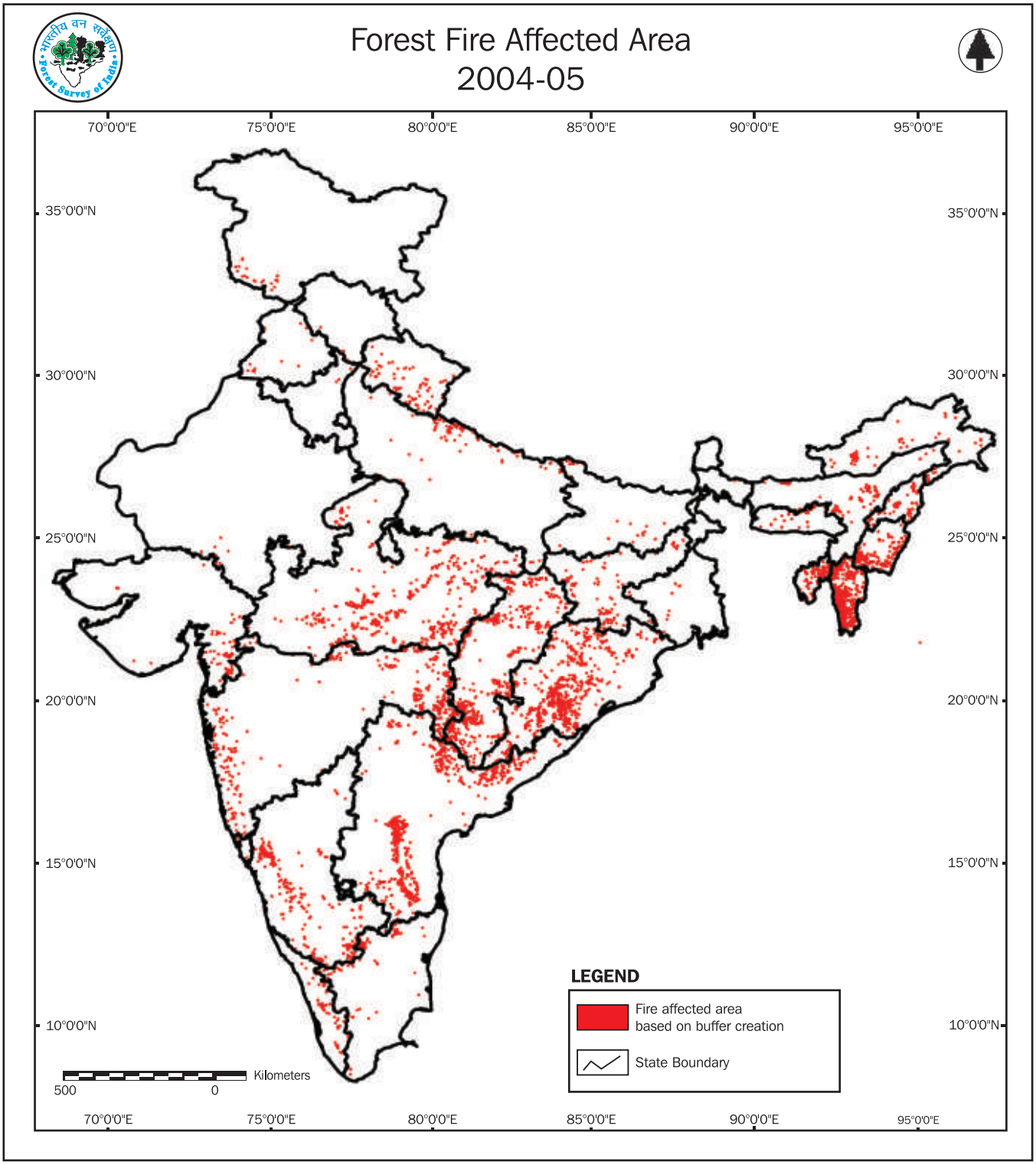


Figure 17: Map showing region of 5 km radius around forest fire incidence

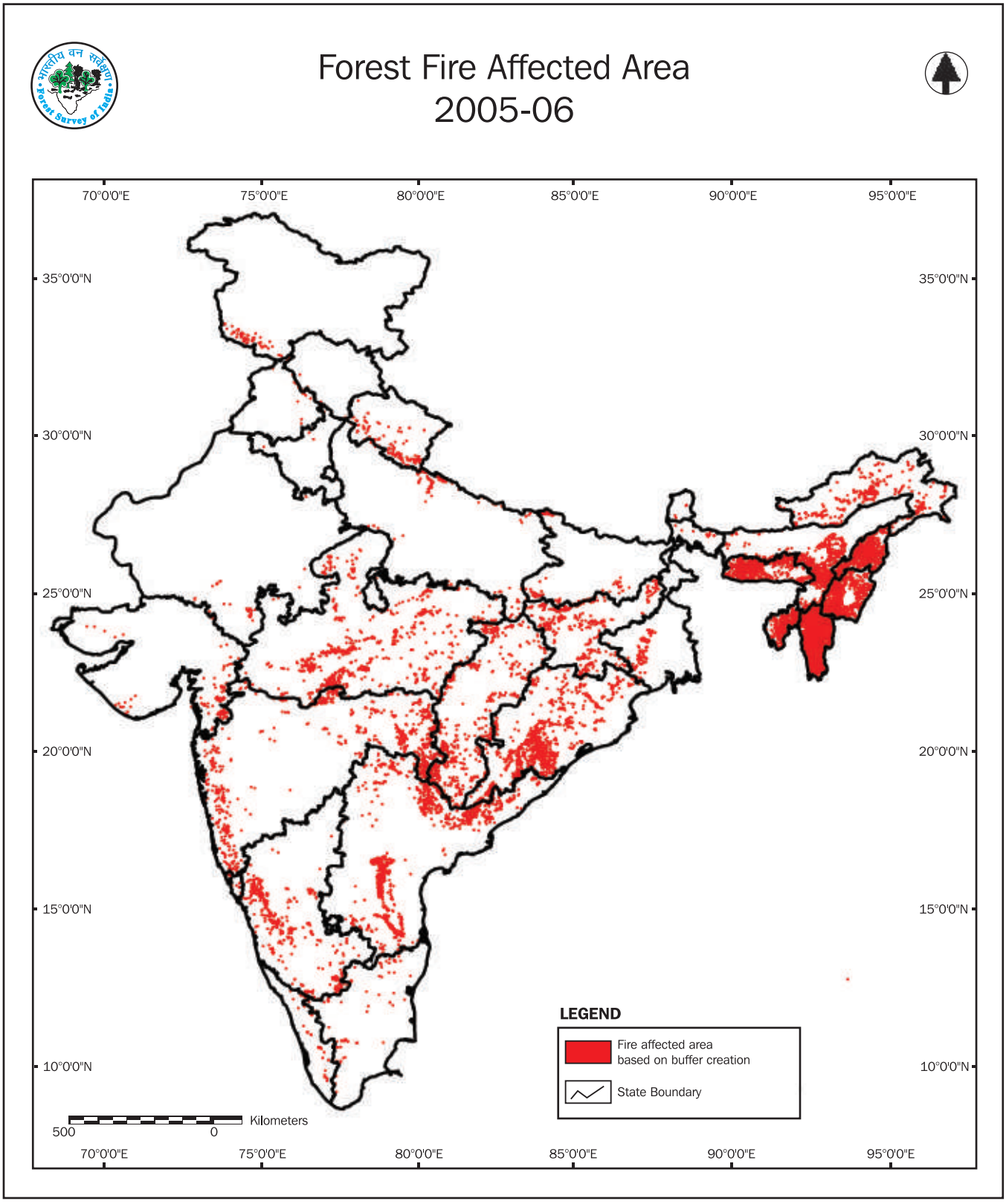


Figure 18: Map showing region of 5 km radius around forest fire incidence

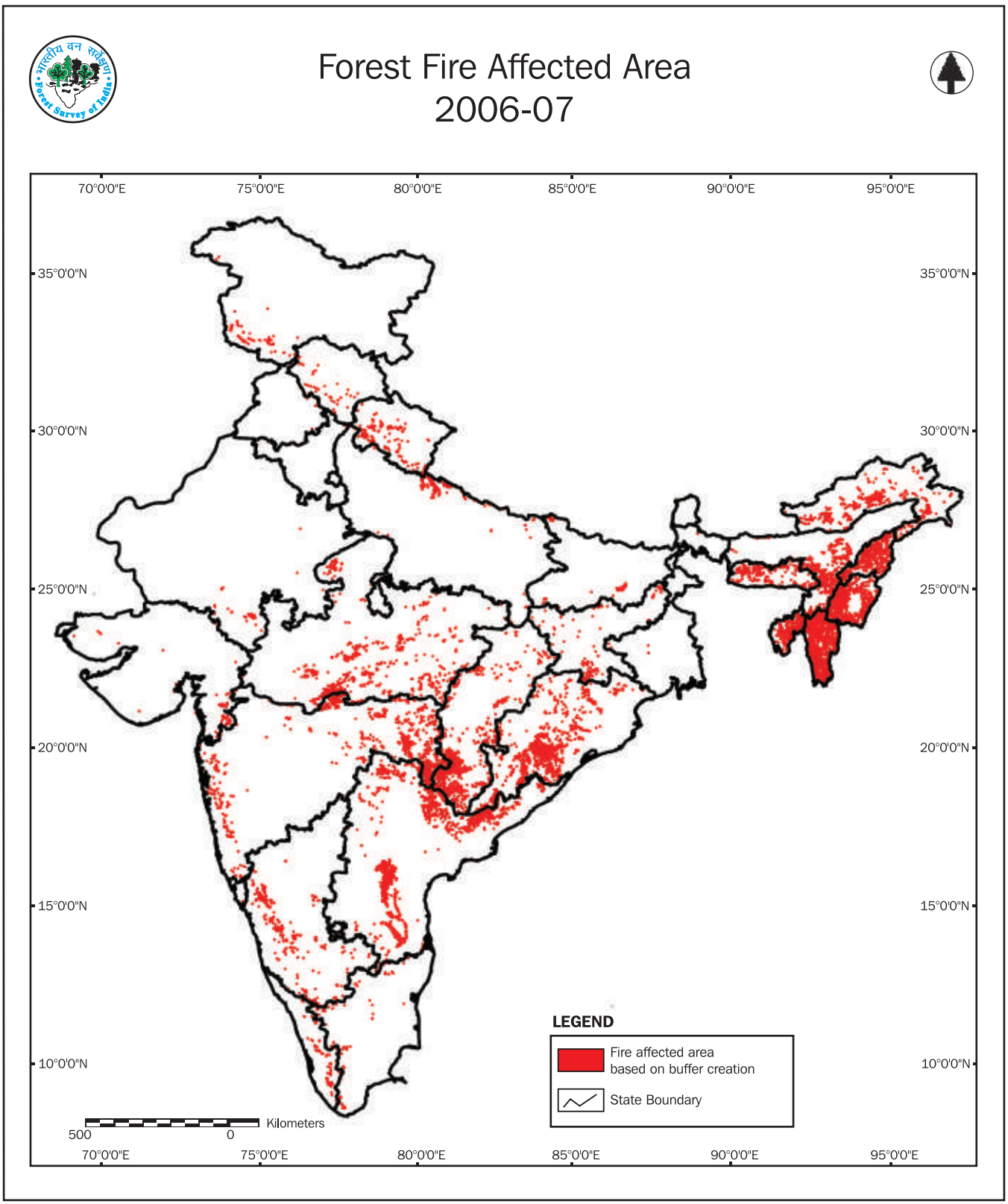


Figure 19: Map showing region of 5 km radius around forest fire incidence

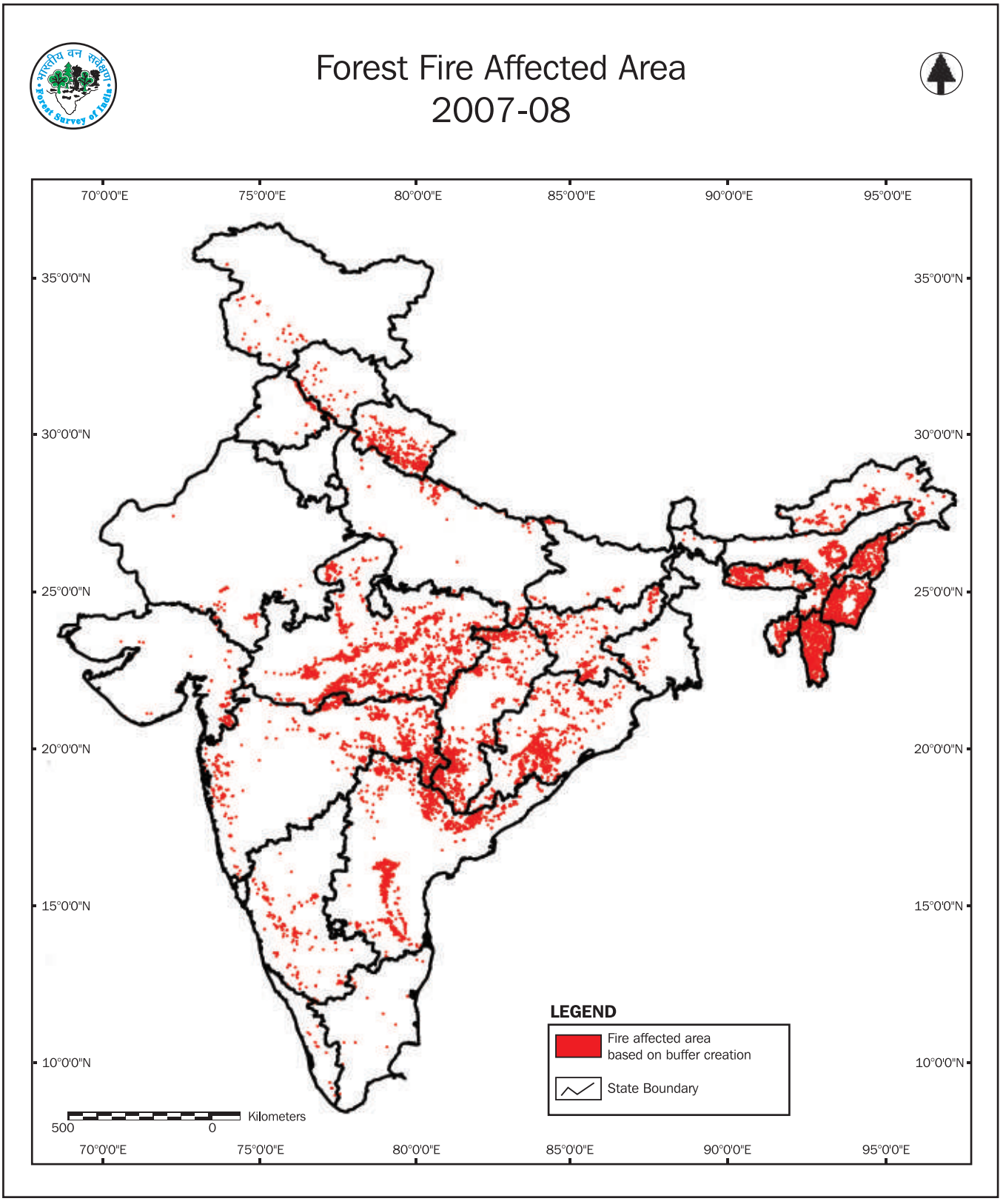


Figure 20: Map showing region of 5 km radius around forest fire incidence

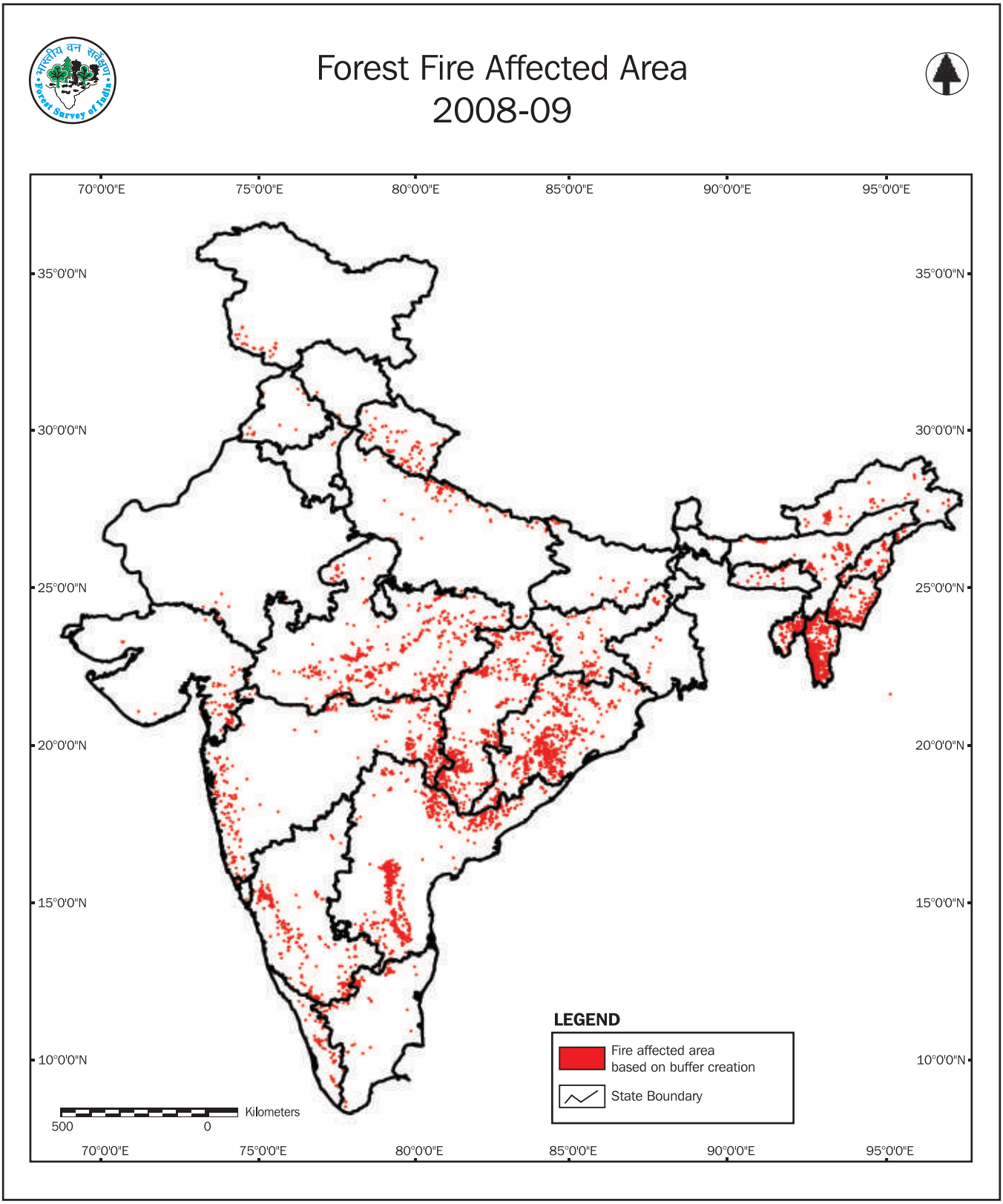


Figure 21: Map showing region of 5 km radius around forest fire incidence

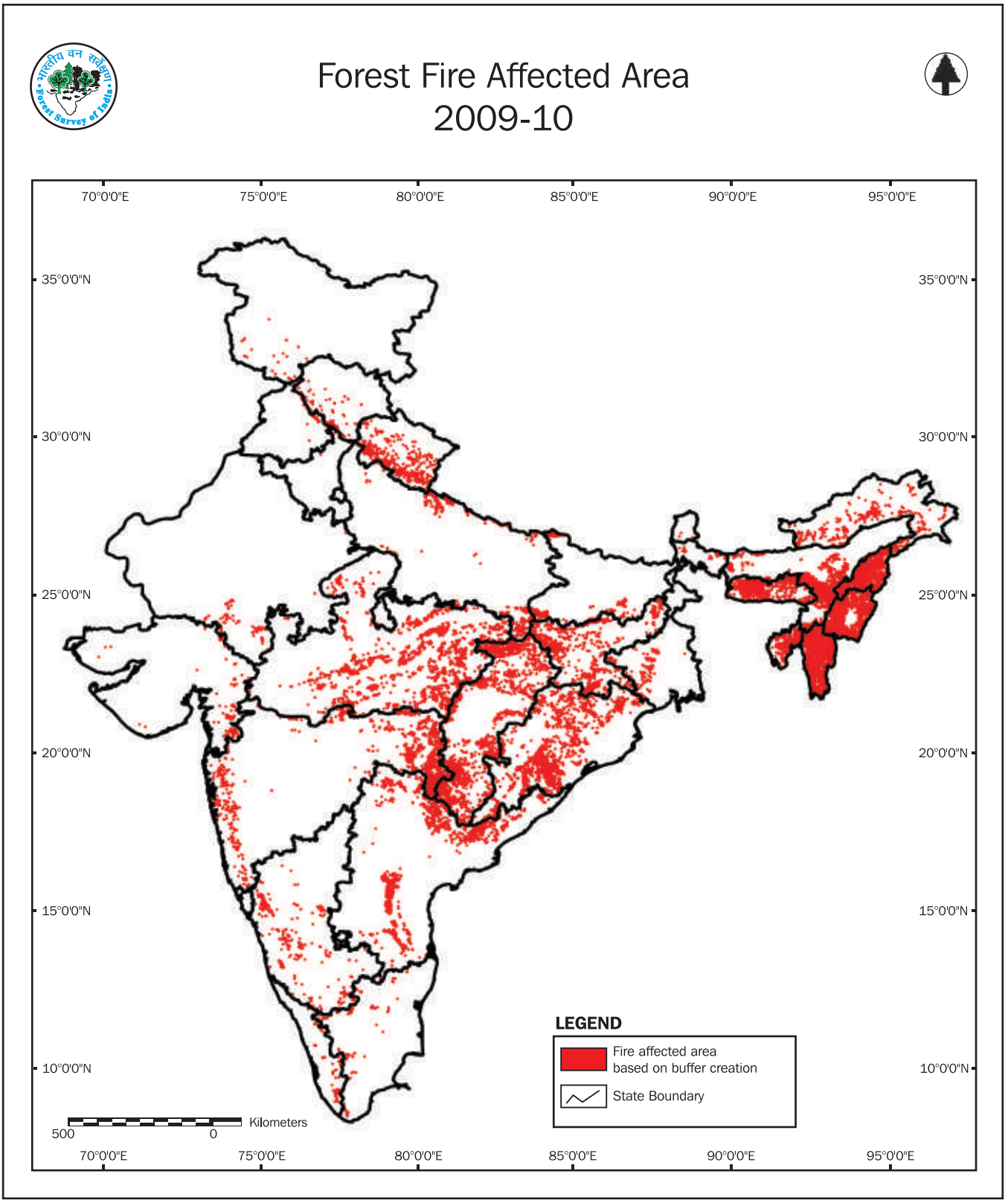


Figure 22: Map showing region of 5 km radius around forest fire incidence

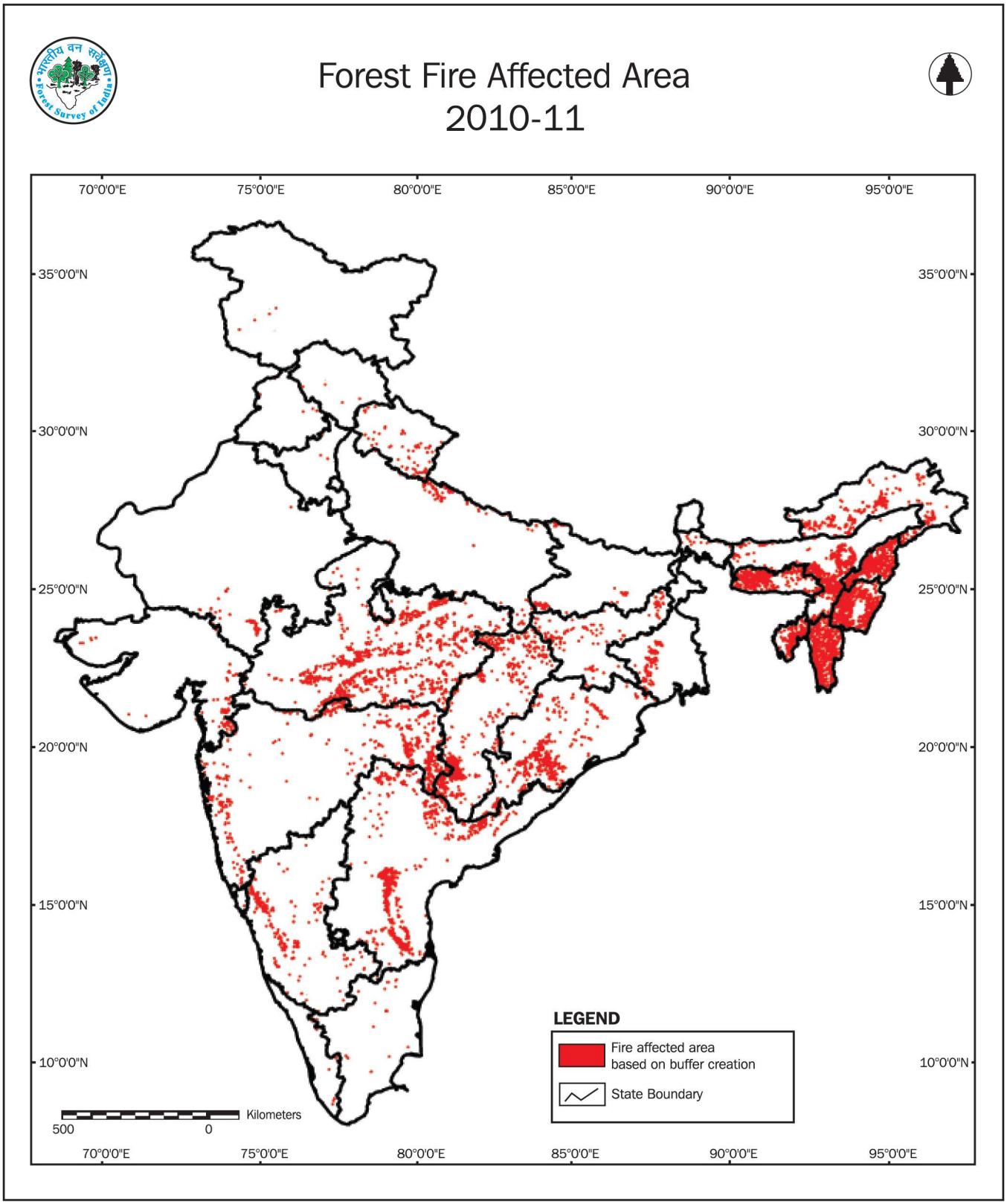


Figure 23: Map showing region of 5 km radius around forest fire incidence

Annexure 1.4

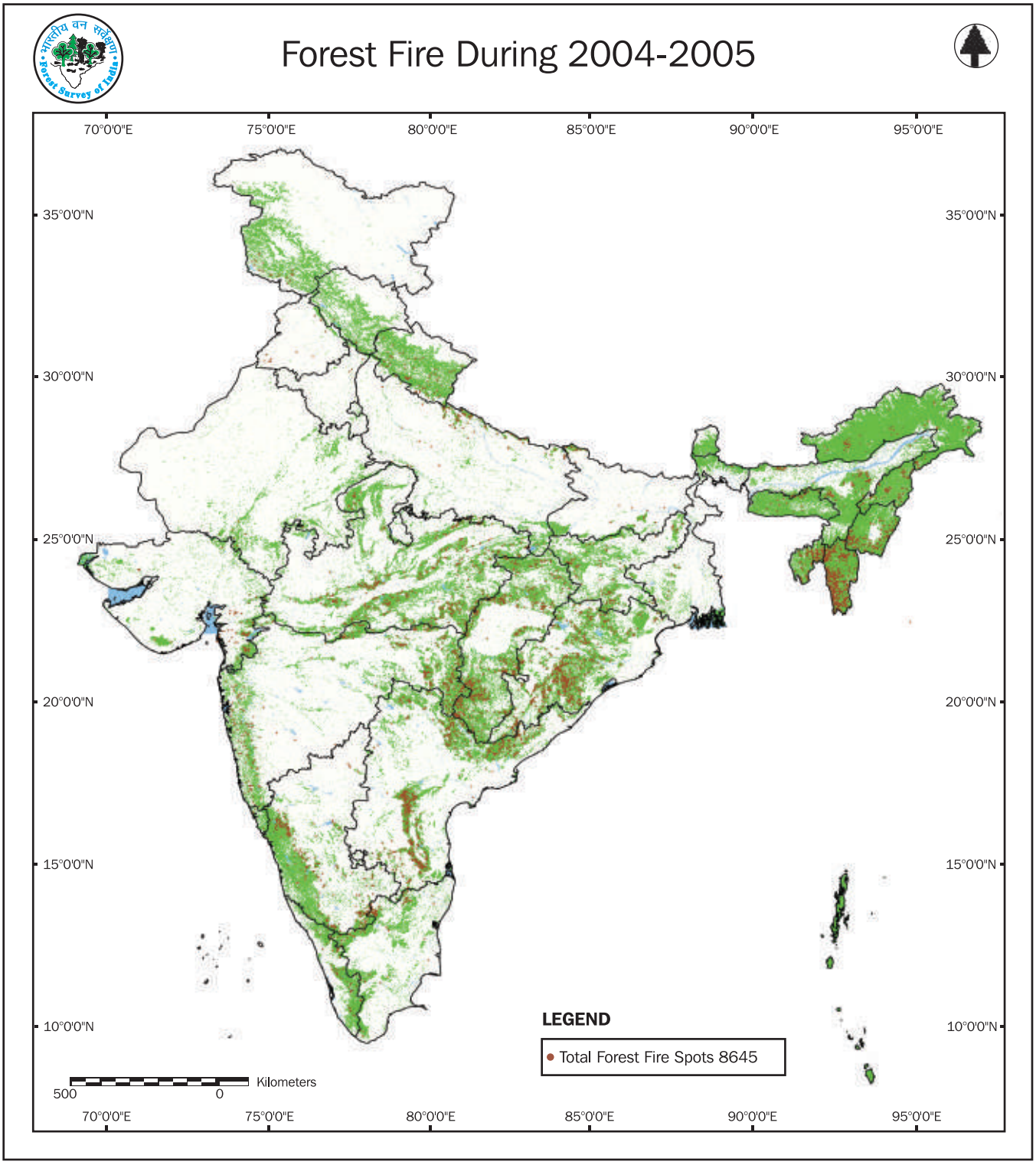


Figure 24: Forest fire incidences overlaid on forest cover map of the country

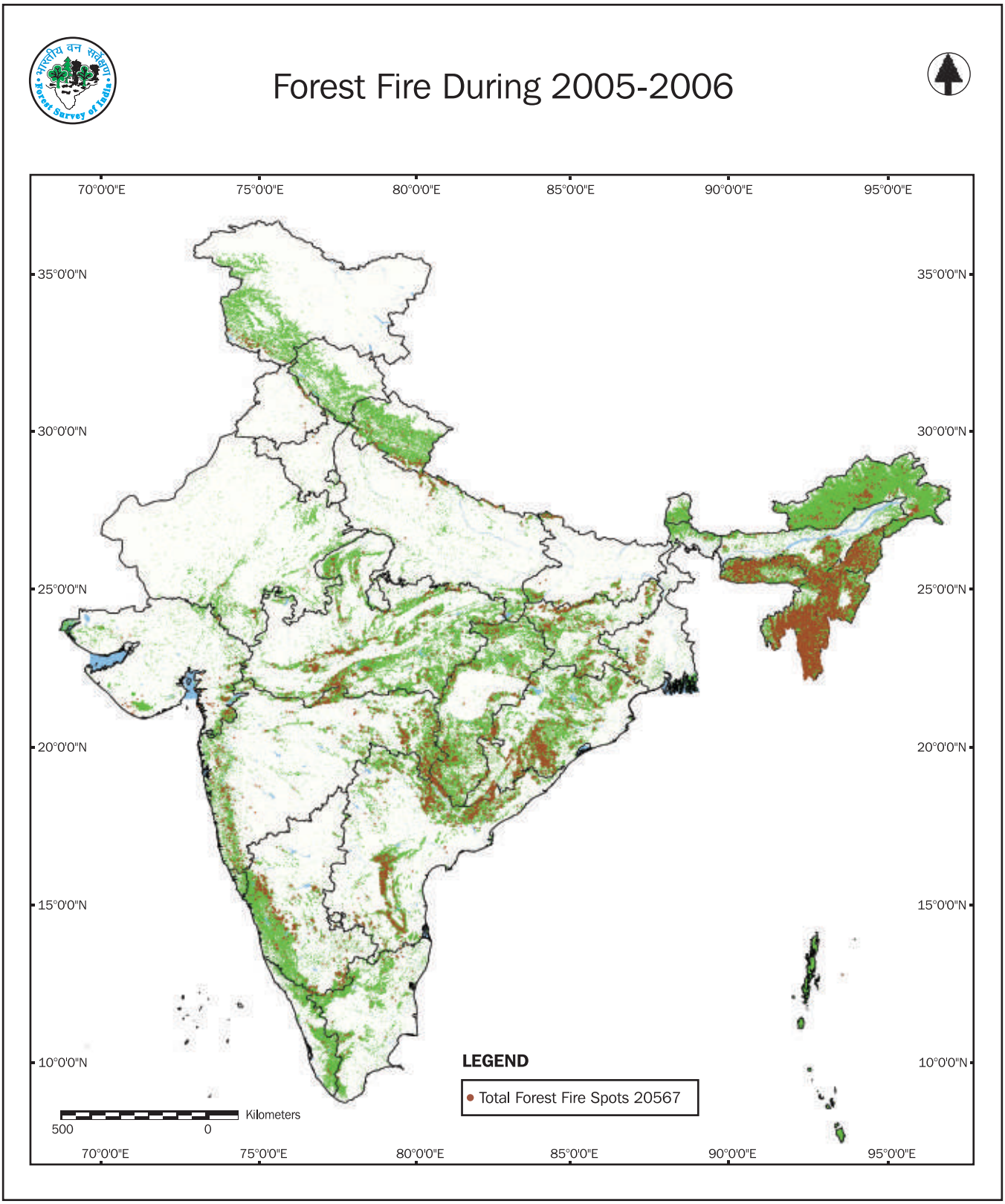


Figure 25: Forest fire incidences overlaid on forest cover map of the country

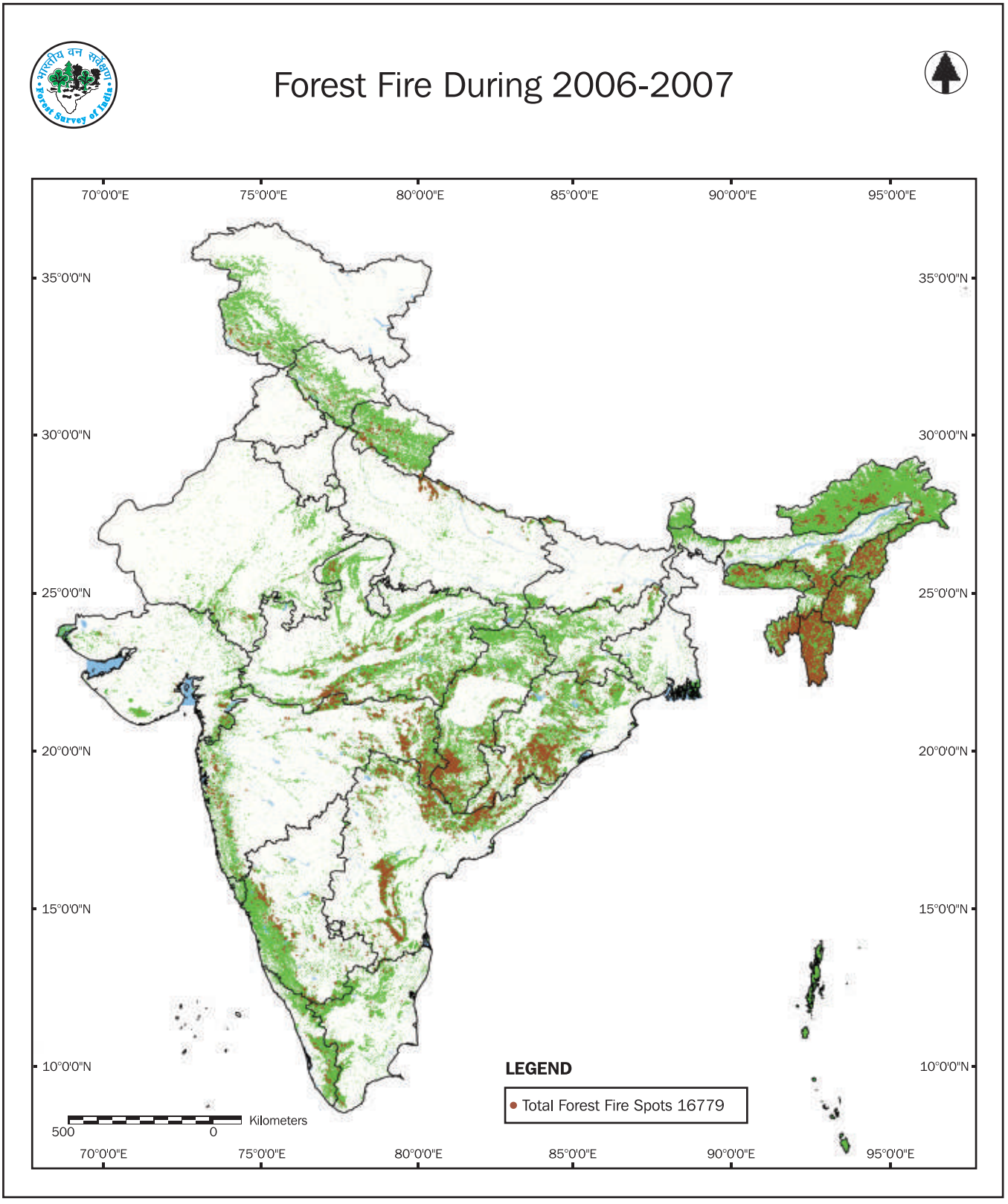


Figure 26: Forest fire incidences overlaid on forest cover map of the country

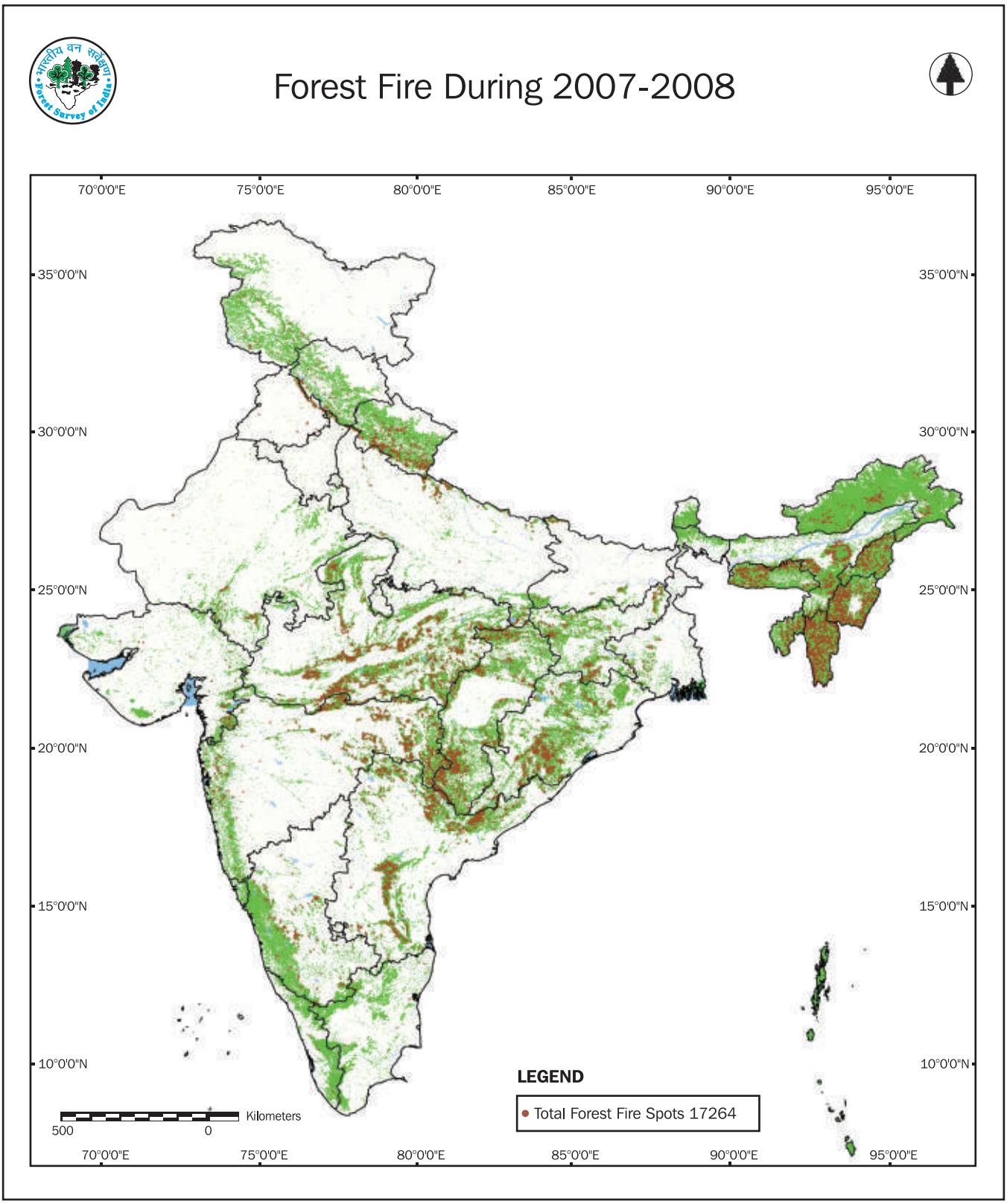


