



**PARLIAMENT OF INDIA
RAJYA SABHA**

**DEPARTMENT-RELATED PARLIAMENTARY STANDING COMMITTEE
ON SCIENCE AND TECHNOLOGY, ENVIRONMENT, FORESTS AND
CLIMATE CHANGE**

FOUR HUNDRED TWELFTH REPORT

**Forest Fires in the Himalayan Region, its adverse effects and mitigation
measures**

*(Presented to the Rajya Sabha on 7th August, 2026)
(Laid on the Table of Lok Sabha on 7th August, 2026)*

भारतीय संसद, राज्य सभा



Parliament of India, Rajya Sabha

**Rajya Sabha Secretariat, New Delhi
August, 2026/ Sravana, 1948 (Saka)**

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* To be appended later

**COMPOSITION OF THE COMMITTEE
(2025-26)**

(Constituted w.e.f. 26th September, 2025)

1. [#]Dr. Medha Vishram Kulkarni - Chairperson

RAJYA SABHA

2. Shri Narayanasa K. Bhandage
3. Shri I. S. Inbadurai
4. Shri Sandosh Kumar P
5. Shri Jairam Ramesh
6. Shri Paka Venkata Satyanarayana
7. @Shri Shivesh Kumar
8. @Shri Sujeet Kumar
9. @Shri Sharadchandra Pawar
10. \$Shrimati Adhikarimayum Sharda Devi

LOK SABHA

11. Shrimati Sajda Ahmed
12. Shri Alfred Kanngam S. Arthur
13. Shri Phani Bhusan Choudhury
14. Shri Biplab Kumar Deb
15. Shri Vamsi Krishna Gaddam
16. Shri Tapir Gao
17. Adv K. Francis George
18. Shri Eswarasamy K.
19. Shri Mahesh Kashyap
20. Dr. Anand Kumar
21. Shri Mohibbullah
22. Shri Jagdambika Pal
23. Shri Jashubhai Bhilubhai Rathva
24. Shri Trivendra Singh Rawat
25. Shrimati Himadri Singh
26. Shri Tejasvi Surya
27. Shri Durai Vaiko
28. Shri Yaduveer Wadiyar
29. Shri Balwant Baswant Wankhade
30. Shri Akhilesh Yadav
31. **Vacant*

(i)

[#] Nominated w.e.f. 18.05.2026

@ Nominated w.e.f. 03.06.2026

\$ Nominated w.e.f. 23.07.2026

* Shri Pradyut Bordoloi ceased to be member of the Committee consequent upon his resignation from the Lok Sabha w.e.f. 20.03.2026.

SECRETARIAT

Shri Rakesh Naithani, Joint Secretary
Shri Arun Kumar, Director
Shri Rajiv Saxena, Deputy Secretary
Shri Ahmar Saleem Ansari, Under Secretary
Shri Vaibhav Jain, Committee Officer

PREFACE

I, the Chairperson of the Department-related Parliamentary Standing Committee on Science and Technology, Environment, Forests and Climate Change, having been authorised by the Committee to present the Report on its behalf, present this Four Hundred Twelfth Report on “*Forest Fires in the Himalayan Region, its adverse effects and mitigation measures*”.

2. In its meetings held on the 17th June, 2026, and 3rd July, 2026, the Committee heard the views of the representatives of the Ministry of Environment, Forest and Climate Change, Forest Research Institute, National Remote Sensing Centre, National Disaster Management Authority, National Disaster Response Force, Government of Union Territory of Jammu & Kashmir, State Governments of Himachal Pradesh, Uttarakhand, Arunachal Pradesh and Manipur and some subject experts.

3. The Committee expresses its thanks to the officers of the Ministry of Environment, Forest and Climate Change, Forest Research Institute, National Remote Sensing Centre, National Disaster Management Authority, National Disaster Response Force, Government of Union Territory of Jammu & Kashmir, State Governments of Himachal Pradesh, Uttarakhand, Arunachal Pradesh and Manipur and the non-official witnesses for placing before the Committee the required material and replying to the clarifications sought by the Committee on the subject

4. In the meeting held on 5th August, 2026, the Committee considered the draft Report and adopted the same.

(DR. MEDHA VISHRAM KULKARNI)

NEW DELHI
7th August, 2026
16 Sravana, 1948 (Saka)

Chairperson,
Department-related Parliamentary Standing Committee on
Science and Technology, Environment, Forests and Climate Change,
Rajya Sabha.

CHAPTER – 1

INTRODUCTION

1.1 The Himalayan region, spanning approximately 17 per cent of India's geographical area and home to about 4 per cent of its population, represents one of the most ecologically sensitive and biodiverse landscapes on Earth. The region's diverse forests—ranging from Chir Pine (*Pinus roxburghii*) forests to broad-leaved deciduous and Himalayan moist temperate forests—provide critical ecosystem services, support unique biodiversity, and sustain the livelihoods of millions of people. However, these fragile ecosystems are increasingly threatened by the growing incidence and intensity of forest fires.

1.2 Forest fires have emerged as a significant environmental challenge across India's forested landscapes, particularly in the Himalayan region, where changing climatic conditions, prolonged dry spells, and anthropogenic pressures have altered their frequency and intensity. The number of forest fire incidences in the country varies from year to year depending on the vulnerability of forests to various risk factors. The Himalayan region, including the North Eastern Region (NER), is highly vulnerable owing to its dense forests, shifting cultivation (*jhum*) in some areas, and difficult terrain. Forest areas are increasingly facing difficult fire-weather conditions and extended fire seasons under the influence of climate change, which is likely to impose immense costs in terms of loss of biodiversity, ecosystem services, human well-being, livelihoods, and national economies. Forest fires are, hence, a major disaster in India, causing significant ecological and economic damage. The forest fire season in India generally extends from November to June.

1.3 Since 2004, the Forest Survey of India (FSI), Dehradun, has been alerting State Forest Departments, including that of the Himalayan States, and other agencies concerned, with regard to forest fires, using remote sensing and satellite-based technology, specifically the MODIS and SNPP-VIIRS sensors. Data on Near Real Time (NRT) Forest Fire detections across the 13 Himalayan States/UTs over the last four forest fire seasons (November to June) reveal marked inter-annual volatility rather than any steady or uniform trend, with most States showing sharp season-to-season swings instead of a consistent rise or decline. Uttarakhand and

Himachal Pradesh stand out for anomalous spikes in 2023-24—Uttarakhand's detections nearly quadrupled to over 21,000, and Himachal Pradesh's rose more than fourteen-fold—before falling back sharply in subsequent seasons, suggesting that these spikes were driven by unusually dry or fire-conducive conditions specific to that season rather than a sustained worsening trend. The larger and more fire-prone North-Eastern States—Assam, Manipur, Meghalaya, Mizoram, and Nagaland—consistently register the highest absolute numbers of detections across all four seasons, though even among these there is no clear directional trend, with Mizoram peaking sharply in 2024-25 while others taper. In contrast, the Trans-Himalayan/high-altitude regions of Ladakh and Sikkim report negligible detections throughout, reflecting their sparse forest cover and cooler, less fire-susceptible ecology.

1.4 The latest 2025-26 season, though measured only till 08th June 2026, presents a mixed picture: some States, such as Arunachal Pradesh, have registered their highest count in four years even before the season's end, indicating a possible worsening trend that merits close monitoring, while others show relative moderation compared to peak years. Taken together, the data underscore that forest fire incidence in the Himalayan region is governed less by any linear trajectory and more by year-specific meteorological and anthropogenic factors, reinforcing the need for continued real-time monitoring and State-specific mitigation strategies rather than a one-size-fits-all approach.

1.5 Forest fires have been an integral part of forest ecosystems, playing a pivotal role in shaping their conservation and management. Managed forest fires are utilised as crucial tools for resource management, improving ecological conditions, and reducing excessive fuel accumulation. Despite these benefits in facilitating regeneration and clearing forest floors, the losses associated with fires far outweigh them. Whether managed or unmanaged, fires within an ecosystem can result in significant alterations to habitat and species composition.

1.6 The principal parameters used to assess loss due to forest fire include timber loss, carbon loss, loss of Non-Wood Forest Products (NWFP), loss of micro-flora and fauna, and loss of habitat. Forest fires destroy vegetation and wildlife habitats, increase soil erosion, and release harmful pollutants that adversely affect air

quality and contribute to climate change. Their consequences extend well beyond the ecological, encompassing human casualties, reduced production and productivity, and landscape-level degradation. Socio-economically, forest fires destroy valuable timber resources, affect agricultural productivity, and disrupt the livelihoods of forest-dependent communities, while substantial resources are, in turn, required for fire suppression and ecological restoration.

1.7 Forest fires in the Himalayan region arise from a complex interplay of natural and anthropogenic factors. Natural causes include the accumulation of inflammable material such as dry leaves, twigs, and pine needles. Chir pine forests are particularly vulnerable, accounting for nearly 57 per cent of forest fire incidents in the western Himalayas: the dry needles of Chir pine, locally known as *pirul*, are rich in resin and highly flammable, and once they collect in thick layers on the forest floor, even a small spark can quickly spread into a wildfire. **Since the accumulated pine needles constitute a principal fuel source, their removal and productive utilisation has been recognised as one of the major mitigation strategies in the Western Himalayan region.** In the Eastern Himalayan region, by contrast, human-induced fires—whether intentional or accidental—are the primary cause, including deliberate burning to clear land or encourage fresh grass growth (slash and burn agriculture), as well as careless acts such as discarding cigarette butts. Climate change has exacerbated the situation across the region, with rising temperatures, longer dry spells, and increasing climatic variability creating conditions conducive to more frequent and intense fires.

