GUIDE ON
FOREST FIRE
MANAGEMENT

TAMIL NADU FOREST DEPARTMENT

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INDEX

1. INTRODUCTION

In natural forest systems, fire plays a very important role. It is one of the methods for the natural recycling of nutrients often helping the tree species to regenerate. The fire ecology often removes invasive weeds and helps in maintaining habitat for wildlife. However, in modern-day society with human populations cohabiting and being heavily dependent on forest resources, the forest fires are becoming more frequent and intense. Also, the over-extraction of resources has led to the degradation of large tracts of forest area. With climate change leading to drying of biomass and adding organic build-up over time the forest fires are enormous and are no longer beneficial to the forest health. According to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, annual carbon emissions from forest fires are in the range of 2.5 billion to 4.0 billion tons of CO_2 (MoEFCC, 2018). Globally, the raging forest fires are affecting the wildlife habitats and biodiversity. These fires are also displacing millions of people and taking away livelihoods.

In India, legal status of the forest is taken into consideration to determine the forest area. According to this 'forest area' is an area recorded in the government records and is commonly known as 'the recorded forest area'. In the Stateof Tamil Nadu, the recorded forest area includes Reserved Forests (RF), Reserved Lands (RL) and Unclassed Forest (UF). Covering an area of 1, 30,060 sq. km., Tamil Nadu has 26419 sq.km of recorded forest area. As per the assessment of the Forest Survey of India (India State of Forest Report, 2021), the forest and tree cover of the State is 30,843.23 sq km which constitutes 23.71% of the total geographical area of the State. Considering this data, forest fire is a critical threat to the health of the forest and depletion of the forest resources. From people perspective, forest fire is risk to the forest fringe communities and the front-line forest staff.

1.1. GLOBAL SCENARIO OF FOREST FIRE

Globally, only around 4% of all forest fires have natural causes while the rest are of anthropogenic origin. Often, the burned areas and with it the entire ecosystem of the plants and animals living within it, are irretrievably lost.

Forest fires across the globe are increasing. In many regions of the world, forest fires are natural processes and can have beneficial effects on forests. However, the recent trends of forest fires are giving a different picture. Some fires are too severe, occurring in habitats where they were very limited, unseasonal, or even more intense and frequent. In these cases, forest fires pose a serious threat to forest ecosystems and well-being of humans. For majority of the fires, humans are responsible – directly or indirectly, deliberately or due to carelessness (Hirschberger, 2016).

In recent times the world has witnessed the forest fires that has engulfed large tracts of forest in the USA, Australia, Siberia, and the Amazon. The California wildfire season was overwhelming with more than 2,59,823 acres burnt and costing about $80 billion in damage and economic losses. In 2018, fires burned through 1.8 million acres in the state as compared to 1.3 million the previous year. Seven of California's ten most destructive fires have happened in the last four years (Goodman and Robinson, 2019).

The Amazon saw more than 80,000 forest fire episodes this year, an increase of 75% from 2018 (The Verge, 2019). Many of these fires have been attributed to people and companies clearing land predominantly for beef and soy farming. Following a particularly hot and dry spell, hundreds of fires were observed across Siberia. Though wildfires happen in Siberia, the scale of the 2019 blazes was unusual and decreased the air quality of nearby cities of Novosibirsk and Krasnoyarsk. Toxic smoke engulfed the entire country and is estimated to have released 300 megatons of carbon dioxide (Goodman and Robinson, 2019). The fires also produce black carbon soot which settles on the Arctic ice and absorbs sunlight, thus exacerbating global warming. The 2019–20 Australian bushfire season, colloquially known as the Black Summer, began in June 2019.

The fires burnt an estimated 18.6 million hectares destroyed over 5,900 buildings (including 2,779 homes) and killed at least 34 people. An estimated one billion animals have been killed and some endangered species may be driven to extinction. At its peak, air quality dropped to hazardous levels.
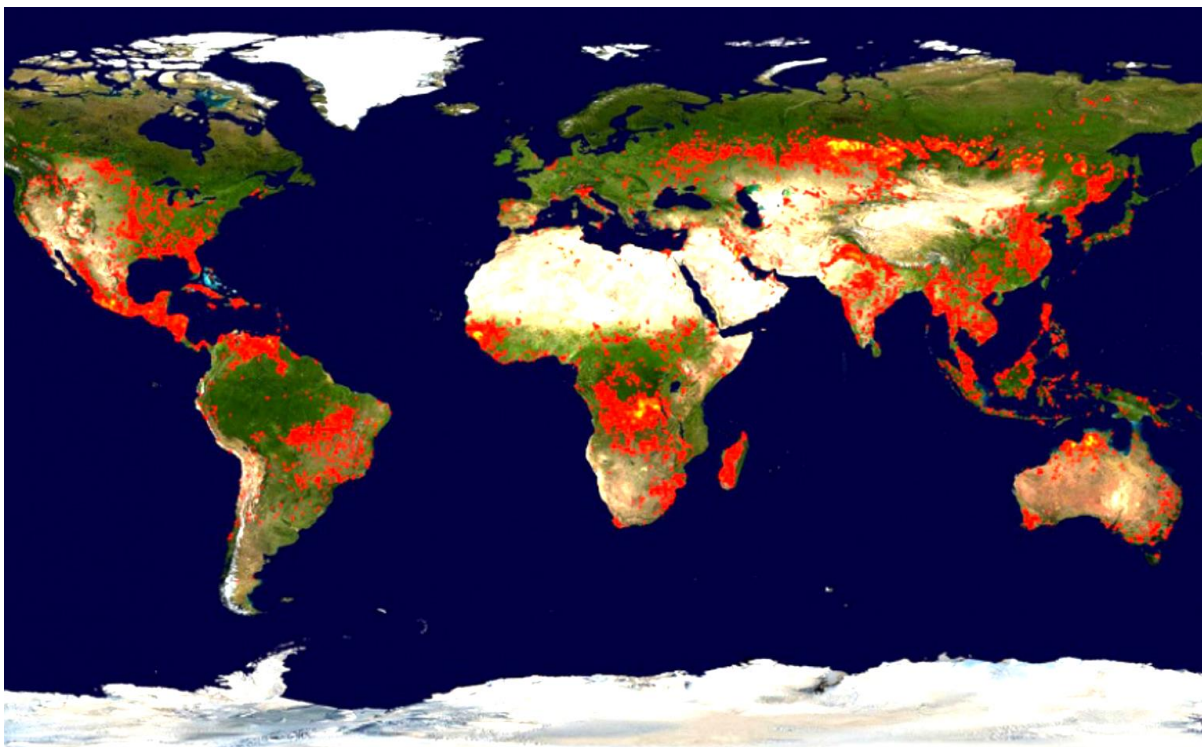
1.2. National Scenario of Forest Fire

Forest fires are a regular phenomenon in our country often observed during summers in India. FSI has evolved its technologies in generating near real time fire detection alerts. Presently MODIS and SNPPVIIRS based alerts are generated by FSI. A number of 52,785 forest fires were detected using MODIS (Moderate Resolution Imaging Spectro-radiometer) sensor and 3,45,989 forest fires were detected using SNPP-VIIRS (Suomi-National Polar-orbiting Partnership - Visible Infrared Imaging Radiometer Suite) in forest fire season from Nov 2020 to June 2021. Figure 1 shows the fire detections between November 2021 and April 2022. Tamil Nadu has seen lesser number of fire incidents when compared to few other states.

An analysis of fire-prone forest areas was carried out by Forest Survey of India (FSI) and the findings of the study indicate that about 35.46% of the country's forest cover has been estimated to be prone to forest fire, out of which nearly 4% of the country's forest cover is extremely prone to fire. (ISFR 2021). In figure 2, it can be clearly seen that most parts of Tamil Nadu fall under the "less fire prone" classification.
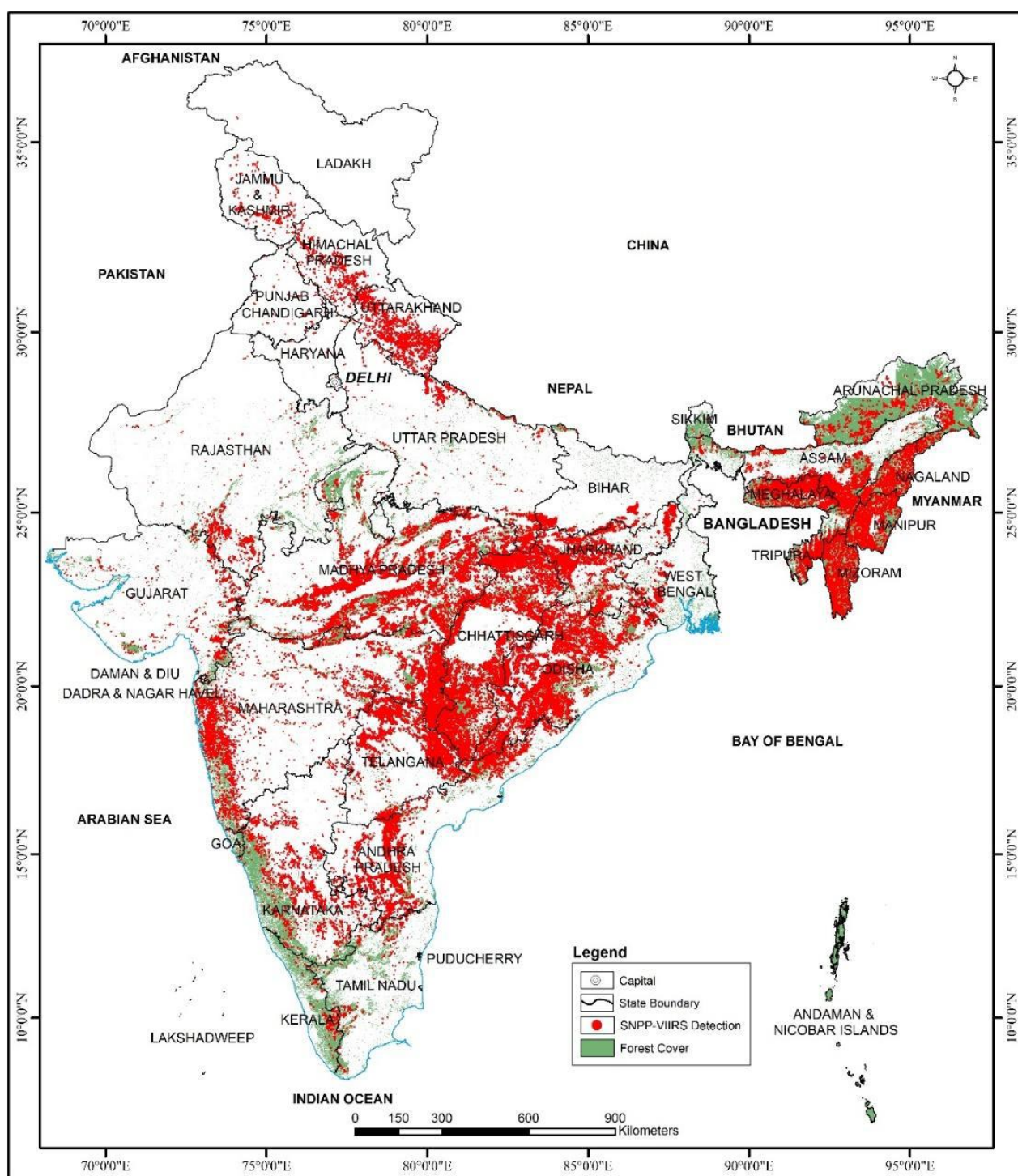
Fig 1.1: Forest fire detections by SNPP-VIIRS sensor during fire season (01stNov 2021 to 30thApril 2022)
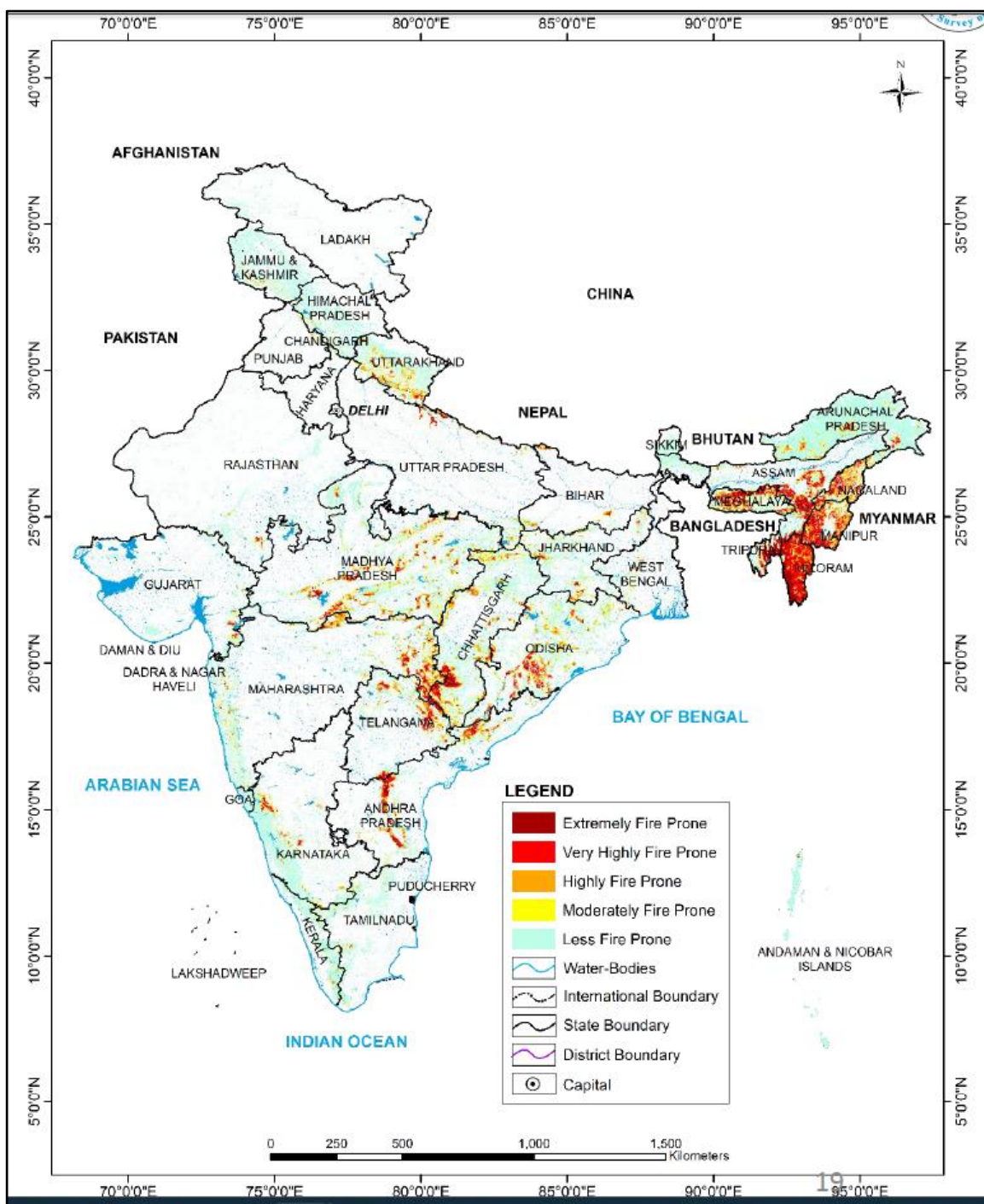
S. No.	Category	Forest cover (in sq km)	% of Total forest cover
1	Extremely Fire Prone	20,074.47	2.81
2	Very Highly Fire Prone	56,049.35	7.85
3	Highly Fire Prone	82,900.17	11.61
4	Moderately Fire Prone	94,126.68	13.19
5	Less Fire Prone	460,638.36	64.54
	Total	713,789.03	100.00

Fig 1.2: Fire Prone Forest Areas in India (ISFR 2021)

1.3. TAMIL NADU – PRESENT STATUS

The State Tamil Nadu has a spectrum of nine major forest types ranging from wet

evergreen forest to moist deciduous, dry deciduous, sholas, grass lands and scrub forest. The Western Ghats, the longest hill range in the State is one of the 25 global hotspots of bio-diversity and one of the three mega centers of endemism in India.

- Forest Cover of the State as per 2021 assessment is 26,419 sq.km which is 20.31 percent of the Geographical Area (GA) of the State.

- Area under forest cover within recorded forest area is 17,531 sq.km, forest cover outside recorded forest area is 8,888 sq.km.

- Area under Very Dense Forest (VDF), Moderately Dense Forest (MDF) and Open Forest (OF) is 3,593 sq.km (2.76% of GA), 11,034 sq.km (8.48% of GA) and 11,792 sq.km (9.07 % of GA) respectively.

- The Recorded Forest Area of the State as per 2021 assessment is 26419 sq.km and total tree cover of the State is 4424 sq.km (Figure 4). The forest and tree cover of the State is 30,843.23 sq km which constitutes 23.71% of the total geographical area of the State. (Figure 5)

- District-wise forest cover shows districts like Erode (2,295.73 sq. km.), Coimbatore (1,985.04 sq. km), Dindigul (1,877.97 sq.km), Vellore (1,824.98 sq. km), The Nilgiris(1,731.38 sq.km) and Dharmapuri (1,702.71 sq.km) has higher forest cover.

Based on the occurrence of the forest fire incidents, the season for forest fire in the state is identified between January to July. Figure 3 shows the comparison between the forest fire danger rating data generated in the early fire season and during the second week of February. As the season progresses towards summer, the moisture level in the air and ground decreases and with more amount of fuel load, the probability of forest fire occurrence increases in the state. This can be clearly seen in Figure 3. The FSI fire alerts generated are based on the fire detections recorded within the forest boundaries. The forest boundaries of Tamil nadu are digitized and the fire detected within these boundaries are notified as alerts.

The summary of the FSI fire alerts detected by MODIS and SNPP-VIIRS during the fire season is provided in the table 1. Table 1 provides the details of number of fire detections recorded in Tamil Nadu and total detections recorded in India for the past three years during the fire season. The values clearly indicate that Tamil Nadu falls under the moderate category of the Forest fire sensitiveness. However, considering the rich forest resources and the number of human habitations close to the forest boundaries, forest fire is one of the critical calamities in the State.
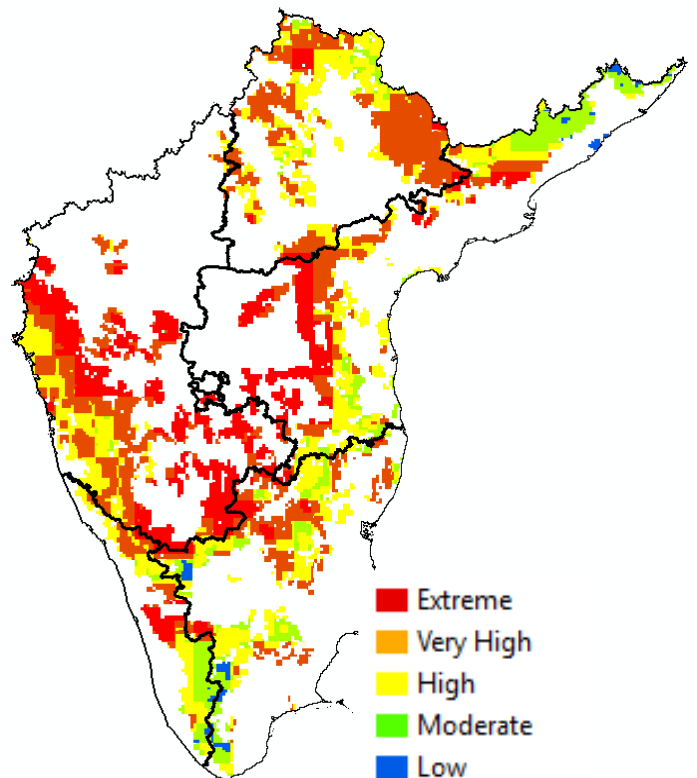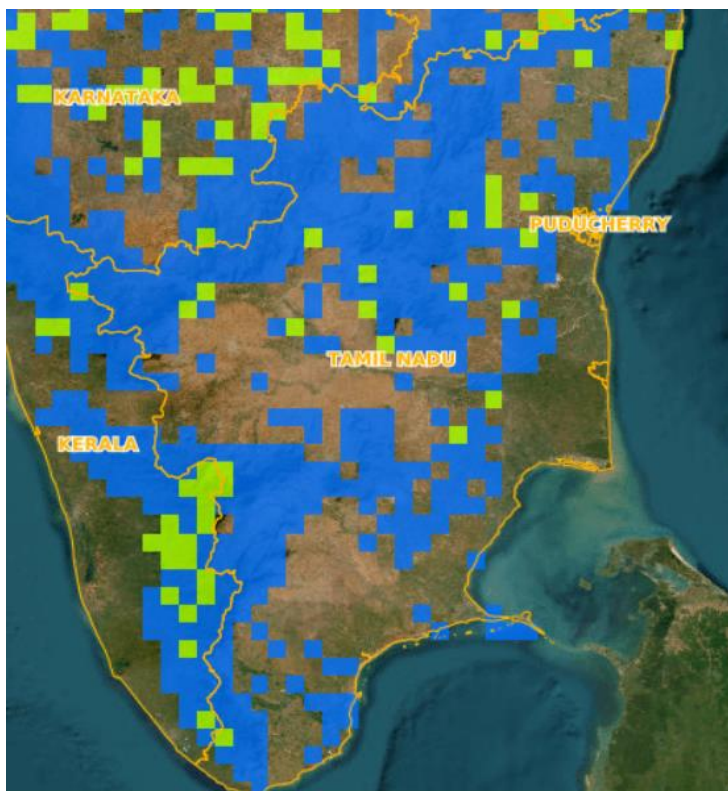
Fig 1.3: Forest Fire Danger Rating System, Southern States compared between early fire season and peak fire season (January 2nd week 2023 and February 2nd week 2020) (Source: Van Agni Portal and FSI)

Fire Season	Tamil Nadu		India	
	MODIS Detections	**SNPP VIIRS Detections**	**MODIS Detections**	**SNPP VIIRS Detections**
Nov 2019 to June 2020	187	1,368	22,477	1,24,473
Nov 2020 to June 2021	202	1,220	52,785	3,45,989
Nov 2021 to June 2022	151	1,035	29,675	2,23,333

