सत्यमेव जयते

# Proposal for Establishment of
# Centre of Excellence
# in
# Forest Survey of India

**Forest Survey of India**

**(Ministry of Environment, Forests & Climate Change)**

**Dehradun**

# Table of Contents

**The total funds required for this activity for five years will be Rs. 500.00 lakhs.**

## 4.4 Forest fire monitoring including burnt area assessment

### *4.4.1 Introduction:*

Forest fires are a recurrent phenomenon in India during fire season, presumed to be between the months of November to June. Forest fires cause incalculable loss to the timber, ground flora, fauna and loss of biodiversity in the region. The losses from the fires are long lasting and damage caused at larger scale brings about secondary changes in terms of climatic variations, ecological and biodiversity changes, loss of exotic species and wildlife. Forest Survey of India started making use of spatial data as point location, which displays active fire location based on MODIS sensor from 2004. Presently, both MODIS and SNPP-VIIRS satellite sensors are used for forest fire detection and monitoring.

Forest fires are one of the most important causes of land degradation that lead to biodiversity loss, deforestation and desertification processes. In India, most forest fires are restricted to the forest floor and are well controlled by beating the fire with the help of the local community. But, the intensity and number of fires vary greatly across the years and are dependent on mostly the moisture conditions in the forest areas. Drier winters, late monsoon onset cause fire season to aggravate and also extent which resulted in large scale damage in some of the parts of the country.

The losses caused to the ecosystem are even more dangerous causing serious losses. As a result of burning of trees and forest floor, the carbon sequestered in middle/under storey vegetation and in dry twigs and litter cause most of the carbon locked to be released in the atmosphere.

### *4.4.2 Current status:*

As per ISFR 2021, 2.81% of the forest cover is Extremely Fire Prone, 7.85% of the forest cover is Very Highly Fire Prone and 11.61% of the forest cover is Highly Fire Prone. In the fire season of 2021-2022, 2,23,333 fire detections have been observed by SNPP-VIIRS sensor & 29,675 fire detections have been observed by MODIS sensor and 13,555 large forest fire detections have been observed throughout the country. At present, alerts are being disseminated for three major programs- Pre-Fire alerts, Near Real time alerts and large forest fire alerts. Under the common alerting program (CAP), the alerts shall also be disseminated through broadcast systems and media.

### *4.4.3 Activities already in place:*

The Following activities are in place for the past few years. A brief note on each of the activities is given below:

1. Near Real Time Alert dissemination: The near real time alerts are generated **using the detections from MODIS and SNPP-VIIRS sensor and are** disseminated to the registered subscribers as SMS alert including the PCCF(HoFF) & forest fire nodal officer of the respective states. The alerts are

also sent to the forest fire nodal officer and PCCF/HoFF of the state as email alert. So far, around 1.6 lakh approx. subscribers have been registered for receiving SMS alert.

2. Large Forest Fire Alert dissemination: The large forest fire alerts are generated using at least 3 proximate detections of SNPP-VIIRS sensor and are disseminated to the subscribers as SMS alert and to the PCCF(HoFF) & forest fire nodal officer of the SFD as email alert.
3. Pre-Fire Alert dissemination: The pre-fire alerts are generated based on the Fire Weather Index that has been customized for different physiographic zones of the country. These alerts are disseminated as email.

In addition to the above activities, the following is proposed for the coming years to understand the impact of forest fires on climate, biodiversity and contribution to atmospheric carbon and strengthen the above activities (item 1 to 3) in terms of technology updation, efficient and robust against false alarms.

### *4.4.4 Activities to be done:*

- **Customization of algorithms** under different methods of geospatial layer classification using advanced methods such as **AI, ML, Deep learning methods** shall be carried out to handle complex data.
- Creation and use of **Digital Elevation Model (DEM)** layer generation as support layer to analyze forest fire under different topographical gradients and their association with the local topographical factors.
- Based on the study correlating biodiversity with ecosystem, loss in ecosystem services on account of forest fires shall be studied.
- Effort shall also be made to calculate **damage cost to the environment and ecosystem services** on account of forest fires. An important objective of the forest fire studies would be to assess overall damage to the forest flora, fauna, biodiversity, environmental degradation and the ecosystem. Besides, loss to soil fertility, soil moisture, and loss of exotic species can also be studied and mapped.
- A study is also planned to understand and quantify the impact of forest fires on climate. For that the forest fire burnt area region shall be used an input in the climate change model. For creation of **accurate burnt area maps**, suitable mixer modeling techniques using AI/ML based methods shall be adopted.
- For understanding impact of fires on climate, work on customization on existing climate change models shall be carried out.
- Estimation of **Carbon sequestered and released on account of fires**- Pre and post optical and SAR data would be used to map AGB in the effected areas. Based on the AGB and suitable empirical factors, carbon sequestrated and released in the affected areas would be precisely estimated. The same shall be further used as input in climate change models for creation of simulation models for climate change effects in the coming time.
- **Fire Progression and Simulation modelling**- Suitable models would be developed to map fire progression based on the data on dynamic variables received from real from respective agencies (IMD, INCOIS etc.)