1.8 Recognising the gravity of the situation and in view of the increase in the number of forest fire incidents in the Himalayan region, the Department-related Parliamentary Standing Committee on Science and Technology, Environment, Forests and Climate Change took up the subject ***"Forest Fires in the Himalayan Region, its adverse effects and mitigation measures"*** for detailed examination. The Committee, accordingly, held a meeting on the subject on 17th June, 2026, and heard the views of the representatives of the Ministry of Environment, Forest and Climate Change and the State Governments of Himachal Pradesh and Uttarakhand. Since the Himalaya is a long and continuous mountain range and conditions differ vastly between its eastern and western regions, the Committee further decided to seek the views of some States of the Eastern Himalayan region as well. Given that,

in the Western Himalayan region, effective utilisation of pine needles has been recognised as one of the major solutions to this problem, the Committee also decided to invite non-official witnesses from the industrial sector with domain knowledge in this field, along with prominent leaders from the local community working on this cause. In this course, the Committee again met on 03rd July, 2026, and heard the views of the representatives of the State Governments of Arunachal Pradesh and Manipur; the Government of the Union Territory of Jammu & Kashmir; and subject-experts viz. Shri Deepak Kumar Varshney, Lt. Col. Monish Ahuja (Retd.) and Shri Mahadev Singh Gangadi. The Committee also felt that, for a holistic understanding of the issue, it needed to understand the mechanism for detection and monitoring of forest fires, the research being undertaken on Himalayan forests, and the management of forest fires after their occurrence. Therefore, in the said meeting, the Committee also heard the views of the Forest Research Institute (FRI), the National Remote Sensing Centre (NRSC), the National Disaster Management Authority (NDMA), and the National Disaster Response Force (NDRF). The Committee further sought the views/opinions/comments on the subject from other subject experts Dr. Dvijendra Kumar Sharma, IFS (Retd.), Former PCFF & HOFF, Tripura and Dr. Balakrishna Pisupati, Country Head, UNEP. Overall, in both meetings, the Committee examined the subject from various points of view and sought to understand the steps taken/being taken by the concerned Ministry(s)/ Department(s) and Agencies as well as State Governments.

CHAPTER – 2

FOREST FIRES IN THE HIMALAYAN REGION: EXTENT AND TRENDS

2.1 In order to understand the extent, impact and consequences of Forest Fires, it is foremost important to have a comprehensive data on country's forest resources, total forest area, forest cover, actual tree cover etc. and other related indicators. For the purpose, Forest Survey of India (FSI), Dehradun, an organisation under the Ministry of Environment, Forest and Climate Change (MoEFCC), has been assessing the forest cover of the country biennially since 1987, with findings published in the India State of Forest Report (ISFR). This Wall-to-Wall Forest Cover Mapping exercise combines remote sensing with intensive ground verification and field data from the national forest inventory.

2.2 FSI also monitors forest fire incidents using Moderate Resolution Imaging Spectro-Radiometer (MODIS) and Suomi National Polar-orbiting Partnership Visible Infrared Imaging Radiometer Suite (SNPP-VIIRS) satellite sensors. Since 2004, it has issued satellite-based Pre-Forest Fire Alerts, Near Real-Time Forest Fire Alerts and Large Forest Fire Alerts to State Forest Departments and other agencies, including in the Himalayan States.

2.3 In their background notes submitted to the Committee, the Ministry of Environment, Forest and Climate Change and Indian Council of Forestry Research and Education-Forest Research Institute (ICFRE-FRI) furnished extensive data on forest fires in different Himalayan States.

2.4 The number of Near Real Time Forest Fire detected by FSI using SNPP-VIIRS sensors during the last four forest fire seasons in the Himalayan Region are as follows:

S. No.	State/UTs	Number of Forest Fire Detections during Forest Fire Seasons (November to June)			
		2022-23	2023-24	2024-25	2025-26 (till 08 th June 2026)
1	Arunachal Pradesh	2,447	2,053	1,962	3,321

2	Assam	9,830	7,639	8,932	5,553
3	Himachal Pradesh	704	10,136	2,231	2,730
4	Jammu & Kashmir	131	3,829	1,990	1,113
5	Ladakh	20	32	21	40
6	Manipur	10,127	4,498	10,149	3,985
7	Meghalaya	6,604	4,319	7,514	2,758
8	Mizoram	5,798	6,627	12,332	3,755
9	Nagaland	3,882	2,609	3,590	2,469
10	Sikkim	49	101	0	11
11	Tripura	4,332	2,089	2,805	1,358
12	Uttarakhand	5,351	21,033	3,563	6,403
13	West Bengal	3,096	2,020	1,609	2,391

2.5 FSI defines Large Forest Fire as an event comprising at least three proximate SNPP-VIIRS satellite pixels. Using an automated algorithm, it identifies blazes spanning an estimated area of more than ~40 hectares with at least three contiguous pixels in any geometry. The State/UT-wise number of Large Forest

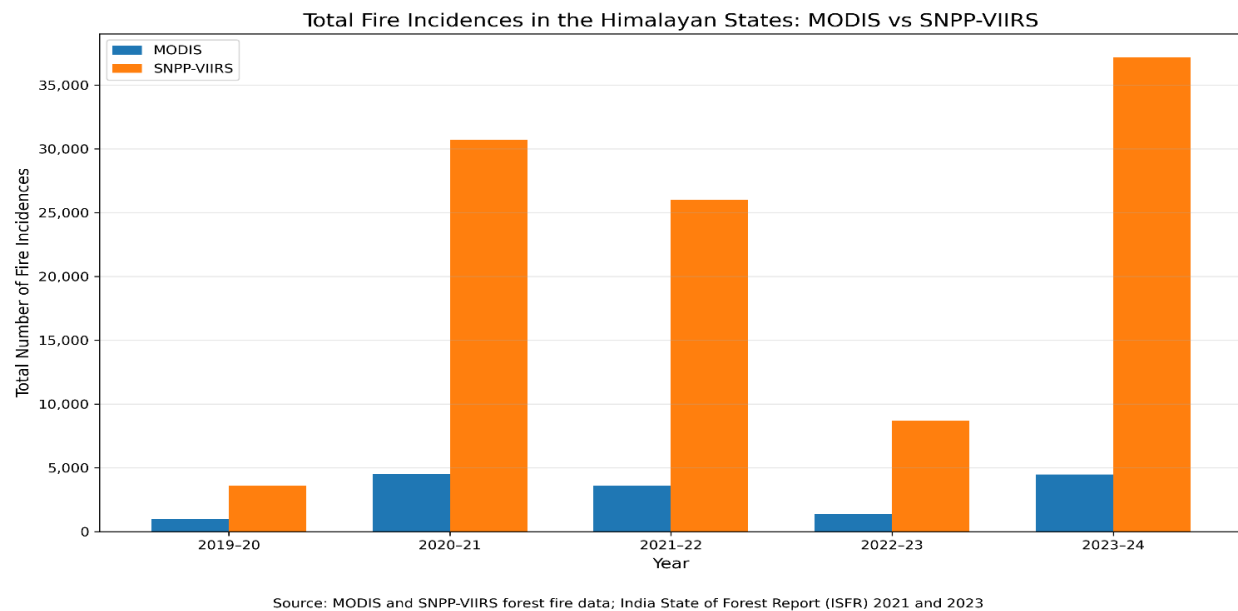
Fire events detected during last four forest fire seasons in the Himalayan Region is given as under:

S. No.	State/UTs	Number of Large Forest Fire Events detected during forest Fire Seasons (November to June)			
		2022–23	2023–24	2024–25	2025–26 (till 08 th June 2026)
1	Arunachal Pradesh	152	127	141	184
2	Assam	612	471	525	324
3	Himachal Pradesh	45	732	121	168
4	Jammu & Kashmir	6	281	147	85
5	Ladakh	2	1	0	1
6	Manipur	701	372	707	327
7	Meghalaya	352	191	431	159
8	Mizoram	430	501	749	267
9	Nagaland	311	209	295	207
10	Sikkim	2	8	0	1
11	Tripura	295	147	226	108
12	Uttarakhand	268	1,313	196	404
13	West Bengal	175	120	83	143

Annual Trend of Forest Fire Incidences during 2019–2024

2.6 The annual trend of forest fire incidences in the Indian Himalayan Region during 2019–20 to 2023–24 shows marked inter-annual variability. Based on SNPP-VIIRS fire detections, total fire incidences increased sharply from 3,566 in 2019–20 to 30,672 in 2020–21. Fire occurrence remained high in 2021–22, with

25,995 incidences, followed by a substantial decline to 8,682 incidences in 2022–23. However, fire incidence increased again in 2023–24, reaching the highest value of the assessment period with 37,152 fire incidences. This pattern indicates that fire occurrence in the Himalayan region is strongly influenced by year-to-year variation in weather conditions, fuel dryness, rainfall distribution and anthropogenic ignition.



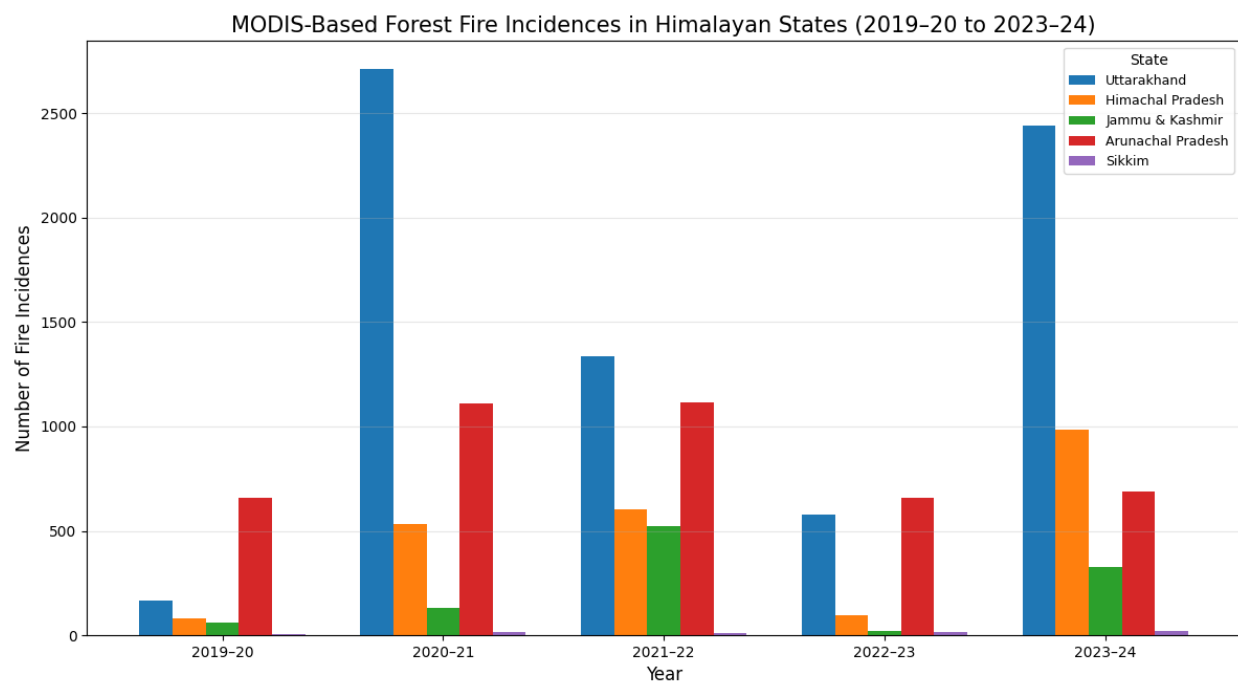
Annual Trend of Forest Fire Incidences in the Indian Himalayan Region (2019–2024)

2.7 The MODIS dataset also shows a similar broad temporal pattern, although it recorded a much lower number of incidences than SNPP-VIIRS. MODIS-based fire detections were relatively low in 2019–20, increased during 2020–21, remained high during 2021–22, declined during 2022–23, and rose again during 2023–24. The difference between the two datasets is expected because MODIS detects fire hotspots at coarser spatial resolution, whereas SNPP-VIIRS captures smaller and short-duration fires more effectively. The sharp rise during 2020–21 and 2023–24 suggests that the Himalayan region is becoming increasingly vulnerable to seasonal fire peaks, especially under dry and warm conditions. These

trends emphasize the need for year-round preparedness, fire-danger forecasting, fuel-load management and rapid ground response in high-risk states.