Figure 27: Forest fire incidences overlaid on forest cover map of the country

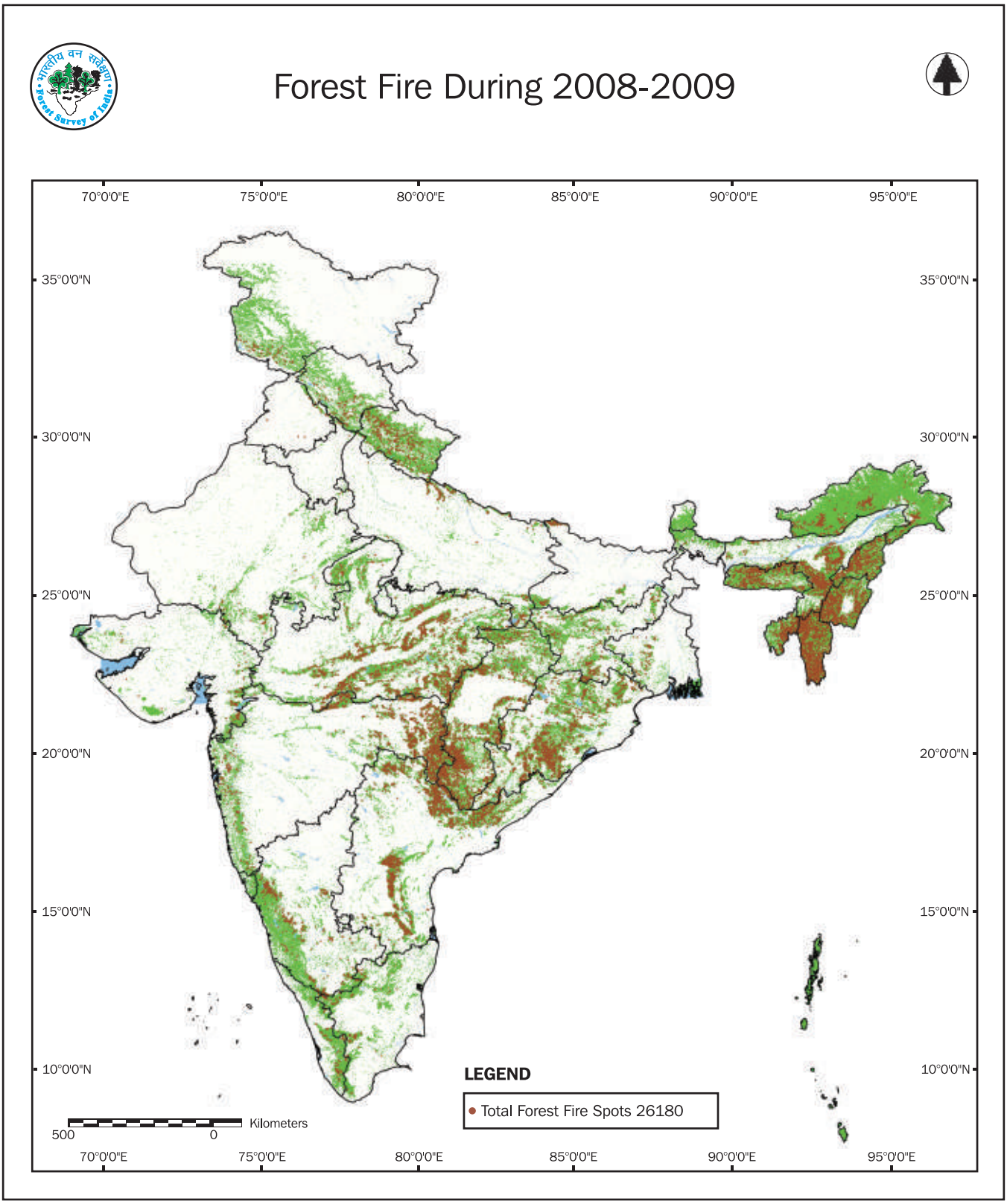


Figure 28: Forest fire incidences overlaid on forest cover map of the country

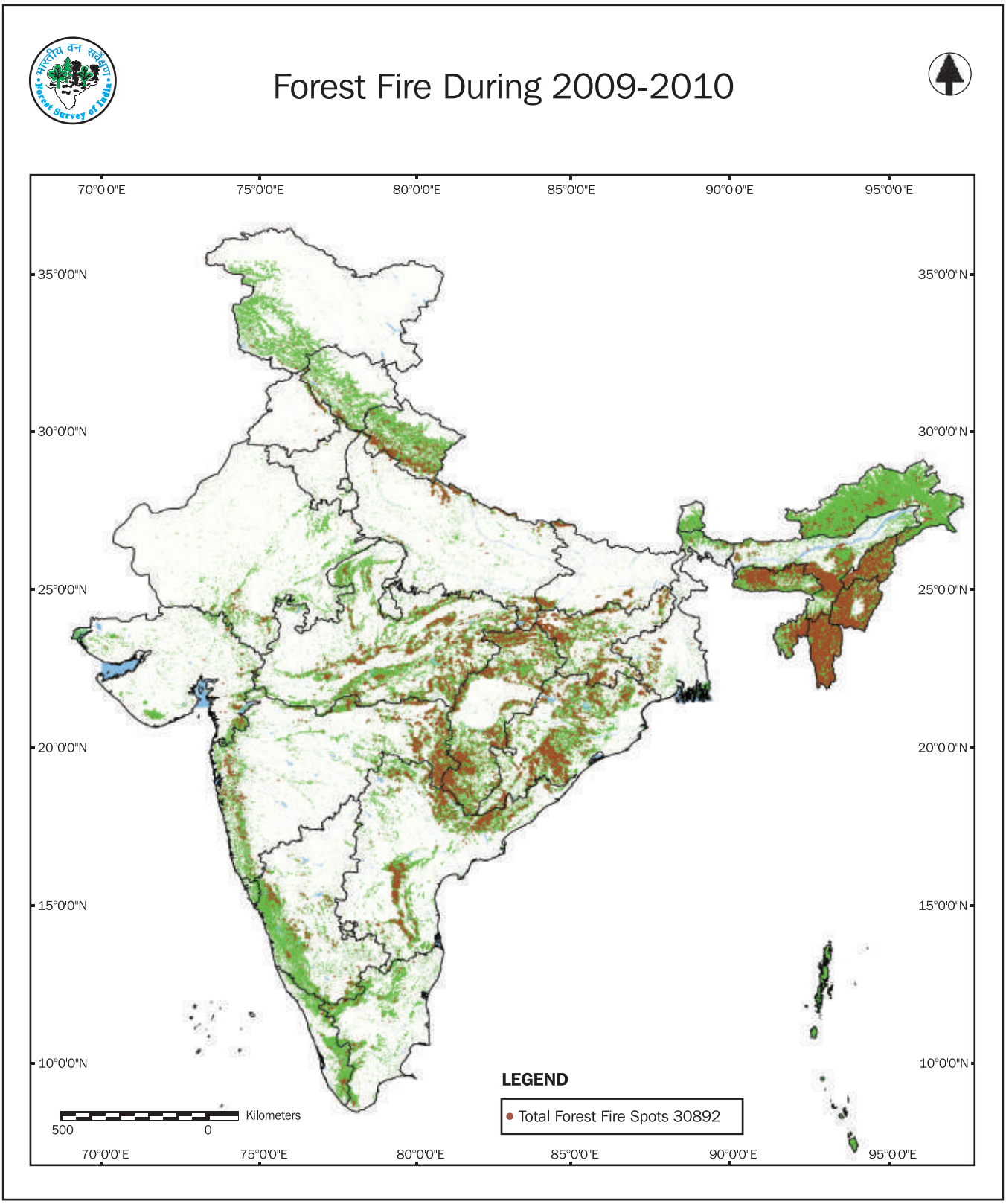


Figure 29: Forest fire incidences overlaid on forest cover map of the country

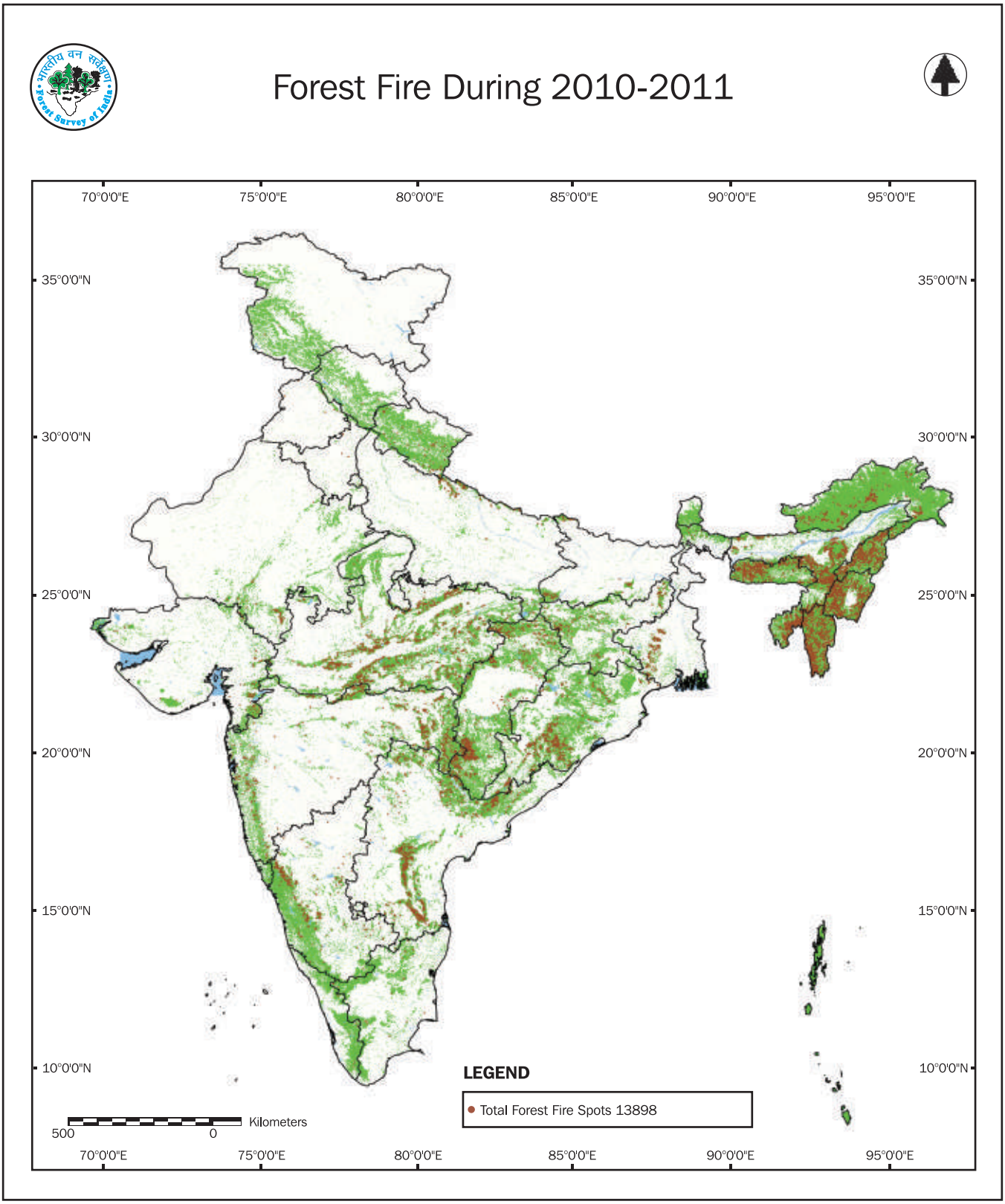
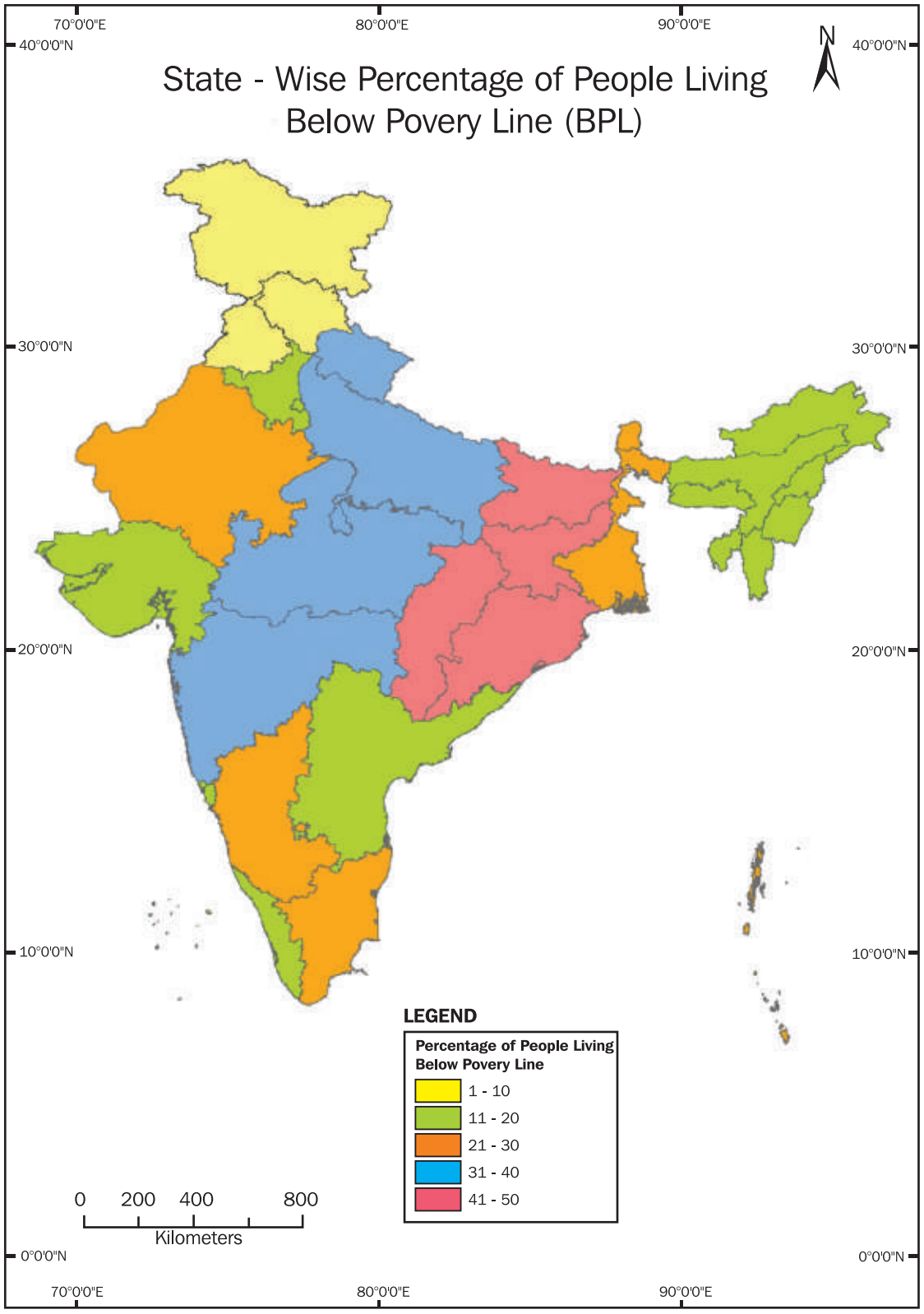
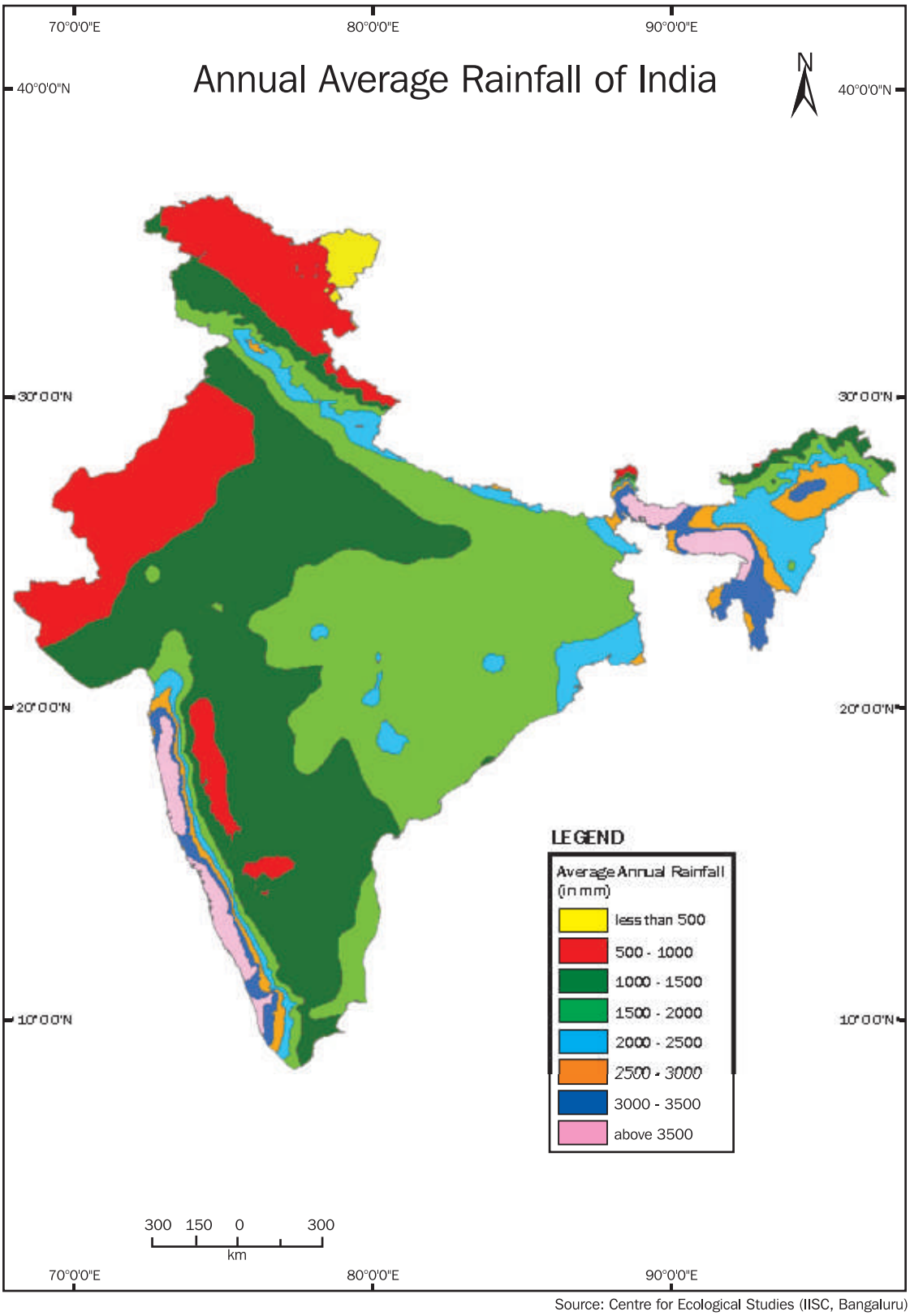


Figure 30: Forest fire incidences overlaid on forest cover map of the country



Source: Based on the data from Planning Commission, India

Figure 31: Poverty Map of India



Source: Centre for Ecological Studies (IISC, Bangaluru)

Figure 32: Annual average rainfall map of India

Annexure 1.5

Table 9: SOI Toposheets having more than 100 forest fire incidences during the last 7 years

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
1	46G	46G11	29	27	21	13	27	30	19	166
2	46H	46H09	22	29	14	31	34	36	14	180
3	48I	48I11	22	27	7	2	44	27	29	158
4	48I	48I12	33	44	16	1	65	34	26	219
5	48I	48I16	39	36	41	11	28	23	24	202
6	48J	48J13	23	26	11	1	19	10	14	104
7	48N	48N08	21	30	24	22	32	20	11	160
8	48O	48O13	7	44	19	26	17	35	36	184
9	53J	53J04	12	13	33	3	4	86	3	154
10	53K	53K05	0	6	24	69	14	54	3	170