Table 1.1: Fire Detections recorded in India vs Tamil Nadu (Source:FSI)

TAMILNADU
NOTIFIED FOREST

TIRUVALLUR

WL CHENNAI

VELLORE

CHENGALPATTU

HOSUR

TIRUPPATTUR TIRUVANNAMALAI(N)

TIRUVANNAMALAI(S)

DHARMAPURI HARUR

VILUPPURAM

KALLAKURICHI

WL STR HASSANUR SALEM

WL MTR ATTUR

GUDALUR ERODE CUDDALORE

NILGIRIS NORTH WL STR SATHY

NILGIRIS SOUTH

WL MTR NAMAKKAL

COIMBATORE PERAMBALUR

ARIYALUR WL NAGAPATTINAM

KARAIKKAL

KARUR TIRUCHIRAPPALLI

WL ATR TIRUPPUR THANJAVUR

THIRUVARUR

WL ATR POLLACHI WL NAGAPATTINAM

KODAIKANAL DINDIGUL PUDUKKOTTAI

THENI MADURAI

WL MEGAMALAI SIVAGANGAI

WL SRIVILLIPUTHUR RAMANATHAPURAM

THOOTHUKUDI WL MARINE NP

TIRUNELVELI

WL KMTR

KANYAKUMARI

0 10 20   40   60   80   100
Kilometers

Legend	
	TAMILNADU FOREST DIVISION
	NOTIFIED FOREST

Fig 1.4: Notified Forest area of Tamil Nadu

14

TAMILNADU
Forest Cover Map

Legend

TAMILNADU FOREST DIVISION

Forest Cover Map

- Water
- Non-Forest
- Scrub
- Open Forest
- Moderately Dense Forest
- Very Dense Forest

0 10 20 40 60 80 100
Kilometers
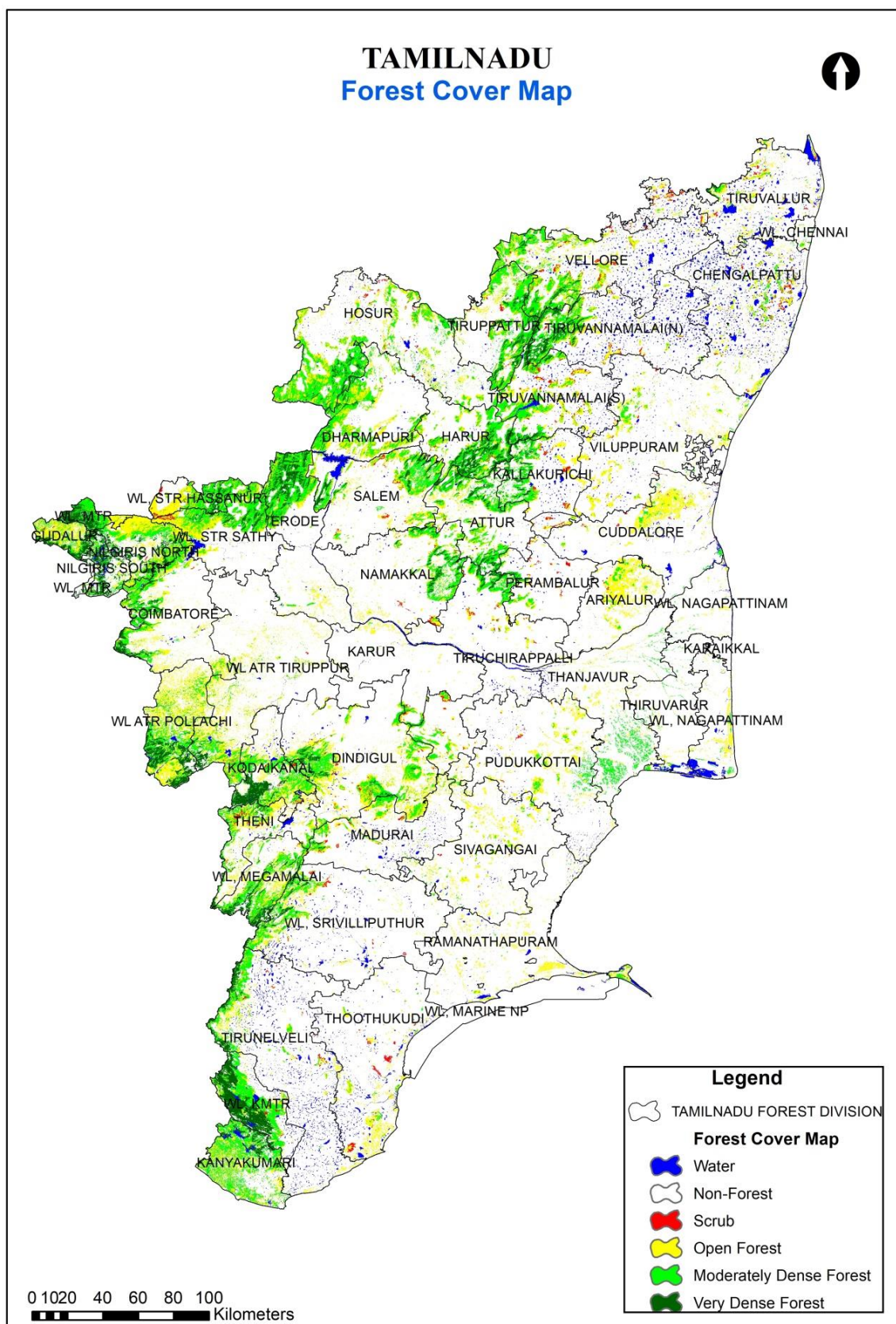
Fig 1.5: Forest Cover map of Tamil Nadu

1.4. Institutional Mechanism for Forest fire in TN

The Geomatics Centre operated under the Information technology wing of the office of the Principal Chief Conservator of Forests in TNFD has been the nodal office that coordinated with FSI with respect to the Forest fire alerts. The center was established during the year 2000. The primary objective of Geomatics Centre is to strengthen field-based applications of Remote sensing & GIS by making use of the latest information and communication technologies and so contributing in planning, monitoring and evaluation of projects. It thus provides an excellent decision support system to the planners and policy makers of the State Forest Department.

One major activity at the Geomatics Centre is Forest fire monitoring using space technology and GIS. Fire burnt area was assessed annually from the year 2001 onwards using multispectral satellite images to assess forest fire damage and its spatial spread. SNPP having higher detection power due to better resolution number of fires detected since 2016 has been higher. A detailed multivariable analysis work was taken up in 2017 & 2018 to assess vulnerability of forests to fire and 106 beats were found to be highly or very highly sensitive / vulnerable to fire.

The activities undertaken at the Geomatics Centre include forest administration database creation and updation including digitization of notified forest boundaries, digital library of forest land records, forest cover mapping, forest type mapping, forest fire burnt area assessment and daily fire alert monitoring using SNPP, MODIS data during the fire season.

Daily fire alert Monitoring using VIIRS, MODIS data

Near real time MODIS and VIIRS data are good for determining the location active fires. Forest fire alerts received from FSI are sent to the concern DFOs/WLWs/DDs for immediate action in the field. A database of these fire locations is maintained at the Geomatics Centre, which will be useful to identify fire sensitive beats, mitigation planning and management strategies.

In 2019, all the DFOs/WLWs/DDs, CCFs/CFs of circles were registered with FSI's fire alert system for quick dissemination of fire alerts. MOU has been signed between Tamil Nadu Forest Department and NRSC, Hyderabad to collaborate on various aspects

especially fire alerts and analysis.

In 2023, the Government of Tamil Nadu and Forest Department has taken a lead initiative in establishing the Forest Fire State Control Centre in the Forest headquarters at the PCCF office. A control Centre for fast flow of information and co-ordination of activities during the crisis at the office of the Principal Chief Conservator of Forests and Head of Forest Force in Chennai has been proposed in the PROJECT FOR RESTORATION OF DEGRADED FOREST LANDSCAPE IN TAMILNADU (PHASE-I) at the total cost of Rs.100 lakhs.

The State Centre will be the nodal office in coordinating and facilitating the action related to forest fire in the state. This will act as the hub to coordinate between nodal agencies in the Government of India, State Government and also with the District Forest Fire Control centers which are newly getting established. A District Forest Fire control Centre (DFFCC) for fast flow of information and co-ordination of activities during forest fire season has been proposed at the district forest headquarters at 34 locations in the state in the PROJECT FOR RESTORATION OF DEGRADED FOREST LANDSCAPE IN TAMILNADU (PHASE-I) (NABARD)at the cost of Rs.20 lakhs each.

1.5. OBJECTIVES

The objective of this book on "Guide on Forest Fire Management" is

- To provide information for effective management of forest fires in the state
- minimize the occurrence and effect of forest fires by informing, enabling and empowering forest fringe communities and all stakeholders by participatory approach and encouraging them to work in tandem with the forest department.
- Substantially focusing on the reduction of the vulnerabilities of forests across the diverse forest ecosystems in the Tamil Nadu against fire hazards, especially in the forest fire sensitive areas
- enhancing the capabilities of forest, other personnel and institutions in fighting fires, and speed up recovery after a fire event.
- To coordinate in an effective manner during the occurrence of forest fire in efficiently managing the incident through collective effort.

2. FOREST FIRE – CAUSES, BEHAVIOR & IMPACT

Forest fires are a recurrent annual phenomenon in India. Almost all the fires in forest areas are manmade and usually the forest dependent communities are known to use fire for various purposes ranging from clearing community forests for shifting cultivation to clearing the forest floor to encourage grass growth. However, uncontrolled and unmanaged fires cause tremendous adverse impact on the environment and the society. In recent years, there have been spurts in the number of forest fire incidents which is a cause of serious concern for all. In recent past, grave wildfires have been observed in different parts of the globe such as California, Tasmania, Cape Town, Melbourne, United Kingdom etc. In one of the major wildfire outbreaks in California, about 60,000Ha of forest was burned resulting in 86 deaths and destruction of approximately 19,000 structures. Forest fire disaster of 2016 in Uttarakhand and Himachal Pradesh, Kurangani fire incident of Tamil Nadu, Mt. Abu and Vaishnodevi fires of 2018 are some of the recent examples from our country.

Forests are vulnerable to a variety threats like insect/pest attack, disease, fire, cyclone, flood, drought etc. Natural threats are part forest ecosystem. Man-made forest fires, their time, intensity and frequency can affect health of forests, survival, productivity, biodiversity and thereby disrupt flow of goods and services from forests. Increasing temperature, rising atmospheric carbon dioxide levels as a result of forest fire accelerate the adverse effect of global climatic change.

Forests fires are as old as the forests themselves. Usually seasonal, forest fires have influenced the evolution, development and management of some forest ecosystems. Small and limited forest fires are an integral part of forest ecosystem and very essential to maintain health and hygiene of the forests. Though fire is a factor for forest degradation, it is often used as a tool to renew natural environment. Controlled burning hasbeen used as a management tool. Prescribed burning is used as a way to put fire in a specific area of land. However, uncontrolled fires cause extensive damage to forests, wildlife, environment, soil fertility and quality and retrogrades forest regeneration.

2.1. CAUSES FOR FIRE

In India, most of the forest fires are attributable to anthropogenic reasons. The list of human motivations includes land clearing and other agricultural activities, maintenance of grasslands for livestock management, easy extraction of non-wood forest produce, hunting, industrial development, attempt to encroach, resettlement, negligence and arson. Some other man-made causes are fire leftover by travellers, campers and picnickers, fire that escape from neighboring agricultural lands while clearing agricultural residues, power lines that run through the forests while unintentional fires caused by careless throwing of burning matchsticks and escape of cooking fire from temporary shelters for road workers also account for many forest fires. Forest Survey of India has reported that 54.40% of forests in India are exposed to occasional fires, 7.49% to moderately frequent fires and 2.40% to high incidence levels while 35.71% of India's forests have not yet been exposed to fires of any real significance. Major affected areas lie in the North East India and in the forests on the Deccan plateau. Prolonged droughts make forests vulnerable to fires and the changing climate further aggravates their vulnerability. The fragmentation of most of Indian forests, interspersed with habitations of all sizes, results in high human presence in most forested areas which adds to their vulnerability to fires. About 99% of forest fires are human related, mostly caused by the people deliberately and have a close relationship to their socio-economic conditions (NRSA, 2006).

2.2. FIRE BEHAVIOR

The components determining the severity and spread of a fire are:

- Fuel load - quantity/size/class of flammable material available

- Weather – temperature/wind/moisture; Droughts favour forest fires and winds aid in their spread.

- Topography – aspect/elevation/slope; slopes that face South are drier and more vulnerable to fire than north facing slope. High wind velocity at higher elevations and steepness of slopes encourages spread of fire especially upwards.

2.3. IMPACTS OF FOREST FIRE

Forest fires cause wide ranging adverse local, regional and global/ social, economic and ecological impacts like loss of life, cattle and property, loss of biodiversity, natural regeneration and reduction in forest cover including wildlife habitat, degradation of water catchment areas resulting in loss of water, increase in greenhouse gases in the atmosphere, resulting rise in temperature, global warming/climate change due to depletion of carbon sinks and so on.

Forest fires are one of the most important causes of land degradation that lead to biodiversity loss, deforestation and desertification processes. In Tamil Nadu, most forest fires are restricted to the forest floor and are well controlled by beating the fire with the help of the local communities. But, the intensity and number of fires vary greatly across the years and are dependent on mostly the moisture conditions in the forest areas.

3. FOREST FIRE MANAGEMENT

India has a strong legal and institutional arrangement for forest fire prevention and management. The national laws strictly forbid setting fire in forests. As per, sections 26 and 33 of the Indian Forest Act of 1927 it is a criminal offense to burn or to allow a fire to remain burning in reserved and protected forests. Section 30 of the Wild Life (Protection) Act of 1972 further prohibits setting fire in wildlife sanctuaries. Ministry of Environment, Forest, and Climate Change (MoEFCC) is the nodal ministry. Recently, the National Action Plan on Forest Fires (NAPFF), has been formulated to minimize forest fires from taking place by informing, enabling, and empowering forest fringe communities and maybe incentivizing them to work in tandem with the forest departments.

Apart from public awareness and their participation in controlling forest fires, use of all the technological options for prevention, detection, early warning, firefighting and damage assessment should be employed under a scientifically prepared forest fire management plan for each district or forest division. Geospatial technological tools and techniques have been very effectively used in forest fire management world over in the last couple of decades.

Several Forest Fire Prevention and Management (FFPM) Practices are used to prevent forest fire. The most common methods of prevention employed by forest departments in India include the clearance of fire lines and conducting controlled burning to limit fuel loads. Other methods may include silvicultural practices such as selective thinning and planting fire-adapted tree species in fire-prone areas. FSI has developed methods to generate early warning and fire danger rating systems which are also a part of the prevention process.

Over the past 10-15 years, remote sensing has been used extensively for forest fire detection in India. FSI implemented its first nationwide system for monitoring active forest fires using remote sensing and providing alerts to local forest departments in 2004. State-level detection and alert systems have also been developed in states of Madhya Pradesh, Andhra Pradesh, Chhattisgarh, Telangana, and Uttarakhand. Tamil

Nadu Forest Department is also working on similar lines to develop the Forest Fire Alert & Report Management Dashboard exclusively for the state to digitize the whole process of fire alert communication, tracking response and reporting in order to improve the efficiency in managing the forest fires in the state.

The Forest Fire Suppression relies very heavily on "dry" firefighting techniques like directly beating out the fire with hand tools to smother the flames (for very low-intensity fires) or by separating the fuel in advance of the active fire by a natural break or deliberately creating mineral earth breaks devoid of fuel.

3.1. FIRE PROTECTION

Forest fire and its management have a long history in Indian forestry. Fire prevention, detection and   control activities are the responsibility of the State government. Fire protection measures revolve around the three stages of fire, namely

1)   **Pre-fire season** (Preparedness)

2)   **During fire** (Fire detection, spread and control planning) and

3)   **Post fire** (Damage assessment and mitigation planning)

The incidence of forest fires in the country is high. Standing trees and other natural regeneration including fodder are destroyed on a large scale by such fires. Special precautions should be taken during the fire season.Improved and modern management practices should be adopted to deal with forest fires. The conventional method of fire protection (pre-fire season preparedness) involves clearing a network of fire lines, watchtowers, block lines and guide lines. During fire season fire watchers are engaged. As prevention is better than cure, a preventive program of zoning, vulnerability/danger rating, early warning and real time monitoring has to be designed and installed.

Post fire scenario–There is need for continuous updation of database from the field for numbers of fires, area burnt, damage caused to floraand fauna, effect of fire on land and soil, causes of forest fire, measures taken, extent and effect of prescribed fires, etc. Burn scar maps derived from remote sensing images also provide information on the spatialextent and distribution of the fire affected areas and the total area burnt which is useful for forest managers for mitigation planning.

3.2. FOREST FIRE RISK MANAGEMENT

Prevention, Mitigation, Response and Recovery are four basic phases of the disaster management cycle. In a situation of forest fire, prevention plays a major role, as it helps to reduce the chances of fire occurrence if not, at least to reduce the effect of the intensity and loss. Early Warning Systems using different apps, web-based software, geospatial tools, and new technological advancements help us in preparation and early detection. Other than this, community awareness, strengthening the local information system, equipping for fire suppression are some ways to ensure mitigation. During the forest fire, controlling it in the early phase is very important. So quick response after warnings and information about the fire is critical. Mobilization of quick response units and local communities for help and co-operation is a must under the response phase. State & District Forest Fire Control Centre are established in Tamil Nadu to ensure quick communication, mobilize resources, and to monitor the action taken. In last, post-fire management by rehabilitation of burnt forest areas, wildlife management in burnt area and supporting regeneration of native species are required.

Basic Steps / Cycles of Forest Fire Prevention
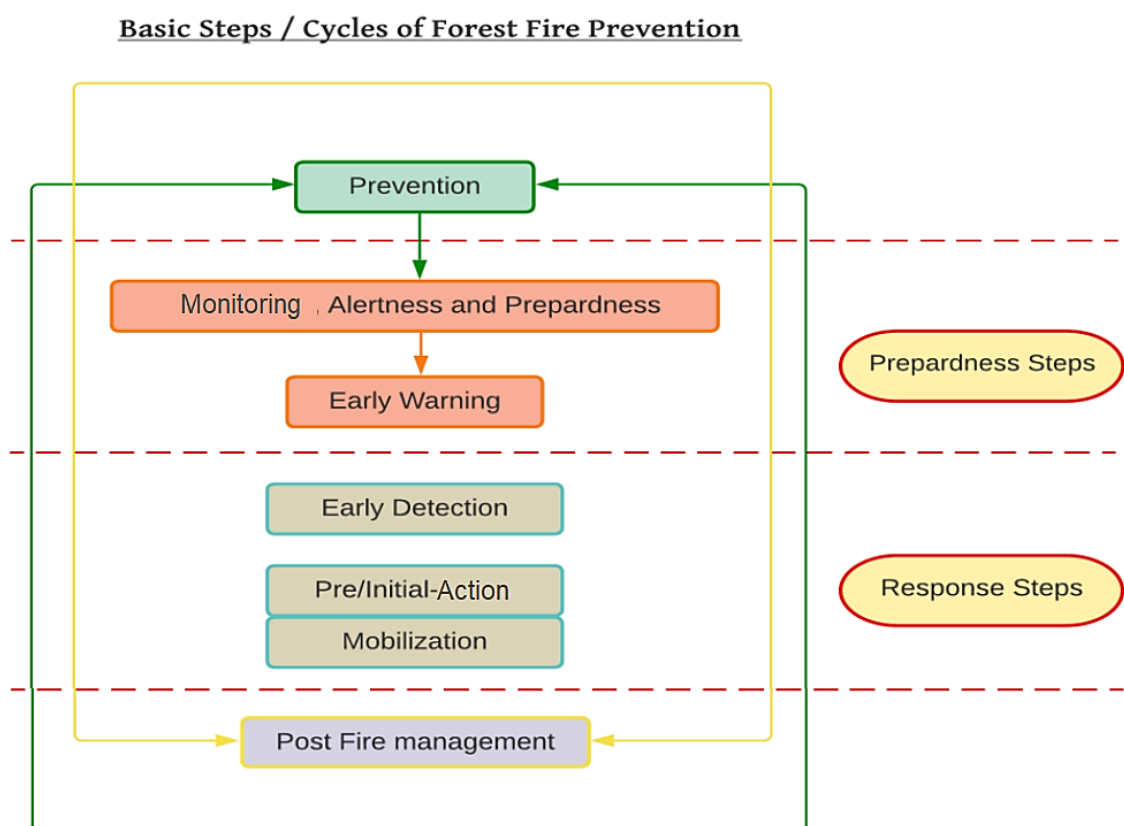
Figure 3.1 Steps in Forest Fire Management

Sl. No.	Phases	Activities
1.	Mitigation & Prevention	• Surveillance/ Watching on forest • Early detection of Forest Fire. • Establishing preventive measures such as watchtower, equipment, community teams, etc. to control the situations • Use of indigenous knowledge and methods for fire prevention • DM Planning (unit level to state-level) • Usage of IoT devices/GPS/Drone technology and Application based models
2.	Preparedness	• Awareness generation • Emergency response & logistics planning • Early warning systems and communications to concerned departments, and authorities. • Constitution of Community/ Volunteer teams and their training
3.	Response	• Activation of fire control methods • Manpower support for large areas of fire • Affected person evacuation • Search & rescue, evacuation and First-aid • Shelter management • Relief camp management
4.	Recovery	• Afforestation Activities • Managing and Taking care of the forest.

Table 3.1 Forest Fire Management in various phases

3.3. FOREST FIRE RISK/VULNERABILITY ZONATION

Vulnerability assessment is a pre requisite for advance planning and preparation to combat fire. The vulnerability of forests to fire varies from place to place depending upon the type of vegetation, topography and the climate. Understanding fire vulnerability and forest fire spread model could provide sufficient data for detailed fire control planning.