MODIS-Based Forest Fire Incidences in Himalayan States

2.8 MODIS-based forest fire statistics for Himalayan states during 2019–20 to 2023–24 show considerable variation among states and years. Among the assessed Himalayan states, Uttarakhand recorded the highest MODIS-based fire incidences in most years, increasing from 166 in 2019–20 to 2,711 in 2020–21, followed by 1,329 in 2021–22, 579 in 2022–23, and 2,441 in 2023–24. This pattern indicates recurrent fire vulnerability in Uttarakhand, particularly during high-fire years. The high fire incidence in Uttarakhand may be linked to extensive Chir pine forests, dry needle accumulation, high human–forest interface, steep slopes and seasonal climatic dryness.



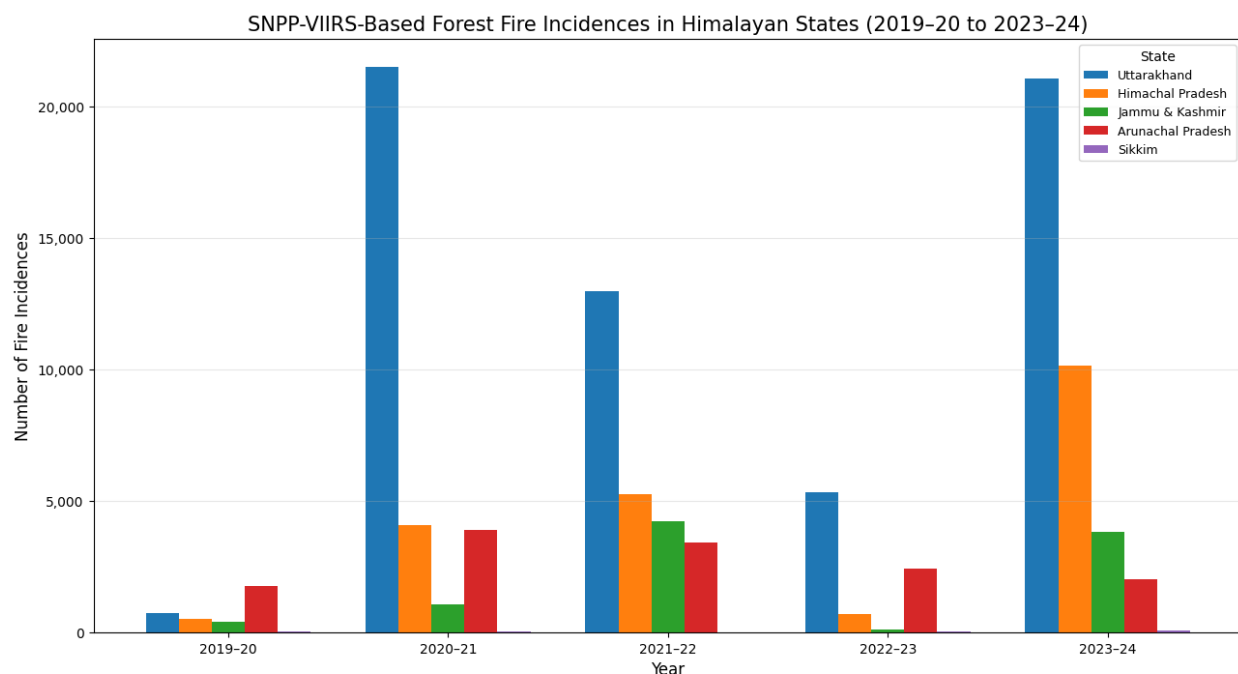
Source: MODIS forest fire data; India State of Forest Report (ISFR) 2021 and 2023

State-wise MODIS-Based Forest Fire Incidences in Himalayan States (2019–2024)

2.9 Arunachal Pradesh also recorded consistently high MODIS-based fire incidence, with 659 fires in 2019–20, 1,108 in 2020–21, 1,110 in 2021–22, 662 in 2022–23, and 690 in 2023–24. Unlike western Himalayan states, Arunachal Pradesh showed comparatively stable fire incidence across years, indicating persistent but less sharply fluctuating fire activity. Himachal Pradesh recorded 83 incidences in 2019–20, followed by 536 in 2020–21, 604 in 2021–22, a decline to 95 in 2022–23, and a rise to 984 in 2023–24. Jammu & Kashmir recorded relatively lower but variable values, with 55 in 2019–20, 135 in 2020–21, 523 in 2021–22, a low value during 2022–23, and 331 in 2023–24. Sikkim recorded the lowest MODIS-based fire incidences, with values remaining below 25 in all years. Overall, MODIS data indicate that 2020–21 and 2023–24 were major fire years for several Himalayan states, particularly Uttarakhand and Himachal Pradesh. The relatively low detections in Sikkim may be associated with its smaller geographical area, high moisture conditions, different forest composition and fewer dry-season fire-prone landscapes compared to larger Himalayan states.

SNPP-VIIRS-Based Forest Fire Incidences in Himalayan States

2.10 SNPP-VIIRS-based forest fire statistics provide a more detailed picture of fire occurrence due to the sensor's finer spatial resolution. During 2019–20 to 2023–24, Uttarakhand recorded the highest number of fire incidences among the Himalayan states, with 759 fires in 2019–20, a sharp rise to 21,487 in 2020–21, 12,985 in 2021–22, a decline to 5,351 in 2022–23, and again a high value of 21,033 in 2023–24. This indicates that Uttarakhand remained the most fire-affected Himalayan state in terms of SNPP-VIIRS detections during high-fire years.



Source: SNPP-VIIRS forest fire data; India State of Forest Report (ISFR) 2021 and 2023

State-wise SNPP-VIIRS-Based Forest Fire Incidences in Himalayan States (2019–2024)

2.11 Himachal Pradesh also showed a strong increasing pattern, with 536 fires in 2019–20, 4,110 in 2020–21, 5,280 in 2021–22, 704 in 2022–23, and 10,136 in 2023–24. The sharp rise in 2023–24 indicates increasing fire vulnerability in the state, possibly linked to dry conditions, combustible biomass and anthropogenic ignition. Jammu & Kashmir recorded 438 fires in 2019–20, 1,098 in 2020–21, 4,255 in 2021–22, a sharp decline to 131 in 2022–23, and a rise to 3,829 in 2023–24. This pattern reflects high inter-annual variability in fire activity.

2.12 Arunachal Pradesh recorded 1,786, 3,914, 3,449, 2,447 and 2,053 fire incidences during 2019–20, 2020–21, 2021–22, 2022–23 and 2023–24, respectively. Unlike the Western Himalayan States, Arunachal Pradesh showed relatively consistent fire occurrence across the period, though values declined after 2020–21. Sikkim recorded the lowest number of SNPP-VIIRS fire incidences, with 47 in 2019–20, 63 in 2020–21, 26 in 2021–22, 49 in 2022–23, and 101 in 2023–24.

2.13 The SNPP-VIIRS dataset clearly shows that forest fire incidence was comparatively low in 2019–20, increased sharply in 2020–21, remained high in

2021–22, declined in 2022–23 and peaked again in 2023–24. The highest fire burden was observed in Uttarakhand, followed by Himachal Pradesh, especially during 2023–24. These findings demonstrate the need for state-specific forest fire mitigation strategies, particularly in the western Himalayan belt.

State-Wise Fire Vulnerability and Emerging Hotspots

2.14 The State-wise fire statistics indicate that fire vulnerability is not evenly distributed across the Himalayan region. Uttarakhand emerges as the most fire-affected State, particularly in 2020–21 and 2023–24, based on SNPP-VIIRS detections. The State's fire vulnerability is associated with extensive Chir pine forests, high surface fuel load, pine needle accumulation, dry pre-monsoon weather, steep slopes, forest-fringe settlements, road networks, grazing and human ignition sources. The repeated high fire counts in Uttarakhand indicate a need for intensive fuel-load management, pine-needle utilization, community-based fire prevention and rapid response systems.

2.15 Himachal Pradesh also shows increasing fire vulnerability, especially in 2023–24, when SNPP-VIIRS detected 10,136 incidences. The State has fire-prone lower and middle Himalayan forests, where dry biomass, conifer litter, human activity and seasonal dryness contribute to fire risk. Jammu & Kashmir shows episodic fire peaks, particularly in 2021–22 and 2023–24, suggesting that fire occurrence may be strongly influenced by seasonal climatic conditions and local ignition patterns. Arunachal Pradesh, although not showing the same extreme peaks as Uttarakhand, recorded consistently high numbers of fire detections, indicating persistent fire activity in the Eastern Himalayan and North-Eastern hill landscape. Sikkim, in contrast, remained the least fire-affected among the assessed States, with consistently low values.

2.16 Emerging hotspots are likely to occur in lower- and mid-elevation forest belts, pine-dominated landscapes, degraded forests, forest edges, road corridors, settlement interfaces, tourist routes and areas with recurrent historical fire incidence. The identification of such hotspots should be supported through GIS-based fire density mapping, recurrence analysis, slope-aspect modelling, forest type classification and integration of anthropogenic pressure indicators. This will enable prioritization of vulnerable forest divisions and ranges for pre-fire

preparedness, fire-line maintenance, fuel-load reduction and community awareness.