11	53K	53K10	1	9	1	57	32	95	1	196
12	53K	53K14	40	0	26	65	9	45	0	185
13	53O	53O03	3	14	3	31	14	58	1	124
14	53O	53O16	4	20	4	48	13	22	7	118
15	54G	54G01	15	10	44	37	18	25	5	154
16	54P	54P11	5	0	1	8	53	29	17	113
17	55B	55B03	4	6	14	67	10	1	28	130
18	55B	55B07	13	37	39	77	41	26	40	273
19	55B	55B11	5	52	7	33	16	30	30	173
20	55C	55C10	2	13	15	52	43	4	6	135
21	55C	55C14	7	6	54	27	51	2	13	160
22	55C	55C15	8	34	23	49	47	2	23	186
23	55E	55E16	9	11	10	40	31	15	25	141
24	55F	55F01	5	43	8	40	28	19	10	153
25	55F	55F05	13	33	10	42	21	36	18	173
26	55F	55F08	2	14	24	32	33	8	20	133
27	55F	55F09	26	31	16	60	31	37	33	234
28	55G	55G01	7	42	44	89	51	9	22	264
29	55G	55G02	7	20	50	20	49	20	14	180
30	55G	55G03	5	16	48	49	34	42	18	212
31	55G	55G05	11	29	21	47	29	19	36	192
32	55G	55G06	11	31	29	69	36	25	34	235
33	55J	55J03	36	50	27	36	34	34	33	250
34	55J	55J07	3	10	7	20	35	17	13	105
35	55M	55M03	7	7	11	49	33	18	15	140
36	55M	55M04	6	11	13	19	30	40	10	129

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
37	55M	55M06	1	8	9	29	38	21	0	106
38	55M	55M07	4	3	9	63	25	13	9	126
39	55N	55N16	14	7	14	11	37	44	14	141
40	55O	55O02	8	8	15	27	37	21	12	128
41	55O	55O06	9	1	5	10	57	29	7	118
42	55O	55O09	10	0	7	26	38	9	14	104
43	55O	55O16	11	5	17	14	32	40	21	140