A study by the Geomatics center of Tamil Nadu Forest Department shows that 56% of the notified forests are either highly or very highly vulnerable to fire and about 30% are moderately vulnerable to fire. It is further observed that 31% of fire incidents were recorded in Moderately Dense Forests, 29% in Open Forests and 30% in Scrub & Grass and only 10% of fire incidents in Very Dense Forests in Tamil Nadu revealing that

Moderately Dense Forests, Open Forests and Scrub& Grass are equally susceptible to fire. When comparing vulnerability of forest types, it is further found that Tropical Dry Deciduous Forests are more prone to fire with 46.5% of fire incidents recorded followed by Grass Lands with 25.75% of fire incidents. The list of Vulnerable/Sensitive beats in Tamil Nadu which are identified based on the FFPs from alerts between 2016 to 2022 is available in Appendix 1. The details of fire vulnerability/sensitive areas in Tamil Nadu is available in chapter 5 under section 5.3 and 5.4.

3.4. ROLE OF COMMUNITIES

Forest fire is a growing threat to communities around the world. Traditionally, reducing forest fire risk was co-managed by the administration and local communities. But over time the role of the local communities has largely reduced. However, community-driven forest fire management can reduce the effect of the forest fires and to reduce the losses. The community cohesion and 'attachment' to local resources are also important for controlled fire use. In Tamil Nadu, there are many instances where the local forest fringe village communities have rendered support to the have successfully taken over forest fire management from sponsored/ government projects. However, the allocation of resources for forest fire management needs careful planning to ensure that rural communities are not overburdened by such arrangements, support the community's needs and in the future should provide benefits.

In recent decades, there is a rising desire to live closer to nature which has pushed populations into the "Wildland-Urban Interface" (WUI) — areas with more vegetation, parks, and forests than their city center and older suburb counterparts. These establishments built on not-local material, with high energy requirements; consumer goods, and not fire resilient design often face severe consequences of the forest fire.

3.5. BRIEF GUIDELINES OF FOREST FIRE MANAGEMENT

1. Classify areas as per Forest Fire Risk Zonation (Forest fire prone areas- FFPA) – extremely high FFPA, High FFPA, forest fire prone area, moderate FFPA, low FFPA – this helps in pre-fire planning and for resource allocation. Prepare district level FFPA map for every 5 years.

2. Identification of all stake holders – Local Communities, State agencies, District

Administration, NDRF & SDRF, FSI, MoEFCC, NDMA & SDMA and Tribal welfare Department.

3. Identify cause of fire – NTFP collection, Local festivals/rituals, clearing for cultivation

4. Involving/motivating communities – Involve Community organizations, VFC etc.

5. Location planning –Equipping the District Forest fire control centre with fast and seamless communication either through wireless or high-speed internet connectivity with the field level staff and also with the State Forest Fire Control Centre. Construction of new watchtowers and maintenance of existing watchtowers, Setting up Base camps at extremely high FFPAs with all firefighting equipment, maps of Fire lines, creation of new Fireline and maintenance of existing fire lines, controlled burning to reduce fuel load.

6. Finalizing Methodology of firefighting different categories of fire based on various factors like fuel load, type of fuel, type of vegetation – District level SoP has to be developed.

7. Training of front-line forest personnels in Forest Fire management including controlled burning, creation and maintenance of fire-lines, fighting fires using equipment, mock drills on firefighting, Training of Trainers on Forest fire dissemination systems of FSI, then training staff.

8. Using the National and State Forest Fire Alert System – Forest Survey of India sends daily alerts on forest fire, Registration of all stakeholders on Forest Fire Alert system. Ensuring that all TNFD front line forest staff are using Tamil Nadu Forest Fire Alert and Report Managing dashboard (mobile application) to get the fire alerts and use this platform to update the status of fire.

9. Post fire monitoring–extent of area burnt, data analytics.

3.6. STRATEGIES

The core strategies in effective forest fire management are,

- o Early Detection
- o Quick Communication
- o Early Action
- Public Oriented Measures
- o Gaining local public support

- o Awareness and education of the masses

- o Restrictions on activities that can lead to forest fires

- o Establishing information system

- o Incentives to fire volunteers

- Administrative and Technical Measures

  - o Close monitoring of sensitive beats

  - o Establishing base camp during fire season

  - o Identifying water points and access to it

  - o Putting in place fire control task teams.

  - o Clearing and Maintaining Fire Lines

  - o Establishing quick wireless communication channels

  - o Ensuring the functioning of fire equipments

Fire Line

Awareness

Watch Tower

Control Burning

Organisations Role

Fire fighting eqipment

State & District
Forest Fire Control Centre

Fire Prevention
Education

Training &
Capacity building

Figure: 3.2– Core strategies for forest fire management

Figure: 3.3 – Training of front-line forest staff on handling fire equipments

4. FOREST FIRE ALERT SYSTEM

Globally forest fires all over the world are under reported due to various factors. Conventional system involves use of fire watch towers at vantage points and fire watchers to detect fires and communication through wireless network to immediate superior officers to mobilize resources for firefighting.

The Fire Information for Resource Management System (FIRMS) distributes Near Real-Time (NRT) active firedata within 3 hours of satellite overpass from both Moderate Resolution Imaging Spectro-radiometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS).

MODIS/VIIRS provides geo-coordinates (latitude and longitude) of centre of pixel, date, time of overpass of satellite, satellite name etc., for the fire hotspots. Each hotspot/active fire detection from MODIS represents the centre of a 1 km. (approx) pixel flagged as containing one or more fires and from VIIRS 375m pixel. For near real time data received from NASA, Geomatics Centre, Tamil Nadu Forest Department downloads these, overlaying with Forest Administrative maps to identify the Forest block/Beat/ Range/Division and then communicates it to the concerned District Forest Officer/Conservator of Forests/Chief Conservator of Forestsfor immediate action in the field. During 2012-2016, 45,499 fire incidents were detected by VIIRS within the geographical area of Tamil Nadu. Ofthese 11,356 fire incidents were recorded within the notified forests of the State.

4.1. MODIS & SNPP VIIRS

The National Aeronautics and Space Administration's Moderate Resolution Imaging Spectroradiometer (MODIS), with channels specifically designed for fire detection, is the most commonly used satellite sensor for detecting fires over large regions. The image resolution used for detection of fires is 1 km. A hotspot is detected by MODIS sensor using data from middle infrared and thermal infrared bands. There are two satellites carrying the MODIS sensor viz. Terra and Aqua, which together provide complete coverage of India approximately 4 times daily. MODIS can routinely detect both flaming and smoldering fires ~1000 m2 in size. Under very good observing conditions (e.g. little or

no smoke, relatively homogeneous land surface etc.) flaming fires one tenth this size can be detected. Under pristine (and extremely rare) observing conditions even smaller flaming fires ~50 m2 can be detected. There is no upper limit to the largest and/or hottest fire that can be detected with MODIS.

The Visible Infrared Imaging Radiometer Suite (VIIRS), operated by the US National Aeronautics and Space Administration (NASA), was designed to be the successor to both AVHRR and MODIS. There are two satellites carrying the VIIRS sensor, which has fire detection channels at both 750-m and 375-m resolution. The resolution of the VIIRS sensor is finer than MODIS and it can detect smaller fires. FSI uses VIIRS-SNPP (375-m resolution) satellite data.

	MODIS (Moderate resolution Imaging spectro-radiometer)	SNPP-VIIRS Suomi National Polar-orbiting Partnership (NPP) satellite
Sensor	36 spectral bands (channel 21,22,31)	5 HR Imagery channels (I-bands), 16 moderate resolution channels (M-bands) and a D/N Band (M13 and M15)
Satellite	Aqua & Terra	Suomi National Polar-orbiting Partnership (NPP) satellite
Launch	Dec 99 & May 2002	Oct-11
Algorithm	Contextual	Thresholding and Contextual (Hybrid)
Equatorial Pass	Terra- 10:30 am and 10:30 pm ; Aqua - 1:30 pm and 1:30 am	1:30pm and 1:30am
Resolution	1 km X 1km	375mx 375m &750m x 750m
Night time performance	Poor	Good
Mapping small fires	No (ideally 1000 sq m)	Yes
Accuracy of mapping large fire boundaries	Poor	Good
Under Canopy Fires detection	Poor	Good

4.2. DETECTING FOREST FIRES THROUGH SATELLITE SENSORS

Satellite sensors record the intensity of electromagnetic radiation from Earth in various spectral wavelengths or channels. The forest fires are detected by thermal sensors aboard satellites, which can detect the temperature of objects. During satellite overpass, those areas having higher temperatures compared to surrounding areas (thermal anomalies), are picked. Only the fire hotspots detected within the forest area (green colored area) are selected and communicated as the Forest Fire Alerts by FSI The fire hotspots falling outside the forest areas are filtered out and not processed any further. up by the sensors due to the radiation emitted from such areas. The data processing software identifies the corresponding fire affected pixels on the satellite data. The MODIS and SNPP VIIRS sensors are aboard polar orbiting satellites and they pass over an area on earth only twice in a day. Therefore, a sensor usually provides two sets of satellite detections corresponding to the overpass timings. FSI uses fire detection satellite data from two sensors viz. MODIS and SNPP. The Terra MODIS instrument acquires data twice daily (10:30 a.m. and 10:30 p.m.), as does Aqua MODIS (1:30 p.m. and 1:30 a.m.). Therefore, four daily MODIS observations are available for forest fires. The SNPP-VIIRS also has its equatorial passes twice a day (1:30 a.m. and 1:30 p.m.). Therefore, FSI communicates forest fire alerts based on a total of 6 satellite passes in a day

4.3. NEAR REAL TIME FOREST FIRE DETECTION SYSTEM

Forest Survey of India (FSI) has initiated Near Real Time monitoringof forest fires in collaboration with National Remote Sensing Centre (NRSC). Geospatial point data showing forest fires provided by National Remote Sensing Centre (NRSC) is acquired and provided to FSI on near real time basis. The active fire spots or hotspots are generated by using MODIS and SNPP-VIIRS satellite sensors. The locations of fires as received from NRSC are regardless of land use and land cover. These coordinates are superimposed on the latest forest cover map of India, to eliminate any fire hotspots coming from industrial, agricultural or any other sources other than forest. Attributes like state, district and Survey of India 1:50000 topo-sheet's numbers are attached with each coordinate of the forest fire locations as attribute information. The processed forest fire information is then converted into *.KML (Keyhole Mark-up Language) format, and is e-mailed to the appointed nodal officers of each state. The sms messages are also sent to every registered

user. Forest fire detection and dissemination of alerts is done twice daily during the fire season i.e December to next year June.

The process of acquisition, processing and dissemination of active forest fire locations generated in KML file format to State Forest Departments involves a time period of 2 hours. After collecting the geo coordinates of the fire spots, through GIS analysis, attributes upto beat level are added to each fire spot and sent between 1100 -1200 and 1400 - 1500 hrs to State Forest Departments and registered users through Email and SMS during fire season giving a summary of total number of forest fires detected in their chosen areas. Usually the MODIS satellite data is processed within 40 to 60 minutes of satellite overpass by NRSC and in case of SNPP VIIRS, it takes around 60 to 90 minutes to process the satellite data. Forest Survey of India using fully automated customized software generates email alerts to the State Nodal officers within 5 minutes of receipt of email alert from NRSC. However, SMS are sent to the users usually within 30 to 60 minutes of receipt of email from NRSC.

The FSI Forest Fire Alerts system has undergone periodic changes to facilitate not only foresters but also common people in a better way. Fully automated Forest Fire Alert System 3.0 disseminates its alert system for 20 states at beat level and 2 states at Range level. Forest fire alerts generated for Tamil Nadu are upto the beat level, which also has details of the concerned reserve forest. The number of FFP alerts generated during the fire season for Tamil Nadu in 2021 and 2022 is available in table 4.1.

		FSI FIRE ALERT - 2021			FSI FIRE ALERT - 2022		
S.NO	MONTH	MODIS	SNPP	TOTAL	MODIS	SNPP	TOTAL
1	JANUARY	6	7	13	3	14	17
2	FEBRUARY	27	134	161	33	129	162
3	MARCH	211	768	979	139	798	937
4	APRIL	32	284	316	13	210	223
5	MAY	4	48	52	19	60	79
6	JUNE	4	14	18	8	28	36
Total				1539			1454

Table 4.1 – Number of Fire alerts in TN during 2021 and 2022

4.4. PROCESS OF FIRE ALERTS DETECTION AND COMMUNICATION

The process of generation and dissemination of forest fire alerts is described below.

1. After a satellite overpass, the active fire spots or hotspots are received by NRSC (National Remote Sensing Centre), Hyderabad in their ground station at Shadnagar, Telangana and are shared through email by NRSC to FSI.

2. The fire alerts provided by NRSC include all thermal anomalies detected by the sensors irrespective of whether these fall within or outside forests. FSI filters out all fires other than forest fires using a custom filter which is a combination of Recorded Forest Area boundaries as well as forest cover data. Enrichment of the forest fire information is carried out by adding attributes like State, District, Division, Range, Beat, Compartment boundaries etc. to the forest fire locations.

3. This information is then disseminated to State Nodal Officers, registered users and also uploaded on the website of FSI in the form of Table and Maps.

4. Users who have specified their areas of interest are also notified of the fires therein through SMS
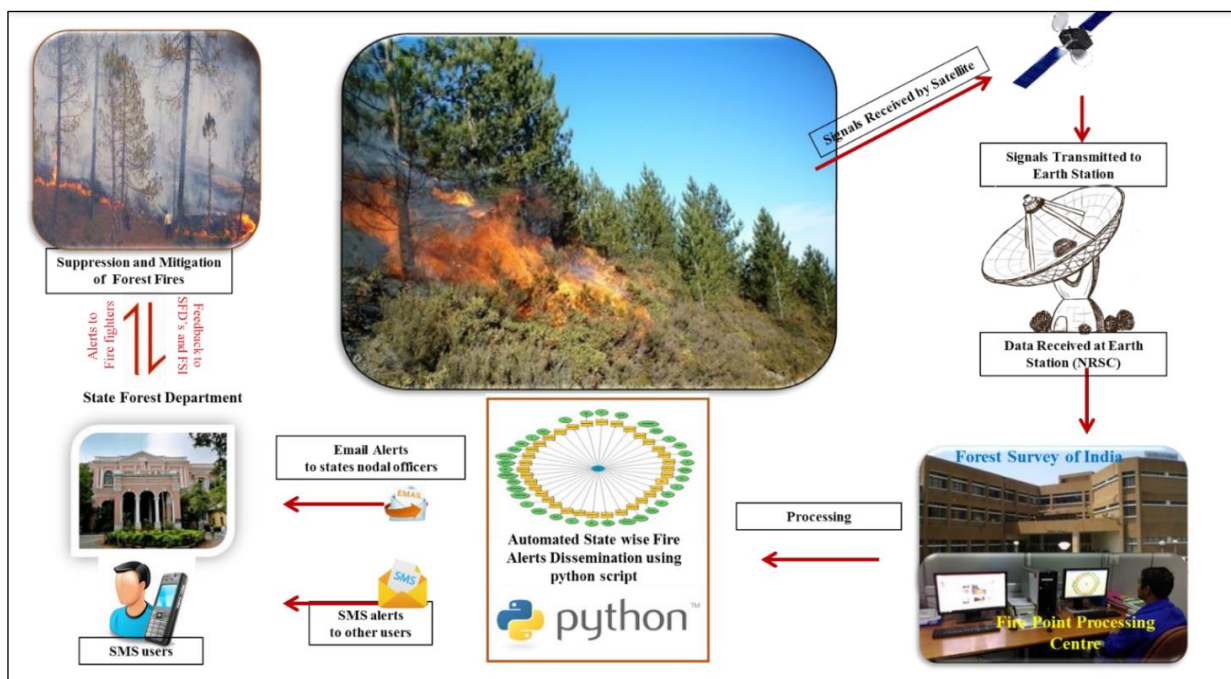
Figure 4.1: Process of Forest Fire detection and alert generation

4.5. LARGE FOREST FIRE MONITORING

Forest Survey of India has also launched the Large Forest Fire Monitoring Programme

using near real time SNPP-VIIRS data in 2019. With the launch of Large Forest Fire Monitoring System under FAST 3.0 (FSI Fire Alerts System), large fire events are tracked across the country and Large Fire alerts are disseminated with the objective to identify, track and report serious forest fire incidents so as to help monitor such fires at senior level in the State Forest Department and also seek timely additional assistance that may be required to contain such fires. The programme detects minimum of 3 SNPP pixels in close proximity to identify a Large Forest Fire. Once detected, it is continuously monitored until it is put off. The programme scans the fire for additional 3 days after its inactivity to detect dormant fires, if any.

'Large Forest Fires' are identified by carrying out the clumping of fire polygons with criteria being atleast 3 SNPP forest fire polygons to be detected in close proximity. This one clump is considered as a single 'large forest' fire. Unique large fire nomenclature is assigned to every large forest fire based on its range/district name. If any fire in the subsequent satellite passes is within 500 m buffer of any of the previous continuing large fire, then it's continued under the same name of the previously continuing fire. Such continuous monitoring is done until the fire douses and for additional 3 days after the inactivity of the fire. 'Large Forest Fire Database' is generated with these details. Dataset of active large fire layer of the current pass of satellite in continuation with its fire extensions from the previous passes is created. Enrichment of the forest fire information is carried out by adding attributes like State, District, Division, Range, Beat, etc. to the large forest fire polygons. This information is then disseminated to State Nodal Officers as kmz through e-mail, to registered users through SMS and also uploaded on the FSI fire geo-portal for interactive viewing.

As per the FSI Portal Data, Tamil Nadu has recorded about 106 Large fire incidents between Jan 2019 to Jan 2023. The details of these large forest fire sites are available in the FSI Large Fire programme portal (https://fsiforestfire.gov.in/lff/). During the period between 1st November 2022 and 24th January 2023, Tamil Nadu has recorded only 3 Large Forest fires whereas the below image shows the top 5 states with highest number of large forest fire events.

Figure 4.2: Top 5 States with highest Large Forest Fire in 2022-23

Figure 4.3 FSI portal on Large Forest Fire Monitoring Programme

FOREST SURVEY OF INDIA
Ministry of Environment, Forest & Climate Change
भारतीय वन सर्वेक्षण

Large Forest Fire

① Large Fire Events - 24-01-2023

#	Fire Name	Division / District	Active Pixels	Total Pixels	KMZ Link	MAP Link	Portal Link	Fire Status
1.	**PALLIPATTU -1** **First Detection:** 24-01-2023 01:36 **Last Detection:** 24-01-2023 01:36	**State:** TAMIL NADU **District:** **Circle:** **Division:** **Range:** **Block:** **Beat:**	3	3	Download KMZ	View	View	Active

Figure 4.4: Details of Large Forest Fire Event as shown in dashboard
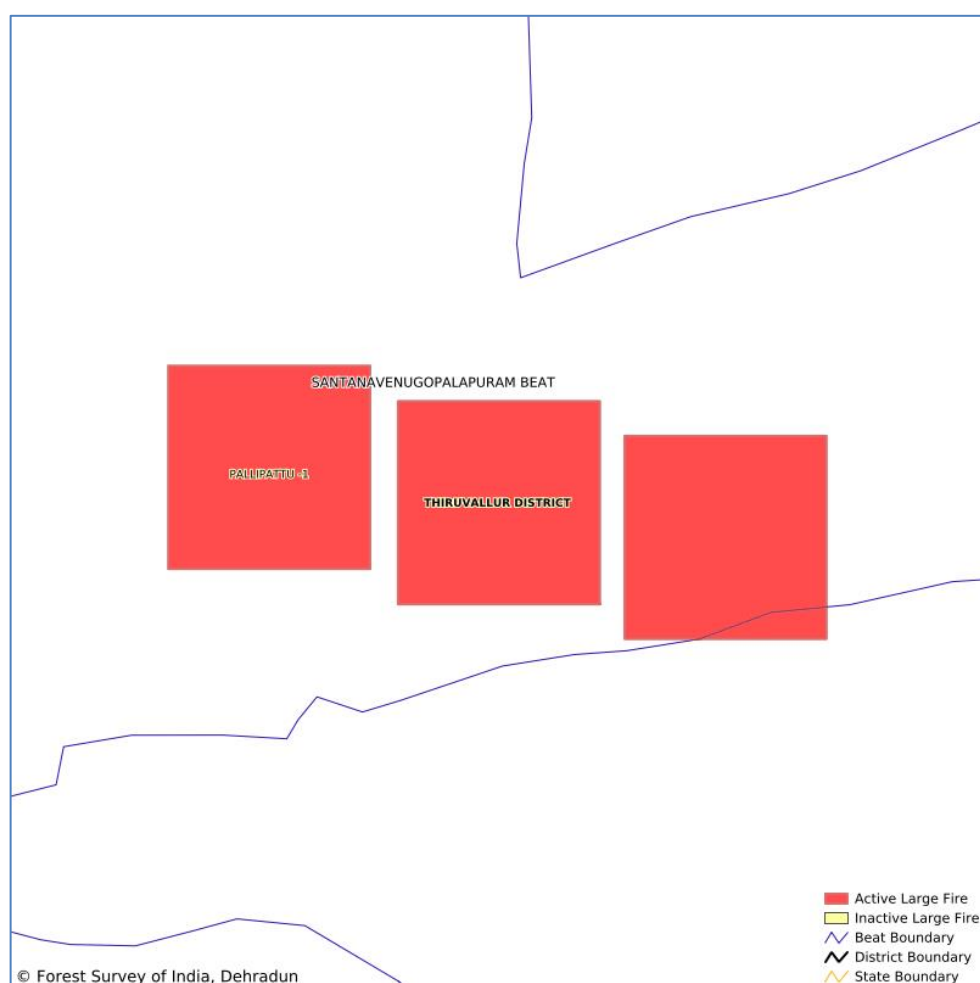
Figure 4.5 Map view of Large Forest Fire

37
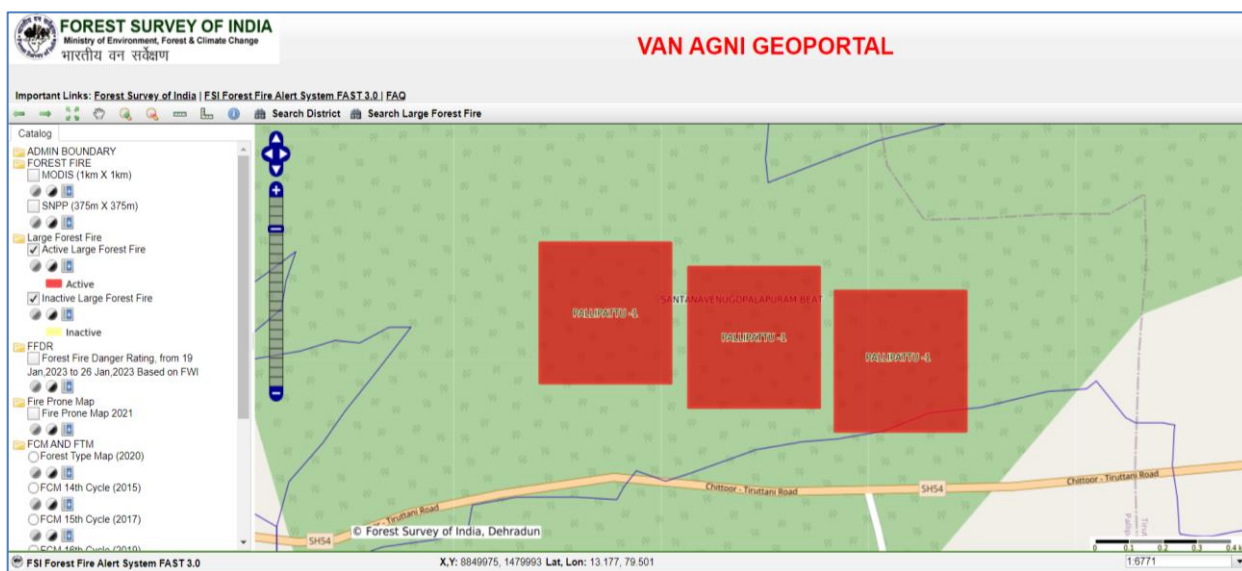
Figure 4.6 View of Large Forest Fire in Van Agni Portal

4.6. FSI FOREST FIRE GEOPORTAL

FSI Forest Fire Geo-portal, VAN AGNI 1.0 (http://117.239.115.44:90/fsi_fire/fire.html) is a portal created using Opensource Softwares viz. MapServer 7.0.7 & GeoMOOSE 2.9. It has been developed for user-friendly interactive viewing where the user can view forest fire related data inter alia, forest fires, large forest fire events tracking etc. along with other thematic layers such as Forest admin boundaries, Forest and Forest cover, forest type etc. A snapshot view of the geo-portal is been shown in Fig.4.6

4.7. NEED FOR OTHER SOURCES OF FIRE DETECTION

FSI is generating forest fire alerts six times in a day from MODIS Aqua, MODIS Terra and SNPP VIIRS sensors. Each of these sensors provides two sets of data every day in a period of 24 hours. Therefore, the forest fire alerts generated by FSI correspond to these 6 satellite overpasses and all fires data active in between these satellite overpasses cannot be detected by the satellite-based fire alert systems. So, it is highly recommended to use the FSI forest fire alerts for strategic purposes and not to rely on these for tactical firefighting purposes fully.