2.17 The Committee desired to know as to whether any research has been undertaken on the linkage between climate change and increasing fire frequency in the Himalayan region and put a query to this effect to the Ministry of Environment, Forest and Climate Change. In response, the Ministry stated that it recognises that rising temperatures, prolonged dry spells and increasing climate variability are contributing factors to the increasing frequency and intensity of forest fire occurrence in the region. The Ministry, however, informed the Committee that no specific research study on this linkage has, as yet, been commissioned or assigned by the Ministry.

2.18 In response to the same query, ICFRE-FRI informed the Committee that although no dedicated study establishing the climate change- forest fire linkage has been conducted, the ICFRE-FRI is currently implementing the "*National Collaborative Scheme on Forest Fire Management (NCSFFM)*", as a part of which, it assesses the impact of future climate change scenarios on forest fire vulnerability. This component aims to generate spatially explicit projections of forest fire vulnerability across four future time periods viz. 2021-2040, 2041-2060, 2061-2080 and 2081-2100, under the IPCC AR6 Shared Socioeconomic Pathway (SSP) scenarios, by integrating projected climatic variables with vegetation, topographic and anthropogenic factors. The ICFRE-FRI noted that the study's approach is oriented towards predictive vulnerability mapping - identifying future fire-prone zones and comparing fire risk across different climate pathways - rather than towards establishing a correlation between historical climate trends and past fire occurrence. The findings, on completion, are to be submitted to the Ministry.

2.19 UNEP, however, informed the Committee that according to its studies climate change and land-use change could increase the global incidence of extreme fires by up to 14 per cent by 2030, 30 per cent by 2050 and 50 per cent by the end of the century, including in areas not previously considered highly fire-prone.

2.20 The Committee notes that there is no dedicated research study to establish or quantify that climate change is a contributing factor to the rising frequency and intensity of forest fires in the Himalayan region. The Committee takes note of the ongoing work under the NCSFFM at ICFRE-FRI; however, it observes that this work, being forward-looking and scenario-based in its design, is oriented towards projecting future fire vulnerability rather than towards empirically establishing the historical relationship between climate variables and past fire incidence. The Committee is, therefore, of the view that a knowledge gap persists in this regard, and that the Himalayan region, given its ecological fragility, topographic complexity and high sensitivity to climatic shifts, requires dedicated region-specific research rather than reliance on general or extrapolated findings from other forest ecosystems.

2.21 The Committee, therefore, recommends that the Ministry should commission a dedicated, region-specific research study to establish the empirical linkage between climate change and forest fire frequency, intensity and seasonality in the Indian Himalayan Region. Such a study should, at a minimum, examine long-term trends in temperature, precipitation and dry-spell duration against historical forest fire incidence data; assess how altitudinal and species-wise variation across Himalayan forest types affects fire vulnerability under changing climatic conditions; and generate predictive fire-risk models that can inform seasonal preparedness, resource deployment and early-warning systems. The Committee further recommends that this research be undertaken in coordination with, and to complement, the vulnerability mapping already underway under the NCSFFM, so as to build an evidence base that spans both retrospective analysis and future projection.

It also recommends that the findings of such research be periodically updated and integrated into the Ministry's forest fire prevention and management guidelines, so that policy responses keep pace with the evolving climate-fire relationship rather than being based on generalised assumptions.

CHAPTER – 3

REGIONAL FIRE REGIMES: WESTERN AND EASTERN HIMALAYA

3.1 The forest fire regimes of the Western and Eastern Himalaya, though sharing a common seasonal window, are shaped by fundamentally divergent climatic forces, vegetative compositions, fuel characteristics and anthropogenic pressures, necessitating a region-differentiated understanding of fire risk.

3.2 In the Western Himalaya, the fire season typically spans February to June, peaking in April–May, driven primarily by pronounced pre-monsoon warming and sustained seasonal dryness. Temperature is the dominant climatic driver in this region. The fire ecology here is closely tied to the extensive subtropical Chir Pine (*Pinus roxburghii*) forests, whose needle litter accumulates into highly combustible fuel loads on the forest floor. This natural fuel vulnerability is compounded by anthropogenic factors: fire frequency declines markedly with increasing distance from roads and settlements, pointing to the significant role of accidental or deliberate human ignition — whether through agricultural residue burning, negligence, or deliberate clearing. Steep slopes and low fuel moisture further intensify fire spread once ignited. Taken together, these factors have driven an increasing trend in fire severity, making the Western Himalaya the most fire-prone zone in the Indian Himalayan Region.

3.3 The Eastern Himalaya presents a contrasting and, in aggregate terms, more severe fire regime. Peak burning is concentrated earlier in the year, during March–April, though fires also occur through the winter and pre-monsoon months. Here, the principal meteorological control is not temperature alone but atmospheric aridity governed by the interplay of precipitation, temperature and soil moisture — which drives fire risk even in a region that is comparatively wetter overall than the west. The rich tropical and sub-tropical forests of the region, together with bamboo brakes and broad-leaved forest fuels, are highly susceptible to these dry atmospheric conditions when they occur. Superimposed on this climatic vulnerability is a distinct anthropogenic pattern: fires in the Eastern Himalaya are closely associated with shifting cultivation (*jhum*) and agricultural burning

practices, as well as forest-fringe activities, particularly in degraded forests and jhum fallow land.

3.4 The Committee observes that these contrasting dynamics — the Western Himalaya's fire threat being driven primarily by extreme pre-monsoon heat, pine-needle fuel loads and proximity-based human ignition, as against the Eastern Himalaya's more complex interplay of atmospheric dryness and cultivation-linked burning practices — demonstrate that a uniform, pan-Himalayan approach to fire prevention and mitigation would be inadequate to the distinct ecological and socio-economic realities of the two regions. The Committee is, therefore, of the considered view that mitigation and adaptation strategies must be tailored separately to each region.

3.5 The Committee further recommends that any national or regional forest fire prevention framework explicitly recognise and provide for this West-East differentiation, so that resource allocation, early-warning systems and community engagement strategies are calibrated to the distinct climatic and anthropogenic drivers operating in each sub-region.

CHAPTER – 4

ADVERSE EFFECTS OF FOREST FIRES

4.1 Forest fires, whether natural, accidental or intentional, cast both short-term and long-term effects on forest ecosystems by altering vegetation structure, biodiversity, soil properties, hydrological processes, carbon dynamics and ecosystem services. In the Himalayan region, these impacts are amplified because the landscape is ecologically fragile, geologically young, topographically steep and strongly dependent on forest-based ecosystem services. The Indian Himalayan Region supports diverse forest types, high biodiversity, rich water resources and the livelihoods of forest-fringe communities that depend on fuelwood, fodder, non-timber forest products and local water sources. Recurrent fires disturb this ecological balance by damaging vegetation and regeneration, increasing soil erosion, releasing greenhouse gases, affecting water quality and quantity, and imposing direct and indirect socio-economic costs. Even low-to-moderate intensity surface fires can become ecologically significant when they recur frequently in shallow-soil mountain landscapes with slow recovery rates. In its background note submitted to the Committee, ICFRE-FRI described the following adverse effects of forest fires:-

1. Loss of Biodiversity: Forest fires cause direct and indirect loss of biodiversity by destroying vegetation, habitats, nesting sites, seed banks and regeneration potential. The Himalayan region supports many endemic, rare, threatened and medicinal plant species that are often restricted to specific altitudinal zones and microhabitats. Fire damages seedlings, saplings, shrubs, herbs and ground flora, thereby weakening natural regeneration and reducing the future recruitment of native forest species. Repeated burning can gradually shift species composition towards fire-tolerant grasses, weeds and invasive plants, while reducing native understorey diversity and forest structural complexity. Wildlife is also affected through loss of shelter, breeding sites, food resources and movement corridors. Small mammals, reptiles, insects, soil organisms and ground-nesting birds are particularly vulnerable because of their limited mobility during fire events. Thus, recurrent fires can reduce habitat quality, simplify forest structure and weaken long-term ecosystem resilience.

2. Soil Degradation and Landslides: The steep slopes of the Himalayan region make soil systems highly vulnerable after fire. Forest vegetation and litter layers normally protect soil from rainfall impact, bind slopes through root networks and regulate surface runoff. When fire removes this protective cover, the exposed soil becomes more susceptible to sheet erosion, rill erosion, gully formation and slope instability. High-intensity fires can destroy soil organic matter, reduce aggregate stability, increase soil bulk density and create water-repellent or hydrophobic layers, which lower infiltration and increase surface runoff. In mountainous terrain, enhanced runoff and loss of root cohesion can accelerate sediment transport and increase the risk of landslides, especially during intense monsoon rainfall. Therefore, soil degradation following fire is not confined to the burnt patch; it can also affect downstream streams, reservoirs, agricultural lands and settlements through sedimentation and debris flow risks.

3. Air Pollution and Greenhouse Gas Emissions: Forest fires release large quantities of smoke, particulate matter, carbon dioxide, carbon monoxide, methane, nitrogen oxides and other pollutants into the atmosphere. These emissions deteriorate local and regional air quality, reduce visibility and can contribute to haze formation in mountain valleys where air circulation is often limited. Biomass burning also releases carbon stored in vegetation, litter and soil organic matter, thereby contributing to greenhouse gas emissions and climate forcing. Repeated fires further reduce the future carbon sequestration capacity of forests by damaging standing biomass, inhibiting regeneration and slowing biomass accumulation. This creates a feedback mechanism in which warming and drying increase fire risk, while fire emissions and forest degradation further weaken the climate-regulation function of Himalayan forests.

4. Impact on Water Resources: Himalayan forests are critical for regulating water availability through interception, infiltration, groundwater recharge, spring discharge and streamflow stabilization. Forest fires disturb these hydrological functions by removing canopy cover, consuming litter and organic matter, and altering soil structure. After fire, reduced infiltration and increased runoff may decrease groundwater recharge and affect springs, streams and small rivers that are essential for drinking water, irrigation and livestock in mountain villages. Fire-induced erosion increases sediment, ash, dissolved organic matter and nutrient

loads in water bodies, which can degrade water quality and reduce the storage capacity of ponds, check dams and reservoirs. Consequently, forest fires affect not only terrestrial ecosystems but also watershed services and downstream water security.