- Use of **drone technology** with **LiDAR/Optical sensor** for real time data capture of burnt area, fire detection and assessment of severity of fires- The drone technology would be used for closed period monitoring of large fires
- **Wireless sensor detection** methods in highly sensitive areas through installation of wireless sensor detecting networks and connecting these sensors through **local cloud** to **FSI server** for further processing and dissemination- For low intensity fires, such sensors would detect the light particles emerging from small but multiple fires and shall capture information and send it to the local cloud
- To meet the targets stated above, **02 Project Associates at middle level management** having knowledge and experience on burnt area assessment, remote sensing based forest fire alert generation and attributing same to the changes in environment using climate change models shall have to be engaged for a 05 years period.

- In addition, **04 Technical Associates** would be engaged to meet out the above targets in lab based processing of satellite data and other datasets. They will also carry the post field correction of the identified burnt polygons on the ground, besides collecting data on vulnerable forest types, species at different point of time.

### *4.4.5 Requirements of funds for five years*

**Table 6: Requirements of funds for five years for Forest Fire Monitoring etc.**

| S. No. | Particulars | No of persons | Total Amount |
|---|---|---|---|
| 1 | Wages of Project Associate (Rs. 55,000 X 2 X 12 months X 5 years) | 2 | 66,00,000 |
| 2 | Wages of 4 Sr. Technical Associate (Rs. 50,000 X 4 X 12 months X 5 years) | 4 | 120,00,000 |
| 3 | Wages of Programmers (Rs. 1,00,000 X 2 X 12 months X 5 years) | 2 | 120,00,000 |
| 4 | Wages of System, Database, and Network Administrator (Rs. 1,00,000 X 2X 12 months X 5 years) | 2 | 120,00,000 |
| 5 | Cost of Satellite Data(Mid and High Resolution) | | 250,00,000 |
| 6 | Procurement of Drone(including maintenance cost for 05 yrs) | | 50,00,000 |
| 7 | Wireless Sensor detection system(for one pilot district preferably a tiger reserve) | | 35,00,000 |
| 8 | Ground Truthing and Field visits including cost of new vehicles | | 65,00,000 |
| 9 | 2 Anticipated Trainings/workshops each | | 25,00,000 |

| | | | |
|---|---|---|---|
| | year | | |
| 10 | Software/Hardware including AMC cost | | 40,00,000 |
| 11 | Miscellaneous Cost(including purchase of field equipment's etc.) | | 10,00,000 |
| | **Total** | | **9,01,00,000** |

**The total funds required for this activity for the five years (April 2023 to March 2028) will be Rs. 901.00 lakhs.**

## 4.5 RADAR application studies in Forestry

## Above Ground Biomass (AGB) Estimation using Synthetic Aperture Radar (SAR) data

### *4.5.1 Introduction:*

The above ground biomass comprising mainly of trees, understorey vegetation constituting shrubs, middle storey trees, and other woody and non-woody vegetation is an important component of forest and is an indicator of forest health that is equally significant for a healthy ecosystem, environment, wild life conservation, forest soil and drainage. The synthetic aperture radar(SAR) data owing to its unique capability to penetrate Cloud and plant canopy provides significant information of below canopy strata including information on forest structure, forest composition and untimely the total biomass of the forest. A study has already been carried out to estimate above ground biomass using SAR data at country level. The study carried out for the first time at pan India level needs to be further refined in terms of methodology, data quality, accuracy. The study is proposed to be further taken up for generating forest carbon maps at country level using SAR data.

### *4.5.2 Current status:*

- Generated estimates of biomass under different forest cover across the country using ALOS PALSAR global mosaic (25m) data
- Creation of Basic Above Ground Biomass(AGB) Wall to Wall Map of the country with different biomass ranges at state level
- Explored the potential of Synthetic Aperture Data for understanding forest structure and ultimately biomass within a tree and Forest
- Prepared uncertainty map for the prepared biomass map
- Prepared detailed report on Above Ground Biomass estimation using SAR data.

### *4.5.3 Activities to be done:*

- Estimation of forest carbon map (wall to wall) using AGB estimates
- Estimation of GHG emission based on the estimates of forest carbon sequestered within the tree and forest
- Estimation of AGB (Carbon) using multi-frequency SAR (NISAR) data on cycle basis.