44	55P	55P07	8	34	36	31	56	59	27	251
45	55P	55P08	22	39	55	51	51	85	27	330
46	55P	55P12	4	30	28	36	34	33	18	183
47	56I	56I11	3	2	19	23	40	7	9	103
48	56I	56I16	12	7	24	16	43	19	10	131
49	56L	56L12	60	42	92	56	91	48	40	429
50	56L	56L16	23	26	52	49	71	31	31	283
51	56M	56M04	1	17	20	13	26	29	4	110
52	56M	56M05	8	25	36	24	44	27	6	170
53	56M	56M10	15	5	14	36	33	36	27	166
54	56M	56M16	1	9	15	7	23	39	11	105
55	56P	56P04	24	16	0	27	22	20	12	121
56	57I	57I09	29	14	16	10	27	18	17	131
57	57I	57I10	12	25	29	9	19	23	8	125
58	57I	57I11	7	26	30	13	28	21	13	138
59	57I	57I12	2	26	17	14	26	27	10	122
60	57I	57I13	47	64	67	45	51	66	55	395
61	57I	57I14	59	74	79	35	76	68	42	433
62	57I	57I15	6	24	25	21	35	27	15	153
63	57I	57I16	15	36	20	15	36	37	28	187
64	57J	57J14	56	11	27	9	22	27	24	176
65	57J	57J15	18	19	17	20	33	39	13	159
66	57N	57N04	15	13	15	14	15	22	25	119
67	57O	57O01	41	40	84	24	58	31	48	326
68	57O	57O05	37	33	31	16	36	15	50	218
69	57O	57O06	14	17	27	4	27	4	38	131
70	58A	58A06	2	21	17	20	47	4	3	114
71	58A	58A10	12	17	24	22	51	12	1	139
72	62D	62D02	9	17	29	14	25	27	18	139
73	62D	62D07	13	19	49	24	48	55	21	229

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
74	62D	62D15	20	22	23	13	15	42	19	154
75	63D	63D04	6	17	4	32	33	36	4	132