5. Loss of Soil Fertility: Soil fertility is severely affected when fires are frequent or intense. The litter layer and humus-rich topsoil contain organic matter, nutrients, microorganisms, fungal networks and seeds that are essential for forest productivity. Fire consumes organic matter and may volatilize important nutrients such as nitrogen and sulphur. Although low-intensity fire can temporarily increase some available nutrients through ash deposition, nutrients are often lost rapidly through runoff, erosion and leaching in steep terrain. High soil temperatures can also kill beneficial microbes and soil fauna, reducing decomposition, nutrient cycling and soil recovery. In the Himalayan context, where soils are generally shallow and formation rates are slow, repeated fertility loss can reduce productivity of forests as well as adjoining agricultural lands.

6. Damage to Forest Resources: Forest fires cause extensive damage to forest resources such as timber, fuelwood, fodder, bamboo, medicinal plants, resin-yielding trees and other non-timber forest products. Fires may kill young regeneration, scorch standing trees, damage cambium tissues and make trees more vulnerable to insects, pathogens and future drought stress. Even when mature trees survive, fire scars may reduce timber quality and economic value. In pine-dominated Himalayan forests, recurrent fire may consume pine needles and surface litter, but repeated burning can also damage regeneration and simplify the understory. Medicinal plants and valuable herbs are often highly vulnerable because many occur on the forest floor or in the understory. Such losses directly affect ecosystem productivity, rural income and the traditional forest-based economy of mountain communities.

7. Impact on Livelihoods and Rural Economy

The livelihoods of Himalayan communities are closely linked with forests. Local households depend on forests for fuelwood, fodder, grazing, leaf litter, edible plants, medicinal herbs, water sources and small-scale forest-based income. Forest fires reduce the availability and quality of these resources and increase the

workload of rural households, particularly women and marginal communities who are often responsible for collecting fuelwood, fodder and water. Fires may damage agricultural fields, orchards, livestock shelters, trails and village infrastructure located close to forest boundaries. Tourism and eco-tourism may also be affected when fires degrade scenic landscapes, wildlife habitats and air quality. Post-fire recovery requires additional expenditure on suppression, restoration, soil conservation and plantation works, thereby creating direct and indirect economic costs for communities and forest departments.

8. Human Health Impacts: Smoke from forest fires poses serious health risks to people living in and around forested areas. Fine particulate matter and gaseous pollutants from wildfire smoke can cause eye irritation, respiratory tract irritation, coughing, reduced lung function, aggravation of asthma and worsening of cardiovascular conditions. Children, elderly people, pregnant women and individuals with pre-existing respiratory or cardiac disease are particularly vulnerable. Frontline forest staff, firefighters and local volunteers face additional occupational risks, including burns, heat stress, dehydration, injuries, smoke inhalation and reduced visibility during suppression operations. In Himalayan terrain, these risks increase due to steep slopes, difficult access, limited water availability and delays in medical support.

9. Long-Term Ecological and Climate Implications: The cumulative impacts of repeated forest fires can be more damaging than a single fire event. Frequent burning prevents natural succession, reduces forest density, favours invasive species, depletes soil fertility and weakens ecosystem resilience. Over time, frequently burnt forests may shift towards degraded scrublands or grass-dominated landscapes, reducing biodiversity, carbon storage, watershed protection and livelihood benefits. Climate change can intensify this risk by increasing temperature, prolonging dry periods and creating fire-conducive weather conditions. In the Himalayan region, the interaction between climate variability, fuel accumulation, land-use pressure and human ignition sources is likely to increase future fire vulnerability. Forest fire should therefore be viewed not merely as a seasonal hazard but as a long-term ecological, climatic and developmental

challenge requiring prevention, preparedness, restoration and adaptive management.

4.2 The Ministry of Environment, Forest and Climate Change in its Background Note submitted to the Committee acknowledged that fire has historically played a role in forest ecosystem regeneration and floor-clearing, and that managed/prescribed fire is itself a recognised resource-management tool. The Ministry was, however, categorical that the ecological and economic losses caused by uncontrolled forest fires far outweigh any such benefits.

4.3 The Committee desired to know from the Ministry whether it maintains any centralized national database of forest fire victims. In response the Committee was informed by the Ministry that it does not maintain a centralised national database of forest fire victims (forest staff or civilians) or of compensation paid – such records being maintained separately by State Governments, Forest Departments and District Administrations under their respective service rules and disaster relief provisions.

4.4 The Committee is of the considered view that this constitutes a significant data gap, particularly since human casualties are explicitly recognised as among the major adverse effects of forest fires. In the absence of a consolidated national record, the true human cost of forest fires across States remains obscured, hampering both accountability and evidence-based policy formulation. The Committee, therefore, recommends that the Ministry take urgent steps, in consultation with State Governments, to develop and maintain a centralised database capturing details of forest fire casualties and compensation paid, to enable systematic monitoring and informed policy interventions.

4.5 The Committee further notes that Himalayan forests perform a critical watershed function, regulating infiltration, groundwater recharge and spring discharge on which the majority of the region's population depends for

drinking water and irrigation. Forest fires, by removing canopy cover and litter and altering soil infiltration, directly compound this existing stress on spring-fed systems, particularly in shallow-soil mountain catchments where recovery is slow even without the added pressure of fire.

4.6 The Committee, therefore, recommends that the Ministry, in coordination with the Ministry of Jal Shakti and concerned State Governments, develop a structured protocol for post-fire watershed and spring rejuvenation, comprising the following elements: first, mandatory post-fire hydrological assessment of burnt catchments, to identify springs, streams and recharge zones within or downstream of the affected area; second, inclusion of such assessments in existing forest fire damage-reporting mechanisms, so that hydrological impact is captured alongside data on area burnt and vegetation loss; third, prioritised taking-up of identified fire-affected springsheds under ongoing National and State spring rejuvenation and watershed management programmes, rather than routing them through the ordinary, non-prioritised project pipeline; and fourth, monitoring of spring discharge and water quality in fire-affected catchments following a fire event, to track recovery and inform future silvicultural and soil-conservation interventions. The Committee is of the view that without such a structured linkage, the water-security consequences of forest fires will continue to go unaddressed, even as the underlying vegetative damage is documented and acted upon.

CHAPTER – 5

FOREST FIRE MONITORING AND EARLY WARNING SYSTEMS

5.1 Satellite-based fire monitoring has improved the understanding of forest fire occurrence across the Himalayan region. The Forest Survey of India (FSI) uses satellite-based forest fire alert systems generated through MODIS and SNPP-VIIRS sensors, with alerts disseminated to State Forest Departments and registered users for rapid response. MODIS has a coarser spatial resolution of about 1 km, while SNPP-VIIRS has a finer resolution of about 375 m, allowing it to detect smaller and lower-intensity fire events more effectively. Therefore, SNPP-VIIRS generally reports a substantially higher number of fire detections than MODIS, particularly in fragmented, rugged and heterogeneous mountain landscapes

5.2 In its meeting held on 3rd July, 2026, the Committee also heard the National Remote Sensing Centre (NRSC), an institution under the jurisdiction of Indian Space Research Organisation (ISRO) working in the domain of remote sensing and satellite data generation & dissemination. Director, NRSC informed the Committee that NRSC has been providing inputs for forest fire management since 2005. The two principal categories of satellite-based input are: (i) Near Real Time (NRT), within 30 minutes of satellite overpass) day/night active fire location; and (ii) fire-affected area assessment using multi-spectral data sets, generated for major fire events. Satellite-derived spatial information supports all three phases of fire management — **pre-fire** (planning, resource allocation, vulnerability assessment), **during-fire** (active fire location and prioritisation for rapid response and suppression), and **post-fire** (burnt-area assessment and monitoring of recovery).

5.3 NRSC further informed that it is the single-source provider of NRT Active Fire Location (AFL) data for India, generated from polar-orbiting thermal remote-sensing satellites — the MODIS sensor aboard AQUA, and the VIIRS sensor aboard the Suomi-NPP, NOAA-20 and NOAA-21 satellites. Data is received and processed at the NRSC Earth Station, Shadnagar (Telangana), with a turnaround-time commitment of under 30 minutes from Loss of Signal, on a 24×7, year-round basis. The Forest Survey of India (FSI), Dehradun, is the primary user of NRT observations. The data is also routed to the Ministry of Home Affairs through the

National Database for Emergency Management, and made publicly available through the BHUVAN portal. With recent system improvements, average end-to-end latency — from satellite overpass to alert dissemination — has been brought down to under 30 minutes across all missions. A comparison of MODIS and VIIRS is shown in the table below:-

Satellite Sensors Used for Active Fire Detection and Monitoring

S. No.	Sensor	Satellite(s)	Bands	Spatial Resolution	Effective Repetivity
1	MODIS	AQUA	21, 22 (3.959 μm)	1000 m	Daily, 2 observations (~01:30, ~13:30)
2	VIIRS	Suomi-NPP, NOAA-20, NOAA-21	I4, I5, M13 (4.05 μm)	375 m	Daily, 6 observations (1100–1430, 0000–0330)

5.4 A comparison of MODIS and SNPP-VIIRS detections for 2019–20 to 2023–24 shows that SNPP-VIIRS consistently recorded substantially more fire incidences than MODIS — chiefly a function of spatial resolution and detection sensitivity rather than data quality. MODIS active-fire data are generally available at approximately 1 km resolution, against VIIRS' 375 m, giving VIIRS materially greater ability to detect small, short-duration, low-intensity fires. This distinction matters particularly in the rugged Himalayan terrain, where fires often occur in small patches, narrow valleys, forest edges and fragmented landscapes that coarser-resolution sensors are liable to miss.

5.5 The scale of the divergence is illustrative: in 2023–24, SNPP-VIIRS recorded 37,152 total fire incidences across the assessed Himalayan States against approximately 4,400 recorded by MODIS; in 2020–21, the corresponding figures were 30,672 against approximately 4,500. The difference does not indicate that either dataset is in error; it reflects differing sensor resolution, detection threshold, overpass timing and fire characteristics. MODIS remains valuable for consistent long-term regional trend analysis, while SNPP-VIIRS is better suited to operational monitoring, early warning, and field-level response planning.

5.6 Therefore, both datasets should be used in a complementary manner. MODIS can provide a consistent long-term overview, while SNPP-VIIRS can improve the accuracy of near-real-time monitoring and identification of localized fire-prone areas. For Himalayan Forest fire management, integrated use of both datasets along with ground validation, forest type maps, weather data, fuel-load information and human activity layers can greatly improve fire-risk assessment and mitigation planning.