Satellite fire detection has also got some minor limitations:

1. The algorithms cannot detect fires through thick cloud, smoke and haze. A large fire may therefore go undetected for several days and then suddenly it reappears

later when the cloud cover gets removed. There are chances that a small fire may burn and even die out without ever being detected.

2. Same could be the case for ground or surface fires under very thick, dense canopy which could go undetected, as optical and thermal (like: MODIS and VIIRS) wavelength-based sensors cannot penetrate through cloud or canopy cover. In those cases, the satellite may miss the existence of fire.

3. The forest fire alerts generated by FSI correspond to only 6 satellite overpasses in a day and all fires data active in between these satellite overpasses cannot be detected by the satellite-based fire alert systems.

4. The time lapse between fire detection by the satellite and dissemination of the alert to the user is between 1 to 1.5 hours, depending on the sensor and processing time. This delay limits the utility of satellite detection for tactical fire operations.

5. The actual size of the actively burning area cannot be determined from satellite imagery. A 1-km^2 hotspot pixel may represent a fire as small as100 m^2. In addition, an intense fire covering an area less than 1 km^2 may actually show up as a cluster of several hotspot pixels.

6. Within a pixel of size 375m X 375m, one cannot specify the actual fire location. In those cases, an approximation is taken as, anywhere the fire is within 375 X 375 sqm; we need to consider its location at the centre of that pixel. When a pixel showing thermal anomaly falls in the junction of two or more adjacent range or beat boundaries; in those scenarios, the fire alert is disseminated to all the concerned persons of the said adjacent ranges and respective beats.

7. Satellite detects any active fire irrespective of its source. Filtration of forest fire is done at FSI. In some cases, fires in industries or agricultural land lying very close to forest area or falling under the RFA boundaries of states are sometimes considered as Forest Fires. Although utmost care is taken to mask out such industrial fires to avoid any false alarm, still sometimes, such fires are disseminated as forest fires.

8. The fire alert doesn't give details about the terrain in which the fire occurs. Steep slopes or interior location with dense ground vegetation makes it very hard for the field forest personnel to reach the point. There will also be challenges in

accessing water points. So, there is need to integrate the digital elevation model with the forest fire points to give the real picture of the site which will help in arranging for additional support in handling such critical fires and tracking the forest fire response.

Therefore, it is highly recommended to use the FSI forest fire alerts for strategic purposes only and not to rely on these for tactical firefighting purposes fully. Other sources of forest fire detection such as observations from watchtowers, ground based sensors, local information etc, wherever they are available, should be integrated and correlated for forest fire detection.

4.8. GUIDELINES FOR THREE TYPES OF ALERTS

(i) Pre-warning Alert system developed by FSI is generated based on short term weather variables, is valid for 1 week and communicated to the Nodal officer on Fridays. On receipt of such information, it will be communicated to Circle and District Forest Fire Control centers which in turn will ensure intensification of patrolling and monitoring for potential fire in areas indicated by the pre-alert for the week.

(ii) Fire alert is issued once the same is detected during satellite overpass and this is communicated to Nodal Officer as well as to all those registered with FSI for the purpose. On receipt of fire alert from FSI, the state nodal Office also shall pass on the information to the concerned District Forest Fire Control centre. The DFFCC will immediately alert the Range officer and team, coordinate with all concerned, mobilize transport, equipment and personnel for firefighting, keep sending feedback to State Level Central Control Centre and ensure necessary assistance to firefighting teams.

(iii) Field detection – When fire watcher/patrol teams or other informers detect forest fires and inform the local staff, they should immediately alert both the firefighting teams and district forest fire control room. The District Toll free number has to be widely publicized especially in the forest fringe areas information boards, local tv channels and district administration. The DFFCC shall pass on this information to the SFFCC and ensure that the concerned range team is getting into the action on fire.

5. PRE-FOREST FIRE SEASON – FIRE CONTROL PREPAREDNESS GUIDELINES

The pre fire scenario needs inputs on effective preparations and planning for managing and combating fire. Understanding fire vulnerability and forest fire spread model could provide sufficient data for detailed fire control planning. Based on Government of India guidelines, past experiences, Tamil Nadu Forest department carryout various fire preventive measures like fire line clearing, patrolling by fire watchers in sensitive and vulnerable beats, mock drill etc.

Forest Fire preparedness is the primary responsibility of every District/Divisional Forest Administration. DFOs shall prepare an inventory of resources critical for forest fire prevention and management and make relevant information available to all in the forest divisions. Resources and assets may include forest department resources such as watch towers, control rooms, check posts, fire lines, patrolling paths, forest roads, water holes and other department resources such as location of fire stations, fire tenders, hospitals and their contact numbers, National and State Disaster Response Forces that could assist in preparedness and planning for response to forest fires.

As per Spatio-temporal analysis of 2012-2016 SNPP-VIIRS forest data of the State, January - June is the fire season, the longest dry spellof the State. The preparedness for forest fire season especially works meant for fire protection shall be completed prior to the month of January i.e. before the start of the fire season every year (pre fire season).

5.1. PRE -FIRE SEASON GUIDELINES

The following guidelines is recommended to be followed during the pre-fire season in Tamil Nadu.

1. **Registration for Fire Alerts**

   District Forest Officers/Wildlife Wardens/Deputy Directors shall encourage and ensure the registration of all frontline staff to register with FSI's forest fire alert system by visiting FSI website. All staff upto the Forest guard shall be encouraged to use only the TN Forest Fire Alert and Report Management Dashboard (and the mobile application) to receive alerts in addition to the FSI sms alerts. This dashboard/ mobile

app has to be used to update the status of the fire and also to report the action taken – flash report and final report. Till the time, this dashboard/application is made operational, the usual mode of reporting through physical means shall be followed.

2. **State Forest Fire Control Centre (SFFCC)**

SFFCC shall be nodal office for national and State level coordination in the state of Tamil Nadu. The centre will be equipped with all relevant data/information, facilities, equipments to ensure that the fire related information is handled in a faster and continuous manner.

3. **District Forest Fire Control Centre (DFFCC)**

District Forest Fire Control Centre(DFFCC) is a nodal forest fire command and control centre located in the Division Headquarters. It is provided with basic facilities to serve as a war room during the forest fire season equipped with communication devices, firefighting equipments. It also serves as the base station for the firefighting crew in coordinating with local support agencies and also with SFFCC.

4. **District Fire Management Plan**

The District Fire Management Plan will be prepared at Division/District level by the concerned DFO. It is a comprehensive document comprising strategy for fire management, resources available, logistics, facilities & operations of District Forest Fire control room, base stations at high-risk areas, communication system, details of fire sensitive areas, formation of committees, assignment of roles and responsibilities at different levels, alerting health services, requirement of resources etc., in a comprehensive manner. Each district has to prepare a comprehensive fire management plan, which will be endorsed by the concerned Circle Conservator of Forests and shall be submitted to the State forest fire control centre(SFFCC) in Chennai.

Action plan for smaller units of Range and beat will be prepared wherein strategies and techniques for prevention and control will be givenin detail based on criteria given below:
- Fire sensitivity / fire vulnerability
- Previous year fire occurrences and present status

- Fuel load position in entire beat

- Fire exiting point in the beat taking current year position

- Sources of water (to be recorded separately for drinking and other purpose) available during fire season in each beat

- Inventory of equipments and other facilities such as hand tools, improved fire-resistant clothing and fire tenders, first aid kits, etc. available within the department and in neighboring government and non-government agencies, hospitals, etc.

- Strength of labour force in surrounding villages and villagers to be covered for awareness.

The action plan should also chalk out details of preparatory works tobe taken up such as extent and location of firelines to be traced, moistureretention work, etc. based on the above criteria.

5. Clearing of fire lines in the forests

Fire lines are gaps in a contiguous forest. They break the continuity of the forest floor with combustible material. These could be of natural origin like streams, rivers, lakes and ponds or man-made structures like roads, canals etc. In addition, fire lines are formed to break the contiguity of vegetation and availability of inflammable material on the forest floor. Fire lines are also used for patrolling and perambulation. In the state of Tamil Nadu February to May is the peak fire season. Fire lines are formed prior to start of fire season, that is during the winter season itself as per the prescriptions of the Management Plans/ Working Plans of the forests with the available fund resources.

Before Work

Latitude: 10.331893
Longitude: 77.415801
Elevation: 1937.55±13 m
Accuracy: 12.3 m

During work

Latitude: 10.331916
Longitude: 77.415703
Elevation: 1936.75±17 m
Accuracy: 8.2 m

Latitude: 10.331938
Longitude: 77.415775
Elevation: 1945.25±21 m
Accuracy: 9.7 m
Time: 27-01-2023 13:34

Figure 5.1 - Before and after Fire Line Clearing at Kodaikanal, Source:DFO

Figure 5.2 – Fire line works carried out at Palani, Source:DFO

6. **Strengthening Local surveillance**

Look out points should be selected on hill tops with a commanding view of the surrounding areas where temporary arrangements for stay is ensured. Necessary improvement and maintenance work to all watch towers and other fire detecting systems etc. including automated surveillance is to be ensured before the fire season to support the watchers.

7. **Wireless Communication**

Proper maintenance of walkie–talkies should be done. DFO shall ensure that field staff and patrol teams shall carry and use the wireless walkie talkie device so that when fire occurrence is noticed, it is informed to the base stations and passed on for quick response to the District Forest Fire Control Centre for immediate fire control action. In remote forest areas where mobile network is not well established, wireless network being the mainstay of communication special care should be taken to ensure fully functional wireless communication which may be strengthened if required.

8. **Rotational Burning/Controlled burning of forest floor litter**

Fire depending on where, when and why it occurs can be either an essential factor or otherwise, in the ecological cycle, it is a destructive unnatural threat. Rotational and controlled burning are the established silvicultural and forestry management practice. Conservator of Forests/District Forest Officer shall decide as per necessity to burn the forest litter to reduce the fuel load and fire risk. Any control burning operations planned to be carried out shall be informed to the State Forest Fire control Centre(SFFCC) in advance so that the concerned authorities are informed in case a fire alert is generated. The details of the area, time and date of control burning shall ne intimated to the SFFCC.

Depending on the fire return interval for each area controlled burning cycle should be fixed. The areas to be control burnt will be basedon vulnerability of the area as per studies made by GIS Cell as well as field staff. These areas must be inspected and approved by the District Forest Officer/Wildlife Warden/Deputy Director, latest by 15th November and the controlled burning must be completed by the end of December.No area should be taken for controlled burning after 31st December.

9. Awareness generation Programmes

Training / Workshop to frontline staff, meetings of Village / Block / District level Fire protection Committees, Distribution of publicity pamphlets had been taken up for awareness generation. At fringe villages, Village level and Block level and meetings are conducted to sensitize the people. Other methods used for awareness towards prevention and reporting of forest fires were pamphlets, hand bills, banners, fire-protection week, sensitization through local TV channels, use of multimedia, video film etc.

Figure 5.3 – Awareness programme through folk dance done at Theni, Source:DFO

Figure 5.4– Engagement of local villagers for fire management works along with front line forest staff

10. Local community participation

All the Panchayat (local bodies) / Village Forest Councils / Joint Forest Management Committees / Eco Development Committees / Self Help Group / Non-Government Organisations / Voluntary Organisations working in the area and youth groups are mobilized to control the forest fires in their respective areas. Workshop, rallies, meetings and distribution of extension/publicity material had been taken up for awareness generation by the Tamil Nadu Forest Department.

Engaging local community, creating awareness in forest fringe villages, training to seasonal fire watchers, engaging JFMCs in fire management for improved ground-based information on forest fire and such other activities will be taken up in each division. Trainings on first aid and rescue shall be organized.

Figure 5.5: Training on first aid and rescue done at Theni Source:DFO

11. Role of each personnel of Tamil Nadu Forest Department in case of fire, agencies other than forest department available and to be involved, role of each such outside agency/government department involved in fire prevention and firefighting should also be pre-determined and well defined. Mock drills will compulsorily be conducted especially in vulnerableareas.

12. Financial Planning

Most importantly, budget required should be worked out, sought for with full

justification and prioritized work taken up with available budget. As the fire season is spread over two financial years, adequate financial resources for the purpose of fire control shall be placed at the disposal of the concerned during both the last quarter of the current year and first quarter of the following year.

13. **Special strategy for Forest Fire Sensitive areas (Forest fire prone areas – FFPA)**

The beats showing high or very high sensitivity/vulnerability to forest fire need specific targeted protection approach. This should be reflected in each action plan which should also be annually updated based on new data.

14. **Review and Monitoring**

The Chief Conservator of Forests/ Conservator of Forests in each circle shall ensure availability of adequate funds, allotment of seasonal fire watchers, timely completion of works/schemes which are aimed at forest fire preparedness. Seasonal fire watchers may be allotted to each division atleast at the rate of one fire watcher per beat for highly vulnerable divisions. Additional allotment for fuel shall be ensured. The CCF/CF shall monitor every aspect of preparedness for fire control and ensure effective communication, enhanced management effectiveness, capacity building, training for field staff and stakeholders, community involvement, awareness generation and so on.

Additional Principal Chief Conservator of Forests (APCCF) P&V shall monitor availability of financial resources, manpower, transport facilities and fire-fighting equipment prior to the fire season. The officer will also ensure that necessary timelines for action against forest fires is followed.

15. **Other measures**
    I. Establishing coordination with line departments like Police, Fire & Rescue, Revenue, PWD, Health and local body.
    II. Engaging fire watchers on daily wage basis as per requirement
    III. Maintenance & mobilizing of rescue material and equipments,
    IV. Identification of Vehicles requirement for movement and transport of crew/ equipments.

16. Annual Plan of Operation for Forest Fire

The tentative calendar of activities shall be as follows:

Months	Activity
October	• Financial Resource allotment
November	• Procurement of firefighting equipments • Fireline clearing and other works • Training/Mock drill • Registering with FSI for fire alert • Inventory preparation & resource mapping
December	• Fireline clearing and other works • Training/Mock drill • Registering with FSI for fire alert
January to March	• Engaging seasonal fire watchers • Regular patrolling • Awareness creation
April	• Finanacial Resource allotment • Engaging seasonal fire watchers • Regular patrolling
May &June	• Engaging seasonal fire watchers • Regular patrolling

17. Strategy to combat forest fires

• Well established coordination between SFFCC in the office of the Principal Chief Conservator of Forests and the DFFCC at Divisions to ensure quick and continuous flow of information during forest fire season.

• Establishment of Rapid Response Team in each Range along with local volunteers and maintenance of 24X7 vigil during fire season.

• Deployment of fire fighters in the rapid response team and in the field.

• Equipment, machinery and vehicles for prevention and control of fire in each range of the division of the State.

• Deployment of forest fire watchers during fire season besides existing forest front line field staff (based on the available resources)

• Fire observation post/Watch towers to watch forest fire and on sighting the fire to inform and direct the RRT to the location for on-field action

• Seeking people support from forest fringe villagers

- All the Panchayat (local bodies) / Village Forest Councils / Joint Forest Management Committees / Eco Development Committees / Self Help Group / Non-Government Organisations / Voluntary Organisations working in the area and tribal, volunteers, youth groups are mobilized to control the forest fires in their respective areas.
- Availability of water in water holes, shoulder mounted pumps and tankers etc. to spray over fire.

5.2. ASSESSMENT OF FOREST FIRE PRONE AREAS

Forest fire risk zonation provides a scientific basis for identifying areas of priority for management interventions, allocating resources to priority areas, and monitoring the effectiveness of measures to reduce or control fire risk. These risk zones shall be reviewed and updated at least once every five years to respond to any changes in the above-mentioned factors.

Frequency of detected forest fires in an area over a period of time indicates proneness of the area to forest fires. Map showing forest area in different classes of fire proneness can be an effective management tool for controlling forest fires. Such map can be used for optimally utilizing scarce resources available for controlling forest fires in fire season. Increased vigil in highly fire prone forest areas may effectively prevent forest fires. Considering usefulness of mapping fire prone forest areas, analysis of the detected forest fire points has been done for Tamil Nadu. The basic data for the study is the record of accumulated forest fire points (FFP) which have been detected by FSI in the last 6 years since 2016. These FFPs may not be exactly the number of forest fire occurrences in the country as these FFPs include repeated detections due to continuance of forest fires at many places. The data of FFPs may not be uniform for all the years because threshold value of confidence for detecting forest fires and also forest fire season has not been kept same in all the past thirteen years. Never the less record of FFPs accumulated in the past six years is an unbiased data which is strongly correlated with fire proneness of an area.

Tamil Nadu Forest Department, with the facility available at the Geomatics Centre, has analyzed the MODIS/VIIRS fire data and mapped fire sensitive zones based on the FFPs from 2016-2022. The fire sensitive area has been identified at beat level based on fire data received from FSI and NRSC. The data was processed at the Geomatics Centre at the office of the Principal Chief Conservator of Forests, Chennai. The report is attached as **Appendix-I.** The previous spatio-Temporal analysis was done for the period 2006-2015

with the decadal MODIS/VIIRS data, based on forest fire incidents in each beat. The forest beats were classified into 5 fire sensitive classes for the whole State. During the decade 2006-2015, 8649 fire incidents were detected within geographical area of the State of Tamil Nadu. Of these, 3272 fire incidents were detected within the notified forests of the state.

During 2016-2022, about 11836 fire incidents within the forest area in Tamil Nadu was detected. At an average, about 1972 fire incidents per annum was detected during the assessment period 2016-2022. The total frequency of forest fire points in each beat has been determined by the summing the frequency of forest fire points observed in the respective beats which ranges from 1 to 113. The maximum frequency of fire occurrence has been 113 times over the period of 6 years (2016-2022) in Moolaiyar Reserved Forest in the Pannaikadu beat, Perumpallam Range in Kodaikanal Division and 112 times in Kukkal RF in Keelanavayal beat, Amaravathi range in Anamalai Tiger Reserve (Tiruppur). The minimum frequency is "1" in about 300 beats during this period. Average annual frequency of observed forest fire in each beat has been computed by dividing total frequency by number of years i.e. 6.

The average number of fire incidents was calculated by dividing the total number of fire incidents by 6 (number of years). Then the frequency class was divided into five classes adopting the same classification used in previous years. Based on the distribution of the frequency data (specific to the assessment period 2016-2022), the five different fire sensitive classes were identified as below,

Fire Sensitivity Class	Frequency Range
a. **Very High**	Average frequency of forest fire (12& Above)
b. **High**	Average frequency of forest fire (9 – 12)
c. **Moderate**	Average frequency of forest fire (6 – 9)
d. **Low**	Average frequency of forest fire (3-6)
e. **Very Low**	Average frequency of forest fire (0-3)

Table 5.1: Fire Sensitivity class (based on FFPs data 2016-2022)

5.3. Fire Sensitive beats in TN

During the assessment period 2016-2022, about 1239 reserved forests have recorded to have had fire incidents based on the FSI data. This includes both the SNPP and MODIS data points. Based on this, the fire sensitive beats are also identified, so that priority can be given to such beats for effective fire management. As beats are the smallest administrative unit in the forest administration, fire sensitive beats are identified to have focused approach. Here "Fire sensitivity " refers to the frequency of the fire incidents detected and reported by FSI.

The analysis shows that about 85 beats are fire sensitive. Among these, there are about 16 – very high fire sensitive beats, 14 – high fire sensitive beat and 55 – moderately fire sensitive beats.