76	63D	63D08	2	8	0	33	29	38	8	118
77	63H	63H01	17	18	0	36	44	37	9	161
78	63L	63L12	79	20	0	4	4	11	0	118
79	63L	63L16	5	23	15	30	18	29	1	121
80	64B	64B08	13	4	11	30	23	29	8	118
81	64B	64B11	3	2	3	4	91	15	6	124
82	64B	64B16	13	7	14	15	49	8	4	110
83	64C	64C11	19	9	7	17	38	42	12	144
84	64D	64D01	1	20	7	4	40	34	2	108
85	64D	64D04	4	3	6	9	38	34	13	107
86	64D	64D05	11	18	20	10	36	27	5	127
87	64D	64D06	13	7	11	9	39	23	1	103
88	64D	64D07	7	11	6	9	50	15	6	104
89	64E	64E03	6	4	2	14	41	44	15	126
90	64E	64E04	8	1	5	59	39	38	2	152
91	64E	64E13	0	0	1	42	25	50	3	121
92	64E	64E14	12	12	0	19	9	36	28	116
93	64F	64F03	10	6	17	24	36	29	11	133
94	64F	64F10	5	8	5	31	27	51	19	146
95	64F	64F11	8	9	6	12	22	38	7	102
96	64F	64F14	6	2	7	16	21	51	18	121
97	64F	64F15	26	13	8	20	39	44	16	166\
98	64H	64H16	20	3	14	33	18	30	0	118
99	64I	64I02	3	19	0	23	14	56	17	132
100	64I	64I06	11	18	0	33	22	31	13	128
101	64I	64I14	14	4	2	22	17	43	12	114
102	64K	64K07	30	20	14	12	3	27	7	113
103	64L	64L04	22	20	13	16	17	37	5	130
104	64L	64L07	16	41	37	11	39	50	8	202
105	64L	64L08	23	45	38	16	39	52	6	219
106	64O	64O09	4	23	3	5	16	58	15	124
107	64P	64P11	15	26	18	8	9	21	18	115
108	64P	64P12	46	70	65	47	50	83	37	398
109	64P	64P15	40	46	24	31	40	36	16	233
110	64P	64P16	21	43	24	25	33	36	17	199