5.7 The Committee also enquired NRSC whether any burnt area mapping activity was carried out by them. In response, NRSC apprised the Committee that burnt-area mapping works on a distinct principle: burning leaves behind ash, charcoal, scorched vegetation and exposed soil, all of which reflect sunlight differently from healthy vegetation. By comparing pre- and post-fire satellite observations and tracking change over time, the location and severity of a fire, and the subsequent pace of ecosystem recovery, can be assessed. NRSC currently generates fire-affected-area products, statistics and reports for selected fire events. Automated products under development will extend this capability — analysing successive AFL passes to infer the duration of burning and prioritise areas for management, and generating rapid multi-spectral burnt-area estimates to aid response — and are expected to be operationalized in the near future.

5.8 India's active-fire monitoring remains dependent on foreign, polar-orbiting satellites, which observe the country only about eight times a day. Both MODIS and SNPP-VIIRS operate on a revisit cycle of roughly 12 hours, with overpasses of the Indian region at approximately 01:30 and 13:30 local time. Consequently, there is no satellite pass — and therefore no NRT detection capability — between 01:30 and 10:30, or between 13:30 and 22:30. The Ministry has itself characterised this as **"a critical observational gap in the diurnal fire monitoring cycle"**; during these windows, fires can start, spread and even extinguish without being observed.

5.9 Geostationary satellites, which continuously view the same region, could in principle provide the observation frequency needed to close this gap. However, India's existing geostationary asset, INSAT, has relatively coarse spatial resolution and misses many fires that VIIRS or MODIS would detect. Newer geostationary systems can combine frequent observation with improved detection sensitivity, but India does not, at present, operate a geostationary sensor with the combination of

sensitivity, spatial resolution and coverage needed for comprehensive, continuous monitoring of active forest fires nationally.

5.10 The Committee desired to know whether the Department of Space has devised any strategy to address the observational gap in the fire monitoring cycle. In response, the Committee was informed that the Department has outlined a short-term and medium-term strategy to address this gap. The short-term track focuses on augmenting current observational capability through additional and higher-resolution data sources, while the medium-term track envisages dedicated Indian satellite assets purpose-built to close the diurnal observation gap. Both tracks are supported by parallel research and development on fire damage assessment, fire behaviour and forest fire emissions. The Committee was informed about both the strategies, the details of which are as under:

Short-Term and Medium-Term Strategy to Address the Observational Gap

Parameters	Short Term	Medium Term
Additional observation sources	Explore commercial high-resolution thermal satellite data; develop an integration strategy for existing and additional Earth Observation sources of Active Fire Location data	Dedicated VIIRS-class satellite: ~300 m resolution, wide swath; MWIR (3.8 μm) and TIR (10.4 μm) bands; sensitive to fires above 3–5 MW Fire Radiative Power; orbit timed to fill the existing VIIRS observation gap
Enhanced/burnt-area products	High-resolution active fire detection (Landsat-8/9, Sentinel-2A/B/C); fire cluster prioritisation; medium-resolution multi-spectral burnt-area maps (3–5 day interval); fire-risk advisory maps	Dedicated burnt-area satellite (AWiFS/LISS-3/GISAT-class): SWIR-1 and SWIR-2 bands; ~50 m resolution; daily revisit
Research & Development	Fire damage assessment; fire behaviour and characteristics; forest fire emissions	Fire damage assessment; fire behaviour and characteristics; forest fire emissions

The Forest Fire Alert System (FAST 3.0)

5.11 The Committee was informed that FSI has issued forest fire alerts to State Forest Departments since 2004. The current-generation system, FAST 3.0, launched in January 2019, is a satellite-based Early Warning System providing near-real-time detection, monitoring and dissemination of fire alerts, drawing on the same MODIS and SNPP-VIIRS sensors described above. It generates three categories of alert: Pre-Fire (weekly, 5 km × 5 km grid, based on a Fire Danger Rating); Near Real-Time (1 km × 1 km from MODIS, 375 m × 375 m from SNPP-VIIRS); and Large Forest Fire Alerts (375 m × 375 m grid, tracked across successive passes while active). The State Government of Uttarakhand informed that it receives live fire alerts up to six times daily during the fire season, disseminated from FSI to State Forest Headquarters and onward to all registered field users.

5.12 FAST 3.0 incorporates several advanced features, including a Van Agni Geoportal for interactive visualization of fire incidents and thematic layers, Web Map Services (WMS) for integration of real-time fire alerts into State Forest Department geoportals, and customized alerts disseminated up to Beat level in most States. The system also provides improved filtering mechanisms to reduce false alarms, dynamic map links in SMS notifications, automated fire tracking, enhanced databases, and a strengthened feedback mechanism through SMS and nodal officer portals. These capabilities have significantly enhanced the preparedness, monitoring and response capacity of State Forest Departments, making FAST 3.0 an important technological tool for effective forest fire prevention, mitigation and management in the country.

5.13 The State Government of Uttarakhand informed the Committee that out of 4,879 FSI alerts received in the current fire season, only around 12.5 per cent

corresponded to verified actual forest fires, the remainder being attributable to non-forest fires, controlled or agricultural burning, and false alarms. This indicates that alert precision, and not merely detection latency, remains a live operational concern.

5.14 The Ministry informed the Committee that there are 4.74 lakhs registered users of the Forest Fire Alert System across the country. The State/UT-wise number of subscribers during last four forest fire season in the Himalayan Region is as follows:

S. No.	State/UTs	Number of Subscribers during Fire Season			
		2022–23	2023–24	2024–25	2025–26 (till 08 th June 2026)
1	Arunachal Pradesh	26	29	973	1,220
2	Assam	44	47	1,284	1,930
3	Himachal Pradesh	49,006	66,874	71,588	90,609
4	Jammu & Kashmir	2,393	3,408	4,624	5,679
5	Ladakh	89	91	89	246
6	Manipur	8,569	9,414	16,184	6,939
7	Meghalaya	85	90	105	93
8	Mizoram	169	174	863	1,265
9	Nagaland	25	28	355	466
10	Sikkim	334	357	526	572
11	Tripura	530	749	951	2,891
12	Uttarakhand	9,028	9,686	14,670	17,338
13	West Bengal	1,108	1,336	3,930	6,988

Other Monitoring Initiatives

5.15 The Ministry also apprised the Committee regarding other monitoring initiatives taken by it. These include completion of a National-Level Forest Fire Risk Zonation Mapping exercise, supporting prioritisation of interventions and

risk-informed resource allocation, circulation of Standard Operating Procedures on prevention, mitigation and response to all States/UTs for five forest types, operationalization of a 24*7 Disaster Management Control Room at Indira Paryavaran Bhawan, New Delhi and development of a Forest Fire Preparedness Index to assess and benchmark the preparedness of individual Forest Divisions.

5.16 On the Committee's query regarding deployment of AI and drone-based thermal imaging, the Ministry replied that while it "promotes the use" of such technologies in principle, there is at present no actual deployment by FSI for fire prediction or real-time monitoring specifically in Himachal Pradesh or Uttarakhand at the national-scheme level.

5.17 However, the State Government of Uttarakhand informed the Committee that it uses drones for aerial reconnaissance and for identifying persons deliberately starting fires.

5.18 The Committee notes that even after so many years of using the satellite technology and despite India being a leader in the space sector; the country is still relying on foreign satellites for monitoring of forest fires. The Committee also notes with concern that there is a significant diurnal observational gap i.e. no satellite pass between 01:30–10:30 and 13:30–22:30. The Committee, therefore, urges the Department of Space to prioritise the launch of a geostationary satellite capable of round the clock monitoring the forest fires.

5.19 The Committee notes the State Government of Uttarakhand's submission that only around 12.5 per cent of FSI alerts received corresponded to verified actual forest fires. The Committee is of the view that a high proportion of false positives carries the real risk of alert fatigue among field-level and nodal officers, who may over time come to treat alerts as routine

rather than actionable, thereby eroding the very purpose of an early-warning system. The Committee accordingly recommends that the Ministry, in coordination with State Forest Departments, institute regular, structured training for nodal officers and field staff on the interpretation, verification and triage of FAST 3.0 alerts, including guidance on distinguishing likely forest fires from agricultural or controlled burning based on geographical, seasonal and land-use context.

5.20 The Committee notes that the Forest Fire Alert System under FAST 3.0 operates on a subscriber-registration model, reaching only those citizens who have proactively enrolled — a number that happens to be low in several highly fire-prone North-Eastern States. The Committee is of the view that a registration-dependent model is structurally unsuited to the objective of an early-warning system, since it excludes, by design, the very population that has not anticipated the need to register. The Committee notes that the National Disaster Management Authority, in coordination with the Department of Telecommunications, has already developed and is progressively operationalising a Cell Broadcast Alert System, capable of delivering geo-targeted alerts to all mobile handsets within an affected area — irrespective of prior registration — for hazards including earthquakes, tsunamis, lightning strikes and man-made hazards. The Committee is of the view that forest fires, given their acute seasonal concentration and the demonstrated speed of alert dissemination achievable under FAST 3.0, are equally suited to this mode of delivery. The Committee accordingly recommends that the Ministry, in coordination with NDMA and the Department of Telecommunications, examine the feasibility of integrating FAST 3.0-generated fire alerts into the Cell Broadcast Alert System

architecture, so that geo-targeted warnings reach all mobile users in a defined at-risk radius — including transient populations, tourists and non-registered residents — without dependence on prior subscription.

5.21 The Committee also notes that both the temperature-driven fire regime of the Western Himalaya and the atmospheric aridity-driven regime of the Eastern Himalaya are, at their core, functions of meteorological variables that fall within the domain expertise of the India Meteorological Department (IMD). The Committee is of the view that forest fire prediction and early-warning capability in the Himalayan region would be considerably strengthened through closer institutional collaboration with IMD. Accordingly, the Committee recommends that the Ministry in coordination with IMD, develop a formal collaborative framework under which IMD's high-resolution weather forecasting models, including its medium-range and extended-range prediction systems, are integrated into forest fire risk assessment and early-warning tools for the region. The Committee further recommends that this collaboration extend to the sharing of real-time data with State Forest Departments and district-level disaster management authorities, so that fire-risk advisories can be issued with sufficient lead time to enable preventive deployment of resources.