The MODIS and VIIRS detected fire incidents, of 2016 to 2022, were overlaid on the forest map of the state to assess the frequency of fire occurrence at beat level. As per analysis, at least one fire incident had been detected in 355 reserved forests. Based on number of fire detections in the beats the sensitivity is classified into five classes' viz. Very Low, Low, Moderate, High and Very High. The range of the class may vary with number of years and the data range. The number of beats in different fire sensitive class is as follows:

S. No	Forest Fire Sensitivity Class	Fire frequency based on 2016 - 2022 forest fire alert data	No of Beats where fire incidents were detected
1	Very Low	0 - 3	1040
2	Low	3 - 6	114
3	Moderate	6 - 9	55
4	High	9 - 12	14
5	Very High	12& Above	16
			1239

Table 5.2: Distribution of beats across the 5 Fire Sensitivity classes (FFPs data 2016-2022)

The list of the 30 – very high and highly fire sensitive beats and 55 – moderately fire sensitive beats is available in Appendix I. The distribution of these fire sensitive beats was done with respect to circles and divisions, accordingly it can inferred from Chart 5.3 that

Vellore has maximum number of fire sensitive beats, followed by KMTR, Dharmapuri, Dindugal and SMTR. In terms of very high fire sensitive beats, ATR & Dindugal has 4 beats in each circle respectively, followed by KMTR.
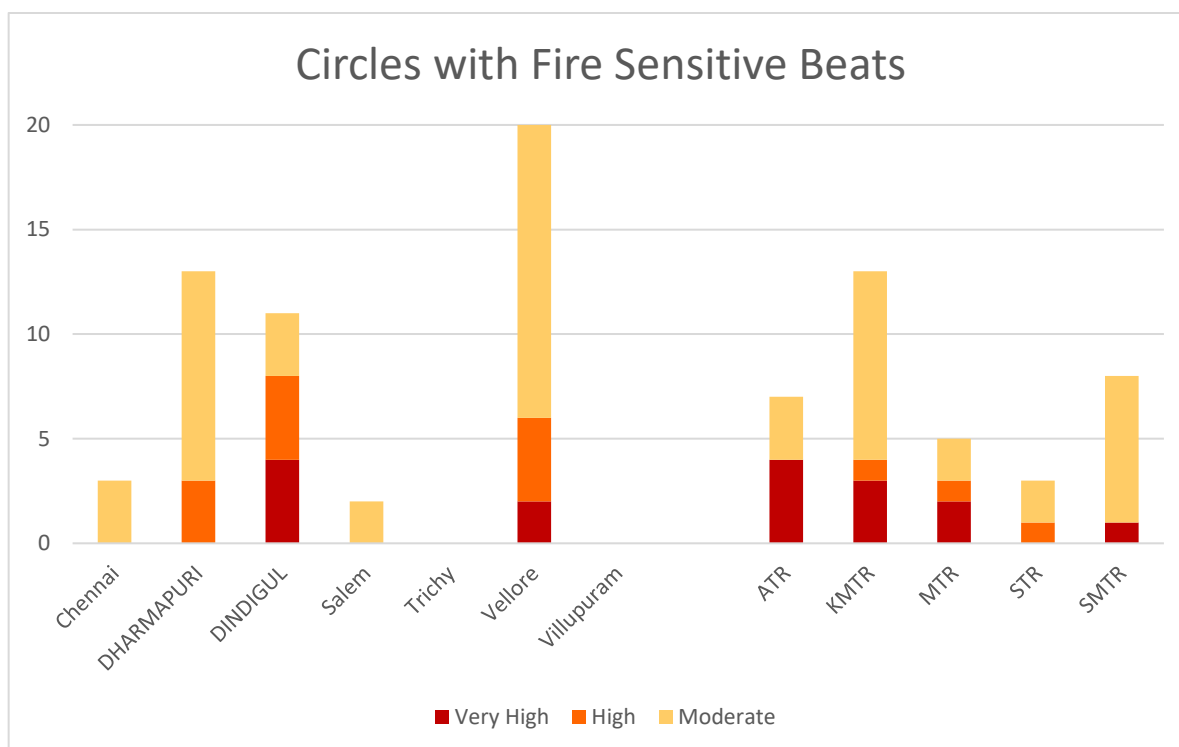
Chart 5.3: Circle wise number of Very High and High fire Sensitive beats (FFP data 2016 – 2022)

Extending the analysis further to the Division level, table 5.3 shows the distribution of fire sensitive beats across various divisions. Chart 5.4 shows the divisions with greater number of forest fire sensitive beats.

- Hosur,
- Vellore,
- Kaniyakumari,
- Kodaikanal,
- Theni,
- ATR Udumalaipettai,
- Tirupattur,
- Tiruvnelveli,
- Thiruvallur,
- Dindugal,
- MTR Masinagudi and STR Hassanur

Table 5.3: Divisions with greater number of Forest fire sensitive beats (2016-2022)

S.No	Division	Fire Sensitivity Class (based on 2016-2022 Fire incidents)			
		No. of Very High Fire Sensitive Beats	No. of High Fire Sensitive Beats	No. of Moderate Fire Sensitive Beats	Total
1	Hosur		3	10	13
2	Vellore	2	2	9	13
3	Kaniyakumari	3	1	5	9
4	Kodaikanal	3	3	2	8
5	Theni	1		7	8
6	ATR Udumalaipettai	4	0	3	7
7	Tirupttur		2	4	6
8	Tirunelveli			4	4
9	Thiruvallur			3	3
10	Dindigul	1	1	1	3
11	MTR Masanagudi		1	2	3
12	STR Hassanur		1	2	3
13	Salem			2	2
14	Tiruvannamalai			1	1
15	MTR Mudhumalai	1			1
16	Nilgiris South	1			1
	Total	**16**	**14**	**55**	**85**
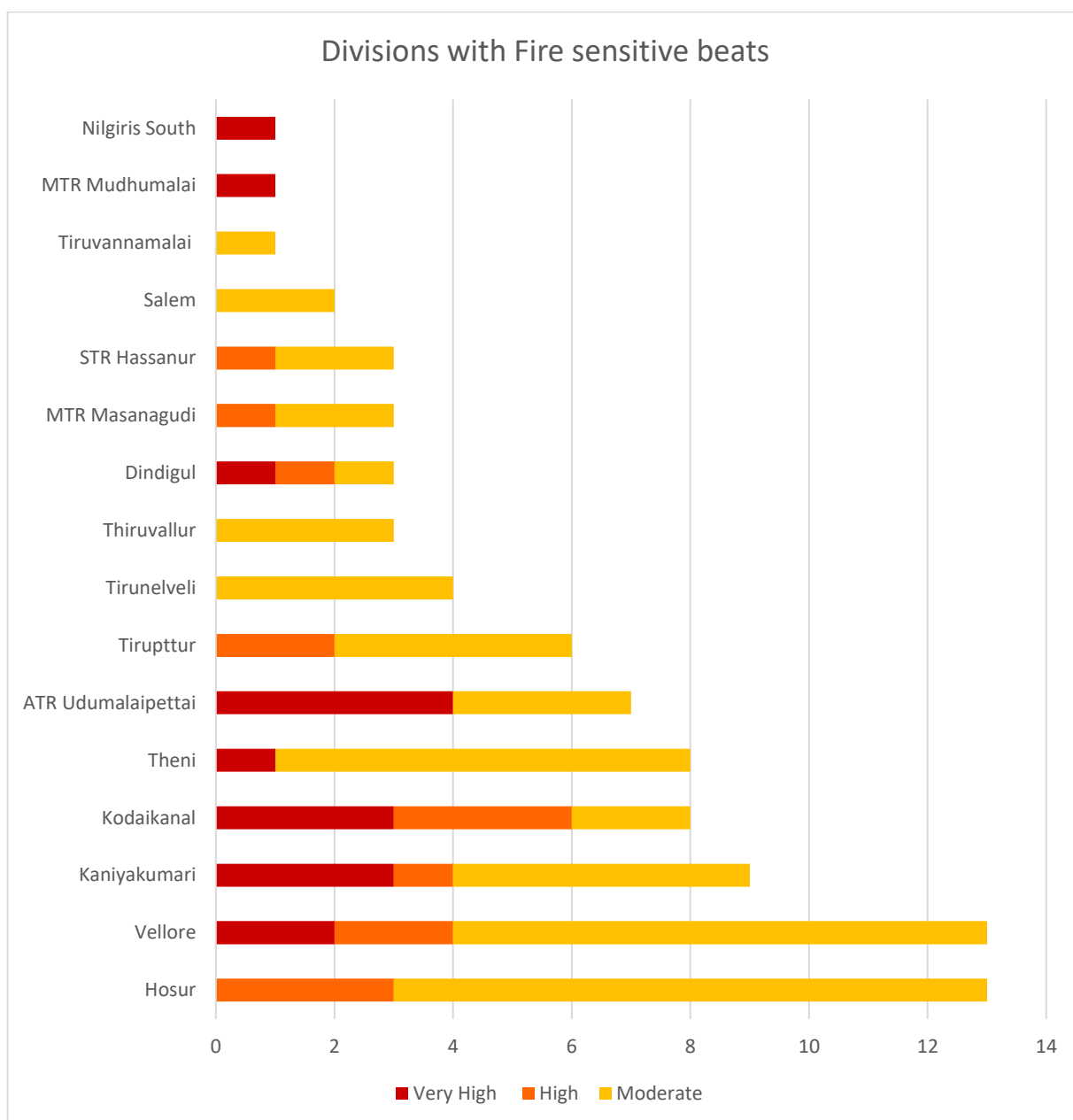
Chart 5.4: Division with more forest fire sensitive beats (FFP data 2016 – 2022)

5.4. FIRE SENSITIVE CIRCLES AND DIVISIONS IN TN

From the total number of fire incidents reported by FSI between 2016 to 2022(fire seasons) through SNPP-VIIRS and MODIS is used for this analysis which is done at Circle and Division level. The average annual fire incidents is calculated by dividing the total fire incidents during the assessment period. Based on the range of the data between minimum and maximum value, the fire sensitivity class is determined. The details of the classification are provided in Table 5.4. From the data it can be clearly inferred that about 60.5% of fire incidents in the state of Tamil Nadu is reported from only 8 divisions which

are – Hosur, Vellore, Kodaikanal, Theni, Kaniyakumari, Tirupattur, Tiruvannamalai and ATR Udumalaipettai. The Divisions that fall under the category of High and Moderately fire sensitive class reports about 32% of state's fire incidents. Therefore, special focus in terms of resource allocation and close monitoring is required for these 22 divisions.

Amongst the Circles, Vellore reports maximum number of fire incidents in a year followed by Dharmapuri, SMTR, KMTR and Dindugal. In the 5 tiger reserve units, SMTR & KMTR are highly sensitive to forest fires. The other three tiger reserves also demands attention because their average annual fire incidents is above 100 within their respective jurisdiction.

S.No	Fire Sensitivity Class	Number of average annual fire incidents	No of Divisions (based on 2016-2022)	% of Fire incidents detected
1	Very high	>100	8	60.48
2	High	>50 <100	6	16.77
3	Moderate	>25 <50	8	15.40
4	Low	>10 <25	6	4.55
5	Very low	<10	20	2.81

Table 5.4: Fire Sensitive class for Divisions and Circles (2016-2022)

Circle wise data on average annual fire incidents (2016 - 2022)

Circle	Value
Villupuram	16
Trichy	16
Chennai	54
Salem	71
STR	118
MTR	137
ATR	158
DINDIGUL	216
KMTR	217
SMTR	258
DHARMAPURI	274
Vellore	438
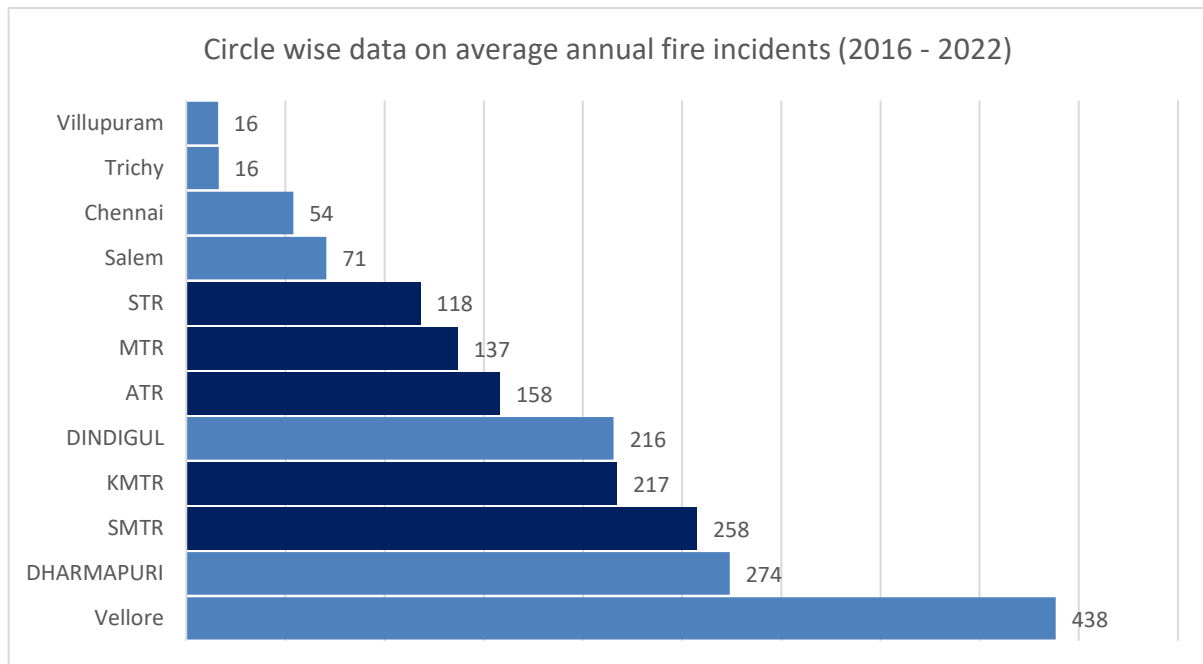
Chart 5.5: Circle wise data on average annual fire incidents detected by FSI (2016-2022)
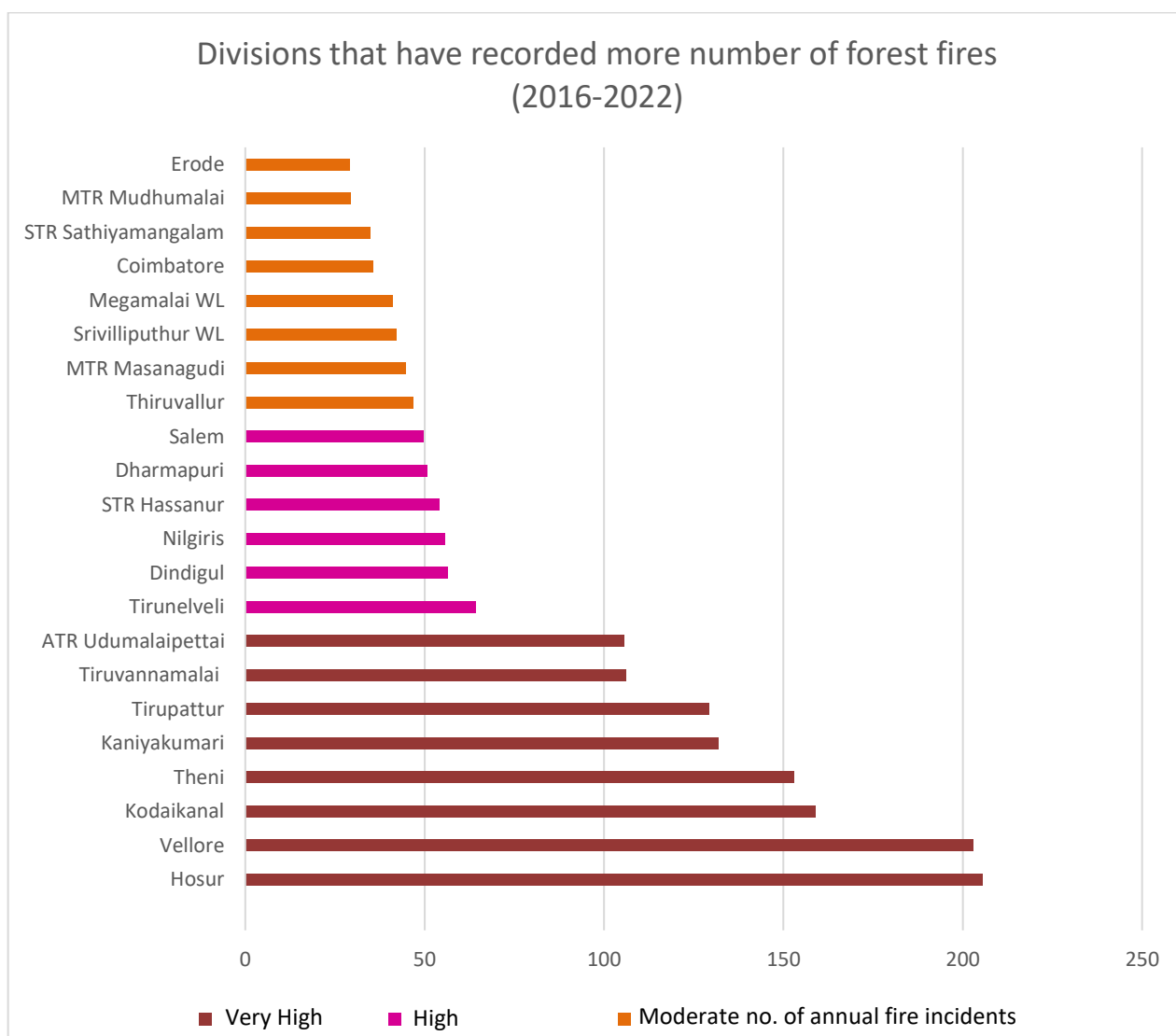
Chart 5.6: Division wise data on average annual fire incidents detected by FSI (2016-2022)

5.5. GUIDELINES FOR FIRE MANAGEMENT IN VULNERABLE AREAS

Increasing the resilience of forests to fires Management interventions for increasing resilience to forest fires may be planned according to the vulnerability to forest fires. Preparedness in forest fire management leads to effective response to fire disasters resulting in reduced impact and quicker recovery. The following steps shall be adopted during the pre-fire season in the forest fire sensitive areas,

a. Moisture and water conservation

As fire hazard is more in drier and deciduous habitats and areas with predominance of grasses, management action would need to aim at moisture retention for longer time after rains and appropriate preventive measures to ensure that minor fire incidences do not escalate into major fire events. A long-term plan for improving the water regime of

the forest areas based on opportunities and feasibility will be useful in reducing vulnerability to fires. Several existing programs for eco-rehabilitation and catchment area treatment plans provide scope for this kind of work.

b. Promoting greater adoption of the Forest Fire Alert System

DFO shall encourage the involvement of all field functionaries in the same, so that the forest fire alert system can percolate down to beat level in least possible time.

c. Improving Ground based Detection

Even with the advances in new remote sensing technologies for fire detection, ground-based detection should continue to be essential and should be sufficiently resourced. The DFO shall perform an assessment of the efficacy of the existing network of watchtowers by a review of the level of functionality and operational use of the existing towers. New watch towers may be proposed in new locations that are vital for fire watchtowers based on coverage, visibility, ignition sources, and other relevant factors.

d. Strengthening engagement with local communities

Local communities are often the first to spot fires and alert the forest department. Locally suitable mechanisms should be identified by the DFOs for sourcing reliable and quick information from local communities.

e. Dedicated phone line

A toll-free telephone number for fire detections and other required support needs to be established at District level to obtain information on forest fires from tourists, passersby and local people. This telephone facility to be manned 24X7 during the forest fire season at the District Forest Fire control Centre. All the call details received on this telephone line shall be recorded with detail of the informer, contact number and location.

f. Wireless network

As mobile telephone network is not well developed In most remote forest areas, the frontline staff shall be supplemented by a dedicated wireless network.

g. Digitize the location of critical resources and assets

District Forest Fire control centre shall conduct inventory mapping of critical resources for forest fire prevention and management and make relevant information available to the range offices. Resources and assets to be inventoried may include forest department resources, such as watchtowers, ground crew stations, controls rooms and fire lines as well as non-department resources, such as the locations of fire stations, fire tenderers and National and State Disaster Response Forces, and army and paramilitary camps. They may also include important infrastructure such as roads, railways, and telecommunications networks and natural resources such as water bodies and natural fire breaks that could assist in preparedness and planning for response to forest fires.

h. Forest Fire Lines

State Forest Fire Control Centre may undertake the mapping and digitizing of the location of existing fire lines and other infrastructure such as roads, transmission lines, and rail lines that may function as fire breaks for all the sensitive divisions.

- A review of the maintenance status, functionality, and adequacy of these fire lines, and an assessment of the need for new fire lines, may be undertaken considering past fire data, forest types, habitations, and other relevant factors.
- Proposals for new fire lines should be made on a scientific basis considering their potential efficacy in reducing fire risk and their proximity to people, property, and areas of special concern (e.g., protected areas).
- Plantations should not be raised on existing or proposed fire lines.

i. Control Burning

Control burning may be necessary in some places for preventing spread of fire. Prioritization of areas for control burning as part of the fire risk zonation analysis and development of site-specific guidelines for control and prescribed burns to be developed

and revised as may be necessary.

Apart from the previous year forest fire occurrence data, there are other local parameters that can also contribute to the forest fire risk. The following factors, among other locally relevant, may be considered for identifying and quantifying fire risks:

i.   **Fuels**, including forest cover and type as a broad indicator of fuel type. Optionally, states may perform field-based studies to measure fuel load and type;

ii.   Proximity to infrastructure, property, and other assets, including roads, habitations and other buildings, agricultural lands, transmission lines, and railways;

iii.   Topography, including slope, aspect, elevation, terrain ruggedness and other characteristics;

iv.   Social indicators, including local dependence on forests for livelihoods, poverty, and traditional land use practices;

v.   Historic fire occurrence and patterns may be used to identify areas that are most prone to fires.

vi.   Areas of special ecological or cultural importance, including protected areas, historic sites, designated heritage sites, temples, pilgrimage routes, etc.; and

vii.   Special ecological conditions, for example, bamboo flowering, may be considered and provided weights.