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
111	65A	65A01	16	15	22	19	60	67	26	225
112	65A	65A02	12	10	17	24	68	33	20	184
113	65A	65A03	9	25	44	42	58	86	20	284
114	65A	65A04	11	40	37	18	67	83	14	270
115	65A	65A05	10	9	4	20	79	36	10	168
116	65A	65A06	10	10	9	13	65	16	7	130
117	65A	65A07	5	11	32	14	41	47	14	164
118	65A	65A08	23	19	42	34	55	86	37	296
119	65A	65A09	6	9	7	16	55	26	11	130
120	65A	65A10	28	22	30	50	44	44	17	235
121	65A	65A11	15	10	63	28	28	36	32	212
122	65A	65A12	17	20	91	57	60	77	23	345
123	65A	65A13	21	22	49	37	84	64	51	328
124	65A	65A14	36	17	171	66	140	72	106	608
125	65A	65A15	28	24	194	68	181	80	127	702
126	65A	65A16	11	7	71	22	81	20	36	248
127	65B	65B01	10	34	38	35	52	65	17	251
128	65B	65B03	24	17	21	30	44	39	9	184
129	65B	65B04	25	41	39	42	38	27	20	232
130	65B	65B05	11	30	29	33	60	69	12	244
131	65B	65B06	33	59	50	61	86	88	20	397
132	65B	65B07	8	25	22	32	56	42	7	192
133	65B	65B08	17	35	36	22	55	24	15	204
134	65B	65B09	14	25	30	31	59	85	33	277
135	65B	65B10	10	34	52	24	83	63	33	299
136	65B	65B11	15	51	43	53	68	52	20	302
137	65B	65B14	7	4	40	8	29	41	11	140
138	65B	65B15	6	4	21	21	43	17	2	114
139	65B	65B16	16	18	18	13	32	18	3	118
140	65C	65C01	19	35	25	35	55	24	8	201
141	65C	65C05	7	23	13	14	49	19	4	129
142	65C	65C09	5	21	21	4	55	18	7	131
143	65C	65C15	7	14	16	23	33	10	6	109
144	65E	65E01	0	0	8	27	35	28	4	102
145	65E	65E02	9	6	71	11	71	43	19	230
146	65E	65E03	9	7	236	82	183	63	87	667
147	65E	65E04	22	44	115	32	74	31	46	364

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
148	65F	65F02	4	13	38	15	10	33	10	123
149	65F	65F07	3	16	24	23	33	11	0	110
150	65F	65F16	6	34	26	10	18	25	24	143
151	65G	65G06	11	7	15	21	26	38	7	125
152	65G	65G07	6	12	34	10	22	30	7	121
153	65G	65G10	4	53	27	88	39	85	28	324
154	65G	65G11	20	34	26	11	40	32	8	171
155	65G	65G13	18	41	119	78	55	74	72	457
156	65G	65G14	29	41	33	28	36	48	35	250
157	65I	65I14	26	28	8	23	12	25	14	136
158	65I	65I16	30	25	31	2	22	36	9	155
159	65J	65J03	16	20	26	15	17	38	12	144
160	65J	65J06	7	15	58	6	8	22	4	120
161	65J	65J07	31	65	41	27	46	65	27	302
162	65J	65J08	36	48	5	27	51	51	24	242
163	65K	65K09	12	26	19	11	13	29	5	115
164	65M	65M02	18	32	32	17	28	54	29	210
165	65M	65M03	26	22	30	17	27	48	10	180
166	65M	65M05	8	13	15	19	18	31	10	114
167	65M	65M06	18	22	23	17	40	70	15	205
168	65M	65M09	33	34	91	103	48	106	40	455
169	65M	65M11	10	24	29	25	17	12	14	131
170	65M	65M13	58	78	98	83	65	81	49	512
171	65M	65M14	26	48	53	40	96	85	51	399
172	65M	65M15	16	32	14	24	25	27	7	145
173	65N	65N01	21	51	49	43	65	47	23	299
174	65N	65N05	2	18	13	4	34	35	6	112
175	72A	72A03	9	22	20	21	36	59	10	177
176	72K	72K08	11	7	34	9	8	44	13	126
177	72P	72P05	10	13	6	10	20	31	12	102
178	73A	73A01	2	24	2	8	4	100	4	144
179	73A	73A02	13	36	1	47	21	12	22	152
180	73C	73C12	29	14	6	21	23	22	0	115
181	73D	73D14	10	17	17	9	37	33	2	125
182	73F	73F04	11	17	16	20	31	59	5	159
183	73F	73F06	11	22	15	43	27	33	11	162
184	73F	73F07	12	15	16	41	26	63	1	174

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
185	74A	74A01	23	32	69	38	60	62	7	291
186	74A	74A02	26	46	45	27	78	68	26	316
187	74A	74A03	22	68	39	7	67	66	27	296
188	74A	74A04	23	63	36	22	35	57	24	260
189	74A	74A06	16	42	36	15	41	51	21	222
190	74A	74A08	23	24	31	0	25	43	8	154
191	78K	78K02	0	55	29	44	25	51	48	252
192	78K	78K03	1	47	15	13	14	6	12	108
193	78K	78K05	0	38	21	25	25	38	20	167
194	78K	78K06	0	92	71	51	25	157	64	460
195	78K	78K07	3	90	4	42	42	79	63	323
196	78K	78K09	0	32	26	13	44	49	14	178
197	78K	78K10	2	97	32	17	54	119	92	413
198	78K	78K11	0	58	14	42	54	63	54	285
199	78K	78K13	5	59	18	29	72	175	52	410
200	78K	78K14	6	69	21	55	48	178	96	473
201	78K	78K15	3	58	8	19	52	72	21	233
202	78O	78O01	1	44	14	27	47	71	14	218
203	78O	78O02	5	54	8	36	23	72	21	219
204	78O	78O03	0	37	19	12	49	86	17	220
205	78O	78O05	22	31	14	27	30	23	10	157
206	78O	78O09	23	65	56	89	82	128	64	507
207	78O	78O13	3	74	10	29	48	84	33	281
208	78P	78P16	30	57	32	13	14	47	22	215
209	79M	79M09	19	76	43	18	18	60	21	255
210	79M	79M10	12	116	61	31	75	20	43	358
211	79M	79M11	7	84	45	20	34	19	53	262
212	79M	79M12	19	64	26	11	33	186	16	355
213	79M	79M13	31	206	92	31	77	105	59	601
214	79M	79M14	11	205	65	23	126	12	84	526
215	79M	79M15	7	47	16	26	28	7	20	151
216	79M	79M16	6	29	17	11	34	0	9	106
217	82L	82L12	2	46	50	1	70	50	57	276
218	83A	83A15	4	12	20	20	44	6	18	124
219	83B	83B04	4	29	23	23	56	43	32	210
220	83B	83B08	0	6	9	30	20	38	30	133
221	83C	83C01	3	79	37	3	94	101	59	376

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
222	83C	83C05	19	46	19	1	36	96	32	249
223	83C	83C08	0	28	9	74	24	21	18	174
224	83C	83C09	19	26	37	28	54	73	53	290
225	83C	83C10	2	35	15	10	36	78	29	205
226	83C	83C11	0	26	12	3	17	30	22	110
227	83C	83C14	0	41	32	19	82	215	30	419
228	83C	83C15	1	90	76	32	161	263	45	668
229	83C	83C16	0	51	24	0	42	46	25	188
230	83D	83D04	37	126	98	29	67	135	31	523
231	83D	83D07	0	36	66	43	57	100	45	347
232	83D	83D08	51	151	179	148	149	222	72	972
233	83D	83D10	0	4	5	1	2	114	0	126
234	83D	83D11	6	103	51	32	69	230	54	545
235	83D	83D12	63	171	123	50	104	12	55	578
236	83D	83D14	0	10	8	11	15	84	12	140
237	83D	83D15	35	94	76	54	98	190	51	598
238	83D	83D16	23	104	105	60	34	0	42	368
239	83E	83E03.	11	3	31	21	50	3	18	137
240	83F	83F03	0	41	13	57	49	35	40	235
241	83F	83F04	7	15	4	17	16	13	36	108
242	83F	83F06	8	36	29	40	28	35	34	210
243	83F	83F07	5	21	8	26	33	1	19	113
244	83F	83F08	4	37	26	33	53	35	41	229
245	83F	83F11	16	32	19	51	58	13	33	222
246	83F	83F12	3	49	27	67	89	45	80	360
247	83F	83F15	8	11	12	12	23	17	26	109
248	83G	83G02	0	41	26	19	49	182	62	379
249	83G	83G03	0	85	31	41	196	306	72	731
250	83G	83G04	0	85	55	52	95	112	87	486
251	83G	83G05	2	30	7	10	38	47	17	151
252	83G	83G07	7	90	68	30	97	227	107	626
253	83G	83G08	0	82	60	47	53	74	111	427
254	83G	83G09	4	23	5	16	15	41	10	114
255	83G	83G10	8	42	49	15	50	130	61	355
256	83G	83G11	2	59	48	33	28	97	50	317
257	83G	83G12	0	50	30	57	50	70	70	327
258	83G	83G13	16	41	13	9	42	74	29	224

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
259	83G	83G14	3	51	15	3	27	84	39	222
260	83G	83G15	0	66	33	5	26	48	28	206
261	83G	83G16	1	38	33	29	36	42	37	216
262	83H	83H01	0	62	34	41	60	31	23	251
263	83H	83H02	15	68	45	23	74	47	50	322
264	83H	83H03	56	82	55	45	86	111	52	487
265	83H	83H04	23	60	66	84	58	111	43	445
266	83H	83H05	3	113	103	100	128	130	95	672
267	83H	83H06	2	65	66	88	73	118	61	473
268	83H	83H07	29	121	100	87	107	133	103	680
269	83H	83H08	11	106	59	78	69	153	38	514
270	83H	83H09	0	117	44	98	86	94	78	517
271	83H	83H10.	3	73	55	36	61	108	40	376
272	83H	83H11.	12	85	18	48	62	105	40	370
273	83H	83H12.	14	100	74	88	65	239	53	633
274	83H	83H16	11	52	50	56	34	127	29	359
275	83I	83I05	3	16	28	10	25	21	16	119
276	83I	83I09	4	20	30	13	24	3	9	103
277	83J	83J03	0	24	24	34	45	22	18	167
278	83J	83J04	6	77	57	58	88	83	70	439
279	83J	83J06	0	14	21	28	14	26	7	110
280	83J	83J07	2	70	55	31	81	68	47	354
281	83J	83J08	16	109	53	29	55	78	69	409
282	83J	83J10	2	62	45	51	26	44	39	269
283	83J	83J11	1	76	44	12	44	68	44	289
284	83J	83J12	0	39	34	7	73	65	37	255
285	83J	83J13	1	23	13	24	26	14	23	124
286	83J	83J14	15	10	46	25	32	45	40	213
287	83J	83J15	4	31	53	21	33	49	29	220
288	83J	83J16	6	32	32	22	37	47	46	222
289	83K	83K01	0	87	36	35	53	119	57	387
290	83K	83K02	2	24	5	3	18	42	8	102
291	83K	83K04	6	49	33	25	37	61	38	249
292	83K	83K05	6	59	73	32	62	93	49	374
293	83K	83K06	0	27	8	6	11	48	5	105
294	83K	83K08	0	26	7	17	19	39	16	124
295	83K	83K09	12	71	14	20	29	76	33	255

Sl. No.	SOI Toposheet 1:2,50000	SOI Toposheet 1:50,000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
296	83K	83K10	4	41	25	16	33	89	8	216
297	83K	83K12	2	18	6	29	15	37	5	112
298	83K	83K13	6	55	45	37	30	64	44	281
299	83K	83K14	4	16	22	5	24	33	21	125
300	83L	83L01	3	23	15	29	41	49	28	188
301	83L	83L02	3	21	15	20	28	37	12	136
302	83L	83L03	16	49	48	42	38	58	46	297
303	83L	83L04	15	18	43	80	31	89	45	321
304	83L	83L05	4	57	48	57	42	81	43	332
305	83L	83L06	31	20	48	42	47	55	46	289
306	83L	83L07	9	24	18	22	39	20	37	169
307	83L	83L09	15	35	12	42	30	38	21	193
308	83N	83N01	0	42	14	10	4	56	32	158
309	84A	84A01	66	190	105	96	71	203	132	863
310	84A	84A02	7	68	45	25	26	75	43	289
311	84A	84A05	145	178	172	56	157	191	133	1032
312	84A	84A06	62	92	79	63	120	99	28	543
313	84A	84A07	92	137	87	89	147	145	52	749
314	84A	84A08	60	112	70	89	71	85	85	572
315	84A	84A09	17	228	132	67	181	194	23	842
316	84A	84A10	7	168	88	144	126	231	34	798
317	84A	84A11	56	163	84	77	105	197	48	730
318	84A	84A12	101	231	156	43	152	257	59	999
319	84A	84A13	50	171	99	54	95	138	40	647
320	84A	84A14	8	144	72	58	142	107	36	567
321	84A	84A15	23	100	49	10	44	181	81	488
322	84A	84A16	39	115	33	71	66	139	44	507
323	84B	84B05	16	40	9	92	16	43	21	237
324	84B	84B09	78	268	123	71	189	210	118	1057
325	84B	84B10	103	211	94	56	98	184	137	883
326	84B	84B11	77	132	100	67	108	119	81	684
327	84B	84B12	36	83	68	25	136	91	79	518
328	84B	84B13	21	136	51	44	149	103	24	528
329	84B	84B14	60	149	98	0	174	83	22	586
330	84B	84B15	74	120	91	0	178	115	27	605
331	84B	84B16	45	94	113	0	181	126	60	619
332	84E	84E01	0	1	75	35	64	173	27	375