CHAPTER – 6

DISASTER MANAGEMENT AND RESPONSE

6.1 Forest fires occupy a distinctive place among the disasters that confront the Himalayan region. Unlike most natural hazards, they are broadly predictable in their seasonality, yet, once they cross a threshold of scale, they become extraordinarily difficult to contain, more so across the steep gradients, dense fuel loads and poor accessibility that characterise Himalayan forests. Disaster response becomes decisive precisely at the point where the coping capacity of the local Forest Department and State machinery is exceeded, and specialised, trained and equipped manpower must be mobilised at short notice, frequently across difficult terrain, constrained road connectivity and adverse weather. In the Himalayan States, where a single major conflagration can span several ridgelines and threaten both ecologically fragile forest cover and human settlements in close proximity, credible and rapidly deployable disaster response architecture is not a peripheral adjunct to forest fire management but one of its central pillars.

6.2 The Committee also heard the representatives of National Disaster Management Authority (NDMA), the apex body responsible for disaster management in the country, in its meeting held on 3rd July, 2026. In its background note submitted to the Committee, NDMA furnished the following information pertaining to forest fire management and mitigation across the country:-

The Mitigation Scheme for Forest Fire Risk Management (MSFFRM)

6.3 The Mitigation Scheme for Forest Fire Risk Management (MSFFRM) is the principal centrally supported national initiative for forest fire disaster response, implemented jointly by the National Disaster Management Authority (NDMA) and the Ministry of Environment, Forest and Climate Change (MoEF&CC). The Scheme covers 144 high-priority forest fire-prone districts spread across 19 States, with a total approved outlay of ₹818.92 crore, of which ₹534.50 crore is to be drawn from the National Disaster Mitigation Fund (NDMF), supplemented by SDRF/NDRF preparedness and capacity-building components, and provision for technical assistance, innovation and monitoring. The 19 States covered in the

scheme **encompasses the entire Himalayan arc from Himachal Pradesh to the North-Eastern Himalayan States.**

6.4 The Scheme is structured around five components:

- i) Mitigation (₹464.47 crore) covers creation and maintenance of fire lines, controlled burning, **reduction of combustible biomass**, promotion of fire-resistant species, habitat management and landscape-level fire-risk zoning;
- ii) Preparedness covers satellite-based early warning, GIS-based vulnerability mapping, strengthening of Fire Control Rooms, training of Forest Department personnel and SDRF/NDRF, procurement of fire-fighting equipment, and community awareness and fire-watcher programmes;
- iii) Response (₹218.95 crore) covers rapid deployment of trained teams, activation of incident response mechanisms, real-time monitoring, and inter-agency coordination among Forest Departments, District Administration, SDRF and NDRF;
- iv) Recovery (₹20.00 crore) covers post-fire damage assessment, restoration of affected forest areas, soil and moisture conservation, assisted regeneration, and restoration of the livelihoods of forest-dependent communities; and
- v) Technical Assistance and Institutional Support (₹61.47 crore) funds specialised support from national institutions.

6.5 The technical-assistance architecture draws on a wide spread of specialised institutions grouped under three heads:

- (i) early warning and fire monitoring — the Forest Survey of India (FSI), National Remote Sensing Centre (NRSC), National Centre for Biological Sciences (NCBS), Indian Institute of Tropical Meteorology (IITM), Indian Institute of Remote Sensing (IIRS) and the India Meteorological Department (IMD);
- (ii) training and capacity building — the National Institute of Disaster Management (NIDM), Indira Gandhi National Forest Academy (IGNFA), the Directorate of Forest Education–Central Academy for State Forest Service (DFE-CASFoS), and the National Fire Service College (NFSC), Nagpur; and

(iii) national-level operational support — the National Disaster Response Force (NDRF) and the Indian Air Force (IAF). These agencies function in accordance with an approved **Forest Fire Event Escalation Matrix**.

Financial Status: Release of Funds

6.6 Among the Himalayan and Himalayan-foothill States specifically, the position of funds released is as follows:

Himalayan / Himalayan-foothill State	NDMF Amount Released (₹ Cr.)
Arunachal Pradesh	12.92
Assam (Himalayan foothill region)	26.50
Himachal Pradesh	7.27
Manipur	24.50
Meghalaya	12.27
Mizoram	27.24
Nagaland	20.65
Uttarakhand	14.90

6.7 National Disaster Response Force (NDRF), the frontline force for tackling disasters across the country, submitted the following information through its background note submitted to the Committee:-

NDRF's Institutional Mandate for Forest Fire Response

6.8 The **National Disaster Response Force was assigned an explicit role in forest fire response only recently**. Based on the recommendations of an expert committee constituted under NDMA, the Ministry of Home Affairs, *vide* order dated 5th July 2022, assigned NDRF the additional responsibility of handling forest fires, and directed it to train and equip three teams on a pilot basis.

6.9 Accordingly, one team each of 50 personnel from the 1st, 10th and 15th Battalions of NDRF underwent specialised training in 'Forest Fire Prevention and Mitigation Strategies' at the Central Academy for State Forest Service (CASFoS).

6.10 The inadequacy of this pilot arrangement became apparent during the 2024 fire season, when the lone team earmarked for Uttarakhand proved insufficient to meet the demands of a prolonged and large-scale fire episode in the State, while the absence of any earmarked team in Himachal Pradesh and certain other affected States meant that NDRF could not be positioned there during critical periods. This experience led to a proposal that NDRF earmark three further teams — one each in Himachal Pradesh (14th Battalion), Madhya Pradesh (11th Battalion) and an additional team in Uttarakhand (15th Battalion) — to strengthen preparedness in the most vulnerable areas.

6.11 As matters presently stand, NDRF has three formally approved and dedicated Forest Fire Response Teams, aggregating 150 personnel, earmarked for Assam (1st Battalion), Andhra Pradesh (10th Battalion) and Uttarakhand (15th Battalion). A proposal for earmarking three additional teams — for Madhya Pradesh (11th Battalion), Himachal Pradesh (14th Battalion) and a second team for Uttarakhand (15th Battalion) — has been pending with the Ministry of Home Affairs (MHA) since January 2025, and approval is awaited. Notably, a total of six teams comprising 300 personnel have already received institutional forest fire training, even though only three teams currently carry formal, approved earmarking.

6.12 The Committee notes that presently only two battalions of NDRF are deployed for forest fires one each in Western and Eastern Himalayan region. The Committee also notes that six NDRF teams stand trained for forest fire duties while only three are formally earmarked, leaving three trained teams without confirmed institutional sanction. The Committee further notes that proposal for two more battalions for the Western Himalayan region is pending, inspite of the demonstrated inadequacy of NDRF's forest fire response capacity — established by the Department's own experience during the 2024 fire season in Uttarakhand and Himachal Pradesh. The Committee

therefore recommends that approval to the pending proposal for three additional teams for forest fire duties may be granted at the earliest.

Training and Specialised Capacity Building

6.13 The Committee was further informed by NDRF that its personnel deployed for forest fire duties receive institutional training distinct from that imparted for standard plains-based or urban disaster response. Training has been conducted at CASFoS Dehradun, Coimbatore and Burnihat, and at the Chandrapur Forest Academy, Maharashtra, with a curriculum oriented to the tactics, safety protocols and physical demands specific to high-altitude and steep forest terrain. Two selected officers have also received advanced training abroad.

6.14 The Committee welcomes the exposure of NDRF officers to international best practices but notes that such exposure has, thus far, been limited to only two officers. The Committee recommend that foreign training and exchange opportunities be systematically expanded, particularly with countries facing comparable montane and boreal fire regimes, and that a structured, terrain-specific curriculum for high-altitude firefighting — going beyond the present institutional arrangements — be formally documented and periodically updated.

Deployment Experience and Response Protocol

6.15 As regards the Committee's query regarding the deployment of teams in forest firefighting operations, the Committee was informed that since the assignment of the forest fire mandate in July 2022, NDRF has deployed a total of 15 teams across 14 forest fire response operations, distributed across Uttarakhand (9 incidents), Arunachal Pradesh (4 incidents) and Manipur (1 incident). Deployment is requisition-based: NDRF teams are activated only on request from the concerned State or District authorities once the situation exceeds local coping capacity. Earmarked teams are maintained in a state of alert at their Unit Headquarters or Regional Response Centres and are mobilised within 30 minutes

of receipt of a requisition, with manpower, equipment and vehicles. The actual time taken to reach the incident site thereafter depends on distance, terrain and weather conditions.

6.16 The Committee notes that the 30-minute benchmark relates only to mobilisation from the Unit Headquarters or Regional Response Centre, and does not capture the time actually taken to reach the fire site — which, in Himalayan terrain, is likely to be the more operationally meaningful metric. The Committee recommends that NDRF maintain and report, on a year-wise and State-wise basis, data on actual site-arrival times in addition to mobilisation times, so as to permit a more accurate assessment of response effectiveness specific to Himalayan conditions.

Coordination Mechanisms

6.17 The Committee was further informed that at the State level, NDRF Nodal Officers remain in regular contact with designated State Nodal Officers, and NDRF receives forest-fire-related inputs from State Emergency Operations Centres (SEOC) and State Disaster Management Authorities (SDMAs), besides independently monitoring the Van Agni Geo Portal. On the ground, NDRF operates in close coordination with local administration and the Incident Commander. At the inter-State level, coordination is maintained through the MHA's Integrated Control Room for Emergency Response, NDMA, SDMAs (through SEOC/DEOC channels) and MoEF&CC.

6.18 Aerial support is coordinated with the Indian Air Force, with ground and aerial forces operating in tandem under clearly defined roles. During recent major incidents in Manipur and Arunachal Pradesh, IAF helicopters undertook aerial dousing of fires while NDRF, State Fire Services and other agencies simultaneously conducted ground-based firefighting, including the creation of fire lines — a combined effort credited with defusing critical situations in a timely manner.

Operational Challenges in Himalayan Terrain

6.19 NDRF has identified a recurring set of challenges in responding to forest fires in remote Himalayan locations: difficult and inaccessible terrain, limited road connectivity, adverse weather conditions, poor communication connectivity, and constraints in transporting personnel and equipment. Despite these constraints, NDRF teams have continued to undertake coordinated operations with State Forest Departments, SDRF, local administration and other stakeholders.

6.20 The Committee recognises that several of these challenges are inherent to Himalayan geography and cannot be eliminated. They can, however, be mitigated through targeted infrastructure investment. The Committee recommend that the Ministry concerned, in consultation with State Governments, identify and develop critical response infrastructure including helipads in the most fire-prone Himalayan districts, so as to reduce the practical impact of terrain and connectivity constraints on response time.