Figure 5.7: Control burning carried out under the monitoring of forest officers

Need to identify the fire risk zones at Division level

The results of the forest fire risk zonation shall be translated into concrete management actions under the District Fire Management plan. The Working Plan Officers (DFOs in the case of Plans already in operation) shall identify activities or interventions to mitigate fire risks or reduce impact of the fire hazards in high-risk areas. These may include creation of additional fire lines, watch towers and other infrastructure in vulnerable areas. The same shall be examined speedily by the appropriate authorities for approval and making provisions for financing the approved activities. The Annual Plan of Operations for all forest divisions and circles, and protected areas, shall include the approved activities and interventions mentioned above. The state planning and finance departments shall prioritize resource allocation for forest fire management.

5.6. EARLY WARNING ALERTS FOR FOREST FIRE

Forest fires are difficult to predict in advance, as almost all fires are caused by people in our country, unlike the case in many Western countries for example Canada where only 60% of forest fires are manmade and the rest are caused by natural factors. Forest fires can thrive only when sufficient fuel is available and weather conditions are suitable for its initiation and spread. Accordingly, countries such as USA, Australia and Canada have Fire Danger Rating Systems (FDRS) in place to provide accurate advance warning of fires to foresters and communities based on current weather and fuel information. The experience of countries such as Indonesia, Croatia, indicate that straightaway adoption of FDR from another country without customization to local conditions can lead to failures.

Therefore, Forest Survey of India, with years of experience with the repository of fire related data, developed in 2016, an indigenous "Early Warning Alert System for Forest Fire". The alerts to State Forest departments are based on parameters like Forest Cover, Forest Type, Climatic Variables (Temperature and Rainfall) and recent fire incidences over the area. The GIS layers of these parameters are overlaid and intersect areas above threshold values are chosen and communicated as pre warning forest fire alerts in the form of KML files through email to the nodal officer of the State Forest Departments. These alerts which are generated based on short term weather variables, are valid for the ensuing week. This process was further refined in 2017 wherein, small areas which are vulnerable to fires were also alerted.

In the year 2017, the analysis was shifted to a grid-based system (5km x 5km) allowing parameters to be quantified and represented within these grids. Certain additional parameters were also included to make the "Early Warning Alert System for Forest Fire" more robust. The parameters currently used in the Pre-Warning System are as follows:

1.Forest Cover Density Classes

2.Forest Type Groups

3.Daily Relative Humidity

4.Daily Maximum Temperature

5.Rainfall (Both of recent past and forecast)

6.Fire Alert database (2004 to 2016)

Forest cover density and Forest Type indirectly denote availability and type of fuel load respectively. Daily Maximum Temperature and corresponding Relative Humidity from Meteorological and Oceanographic Satellite Data Archival Centre (MOSDAC) was used to denote the moisture content of fuel and prevalent drought conditions over the area. Rainfall data of the previous 7 days obtained from Customized Rainfall Information System (CRIS) of India Meteorological Department (IMD) and Short term Rainfall forecast from Indian Institute of Tropical Meteorology (IITM), Pune was used to mask out areas receiving adequate rainfall so that such grids are not alerted.

The TN State Forest Fire Control Centre at Chennai, shall take up similar initiative in collaboration with FSI and technical guidance from other nationalized institutions, to develop a early warning forest fire detection for the state at the beat level. This will help the local forest administration to initiate appropriate action in advance to reduce the intensity of the fire and also helps to increase the level of preparedness.

6. DURING FIRE - FOREST FIRE ALERT & FIRE CONTROL GUIDELINES

Detection of forest fire is one of the most important factors for earlycontrol since it is very difficult to control forest fires from spreading unlessdetection and firefighting starts early. Conventional methods of detection involve construction of watch towers at vantage points, communication through network of wireless sets, engaging fire watchers. Sometimes, due to the remoteness of the tract, forest fires, may remain undetected for a day or two during which time they spread to an uncontrollable extent. Thus, adequate measures have to be taken for the early detection of outbreak of forest fire. Sometimes due to lack of coordination, non-availability of man power or communication system, large areas get affected by fire. This issue should be methodically addressed.
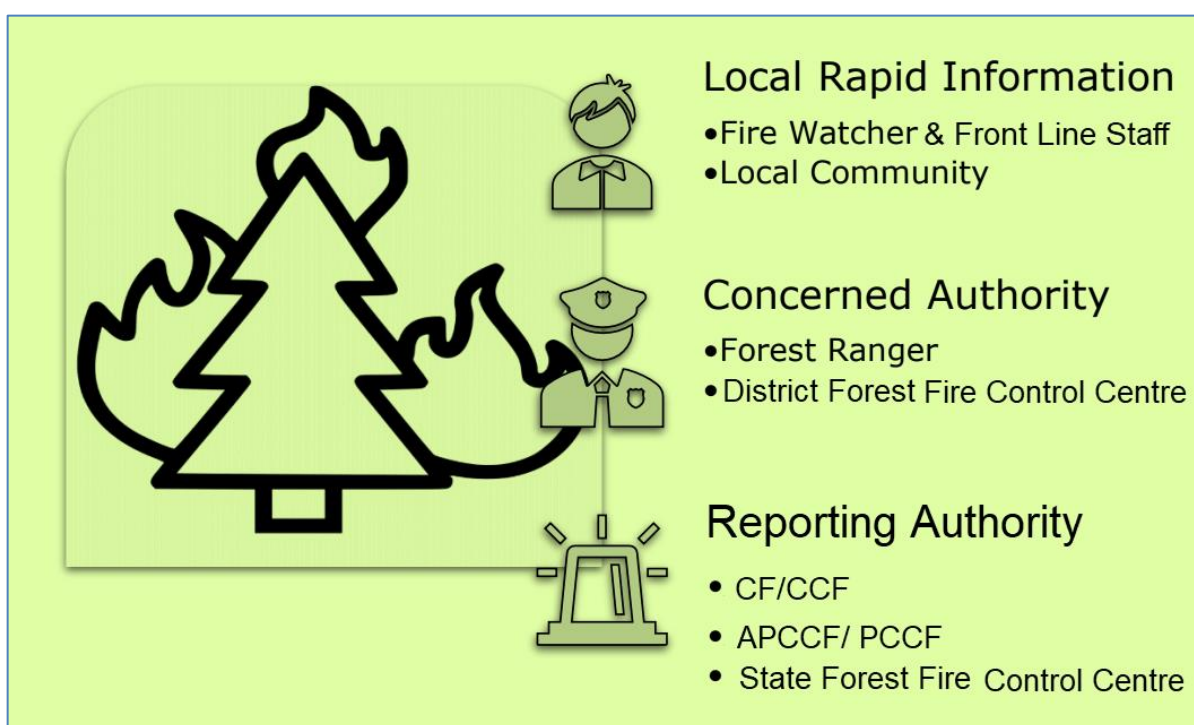
6.1. GUIDELINES FOR FIRE SUPPRESSION

Immediate response to forest fires after receipt of information is of utmost importance. DFOs must develop a culture of emergent response to fire alerts under which all available resources are used to douse the fire. This needs intense training at all levels, strengthening of infrastructure, and coordination with other relevant agencies.

I.   **Training for field staff, firewatchers, and community firefighters**

The principal need for forest fire suppression is to have adequate competent, trained, and equipped workforce on the ground, ready to respond and take immediate action. Training should be provided to field officers, seasonal firewatchers, and community volunteers involved in firefighting. All these firefighters should understand basic principles of forest fire management for using the most effective suppression technique at their disposal and know when retreat is necessary. The type of training provided to firefighters should be tailored according to the landscape, nature of terrain, their level of responsibility and role in the command structure in responding to fires.

I.   A modern and standardized training curriculum should be developed by TNFD. Other agencies involved in fire response, including National Disaster Management Authority (NDMA), NDRF, and the State Disaster Management Authorities may be involved in a consultative role.

II.   Mock drills should be organized before fire season at various fire prone areas involving all the stakeholders such as District Administration, Police, Fire Department, NDRF, SDRF personnel, community organizations etc. for identification of gaps in the existing mechanism and better preparedness during crisis time.

Figure 6.1 – Mock drill conducted at Kodaikanal, Source: DFO Kodaikanal

III.   Provision of training, equipment, and coordination should extend beyond government departments and staff to community institutions in those

divisions which are identified as Fire sensitive Divisions

II. Equipping the firefighters

I. The firefighting squad including field staff, seasonal firewatchers, and community firefighters should be provided with adequate firefighting equipment including leaf litter blowers, and protective clothing (List of fire equipments with technical specifications is available in Appendix)

II. There should be sufficient practice sessions for the firefighting personnel in the use of the firefighting equipments including leaf litter blowers, and protective clothing so as to enhance their efficiency in actual firefighting.

III. All such equipments should be well maintained and should be tested well in the pre-fire season. DFOs have to ensure this equipment testing activity.

III. Development of adequate infrastructure for fire suppression

I. An effective communication network should be ensured in all fire prone forest areas using wireless where necessary.

II. DFOs to ensure prompt access to field vehicles from nearby forest divisions for movement of firefighting personnel to the fire spots at the earliest.

III. Advance technologies such as use of drones shall be explored in identification of exact location of fire points, to assess the intensity & direction of fire to facilitate fire extinguishment at the earliest.

IV. Forest road network should be properly maintained for quick movement of firefighting forces to the fire site.

IV. Arrangements for adequate manpower in fire prone areas

I. The vacancies at the fire sensitive beats should be filled immediately whenever any such vacancy arises, especially at the level of frontline forest officials in the fire prone areas on priority basis.

II. Trained manpower may also be mobilized from other agencies such as Police, District Fire services, NDRF, SDRF etc.

III. The Communities living near the fire prone areas should also be sensitized and may be incentivized towards fire suppression activities.

IV.   There should be a mechanism for mobilization of forest fire fighting volunteers and providing them with adequate training. The District Forest Fire Control centre should ensure that all of these guidelines are adhered in a time bound manner. A database of the firefighting volunteers should be maintained by the District Forest Fire Control Centre.

V.   **Quick response to the Fire information**

I.   Apart from the FSI fire alerts which is received through sms or mail, the Division officer shall ensure that all staff have access to the TNFD Forest Fire Alert & Report Management system which has to the only platform used to communicate the status of forest fires.

II.   Detection of forest fire incidents shall also be through information gathered from local sources, patrolling teams on watch towers, district forest toll free service, FSI / MODIS based satellite data and other sources.

VI.   **Managing forest fire at the site**

I.   The information related to fire, fire-fighting team (Crew / Mobile) team moves to the reported area of fire incidence, seeks assistance of local villagers, if available and required. These teams try to extinguish the fire with help of tools, equipment and locally available resources. (Appendix)

II.   Counter fire, if required shall be considered.

III.   Beating the ground fire by brushwood and removal or clearing of forest hazard fuel load and dry fallen leaves.

VII.   **Mechanism to combat forest fires in large scale fires/emergencies (Crisis Management)**

In case of large-scale fires/emergencies, highest degrees of coordination amongst various agencies of the Government (eg. Forest Department, District Administration, Police, Fire Brigade, Public Works Department, Health etc.)and local groups/institutions is ensured. Help of State Disaster Management Authority, Para-Military Forces, National Disaster Rescue Force, State Disaster Rescue Force, Eco-Task Force, Army, Police and Administration will be sought.

In the case forest fires spread outside forests, mechanism to be adopted shall include –

❖ Warning to the public and community near the fire spread area.

❖ Caution zone will be declared in and around human habitation (in coordination with District administration if necessary)

❖ Additional man power shall be be deployed to control the fire (DFFCC shall be responsible for this, in consultation with CCF/CF/DFO

❖ Organizing the community into groups and supply equipment to combat fire.

❖ If necessary, evacuation of public to a safe zone

❖ Adequate efforts will be made to protect public, human life & livestock, their property

❖ Top priority for safeguarding human life, livestock

VIII. **Engaging local community**

All the Local bodies / Village Forest Councils / Joint Forest Management Committees/ Eco Development Committees/ Self Help Group / Non-Governmental Organisations/ Voluntary Organizations working in the area and youth groups, volunteers, tribal and Forest dwellers residing in the vicinity of forest areas, shall be encouraged to help the department in dousing the fire. Prescribed safety measures for personnel life have to be followed. Adequate drinking water and first aid kit has to be available.

IX. **Involving other departments**

• Fire & Rescue Department - for fire extinguishing operation

• Police - to maintain law & order, rescue works

• Panchayats - in providing logistics as and when required.

• Revenue - for evacuation, logistics to public rescue crew, regarding prevention of forest fire, preparation of strategies, its execution & proper monitoring.

• Medical Service/Hospitals - for emergency medical facility, ambulance service in case of any emergency.

Latitude: 9.274683
Longitude: 77.339661
Elevation: 614.65±3 m
Accuracy: 3.0 m
Time: 05-28-2022 12:01
Note: naranapuram beat fire

Figure: 6.2: fire extinguishing carried out by forest staff in assistance with villagers at various fire sites in Tamil Nadu

7. INFRASTRUCTURE & CRISIS MANAGEMENT

Tamil Nadu Forest Department has established State level Forest fire control centre for fast flow of information and coordination of activities during the forest fire incidents

Location: Office of the Principal Chief Conservator of Forests (HOFF), Chennai

Address: Office of the Principal Chief Conservator of Forests (HoFF), Forest Headquarters building, Guindy, Velachery main road, Chennai 32

Toll free number - 18004254409

State Forest Fire Control Centre and the District control centres are expected to provide adequate support for the forest fire management at three different levels viz.

1. Pre fire (preparatory planning for fire control),
2. during fire (Fire detection, spread and control planning) and
3. Post fire (mitigation, Damage assessment and planning).

The State Forest Fire Control Centre will receive the near real time fire information from FSI/NRSC/MODIS/NASA/VIIRS/SNPP, integrate the data with State Forest Administration GIS database and communicate to the respective Divisions over Email/Fax/Phone for on-field fire control measures. Each Forest Division is provided with Forest Fire Risk/Sensitivity beats details to prioritize fire prevention, monitoring and planning mitigation measures.

7.1. STATE LEVEL CENTRAL CONTROL ROOM

Tamil Nadu Forest Department is presently upgrading and establishing a "State Forest Fire Control Centre" (SFFCC) for fast flow of information and coordination of activities during the crisis of fire. The objective of Tamil Nadu Forest Fire State Control Centre is to function as a command centre for the district forest fire control centre and shall coordinate with the nationalized organisations/institutions and the state authorities on the subject of forest fire. SFFCCs is operated by the IT wing in close coordination with Protection and Vigilance wing which takes care of the fire management activities at the State level.

Duties of SFFCC

The duties to be performed by the Tamil Nadu Forest Fire State Control Centre (SFFCC)are,

1. The centre will receive the real time fire information from FSI/NRSC/MODIS/NASA/VIIRS/SNPP,

2. Integrate the data with State Forest Administration GIS database and communicate to the respective District Forest Fire Control centre.

3. To get regular updates from all the Forest Division on the status of the forest fire and also to gather details to prioritize fire prevention, monitoring and planning mitigation measures.

4. To render guidance regarding the fire location

5. To coordinate between nationalised institutions, state authorities and district centres

6. To keep Nodal Officers updated about the fire and action being taken

7. To render assistance in carrying out the burnt area assessment

8. To carry out data analytics on the forest fire, prepare vulnerability reports, identify sensitive beats.

9. To adopt latest ICT technologies for effective forest fire management

10. To act as communication and command centre for forest fire management

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┌──────────┐   ┌──────────┐   ┌──────────┐   ┌──────────────┐
│  MOEFCC  │   │   NRSC   │   │   FSI    │   │ State Disaster│
│          │   │          │   │          │   │  Management   │
│          │   │          │   │          │   │   Authority   │
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     └──────────┤   TN Forest Fire     ├────────────┘
                │   State Control       │
                │     Centre            │
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                   │ District Forest │
                   │ Fire            │
                   │ Control Centres │
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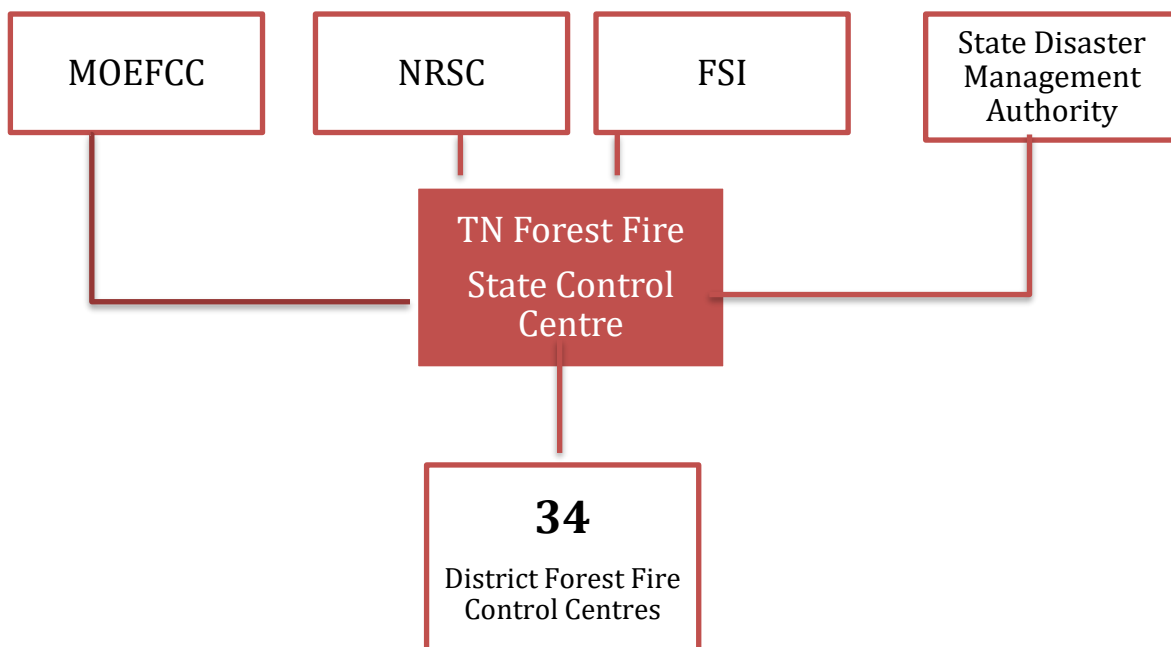
Functioning of State Forest Fire Control Centre – Roles & Responsibilities

1. **Forest Fire Alert System - Real Time Fire information from FSI/NRSC**:

Fire Alerts received from FSI and NRSC will be immediately viewed at the centre. Though the forest staff and officers have registered for the fire alerts in the FSI portal, this centre will be intimated of the all the alerts through the Real Time Fire Monitoring dashboard which has been developed by the IT wing of TNFD. Presently the alerts are generated four times in a day based on the satellite passing and the fire alerts are received as sms on the registered mobile. Sometimes, there are chances for the field personnel to miss these alert messages, but the centre will immediately respond to the alert through the 24 hours manned personnel (during forest fire season) and the respective district and field officers will be alerted which will ensure the immediate response to the forest fire.

2. Forest Fire Response Tracking, Reporting and Data Analysis

The centre will be using the Real Time Forest Fire Alert and Report Management Dashboard for tracking the status of each forest fire case that is reported. The status will be followed up as and when the concerned district officer updates the status from the field. Daily reports will also be generated with the updated status. This will help to assess and arrange for required support to the concerned District Forest team to douse the forest fire at the earliest possible. When the final report is generated, the respective forest fire comes to an end, after which the district forest team has to provide the burnt area assessment details. Necessary technical support will be provided in terms of geo-spatial technology assistance to the district forest team. The staff availability at this centre shall be - one Forest Range Officer, two foresters, one GIS expert and two technical assistants. These works will be carried out under the guidance of APCCF IT and DCF GIS.

Regular updation of database from the field such as extent and distribution of the fire affected areas, the total area burnt, type of damage, etc. which is useful for forest managers for mitigation planning shall be carried out. Fire mapping with fire reports compilation is thus an important activity after fire. The centre will have dedicated forest personnel to work on the fire data, carry out data analysis, assess vulnerabilities, burnt area, predictive index for forest fire etc.,

3. Dedicated Toll-Free Number for Forest Fire Reporting

Presently a toll-free number is operated for the people to report the forest fire and the number is 18004254409. The toll-free number shall be manned by two staff on regular duty during fire season. The information received on the call will be quickly communicated to the field staffs and the truth of the information will be assessed. All the call information along with the name, contact number of the caller and the location of the caller will be recorded. The fire will be tracked from that point and the status will be updated in the Real time forest fire dashboard. Two channels to communicate information with forest officers on field and other parts of the State will be available at the SFFCC

In case the fire is detected when fire watcher/patrol teams or other informers detect forest fires at field, they can reach out to the SFFCC to spread this information to the local response team. The SFFCC will maintain a record with the details of the name, address and contact number of the local response team for each range and division. SFFCC will trigger alert messages to all the local response team in case of any fire alert or case reported through the District Control centre. SFFCC will also help the local team get further assistance and mobilise resources based on their request.

4. Coordination with Nationalised Institutions and State Authorities

There is a continuous flow of information from MOEFCC, FSI and NRSC related to forest fire. SFFCC will be the nodal centre of the state to coordinate on the forest fire alert with the national level organisations and institutions. It will engage in works to collect the satellite images, carrying out assessments, collating forest fire data, developing guidelines, generating annual state forest fire reports based on the district reports. The centre will develop its expertise in using latest ICT tools and geo-spatial technologies for the effective forest fire management. SFFCC will also work along with the State Disaster Management Authority in the matters of forest fire.

SFFCC will work closely with FSI with respect to the Pre-warning Alert system developed by FSI which is generated based on short term weather variables, is valid for 1 week and communicated to the District FFCC. It will in turn ensure intensification of patrolling and monitoring for fire sensitive beats indicated by the pre-alert for the week.

5. Forest Fire – Centre of Excellence

SFFCC shall be the repository of information on forest fires which also includes display of forest firefighting equipment and rescue kits to sensitize the front-line forest staff. It will gather all relevant information on the forest fire and will develop expertise on forest fire management. SFFCC will work towards becoming a centre of excellence for Forest fire.