Sl. No.	SOI Toposheet 250000	SOI Toposheet 50000	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	Total
333	84E	84E02	38	107	51	71	63	106	31	467
334	84E	84E03	16	123	67	85	43	114	50	498
335	84E	84E04	15	95	62	25	43	93	45	378
336	84E	84E05	16	99	26	53	38	83	25	340
337	84E	84E06	14	82	29	29	21	67	14	256
338	84E	84E07	11	59	30	25	19	38	5	187
339	84E	84E08	14	64	40	11	20	29	20	198
340	84F	84F01.	26	45	34	14	27	84	26	256
341	84F	84F02.	19	71	25	36	80	59	25	315
342	84F	84F03	20	103	42	14	60	124	30	393
343	84I	84I01	3	6	16	18	5	38	15	101
344	92A	92A02	0	18	18	16	64	15	14	145
345	92A	92A03	1	21	30	5	31	10	17	115
346	92A	92A06	1	36	50	14	43	51	27	222

Annexure 1.6

Table 10: Forest fire vulnerable districts and percentage of population below poverty line

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
1	Highly Vulnerable	Andhra Pradesh	Adilabad	11-20
2	Moderately Vulnerable	Andhra Pradesh	Anantapur	11-20
3	Highly Vulnerable	Andhra Pradesh	Chittoor	11-20
4	Highly Vulnerable	Andhra Pradesh	Coddapah	11-20
5	Highly Vulnerable	Andhra Pradesh	East Godawari	11-20
6	Highly Vulnerable	Andhra Pradesh	Karimnagar	11-20
7	Highly Vulnerable	Andhra Pradesh	Khammam	11-20
8	Highly Vulnerable	Andhra Pradesh	Kurnool	11-20
9	Highly Vulnerable	Andhra Pradesh	Mahboobnagar	11-20
10	Less Vulnerable	Andhra Pradesh	Medak	11-20
11	Highly Vulnerable	Andhra Pradesh	Nellore	11-20
12	Less Vulnerable	Andhra Pradesh	Nizamabad	11-20
13	Highly Vulnerable	Andhra Pradesh	Prakasam	11-20
14	Less Vulnerable	Andhra Pradesh	Rangareddy	11-20
15	Highly Vulnerable	Andhra Pradesh	Srikakulam	11-20
16	Highly Vulnerable	Andhra Pradesh	Vijianagaram	11-20
17	Highly Vulnerable	Andhra Pradesh	Vishakhapatnam	11-20
18	Highly Vulnerable	Andhra Pradesh	Warangal	11-20
19	Highly Vulnerable	Andhra Pradesh	West Godawari	11-20
20	Less Vulnerable	Arunachal Pradesh	Changlang	11-20
21	Highly Vulnerable	Arunachal Pradesh	Dibang Valley	11-20
22	Highly Vulnerable	Arunachal Pradesh	Kameng East	11-20
23	Moderately Vulnerable	Arunachal Pradesh	Kameng West	11-20
24	Highly Vulnerable	Arunachal Pradesh	Lohit	11-20
25	Highly Vulnerable	Arunachal Pradesh	Papum Pare	11-20
26	Highly Vulnerable	Arunachal Pradesh	Siang East	11-20
27	Less Vulnerable	Arunachal Pradesh	Siang Upper	11-20
28	Highly Vulnerable	Arunachal Pradesh	Siang West	11-20
29	Highly Vulnerable	Arunachal Pradesh	Subansiri Lesser	11-20
30	Highly Vulnerable	Arunachal Pradesh	Subansiri Upper	11-20
31	Less Vulnerable	Arunachal Pradesh	Tawang	11-20
32	Highly Vulnerable	Arunachal Pradesh	Tirap	11-20
33	Highly Vulnerable	Assam	Barpeta	11-20
34	Highly Vulnerable	Assam	Bongaigoan	11-20
35	Highly Vulnerable	Assam	Cachar	11-20

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
36	Less Vulnerable	Assam	Darrang	11-20
37	Less Vulnerable	Assam	Dhemaji	11-20
38	Less Vulnerable	Assam	Dhubari	11-20
39	Less Vulnerable	Assam	Dibrugarh	11-20
40	Highly Vulnerable	Assam	Goalpara	11-20
41	Highly Vulnerable	Assam	Golaghat	11-20
42	Highly Vulnerable	Assam	Hailakandi	11-20
43	Highly Vulnerable	Assam	Jorhat	11-20
44	Highly Vulnerable	Assam	Kamrup	11-20
45	Highly Vulnerable	Assam	Karbi Anglong	11-20
46	Highly Vulnerable	Assam	Karimganj	11-20
47	Less Vulnerable	Assam	Kokrajhar	11-20
48	Less Vulnerable	Assam	Lakhimpur	11-20
49	Less Vulnerable	Assam	Morigoan	11-20
50	Less Vulnerable	Assam	Nalbari	11-20
51	Highly Vulnerable	Assam	Naogoan	11-20
52	Highly Vulnerable	Assam	North Cachar Hills	11-20
53	Highly Vulnerable	Assam	Sibsagar	11-20
54	Less Vulnerable	Assam	Sonitpur	11-20
55	Less Vulnerable	Assam	Tinshukia	11-20
56	Less Vulnerable	Bihar	Aurangabad	41-50
57	Less Vulnerable	Bihar	Banka	41-50
58	Moderately Vulnerable	Bihar	Gaya	41-50
59	Highly Vulnerable	Bihar	Jamui	41-50
60	Less Vulnerable	Bihar	Kaimur	41-50
61	Highly Vulnerable	Bihar	Lakhisarai	41-50
62	Highly Vulnerable	Bihar	Munger	41-50
63	Moderately Vulnerable	Bihar	Nalanda	41-50
64	Moderately Vulnerable	Bihar	Nawada	41-50
65	Highly Vulnerable	Bihar	Pashchimi Champaran	41-50
66	Highly Vulnerable	Bihar	Rohtas	41-50
67	Highly Vulnerable	Chhattisgarh	Baster	41-50
68	Highly Vulnerable	Chhattisgarh	Bilaspur	41-50
69	Highly Vulnerable	Chhattisgarh	Dantewara	41-50
70	Highly Vulnerable	Chhattisgarh	Dhamtari	41-50
71	Less Vulnerable	Chhattisgarh	Durg	41-50
72	Less Vulnerable	Chhattisgarh	Janjgir Champa	41-50
73	Moderately Vulnerable	Chhattisgarh	Jashpur	41-50

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
74	Highly Vulnerable	Chhattisgarh	Kawardha	41-50
75	Highly Vulnerable	Chhattisgarh	Korba	41-50
76	Moderately Vulnerable	Chhattisgarh	Korea	41-50
77	Highly Vulnerable	Chhattisgarh	Mahasamund	41-50
78	Highly Vulnerable	Chhattisgarh	Raigarh	41-50
79	Highly Vulnerable	Chhattisgarh	Raipur	41-50
80	Highly Vulnerable	Chhattisgarh	Raj Nandgaon	41-50
81	Highly Vulnerable	Chhattisgarh	Sarguja	41-50
82	Less Vulnerable	Dadra & Nagar Haveli	Dadra & Nagar Haveli	31-40
83	Less Vulnerable	Goa	North Goa	11-20
84	Less Vulnerable	Goa	South Goa	11-20
85	Less Vulnerable	Gujarat	Amreli	11-20
86	Less Vulnerable	Gujarat	Bharuch	11-20
87	Less Vulnerable	Gujarat	Bhavnagar	11-20
88	Less Vulnerable	Gujarat	Dahod	11-20
89	Less Vulnerable	Gujarat	Junagarh	11-20
90	Moderately Vulnerable	Gujarat	Kuchchh	11-20
91	Highly Vulnerable	Gujarat	Narmada	11-20
92	Moderately Vulnerable	Gujarat	Navsari	11-20
93	Moderately Vulnerable	Gujarat	Panch Mahals	11-20
94	Less Vulnerable	Gujarat	Sabar Kantha	11-20
95	Highly Vulnerable	Gujarat	Surat	11-20
96	Highly Vulnerable	Gujarat	The Dangs	11-20
97	Moderately Vulnerable	Gujarat	Vadodara	11-20
98	Less Vulnerable	Gujarat	Valsad	11-20
99	Less Vulnerable	Haryana	Ambala	11-20
100	Moderately Vulnerable	Haryana	Panchkula	11-20
101	Less Vulnerable	Himachal Pradesh	Hamirpur	1-10
102	Less Vulnerable	Himachal Pradesh	Kangara	1-10
103	Less Vulnerable	Himachal Pradesh	Kullu	1-10
104	Less Vulnerable	Himachal Pradesh	Mandi	1-10
105	Less Vulnerable	Himachal Pradesh	Shimla	1-10
106	Moderately Vulnerable	Himachal Pradesh	Sirmaur	1-10
107	Moderately Vulnerable	Himachal Pradesh	Solan	1-10
108	Highly Vulnerable	Himachal Pradesh	Una	1-10
109	Less Vulnerable	Jammu & Kashmir	Jammu	1-10
110	Moderately Vulnerable	Jammu & Kashmir	Rajouri	1-10
111	Moderately Vulnerable	Jammu & Kashmir	Poonch	1-10

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
112	Moderately Vulnerable	Jammu & Kashmir	Anantnag	1-10
113	Less Vulnerable	Jammu & Kashmir	Srinagar	1-10
114	Less Vulnerable	Jammu & Kashmir	Udhampur	1-10
115	Highly Vulnerable	Jharkhand	Bokaro	41-50
116	Highly Vulnerable	Jharkhand	Chatra	41-50
117	Less Vulnerable	Jharkhand	Dhanbad	41-50
118	Less Vulnerable	Jharkhand	Dumka	41-50
119	Moderately Vulnerable	Jharkhand	Garhwa	41-50
120	Less Vulnerable	Jharkhand	Giridih	41-50
121	Highly Vulnerable	Jharkhand	Godda	41-50
122	Moderately Vulnerable	Jharkhand	Gumla	41-50
123	Highly Vulnerable	Jharkhand	Hazaribagh	41-50
124	Highly Vulnerable	Jharkhand	Koderma	41-50
125	Less Vulnerable	Jharkhand	Lohardaga	41-50
126	Moderately Vulnerable	Jharkhand	Pakur	41-50
127	Highly Vulnerable	Jharkhand	Palamu	41-50
128	Highly Vulnerable	Jharkhand	Pashchimi Singhbhum	41-50
129	Moderately Vulnerable	Jharkhand	Purbi Singhbhum	41-50
130	Highly Vulnerable	Jharkhand	Ranchi	41-50
131	Moderately Vulnerable	Jharkhand	Sahebganj	41-50
132	Less Vulnerable	Karnataka	Bagalkot	21-30
133	Moderately Vulnerable	Karnataka	Bangalore City	21-30
134	Moderately Vulnerable	Karnataka	Bangalore Rural	21-30
135	Highly Vulnerable	Karnataka	Belgaum	21-30
136	Highly Vulnerable	Karnataka	Bellary	21-30
137	Highly Vulnerable	Karnataka	Chamrajanagar	21-30
138	Highly Vulnerable	Karnataka	Chikmagalur	21-30
139	Moderately Vulnerable	Karnataka	Chitradurg	21-30
140	Highly Vulnerable	Karnataka	Dakshin Kannad	21-30
141	Highly Vulnerable	Karnataka	Davangere	21-30
142	Highly Vulnerable	Karnataka	Dharwar	21-30
143	Less Vulnerable	Karnataka	Gadag	21-30
144	Less Vulnerable	Karnataka	Gulbarga	21-30
145	Moderately Vulnerable	Karnataka	Hassan	21-30
146	Moderately Vulnerable	Karnataka	Haveri	21-30
147	Moderately Vulnerable	Karnataka	Kodagu	21-30
148	Moderately Vulnerable	Karnataka	Kolar	21-30
149	Highly Vulnerable	Karnataka	Mandya	21-30

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
150	Highly Vulnerable	Karnataka	Mysore	21-30
151	Highly Vulnerable	Karnataka	Shimoga	21-30
152	Less Vulnerable	Karnataka	Tumkur	21-30
153	Less Vulnerable	Karnataka	Udipi	21-30
154	Highly Vulnerable	Karnataka	Uttar Kannad	21-30
155	Moderately Vulnerable	Kerala	Ernakulam	11-20
156	Moderately Vulnerable	Kerala	Idukki	11-20
157	Moderately Vulnerable	Kerala	Kollam	11-20
158	Less Vulnerable	Kerala	Kottayam	11-20
159	Less Vulnerable	Kerala	Kozhikode	11-20
160	Less Vulnerable	Kerala	Malappuram	11-20
161	Less Vulnerable	Kerala	Palakkad	11-20
162	Less Vulnerable	Kerala	Pathanamthitta	11-20
163	Moderately Vulnerable	Kerala	Thrissur	11-20
164	Less Vulnerable	Kerala	Thrivanantapuram	11-20
165	Moderately Vulnerable	Kerala	Wayanad	11-20
166	Highly Vulnerable	Madhya Pradesh	Balaghat	31-40
167	Highly Vulnerable	Madhya Pradesh	Barwani	31-40
168	Highly Vulnerable	Madhya Pradesh	Betul	31-40
169	Less Vulnerable	Madhya Pradesh	Bhind	31-40
170	Highly Vulnerable	Madhya Pradesh	Bhopal	31-40
171	Moderately Vulnerable	Madhya Pradesh	Chhatarpur	31-40
172	Highly Vulnerable	Madhya Pradesh	Chhindwara	31-40
173	Highly Vulnerable	Madhya Pradesh	Damoh	31-40
174	Less Vulnerable	Madhya Pradesh	Datia	31-40
175	Highly Vulnerable	Madhya Pradesh	Dewas	31-40
176	Moderately Vulnerable	Madhya Pradesh	Dhar	31-40
177	Highly Vulnerable	Madhya Pradesh	Dindori	31-40
178	Highly Vulnerable	Madhya Pradesh	East Nimar	31-40
179	Highly Vulnerable	Madhya Pradesh	Guna	31-40
180	Less Vulnerable	Madhya Pradesh	Gwalior	31-40
181	Highly Vulnerable	Madhya Pradesh	Harda	31-40
182	Highly Vulnerable	Madhya Pradesh	Hoshangabad	31-40
183	Highly Vulnerable	Madhya Pradesh	Indore	31-40
184	Less Vulnerable	Madhya Pradesh	Jabalpur	31-40
185	Moderately Vulnerable	Madhya Pradesh	Jhabua	31-40
186	Highly Vulnerable	Madhya Pradesh	Katni	31-40
187	Highly Vulnerable	Madhya Pradesh	Mandla	31-40