7.2. DISTRICT FOREST FIRE CONTROL CENTRE

District Forest Fire control Centre (DFFCC) is established for fast flow of information and co-ordination of activities during forest fire season at the district forest headquarters in the state. The objective of District Forest Fire State Control Centre is to function as a command centre to coordinate with the field staff during the forest fire events and also act as local unit in collating data on fire occurrences, updating fire data and to coordinate the activities under the guidance of TN forest fire State control centre.

Duties of DFFCC

The following are identified as the duties of the District Forest Fire Control centre,

1. To act as nodal centre of the division/district in handling forest fires.
2. To respond to the fire alters and sending quick communication to field staff and fire volunteers to address the fire.
3. To coordinate with the local staff and rendering support to arrange for additional support while fighting the fire
4. To update the status of forest fire in the TN Real time Forest fire Dashboard
5. To be equipped with adequate firefighting and recue kits to support the field staff during crisis.
6. To generate reports with respect to forest fire and to carry out burnt areas assessments after the fire occurrence.

Functioning of DFFCC – Roles & Responsibilities

1. Response to Fire Alerts

The DFFCC will immediately respond to the fire alerts received either from FSI or SFFCC. The centre shall ensure that all the field staff and local volunteers are registered for fire alerts in the FSI portal. On receiving any information on a fire incident, quick

communication shall be sent to the concerned field staff and the local fire volunteers. The DFFCC shall compile and display the contact information of all the field staff, volunteers, district fire officers, senior forest officers and the disaster management teams. The centre will ensure that the forest field staff have reached the location of the fire and shall get continuous updates from the field.

There shall be a dedicated district level toll free number or contact number for the public to report the fire incidences. The information received shall be compiled along with the caller details like name, phone number, location, time of call etc., During the Forest fire season- the centre should be operating 24 X 7 to ensure quick and immediate response to the alerts.

2. **Action on Fire**

A Rapid Response Team (RRT) shall be formed for each Division at the range level who will respond to all information pertaining to fire and galvanize into action for fire control without delay. The concerned Range officer shall be the nodal point of contact to coordinate the field operations under the guidance of DFO/DD. The FRO shall also update the status of action to the DFFCC. Personnel at the DFFCC shall ensure that the real time status updation in the Forest Fire Alert and Report Management Dashboard.

3. **Support to Local Forest staff**

The DFFCC shall arrange for local support to the firefighting team by means of available firefighting equipments, rescue kits or human assistance by pooling staff from adjacent ranges and divisions, volunteers, district fire rescue team etc.,

4. **Tracking response & real time updation in the dashboard**

DFFCC shall ensure that the Forest fire Alert and Report Management dashboard is updated on real time basis with required information like location details, photos, personnel attending to the fire etc, The DFFCC shall engage in constant updation of the dashboard, generating reports and assisting the local forest staff in calculating the burnt area after the fire is doused.

5. **Coordination with SFFCC**

The DFFCC being the district nodal centre for forest fire shall be in constant touch with the TN Forest Fire state Control centre to get timely inputs from the state centre and to have effective coordination.

The following facilities are identified as preliminary requisites for the DFFCCs,

1. **IT infrastructure**

   In order to carry out the above-mentioned functions, the required IT infrastructure includes,

   a. One dedicated Workstation with the advanced configuration to operate the dashboards and GIS software.

   b. Software – Access to Real Time Forest fire Dashboard, Toll free number dashboard, ArcGIS (desktop version), Google Earth Engine Pro, Anti-virus and Internet security software, Software for documentation and reporting.

2. **Duties of Nodal officer for DFFCC**

   a. The District Forest Officer shall be the District Nodal Officer for the respective district to deal with the crisis of forest fires in the district and shall coordinate with IRTs, district administration and other government agencies to mobilize resources and manpower in the event of outbreak of forest fire.

   b. They will also inform the Circle level Rapid Response teams and call for assistance of Forest Elite Force based on the status of the fire incident.

   c. Fire and Rescue Services, Police, Medical, Animal Husbandry and Revenue departments shall be called upon to work in tandem with forest department when so required.

   d. The Headquarters Range Officer shall be in charge of the DFFCC who will work under guidance of DFO/DD. One Forester and one forest guard with basic computer knowledge and documentation skills shall be posted at this DFFCC.

   e. Based on the availability of funds, one technical assistant shall be engaged to carry out the technical works in handling/updating the dashboards on real time, generating reports, carrying out analysis using GIS tools.

   f. The centre will be functioning 24X7 during the forest fire season.

   g. The technical assistant will also be attending to the calls received in the toll-free number.

h. Telephone connection for the local district toll free number and the seamless hi-speed internet connection should also be available.

Figure 7.1: Forest Fire Management Rapid Response Team at Kodaikanal

7.3. FOREST FIRE AS DISASTER - STATE NODAL OFFICER

During the crisis of forest fire disaster, the State Forest Fire Control Centre (SFFCC) shall function as Incident Command Centre. In case of fire inthe proportion of a disaster, Additional Principal Chief Conservator of Forests (P&V) shall be the State Nodal Officer who will take over operations from head office or as directed by the Principal Chief Conservator of Forests (HoFF), assisted by APCCF(WL) in case of fire in Protected Areas and APCCF(IT) for ICT inputs and assistance of SFFCC. The State Nodal Officer shall coordinate with other government agencies at District, State and National levels for activating their support in mobilizing resources and manpower.

In such circumstances when forest fire is declared or identified as a disaster, a war room shall be established at the Circle office to coordinate with neighboring forest divisions /circles to mobilize resources during crisis. The Chief Conservator of Forests /Conservator

of Forest of that respective circle shall be the Nodal Officer for the respective circle who shall correspond with higher officials, neighboring region and other government departments for assistance and resource to deal with disaster like situation. They shall coordinate closely with the State Nodal Officer for collaborative action to control the crisis situation. In case of a major fire with a propensity towards disaster the Rapid Response teams and the war room at the Circle/Tiger Reserve under the chairmanship of the Chief Conservator of Forests of the Circle/Conservator of Forests (comprising the District/Divmock isionalForest Officers, Assistant Conservator of Forests as members), which will monitor the actions, will take leadership role at circle level in ensuring better communication and quick action to control the crisis.

Figure 7.2 –Planning and Consultative Meeting with local volunteers

7.4. ROLE OF CIRCLE OFFICERS

Tamil Nadu Forest Department is divided into 12 Forest Circles for administration. Sanctuaries, Birds sanctuaries and National Parks, other than those included in tiger Reserves, are also included in the respective circles.

- Chennai Circle, Chennai
- Vellore Circle, Vellore
- Dharmapuri Circle, Dharmapuri
- Villupuram Circle, Villupuram
- Salem Circle, Salem
- Tiruchirappalli Circle, Tiruchirappalli
- Dindigul Circle, Dindigul
- Anamalai Tiger Reserve, Pollachi, Coimbatore
- Kalakkadu-Mundunthurai Tiger Reserve, Tirunelveli
- Mudumalai Tiger Reserve, Nilgiris
- Sathyamangalam Tiger Reserve, Erode
- Srivilliputur Meghamalai Tiger Reserve

Social Forestry/functional divisions are included in the respective Territorial Circles for administration. Arignar Anna Zoological Park circle, Research divisions or any other special divisions shall take assistance from the respective geographical Circles/Divisions in the event of any fire crisis/disaster in their respective jurisdiction. The list of circles, divisions and ranges is provided in **Appendix III.**

The Chief Conservator of Forests/ Conservator of Forest shall monitor the fire management works carried out at the divisions. The officer shall play the role of facilitator in coordinating support from other sources in the following scenarios,

1. when the forest fire continues for more than 2 days
2. in case of large forest fire adjoining division boundaries
3. Circumstances when there is a deficit of resources – personnel or firefighting equipment

8. POST FIRE GUIDELINES

8.1. NEED FOR POST FIRE ANALYSIS

The burnt area assessment assumes importance in terms of local, national and global relevance. The burnt area information in terms of area, location and its spatial spread will give required database for forest managers and scientific community at different levels. Satellite Remote Sensing based damage assessment may provide ample information for temporal monitoring and fire recurrence assessment, identification and prioritization of sensitive areas, understanding the impacts, fire risk zonation etc. Fire burnt areas give unique spectral signatures as compared to green or defoliated canopies due to loss of vegetation and black carbon left on the ground. Such areas are mapped for precise burnt area assessment.

There is need for continuous updation of database from the field such as extent and distribution of the fire affected areas, the total area burnt, type of damage, etc. which is useful for forest managers in mitigation planning. Fire mapping with fire reports compilation is thus an important activity after fire. DFOs will therefore furnish detailed report to Head Office in the proforma format through the Forest fire Alert and report management dashboard.

8.2. ACTIVITIES TO BE CARRIED OUT POST FIRE

1. Assessment of loss due to forest fires

SFFCC may develop a state level database for burnt area assessment on an yearly basis after the fire season. A report with the finding of the analysis shall be published every year as a regular activity. This report will act as a wonderful tool to plan the tree planting and eco-restoration activities.

In consultation with ICFRE, standard methodologies for assessing losses due to forest fire including loss of intangibles such as ecosystem services may also be carried out depending on the availability of sufficient funds by engaging technically qualified persons.

State Forest Department may plan to organize adequate training programs for forest

officials at various level for this purpose.

2. Proper investigation of the causes

The SFD shall ensure that the causes for every fire incident are properly investigated and adequate measures taken immediately including legal actions where necessary.

3. Restoration of fire affected areas

- A proper restoration plan should be prepared for the fire affected areas with the objective of restoring to its natural profile. Appropriate silviculture practices should be prescribed taking into account the ecological successional dynamics.
- Adequate soil moisture conservation measures may be taken up in the fire affected areas for enhancing the moisture retention capacity of the land.
- Indigenous vegetative barriers may be identified and planted around the fire affected areas

4. Publicity and extension

Post fire season is the ideal period to carry out publicity and extension by engaging the local community through e.g. pamphlets, handouts, circulars, posters and media programs through TV, radio, video tapes, etc. Promotion of people's participation- Through involvement of NGOs, Voluntary Organisations, Village Forest Committees (VFCs) etc.

5. Training and education

During post fire season, trainings in the form of exposure visits, workshops and hand on sessions can be organized for front line forest staff, local communities sand other volunteers. Scope of the advanced technologies in forest fire management can also be a topic for skill development of the forest personnels. Designing syllabus for planning, management and ground level firefighting courses in Forestry Institutions.

6. Research and development

This period shall be ideal for strengthening the existing and carrying out new R&D works in the subject of forest fire management.

8.3. BURNT AREA ASSESSMENT

The objective of Forest fire burnt area assessment is very important for damage assessment and mitigation planning. The burnt area information in terms of area, location and its spatial spread will give required database for forest fire management and mitigation planning. The National Action plan for Forest Fire recommends for assessment of loss due to forest fire.

In the State of Tamilnadu each year January to June is longest dry spell and fire sensitive period with mid-January to April being the peak fire season. At the end of the fire season Satellite image based fire burnt area is assessed for every year. MoEFFCC in their NAPFF has also emphasized for burnt area assessment on yearly basis. Fire burnt Area assessment upto 2018 detected by unsupervised classification of satellite image using ERDAS Imagine software with the help of FSI fire alert data(VIIRS) was done by the Geomatics centre. Similar assessment for the remaining years will also be carried out.

Fire burnt areas give unique spectral signatures as compared to green or defoliated canopies due to loss of vegetation and black carbon left on the ground. Such areas are mapped for precise burnt area. Fire burnt area assessed is 15,171ha and 2048ha on 06th March and 30th March of 2018 respectively, after the removal of overlapping of fire occurrences then Fire Burnt Area of 2018 is 16,620ha and it occupies 1% of the total area of RF/RL in Tamil Nadu.

As per spatio-temporal decadal forest fire analysis for the State of Tamil Nadu, Moderately dense forests, Moist and Dry deciduous forests are highly sensitive for fire. Both Eastern Ghats and Western Ghats are sensitive for fire and 3rd week of January to 3rd week of April is the Fire Sensitive period in the State.

TAMILNADU
FIRE BURNT ASSESMENT AREA OF 2018

1:2,500,000

TIRUVALLUR

WL, CHENNAI
CHENNAI

VELLORE

CHENGALPATTU
WL, CHENNAI
WL, CHENNAI

KRISHNAGIRI TIRUPPATTUR

HOSUR

TIRUVANNAMALAI

DHARMAPURI

PUDUCHERRY
PUDUCHERRY

VILUPPURAM

PUDUCHERRY
PUDUCHERRY
PUDUCHERRY

WL, STR HASSANUR

SALEM

WL, MTR OOTY
WL, MTR MASINAGUDI
GUDALUR

ERODE

WL, STR SATHY

WL, MTR OOTY

NILGIRIS

TAMILNADU

COIMBATORE

WL ATR TIRUPPUR

WL ATR POLLACHI

KODAIKANAL

DIND

HOSUR

THENI

WL, MEGAMALAI

WL, SRIVILLI

TIRUNELVELI

THOOTI

WL, KMTR AMBASAMUDRAM

WL, KMTR KALAKKADU

KANYAKUMARI

0 10 20   40   60   80   100
Kilometers

Legend

Part of Hosur

Fire Burnt Area of Hosur

Fire Points of Hosur

0 1.5 3   6   9   12   15
Kilometers

9. FIRE EQUIPMENTS & ITS APPLICATIONS

9.1. Backpack Leaf Blower

Prime Mover	Air Cooled Petrol Engine
Power Capacity	3.7 or above
Engine Cycle	4 Stroke
Drive Mode	Direct Drive
Max Speed (in RPM)	2000 and above
Length of Tornado Tip	1.3 Meter
Blowing Force	32 N or above
Accreditation	ILAC
Brand/Make	Stihl/husqvarna/Honda/Hyundai/Bosch/Hitachi
Product Warranty	12 Month
Service Warranty	36 Month

The use of backpack leaf blowers in fighting forest fires has become a key tool in fire management becauseof its multiple advantages over conventional firefighting tools. The backpack leaf blower (simply a blower) is a verypopular and useful garden tool that has been in great use since the 1970s. The backpack leaf blower works by propelling air out of it through a nozzle. The blower has a motor and a fan that has many blades. When the engineis turned on and the motor starts to run and spin the fan. When the fan inside the machine spins, it draws in outsideair which builds up in the machine due to the centrifugal force and forces it out of the fan body through a long airtube. The effectiveness of a blower depends on the airspeed. The advantages of using the four-stroke engine blower are that the machine islighter, easy to operate and carry; less expensive and offers optimum performance as it can work at any angle without problems. The blower also is effective in pushing smaller woody debris off the line of fire. These features augur well for the difficult forest terrains of the state of Tamil Nadu wherein the proximity of fire and logistics facilities are often not on the same page.

9.2. Fire Leaf Blowers (HUSQVARNA 578BTF)

Cylinder displacement	75.6 cm^3
Power output	3.14 kW
Fuel tank volume	2.2 l
Fuel consumption	410 g/kWh
Maximum power speed	8,000 rpm
Idling speed	2,000 rpm
Weight	10.5 kg

The machine is designed for removal of combustible material and to control smaller grass fires.

9.3. Fire Blower 75.6 cc

Specifications:
Displacement: 75.6cc
Power: 3.0/7200kw/r/min
Fuel consumption:544g/kw.h
Fuel Capacity:3L
Weight: 12.6kg

This equipment is used for removal of combustible material, to control and douse smaller fires.

9.4. Fire Blower with BR 600

Displacement : 64.8 cc (3.95 cu. in.)
Engine Power : 2.8 kW (3.8 bhp)
Weight : 9.8 kg (21.6 Ibs.)
Fuel Used : Petrol
Fuel Capacity : 1400 ml
Blowing Force : 32 Newtons
AVG. Air Velocity : 89 m/sec. (199 mph)
MAX. Air Velocity : 106 m/sec. (238 mph)
Air Volume at Nozzle : 1150 m3/h (677 cfm)

These backpack blowers from are ideal for tending large areas. Leaves, grass cuttings and debris are moved easily with the powerful air stream. Even larger items such as paper cups and cans are swept up thus mitigating the extent of fire.

9.5. Handheld Brush Cutter

Displacement Capacity	35 CC or above
Power Capacity	1.3 HP or above
Engine Cycle	4 Stroke
Fuel Type	Petrol
Cutter Diameter (in mm)	300 or above
Shaft Length (in mm)	1500 or above
Shaft Type	Stainless Steel
Blade Material	Hardened Steel/Carbon Steel
Brand/Make	Stihl/Husqvarna/Honda/Hyundai/Bosch/Hitachi/Bajaj
Product Warranty	12 Month
Speed Control	Variable

Brush cutters are powerful enough to cut through overgrown brush in fire prone areas. They also cut in hard-to-reach areas where larger machines can't enter which is often the case in forest areas. brush cutters have a straight shaft and anti-vibration features to reduce operator fatigue, thus the fire fighters/watchers/frontline staff would feel less fatigue. Using a harness also helps control the machine and lightens the load on the fire fighters/watchers as they work. Brush cutters can be used with several blade attachments, allowing them to be used on a range of materials. Having a brush cutter eliminates the need to purchase multiple tools for eliminating naturally occurring elements that may directly or indirectly influence the events of fire. Brush cutters are made to cut through the woody, overgrown brush & can also effectively work in confined spaces where a larger piece of equipment won't fit because of the range of blade alternatives.

9.6. Power Chain Saw
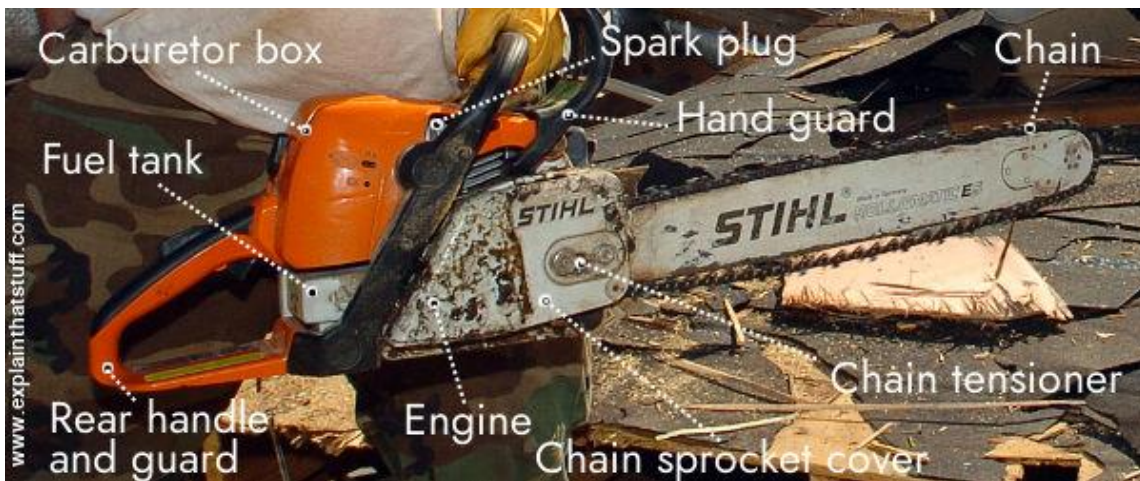
Cylinder Displacement	74 CC or above
Power Capacity	5.5 HP or above
Engine Type	2 Stroke (Air cooled petrol driven)
Cutter Rate	20 mm/minute or above
Length of Guard	18 Inch or above
Blade Type	Carbide Tipped Blade (one piece construction)
Fuel Type	Petrol
Standardization	EN/DIN/US Equivalent Standards
Brand/Make	Stihl/Husqvarna/Honda/Hyundai/Bosch/Hitachi
Product Warranty	2 Years
Adjustable Depth of Cut	8 Inch or above

In Forest firefighting, chain saws are used to cut hampering trees, snags and to clear fire lines. The chain saws are a handy tool for forcible entry into an otherwise inaccessible place in the wild during fires. This tool is effective in clearing fallen trees and debris in the aftermath of Forest fires. Wildland firefighters in areas with heavy timber will need a power chain saw so as to safely and quickly navigate to the heartland of the firezone and to begin efforts to douse the same. During events of fire Chain saws can be sharpened in the field with a file, or they can be easily replaced. Used chains can be sharpened for later use. Thus, Chain saws are an essential and effective tool in fighting fire in the wild.

9.7. Water Mister

Weight	12 kg
Displacement	62 cm3
Power Output	2.8 kW
Discharge Liquid	4 Ltrs Per Min

Water misters are fire suppression systems that are useful in dousing fire with small water droplets. These droplets are effective at controlling fires while using less water.

9.8. Solar power generator power oak 1200 watt

Item Weight	10 Kilograms
Voltage	54 Volts
Engine Displacement	418 Cubic Centimetres
Total Power Outlets	2
Frequency	50 Hz

This item is widely used outdoor in areas of fire as portable power bank to charge the devices from the appliance to the outside. This item can easily be powered by the solar charger and supply AC Wall.

9.9.   Smoke Proof Googles

Colour	Clear Lens
Item Weight	0.28 grams
Lens Colour	Clear
Material	Polycarbonate
Material Feature	Heat Resistant
Size	6.5" x 2.5" Viewing Area
Special Features	Flame Resistant Strap

Firefighter Goggles are designed to protect the wearers eyes from harsh conditions caused by fires and bush fires including fire, heat, smoke, wind and steam. The design of Fire Fighting Goggles reduces eye irritation caused by these harsh conditions and improves visual comfort. Fire Fighting Goggles resist the effects of humid air (caused by fighting fires and bush fires with water), combating lens fogging and ensuring lens clarity.

9.10.   First Aid Kit

S. No.	Description	Quantity
1	Sterilized Dressing Long	2 Nos.
2	Sterilized Dressing Medium	3 Nos.
3	Sterilized Dressing Small	4 Nos.
4	Burn Dressing long	2 Nos.
5	Cotton 15grm	3 Nos.
6	Roller Bandage	4 Nos.
7	Adhesive Roll	1 Nos.
8	Crape Bandage	1 Nos.
9	Eye Pad	2 Nos.
10	Eye Wash Cup	1 Nos.
11	Scissors 5"	1 Nos.
12	Forceps 5"	1 Nos.
13	Tourniquet	1 Nos.
14	Splint Set (wooden)	1 Nos.

In the event of injuries in course of fighting the fires, first aid kits serve as the first line of defence in treating the injuries and nursing the fire fighters back to safety.

15	Safety Pin	1 Nos.
16	Melco chrome	1 Nos.
17	Savlon 50 ml.	1 Nos.
18	Salvola tiles 50 ml.	1 Nos.
19	Snakebite Plate	1 Nos.
20	Band Aid	8 Nos.
21	Potassium Parg	1 Nos.
22	Moov Spray	2 Nos.

9.11. Fire Safety Leather boots

Upper Shoe Material	Leather
Outsole Material	PVC
Usage	Fire Safety
Ankle Type	High Ankle
Colour	Black
Features	Heat Resistant

These boots help fire fighters to stay agile on their feet, and protect what is often the point of contact with dangerous debris and flames on the floor. The boots are designed to resist fire and heat.

Sleeve Type	Full Sleeves
Gender	Men
Material	Nylon
Wear Type	Reflective

9.12. Flame resistant coverall

A fire-resistant coverall is simply a **protective suit**. It's a type of **coverall dress** made of naturally fire-resistant materials or fabrics. These are woven together to produce a **boilersuit** that protects you from fires and help fire fighters actively fight fires.

9.13. Water proof Back Pack (Dry Bag)

Height: 46cm / 18.1"
Width: 28cm / 11"
Depth: 24cm / 9.4"
Capacity: 1800 cubic inch
Weight: 0.84kg

These bags are easy to carry in difficult terrains. They help store essential supplies like food, water and other paraphernalia while the fire fighters navigate the area of fire.

9.14. Fire Proximity Suit (Aluminium)

Number of Layer	4
Usage/Application	Application of aluminized suit is Molten metal , fire fighting furnace safety
Type	3 Layer, Fire Fighting Suit, Fire Proximity Suit
Material	Aluminised
Features	Heat Resistant Aluminised suit

This fabric has the reflective function and supreme fire protection performance, can't be burned or help burning. It is a stable fabric without extension or shrinkage under high or low temperature. Owing to these qualities, these suits are useful in fighting fire from a close

proximity without risking injury.

9.15. Emergency Rescue Stretcher

Packing size	91.5x36x36.5CM.
Folding size	2 or 3 fold
Gross weight	12.3KG
Net weight	10.4KG
Loading	≤159KG
Material	Compound plastic

These emergency stretchers are foldable and easy to carry. They are useful in transporting the injured persons from the fire zone to a safer area.

9.16. Neck and Chest Guard

The Neck and Chest Guards protect the Fire Fighters from any unexpected impact to the neck and chest areas that they may have to encounter in the line of duty while fighting.

9.17. Tent

Sleeps: 2

Weight: 4.2 Kg

Packed Dimensions: 30 x 7 x 7"

Center Height: 59"

Floor Area: 90" x 84" (7.5' x 7')

Floor Material: 70D Hybri-lite Ripstop

Fly Material: Polyester Taffeta

These tents are easy to set up and protect victims and helpers against sunlight from the side, whirling dust, and fumes outside during fire. At the same time, sidewalls also provide discretion during a firefighting deployment and obstruct the view of events. Helpers can then work with full concentration and without distractions. Also, the victim's privacy rights can be protected better with a concealing screen.

9.18. Nylon Rope 12mm

These ropes are useful in rescue operations, to facilitate escape amidst intense fire and as an emergency rope for climbing and navigating difficult terrain.

9.19. Ruck Sack

Volume: 40L

Dimensions: H 64 cm, W 35 cm, D 25 cm

Weight: 1.1 Kg

12mm x 50 m nylon rope

50 m

Nylon

These Ruck Sacks are useful for carrying

emergency supplies and basic equipment to the fire zone.

9.20. Fire Fighter Shovel

Fire Fighting shovels are specifically designed for use in constructing a fireline; has a tapered blade with both edges sharpened for scraping, digging, grubbing, cutting, and throwing. During fire the shovel is used to dig out burning roots, logs, and to bury smoldering fires. The Firefighting shovels are easy to carry, light weight & corrosion resistant. Owing to their ease of access, they remain a rudimentary yet preferred tool in preventing the occurrence of fire and also dousing fire. A shovel can be the most useful basic fire suppressant tool on hand as small surface or grass fires can be beaten down with a shovel. A shovel can also be used to create a small fire break in the path of a fire, and soil can be quickly shoveled on a fire to smother it. A shovel can be used to break up large smouldering embers into smaller chunks, which can then be covered in soil. Due to the simplicity of this tool it requires no special training for the fire fighters to employ the usage of the shovel in dousing the fire.

9.21.   Fire Fighting Broom

In forests when the element of fire is Grass fires in short grass and/or leaves then the broom can be used to attack and douse the fire directly. In some cases, the broom can be used to approach the flanks of the fire area, on both sides if possible, and while working towards the head or front of the fire, sweep the burning embers back into the burned area. When the fire occurs on the surface under tall timber, the fire broom may be used as in grass and leaf fires. In fires involving undergrowth or tall timbers, the fire broom are limited to patrolling fire breaks.

9.22. Pulaski

The Pulaski is a special hand tool used in fighting <u>wildfires</u>, which combines an <u>axe</u> and an <u>adze</u> in one head. it has a rigid handle of wood, plastic, or fiberglass. The Pulaski is used for constructing <u>firebreaks</u>, able to both dig soil and chop wood. It is also well adapted for <u>trail</u> construction, and can be used for excavation and digging holes in root-bound or hard soil which are prevalent in Forest areas. The design of this tool is highly helpful for chopping, grubbing, and digging fire lines in brush-filled or rocky terrain. A common use for the Pulaski is in creating fire breaks in sections of land devoid of vegetation which can help contain forest fires. Fire fighters chop down trees with the axe side, cut away roots and shrubs with the end of the adze blade, and dig barriers with the wide portion of the adze. Thus, the tool also helps in forward navigation.

9.23. Fire Rake

In instances of Forest Fire, the rake quickly clears a path of leaves and is an efficient tool in areas where there is little brush and the primary material burning is leaves. A rake with large triangular cutting teeth is helpful in fire-line digging. The rake generally consists of four mowing machine cutter blades riveted to a steel frame. Apart from general terrain, the rake is a handy fire-line digging tool which is instrumental on mountainous and rocky terrain. This tool can be a bit heavy but are sturdy enough to do the job of beating and smothering out fires caused by airborne embers floating across the fire line in forest areas.

APPENDIX

APPENDIX– I

FIRE SENSITIVE BEATS (BASED ON 2016-2022 FSI FFP DATA)

Legend

(orange)	Very high Fire sensitive beat
(grey)	High Fire sensitive beat
(light blue)	Moderately Fire sensitive beat

SI.NO	CIRCLE	DIVISION	RANGE	BEAT
1	DINDIGUL	KODAIKANAL	PERUMPALLAM	PANNAIKADU
2	ATR	WL ATR TIRUPPUR	AMARAVATHI	KEELANAVAYAL
3	VELLORE	VELLORE	ARCOT	PUNGANUR SOUTH
4	MADURAI	THENI	THENI	ARUNGULAM EAST
5	TIRUNELVELI	KANYAKUMARI	AZHAGIAPANDIPURAM	THADIKARANKONAM SOUTH
6	ATR	WL ATR TIRUPPUR	UDUMALAIPETTAI	KOKKANAMALAI
7	DINDIGUL	KODAIKANAL	KODAIKANAL	MACHUR
8	MTR	WL, MTR OOTY	MUKURTHY	AVALANCHE(WL)
9	TIRUNELVELI	KANYAKUMARI	AZHAGIAPANDIPURAM	ASAMBU
10	VELLORE	VELLORE	ODUGATHUR	AGARAM
11	DINDIGUL	DINDIGUL	KANNIVADI	KANNIVADI
12	DINDIGUL	KODAIKANAL	PALANI	KALAYAMPUTHUR
13	MTR	NILGIRIS	NADUVATTAM	MUDIMUND
14	TIRUNELVELI	KANYAKUMARI	AZHAGIAPANDIPURAM	AZHAGIAPANDIPURAM
15	ATR	WL ATR TIRUPPUR	UDUMALAIPETTAI	KOMBU WEST
16	ATR	WL ATR TIRUPPUR	UDUMALAIPETTAI	THIRUMOORTHIMALAI
17	DHARMAPURI	HOSUR	DENKANIKOTTAI	GUDIYUR
18	DINDIGUL	KODAIKANAL	PALANI	BALASAMUDRAM EAST
19	VELLORE	TIRUPPATTUR	ALANGAYAM	VELLAKUTTAI
20	VELLORE	VELLORE	VELLORE	PALAMADI
21	VELLORE	VELLORE	ARCOT	PUNGANUR NORTH
22	VELLORE	TIRUPPATTUR	TIRUPPATTUR	SWAMIMALAI(VLR)

23	DHARMAPURI	HOSUR	DENKANIKOTTAI	THOLUVABETTA EAST
24	TIRUNELVELI	KANYAKUMARI	KULASEKARAM	PECHIPARAI
25	STR	WL, STR HASSANUR	GERMALAM	MINCHIGULI
26	MTR	WL, MTR MASINAGUDI	MASINAGUDI	KARADIBETTA
27	DINDIGUL	KODAIKANAL	KODAIKANAL	PERUMALMALAI(K)
28	DHARMAPURI	HOSUR	JAWALAGIRI	JAWALAGIRI SOUTH
29	DINDIGUL	KODAIKANAL	PERUMPALLAM	KAMANUR
30	DINDIGUL	DINDIGUL	KANNIVADI	SITHAYANKOTTAI
31	MTR	WL, MTR MASINAGUDI	SEGUR	SIROOR SOUTH
32	TIRUNELVELI	KANYAKUMARI	VELIMALAI	CHELLAMTHURUTHI
33	TIRUNELVELI	TIRUNELVELI	SANKARANKOIL	CHELLUPULI
34	DINDIGUL	KODAIKANAL	PALANI	KAVALAPATTY
35	CHENNAI	TIRUVALLUR	PALLIPATTU	SANTANAVENUGOPALAPURAM
36	TIRUNELVELI	KANYAKUMARI	VELIMALAI	SURULACODE
37	MADURAI	THENI	UTHAMAPALAYAM	KOMBAI
38	ATR	WL ATR TIRUPPUR	UDUMALAIPETTAI	VANDAL
39	DHARMAPURI	HOSUR	DENKANIKOTTAI	GULLATTI WEST
40	TIRUNELVELI	KANYAKUMARI	KALIYAL	KALIYAL
41	DHARMAPURI	HOSUR	URIGAM	KESTHUR
42	DINDIGUL	KODAIKANAL	PALANI	PALLANGI WEST
43	MADURAI	THENI	UTHAMAPALAYAM	THEVARAM SOUTH
44	VELLORE	VELLORE	ODUGATHUR	PALLIKONDA
45	VELLORE	VELLORE	ARCOT	NATTHAM
46	VELLORE	VELLORE	PERANAMPATTU	NAYAKKANERI
47	CHENNAI	TIRUVALLUR	PALLIPATTU	NOCHILI
48	DHARMAPURI	HOSUR	JAWALAGIRI	PANAI WEST
49	VELLORE	TIRUVANNAMALAI	CHENGAM	CHEYYAR
50	VELLORE	TIRUPPATTUR	SINGARAPETTAI	KUPPANATHAM
51	STR	WL, STR HASSANUR	TALAVADI	NEITHALAPURAM NORTH
52	VELLORE	VELLORE	ARCOT	MAGIMANDALAM
53	MADURAI	THENI	THENI	VARATTAR

54	TIRUNELVELI	KANYAKUMARI	VELIMALAI	VELIMALAI NORTH
55	DHARMAPURI	HOSUR	URIGAM	MANJUKONDAPALLI
56	VELLORE	VELLORE	PERANAMPATTU	RANGAMPETTAI
57	VELLORE	VELLORE	ARCOT	AMMUR NORTH
58	DHARMAPURI	HOSUR	DENKANIKOTTAI	KEMPAGARAI
59	ATR	WL ATR TIRUPPUR	UDUMALAIPETTAI	KOTTAIYARU
60	MADURAI	THENI	UTHAMAPALAYAM	UTHAMAPALAYAM
61	VELLORE	VELLORE	ODUGATHUR	ASANAMPATTU
62	VELLORE	VELLORE	VELLORE	KANIYAMBADI
63	ATR	WL ATR TIRUPPUR	UDUMALAIPETTAI	KULIPATTI
64	MTR	WL, MTR MASINAGUDI	MASINAGUDI	MORGANBETTA
65	MADURAI	THENI	BODI	PITCHANGARAI
66	VELLORE	TIRUPPATTUR	AMBUR	THOTTALAM NORTH
67	VELLORE	TIRUPPATTUR	SINGARAPETTAI	SINGARAPETTAI EAST
68	TIRUNELVELI	TIRUNELVELI	SANKARANKOIL	VASUDEVANALLUR
69	TIRUNELVELI	TIRUNELVELI	KADAYANALLUR	VELLAKKALTHERI
70	DHARMAPURI	HOSUR	DENKANIKOTTAI	BELLATTY
71	DHARMAPURI	HOSUR	DENKANIKOTTAI	BETTAMUGILALAM
72	TIRUNELVELI	KANYAKUMARI	KULASEKARAM	KULASEKARAM NORTH
73	SALEM	SALEM	SHERVAROYS SOUTH	KURUMBAPATTY
74	VELLORE	TIRUPPATTUR	ALANGAYAM	NAICKANUR SOUTH
75	MADURAI	THENI	THENI	TAMBIRANKANAL
76	STR	WL, STR HASSANUR	HASSANUR	BINAKANAHALLI NORTH
77	MADURAI	THENI	THENI	ARUNGULAM WEST
78	DHARMAPURI	HOSUR	DENKANIKOTTAI	AYYUR
79	SALEM	SALEM	SHERVAROYS SOUTH	GUNDUR EAST
80	DHARMAPURI	HOSUR	JAWALAGIRI	JAWALAGIRI NORTH
81	TIRUNELVELI	TIRUNELVELI	KADAYANALLUR	KADAYANALLUR
82	DINDIGUL	DINDIGUL	VATTALAKUNDU	MANALAR(D)
83	DHARMAPURI	HOSUR	DENKANIKOTTAI	NOGANUR
84	VELLORE	VELLORE	PERANAMPATTU	PACHAMARPENTA
85	CHENNAI	TIRUVALLUR	PALLIPATTU	PULLUR EAST

APPENDIX II

LIST OF CIRCLE, DIVISION, RANGE (AS ON JAN 31ST, 2023)

Sl.No	Name of Circle	Name of the Division	Name of Range
1	Chennai	Chennai	Pallikaranai
			Tambaram
			Head Quarters
			Anna Nagar Spl Range
			Tambaram Spl Range
			Velachery Spl Range
		Chengalpattu Division	Chengalpattu
			Tiruporur
			Sriperumbudur
			Mathuranthagam
		Tiruvallur	Tiruvallur
			Redhills
			Gummidipoondi
			Tiruttani
			Pallipet
			Tiruttani SF
			Ponneri SF
			Forest Station
			Enforcement
			Publicity Officer
		Chengalpattu SF	Chengalpattu
			Membakkam
			Sriperumbudur
			Maduranthagam
			Uthiramerur
			Walajabad
2	Vellore	Vellore	Gudiyatham
			Pernampet
			Arcot
			Vellore
			Odugathur
			Amirthi
		Tirupattur	Ambur
			Tirupattur
			Singarapettai
			Alangayam
		Thiruvannamalai	Thiruvannamalai

102

			Thanipadi
			Sathanur
			Chengam
			Pudhupalayam
			Polur
			Santhavasal
			Arani
			Jamnamarathur
			Nadanur
			Melpet
3	**Dharmapuri**	Dharmapuri	Dharmapuri
			Pennagaram
			Palacode
			Hogenakkal
			Harur
			Kottapatty
			Morappur
			Theerthamalai
		Hosur WL	Anchetty
			Urigam
			Jawalagiri
			Denkanikottai
			Hosur
			Rayakotta
			Krishnagiri
4	**Salem**	Salem	Shervarayan South
			Shervarayan North
			Danishpet
			Yercaud
			Mettur
			Valapadi
			DLO SW Depot
			SLO SW Depot
			Kurumbapatti Zoo
			FE Sidder koil
			Salem SF
			Mettur SF
			Sankari SF
			Omlaur SF
			Edapady SF
			Vazhapady SF
		Attur	Attur
			Thumbal
			Gengavalli

			Thammam patti
			Kalrayan
			Pethanaickan Palayam SF
			Attur SF
			Gengavalli SF
			Survey & Demarcation
		Namakkal	Namakkal
			Rasipuram
			Mullakurichi
			Kolli Hills
5	**Dindigul**	Dindigul	Sirumalai
			Ayyalur
			Natham
			Alagarkoil
			Batlagundu
			Kannivadi
			Oddanchatram
		Karur	Karur
		Kodaikanal	Kodaikanal
			Perumpallam
			Poombarai
			Mannavanur
			Berijam
			Devathanapatty
			Palani
			IDP (Tourism range)
6	**Trichy**	Tiruchirappalli	Tiruchirappalli
			Thuraiyur
			Manapparai
			Thuvarankurichi
		Thanjavur	Thanjavur
			Kumbakonam
			Pattukkottai
			Pattukkottai
			Muthupet
		Thiruvarur	Mannargudi
			Thiruvarur
		Nagapattinam	Nagapattinam
			Vedaranyam
			Sirkali
		Perambalur	Perambalur
			Veppanthattai
		Pudukkottai	Pudukkottai

			Arantangi
			Ponnamaravathi
			Keeranur
			Tirumayam
		Ariyalur	Ariyalur
7	**Villupuram**	Villupuram	Kallakurichi
			Vellimalai
			Gomuzhi
			Innadu
			Palapattu
			Cherapattu
			Ulundurpet
			Gingee
			Villupuram
			Tindivanam
		Cuddalore	Cuddalore
			Chidambaram
			Vrithachalam
			Shelter belt range,Cuddalore
			Social Forestry Range , Neyveli
			Publicity range , Neyveli
8	**ATR, Coimbatore**	ATR, Tiruppur	Udumalpet
			Amaravathi
			Kangayam
			Vandharavu
			Kolumam
		ATR, Pollachi	Ulandy
			Manambolly
			Pollachi
			Valparai
		ATR, Coimbatore	Madukkarai
			Bolampatti
			P.N.Palayam
			Coimbatore
			Karamadai
			Mettupalayam
			Sirumugai
9	**MTR, Udhagai**	Mudumalai Tiger Reserve, Udhagai.	Nelakkottai
			Mudumalai
			Theppakkadu
			Kargudy
			Mukurthy

			Segur
		Mudumalai Tiger Reserve, Masinagudi.	Singara
			Singara
			Nilgiri Eastern Slope
			Masinagudi
		Nilgiris Forest Division	Naduvattam
			Pykara
			Parsonsvalley
			Governorshola
			Korakundah
			Kundah
			Udhagai South
			Udhagai North
			Coonoor
			Kotagiri
			Kilkotagiri
			Kattabettu
		Gudalur Forest Division	Gudalur
			Cherambady
			Bitherkadu
			Pandalur
			O'Valley
			Nadugani
10	STR, Erode	Erode Forest Division, Erode	Anthiyur
			Bargur
			Thatakarai
			Chennampatti
			Erode
		Sathyamangalam	Sathyamangalam
			T.N.Palayam
			Bhavanisagar
			Talamalai
			Kadambur
			Vilamundi
		Hasanur	Hasanur
			Germalam
			Thalavadi
			Jeerahalli
11	SMTR, Madurai	Sivagangai	Sivagangai
			Thiruppathur

		Ramanathapuram	Ramanathapuram
			Sayalkudi
		Srivilliputhur WL	Rajapalayam
			Srivilliputhur
			Watrap
			Saptur
		Megamalai	Chinnamanur
			Cumbum East
			Gudalur
			Varushanadu
			Megamalai
			Gandamanur
		Ramnad WL	Ramnathapuram
			Keelakarai
		Theni	Theni
			Periyakulam
			Bodi
			Uthamapalayam
			Cumbum West
			Andipatty
		Madurai	Madurai
			Sholavandan
			Usilampatty
12	**KMTR, Tirunelveli**	Tirunelveli	Tirunelveli
			Courtallam
			Kadaiyanallur
			Sankarankovil
			Sivagiri
		Kanyakumari	Boothapandy
			Velimalai
			Kaliyal
			Azhagiyapandiyapuram
			Kulasekaram
		Thoothukudi	Thoothukudi
			Srivaikundam
			Tiruchendur
			Kovilpatti
		Ambasamudram	Ambasamudram
			Papanasam
			Mundanthurai
			Kadayam
		Kalakad	Kalakad
			Thirukkurungudi

			Upper Kothaiyar
		Eco Development division	Kalakad Eco Range
			Thirukkurungudi Eco Range
			Ambasamudram Eco Range
			Papanasam Eco Range
		Forest Protection Squad, Tirunelveli	
		KMTR Squad wing, Tirunelveli	
		Forest Station, Tirunveli	

FIRE INCIDENT FINAL REPORT

1	Date of fire occurrence		
2	Name of the forest land (RF/RL / Plantation area (in respect of non forestarea)		
3	Name of the Range		
4	Name of the section		
5	Name of the beat details		
6	Name of the Area		
7	Time of fire occurrence		
8	Time of the departure of Forest officialsand Villagers assisting in fire fighting		
9	Time of the arrival of Forest staff andVillagers at the site of the fire.		
10	(a)Time of the extinguishing fire		
	(b)Time of return to headquarters		
11	Fire affected area (in hectares)		
12	Day of inspection by the Forester		
13	Cause of fire		
14	Action taken by the Forest Officials toextinguish fire		
15	Government loss		
	(a) Physical (kind of vegetation,property etc. damaged)		

	(b) Financial in Rupees		
1 6	Date of inspection by Forest RangeOfficer		
1 7	whether enclosures attached as follows:		
	(a) Location sketch		Yes/No
	(b) Survey sketch of Fire burnt area withGPS readings.		Yes/No
	(c) Photographs (if any)		Yes/No

Fire report No: **dt.**

Signature of District Forest Officer

GUIDE ON FOREST FIRE MANAGEMENT

**TAMIL NADU
FOREST DEPARTMENT**

PUBLISED IN 2023