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
188	Highly Vulnerable	Madhya Pradesh	Narsimhapur	31-40
189	Less Vulnerable	Madhya Pradesh	Neemach	31-40
190	Highly Vulnerable	Madhya Pradesh	Panna	31-40
191	Highly Vulnerable	Madhya Pradesh	Raisen	31-40
192	Moderately Vulnerable	Madhya Pradesh	Rewa	31-40
193	Highly Vulnerable	Madhya Pradesh	Sagar	31-40
194	Moderately Vulnerable	Madhya Pradesh	Satna	31-40
195	Highly Vulnerable	Madhya Pradesh	Sehore	31-40
196	Highly Vulnerable	Madhya Pradesh	Seoni	31-40
197	Moderately Vulnerable	Madhya Pradesh	Shahdol	31-40
198	Highly Vulnerable	Madhya Pradesh	Sheopur	31-40
199	Moderately Vulnerable	Madhya Pradesh	Shivpuri	31-40
200	Moderately Vulnerable	Madhya Pradesh	Sidhi	31-40
201	Highly Vulnerable	Madhya Pradesh	Umaria	31-40
202	Moderately Vulnerable	Madhya Pradesh	Vidisha	31-40
203	Highly Vulnerable	Madhya Pradesh	West Nimar	31-40
204	Less Vulnerable	Maharashtra	Ahmadnagar	31-40
205	Highly Vulnerable	Maharashtra	Akola	31-40
206	Highly Vulnerable	Maharashtra	Amravati	31-40
207	Highly Vulnerable	Maharashtra	Bhandara	31-40
208	Less Vulnerable	Maharashtra	Bombay Suburban	31-40
209	Highly Vulnerable	Maharashtra	Buldana	31-40
210	Highly Vulnerable	Maharashtra	Chandrapur	31-40
211	Highly Vulnerable	Maharashtra	Garhchiroli	31-40
212	Highly Vulnerable	Maharashtra	Gondiya	31-40
213	Less Vulnerable	Maharashtra	Hingoli	31-40
214	Highly Vulnerable	Maharashtra	Jalgaon	31-40
215	Highly Vulnerable	Maharashtra	Kolhapur	31-40
216	Highly Vulnerable	Maharashtra	Nagpur	31-40
217	Less Vulnerable	Maharashtra	Nanded	31-40
218	Highly Vulnerable	Maharashtra	Nandurbar	31-40
219	Less Vulnerable	Maharashtra	Nashik	31-40
220	Highly Vulnerable	Maharashtra	Pune	31-40
221	Highly Vulnerable	Maharashtra	Ratnagiri	31-40
222	Highly Vulnerable	Maharashtra	Raygad	31-40
223	Less Vulnerable	Maharashtra	Sangli	31-40
224	Highly Vulnerable	Maharashtra	Satara	31-40
225	Highly Vulnerable	Maharashtra	Sindhudurg	31-40

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
226	Highly Vulnerable	Maharashtra	Thane	31-40
227	Highly Vulnerable	Maharashtra	Wardha	31-40
228	Less Vulnerable	Maharashtra	Washim	31-40
229	Moderately Vulnerable	Maharashtra	Yavatmal	31-40
230	Less Vulnerable	Manipur	Bishnupur	11-20
231	Highly Vulnerable	Manipur	Chandel	11-20
232	Highly Vulnerable	Manipur	Churachandpur	11-20
233	Highly Vulnerable	Manipur	Imphal East	11-20
234	Moderately Vulnerable	Manipur	Imphal West	11-20
235	Highly Vulnerable	Manipur	Senapati	11-20
236	Highly Vulnerable	Manipur	Tamenglong	11-20
237	Highly Vulnerable	Manipur	Thoubal	11-20
238	Highly Vulnerable	Manipur	Ukhrul	11-20
239	Highly Vulnerable	Meghalaya	East Garo Hills	11-20
240	Less Vulnerable	Meghalaya	East Khasi Hills	11-20
241	Less Vulnerable	Meghalaya	Jaintia Hills	11-20
242	Highly Vulnerable	Meghalaya	Ri Bhoi	11-20
243	Highly Vulnerable	Meghalaya	South Garo Hills	11-20
244	Highly Vulnerable	Meghalaya	West Garo Hills	11-20
245	Highly Vulnerable	Meghalaya	West Khasi Hills	11-20
246	Highly Vulnerable	Mizoram	Aizawl	11-20
247	Highly Vulnerable	Mizoram	Champhai	11-20
248	Highly Vulnerable	Mizoram	Lawngtlai	11-20
249	Highly Vulnerable	Mizoram	Lunglei	11-20
250	Highly Vulnerable	Mizoram	Saiha	11-20
251	Highly Vulnerable	Mizoram	Serchhip	11-20
252	Highly Vulnerable	Nagaland	Dimapur	11-20
253	Highly Vulnerable	Nagaland	Kohima	11-20
254	Highly Vulnerable	Nagaland	Mokokchung	11-20
255	Highly Vulnerable	Nagaland	Mon	11-20
256	Highly Vulnerable	Nagaland	Phek	11-20
257	Highly Vulnerable	Nagaland	Tuensang	11-20
258	Highly Vulnerable	Nagaland	Wokha	11-20
259	Highly Vulnerable	Nagaland	Zunheboto	11-20
260	Moderately Vulnerable	Odisha	Balangir	41-50
261	Less Vulnerable	Odisha	Baleshwar	41-50
262	Highly Vulnerable	Odisha	Cuttack	41-50
263	Highly Vulnerable	Odisha	Dhenkanal	41-50

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
264	Highly Vulnerable	Odisha	Ganjam	41-50
265	Highly Vulnerable	Odisha	Kalahandi	41-50
266	Highly Vulnerable	Odisha	Kendujhar	41-50
267	Highly Vulnerable	Odisha	Koraput	41-50
268	Moderately Vulnerable	Odisha	Mayurbhanj	41-50
269	Highly Vulnerable	Odisha	Phulabani	41-50
270	Moderately Vulnerable	Odisha	Puri	41-50
271	Highly Vulnerable	Odisha	Sambalpur	41-50
272	Highly Vulnerable	Odisha	Sundargarh	41-50
273	Low Vulnerable	Punjab	Gurdaspur	1-10
274	Highly Vulnerable	Punjab	Hoshiarpur	1-10
275	Less Vulnerable	Punjab	Jalandhar	1-10
276	Less Vulnerable	Punjab	Ludhiana	1-10
277	Less Vulnerable	Punjab	Patiala	1-10
278	Moderately Vulnerable	Punjab	Rupnagar	1-10
279	Less Vulnerable	Rajasthan	Banswara	21-30
280	Less Vulnerable	Rajasthan	Chittaurgarh	21-30
281	Less Vulnerable	Rajasthan	Pali	21-30
282	Less Vulnerable	Rajasthan	Rajsamand	21-30
283	Moderately Vulnerable	Rajasthan	Sirohi	21-30
284	Moderately Vulnerable	Rajasthan	Udaipur	21-30
285	Less Vulnerable	Sikkim	South	21-30
286	Less Vulnerable	Tamil Nadu	Anna	21-30
287	Less Vulnerable	Tamil Nadu	Coimbatore	21-30
288	Moderately Vulnerable	Tamil Nadu	Dharmapuri	21-30
289	Less Vulnerable	Tamil Nadu	Kanniyakumari	21-30
290	Less Vulnerable	Tamil Nadu	Namakkal	21-30
291	Moderately Vulnerable	Tamil Nadu	Nilgiri	21-30
292	Highly Vulnerable	Tamil Nadu	Periyar	21-30
293	Less Vulnerable	Tamil Nadu	Salem	21-30
294	Less Vulnerable	Tamil Nadu	South Arcot	21-30
295	Less Vulnerable	Tamil Nadu	Theni	21-30
296	Less Vulnerable	Tamil Nadu	Thiruvallur	21-30
297	Less Vulnerable	Tamil Nadu	Tirunelveli Kattabom	21-30
298	Less Vulnerable	Tamil Nadu	Tiruvanamalai	21-30
299	Moderately Vulnerable	Tamil Nadu	Vellore	21-30
300	Highly Vulnerable	Tripura	North Tripura	11-20
301	Highly Vulnerable	Tripura	South Tripura	11-20

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
302	Highly Vulnerable	Tripura	West Tripura	11-20
303	Less Vulnerable	Uttar Pradesh	Agra	31-40
304	Less Vulnerable	Uttar Pradesh	Bahraich	31-40
305	Highly Vulnerable	Uttar Pradesh	Balrampur	31-40
306	Moderately Vulnerable	Uttar Pradesh	Banda	31-40
307	Less Vulnerable	Uttar Pradesh	Bara Banki	31-40
308	Highly Vulnerable	Uttar Pradesh	Bijnor	31-40
309	Less Vulnerable	Uttar Pradesh	Chandauli	31-40
310	Moderately Vulnerable	Uttar Pradesh	Chitrakoot	31-40
311	Less Vulnerable	Uttar Pradesh	Etawah	31-40
312	Less Vulnerable	Uttar Pradesh	Faizabad	31-40
313	Less Vulnerable	Uttar Pradesh	Firozabad	31-40
314	Less Vulnerable	Uttar Pradesh	Jhansi	31-40
315	Less Vulnerable	Uttar Pradesh	Kannauj	31-40
316	Less Vulnerable	Uttar Pradesh	Kanpur Dehat	31-40
317	Less Vulnerable	Uttar Pradesh	Kanpur Nagar	31-40
318	Highly Vulnerable	Uttar Pradesh	Kheri	31-40
319	Less Vulnerable	Uttar Pradesh	Kushinagar	31-40
320	Highly Vulnerable	Uttar Pradesh	Lalitpur	31-40
321	Highly Vulnerable	Uttar Pradesh	Maharajganj	31-40
322	Less Vulnerable	Uttar Pradesh	Mirzapur	31-40
323	Less Vulnerable	Uttar Pradesh	Muzaffarnagar	31-40
324	Highly Vulnerable	Uttar Pradesh	Pilibhit	31-40
325	Less Vulnerable	Uttar Pradesh	Rampur	31-40
326	Moderately Vulnerable	Uttar Pradesh	Saharanpur	31-40
327	Highly Vulnerable	Uttar Pradesh	Shahjahanpur	31-40
328	Moderately Vulnerable	Uttar Pradesh	Shrawasti	31-40
329	Moderately Vulnerable	Uttar Pradesh	Sonbhadra	31-40
330	Less Vulnerable	Uttar Pradesh	Sultanpur	31-40
331	Moderately Vulnerable	Uttarakhand	Almora	31-40
332	Moderately Vulnerable	Uttarakhand	Bageshwar	31-40
333	Moderately Vulnerable	Uttarakhand	Chamoli	31-40
334	Less Vulnerable	Uttarakhand	Champawat	31-40
335	Highly Vulnerable	Uttarakhand	Dehra Dun	31-40
336	Moderately Vulnerable	Uttarakhand	Haridwar	31-40
337	Highly Vulnerable	Uttarakhand	Naini Tal	31-40
338	Highly Vulnerable	Uttarakhand	Pauri Garhwal	31-40
339	Moderately Vulnerable	Uttarakhand	Pithoragarh	31-40

Sl. No.	Forest fire vulnerability	State	District	Percentage of Population Below Poverty Line
340	Less Vulnerable	Uttarakhand	Rudraprayag	31-40
341	Moderately Vulnerable	Uttarakhand	Tehri Garhwal	31-40
342	Highly Vulnerable	Uttarakhand	Udham Singh Nagar	31-40
343	Moderately Vulnerable	Uttarakhand	Uttarkashi	31-40
344	Moderately Vulnerable	West Bengal	Bankura	21-30
345	Moderately Vulnerable	West Bengal	Barddhaman	21-30
346	Less Vulnerable	West Bengal	Birbhum	21-30
347	Less Vulnerable	West Bengal	Darjiling	21-30
348	Less Vulnerable	West Bengal	Jalpaiguri	21-30
349	Moderately Vulnerable	West Bengal	Medinipur	21-30
350	Moderately Vulnerable	West Bengal	Puruliya	21-30

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Visit www.fsi.nic.in- the official website of Forest Survey of India for forest fire information. A separate column for the forest fire monitoring is available right on the home page where one can see the country map of the current fires and through the link provided one can see the tabulated information of the country upto district level. The tabulated information since year 2004 is available on the website. A user can also register himself through the website to receive daily SMS and email alerts during the forest fire season. From the year 2012, an online feedback facility has also being started for the state forest department to forward their response to FSI on validated forest fire points on the ground through on-line link provided for the same. The entire exercise is being operationalized at state level through the nodal officer nominated for forest fire by the department.

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