Self-Assessed Adequacy and the Way Forward

6.21 NDRF has itself assessed its current approved strength of three teams (150 personnel) as inadequate to respond simultaneously to forest fire incidents across multiple Himalayan States during peak fire season. NDRF teams have requested States experiencing large forest fires to earmark SDRF personnel for forest fire response.

6.22 Drawing on recent operational experience, NDRF has identified several lessons for strengthening preparedness: the need for advance pre-positioning of response teams ahead of the fire season; improved situational awareness through technology-based monitoring and early warning; enhanced public awareness campaigns involving volunteers and NGOs; earmarking and pre-positioning of local SDRF resources; regional-level coordination meetings with all stakeholders; induction of dedicated forest fire equipment at the State level; and regular training workshops and joint exercises to enhance inter-operability.

6.23 On infrastructure, NDRF has estimated that establishing a fully functional dedicated Battalion in the Himalayan region would cost approximately ₹250 to 300 crore, and a Regional Response Centre would cost between ₹30 and 40 crore.

NDRF has, however, stated that no direction has yet been issued regarding development of a dedicated forest fire response capability in the Himalayan region.

6.24 The Committee feels that in view of NDRF's own assessment of inadequate manpower, its detailed articulation of operational lessons, and the availability of cost estimates for a dedicated Himalayan Battalion and Regional Response Centre, a dedicated, rather than a purely requisition-based and pilot, disaster response capability, for the region, is required. The Committee, therefore, recommends that the Ministry of Home Affairs and NDMA take a time-bound decision on establishing at least two Regional Response Centers dedicated to the Himalayan region — one for the Western Himalaya and one for the Eastern Himalaya.

CHAPTER – 7

FINANCIAL ASSISTANCE FOR FOREST FIRE PREVENTION AND MANAGEMENT

7.1 The Ministry of Environment, Forest and Climate Change (MoEFCC), in its submission, informed the Committee that the Forest Fire Prevention & Management (FFPM) Scheme is the current flagship centrally sponsored initiative of the Ministry, designed to tackle the growing ecological and economic threats posed by wildfires across India.

7.2 Under the FFPM Scheme, the MoEFCC supports the efforts of the States/UTs in the prevention and control of forest fires by providing financial assistance for various forest fire prevention and management measures such as modern tools for fire extinguishing, use of ICT (Information and Communication Technology), creation and maintenance of fire lines in forest areas, engagement of fire watchers, creation of water storage structures in forest areas, strengthening of forest infrastructure, procurement of firefighting equipment, soil and moisture conservation works in high-risk areas, awareness creation, incentivizing villages/communities for protection against forest fire etc.

7.3 The Committee enquired about the financial allocation to State/UT's under the ongoing FFPM scheme. The Ministry provided the following information regarding the years 2023-24 to 2025-26:

(Rs. In Lakh)

S. No.	States	FY 2023-24 Amount Released	FY 2024-25 Amount Released	FY 2025-26 Amount Released*
1	Himachal Pradesh	180.80	1.665	115.15
2	Uttarakhand	337.98	144.93	348.03
3	Assam	0.00	0.00	0.00
4	Arunachal Pradesh	198.12	186.12	187.01
5	Manipur	106.61	92.47	50.87
6	Meghalaya	46.72	52.84	61.28

7	Mizoram	48.14	78.93	77.47
8	Nagaland	288.37	98.98	100.97
9	Sikkim	144.62	6.455	87.67
10	Tripura	47.64	29.725	75.60
11	Jammu & Kashmir	0.00	0.00	11.08
	Total	1399	692.115	1115.13

7.4 The details of expenditure incurred during 2020-21 to 2025-26 under the ongoing FFPM scheme is shown in the table below:

(Rs. In Crore)

Year	Expenditure incurred
2020-21	32.8566
2021-22	34.8103
2022-23	29.1718
2023-24	39.9764
2024-25	31.7940
2025-26	32.03

7.5 The Ministry apprised the Committee that since the FFPM scheme has completed five years from 2020-21 to 2025-26, it is currently under review and a Standing Finance Committee (SFC) for continuation of strengthened FFPM for the next five years is under consideration for approval.

7.6 Funds for forest fire prevention and management activities are also approved by the National Authority, Compensatory Afforestation Fund Management and Planning Authority (CAMPA), in accordance with the provisions of the Compensatory Afforestation Fund Act, 2016 and the Compensatory Afforestation Fund Rules, 2018. The release and utilisation of funds are based on the Annual Plan of Operations (APO) submitted by the respective States/Union Territories and approved by the National Authority. The APOs include various forestry and forest protection activities, including measures for forest fire prevention, mitigation, preparedness, infrastructure development, capacity building, and community participation, as per the priorities and requirements identified by the concerned State/UT administration. The details of CAMPA funds approved for Forest Fire Prevention and Control (FFPC) Operations are shown in the table below:

**State-wise CAMPA Funds Approved for Forest Fire Prevention and Control (FFPC)
Operations during FY 2020-21 to FY 2025-26 (₹ Crore)**

S. No.	State/UT	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	Total
1	Arunachal Pradesh	1.48	0.24	0.66	0.32	0.00	2.58	5.28
2	Assam	0.00	0.00	0.00	0.00	0.00	0.12	0.12
3	Himachal Pradesh	4.44	3.00	7.00	8.94	6.00	30.21	59.59
4	Jammu & Kashmir	2.36	3.41	3.21	5.98	5.23	5.10	25.29
5	Ladakh	0.00	0.00	0.00	10.76	0.00	0.31	11.07
6	Manipur	0.56	1.07	0.77	0.82	0.00	0.00	3.22
7	Meghalaya	1.29	0.20	0.00	1.44	0.39	0.23	3.55
8	Mizoram	0.80	1.85	1.20	2.00	1.67	0.63	8.15
9	Nagaland	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	Sikkim	0.26	0.45	0.00	0.00	0.00	0.25	0.96
11	Tripura	0.32	0.00	0.00	0.00	0.30	0.95	1.57
12	Uttarakhand	9.80	8.80	5.00	8.96	10.00	12.00	54.56
13	West Bengal	4.00	2.74	2.27	1.50	0.67	1.27	12.45
Grand Total		25.31	21.76	20.11	39.72	24.26	53.65	186.81

7.7 In addition, the Ministry provides financial assistance to States/UTs under the Centrally Sponsored Schemes **"Development of Wildlife Habitats"** and **"Project Tiger and Project Elephant"** for strengthening protection and management of forests and wildlife. These interventions, inter alia, support forest fire prevention, preparedness, control and mitigation measures within protected areas and adjoining forest landscapes.

7.8 The Committee recommends that the Ministry expedite the SFC's approval for the continuation of the strengthened FFPM scheme at the earliest since the scheme has already lapsed its five-year tenure, there is no let up in forest fire incidents and any hiatus in dedicated forest-fire funding carries direct operational risk during the fire season. The Committee is also of the opinion that till such time, the SFC comes up with any recommendation regarding renewal of FFPM, an alternate mechanism on the lines similar to

FFPM, may be put in place as an interim measure. The Committee further recommends that in the renewed FFPM scheme, subsequent fund releases should be explicitly tied to quantifiable performance indicators, including measurable reductions in fire counts and burnt areas, improved average response times, and the consistent maintenance of fire lines. States should be required to submit detailed Annual Fire Management Plans, similar to CAMPA's Annual Plan of Operations, that clearly delineate physical targets against financial outlays.

7.9 The Committee recommends that instead of relying on CAMPA funds, which are intended primarily for compensatory afforestation and allied purposes, to substantially finance forest fire prevention and control operations, the renewed FFPM scheme be adequately funded to manage the requisite finances.

CHAPTER – 8

BEYOND THE CHIR PINE MONOCULTURE: RESTORING THE HIMALAYAN FOREST

8.1 Among the recurring threads running through the evidence tendered before the Committee, none appeared with greater consistency than the vexed relationship between Chir Pine (*Pinus roxburghii*) and the annual cycle of forest fires that afflicts the Western Himalayan region. All the stakeholders including State Governments and MoEFCC were unanimous that the species' ecology — resinous bark, highly combustible needle-litter, and its tendency to form dense, even-aged stands — renders Chir Pine-dominated forests structurally predisposed to fire in a manner that broad-leaved formations are not.

Extent and Origin of Chir Pine Dominance

8.2 The Committee sought to ascertain whether the present dominance of Chir Pine in the lower Himalayan belt was a natural climax condition or a legacy of historical forest-management practice, including colonial-era silviculture oriented towards resin and timber extraction. In its written reply, FRI candidly stated that *"FRI has not conducted any study on role of colonial rule played in its widespread dominance in the lower Himalayas"* and that no institutional information exists on the tree species that were dominant in the lower Himalayas prior to colonial rule.

8.3 The Committee finds this admission significant. It indicates a gap in the evidentiary and historical-ecological record that has, for decades, allowed the "naturalness" of Chir Pine dominance to go unexamined even as its consequences for fire regimes have grown steadily more severe.

8.4 The Committee was, however, informed that Chir Pine's expansion is an active and ongoing process rather than a static historical fact. FRI informed the Committee that Chir Pine — though a native conifer — has been recorded expanding into oak-dominated habitats within the Himalayan Biodiversity Hotspot

between 2001 and 2021, a trend attributed to climate change and anthropogenic disturbance, and one projected to intensify under future climate scenarios.

8.5 The Committee is of the considered view that this finding recasts the problem: the challenge before the Government is not merely the management of a historically inherited monoculture, but the active containment of a still-expanding one that is displacing broad-leaved oak forests of far greater ecological and hydrological value. The Committee recommends the Ministry to commission, through FRI or an appropriate research body, a dedicated historical-ecological study tracing the changes in forest composition in the Western Himalayan belt from the pre-colonial period to the present. Without such a study, the Government's restoration strategy will continue to be formulated without a clear reference point for what constitutes ecological recovery.

The Statutory and Administrative Framework: Working Plans

8.6 In response to a query of the Committee as to whether the Government has considered a programmatic replacement of Chir Pine with broad-leaved species such as Deodar and Oak, the Ministry stated that forest management interventions — including retention, regeneration, enrichment planting, or replacement of species — are undertaken strictly on the basis of ecological suitability, local climatic conditions, and the scientific prescriptions contained in approved Working Plans, which are statutory management documents prepared in accordance with the National Forest Policy. The Ministry further clarified that *"No forest is permitted to be worked without an approved management plan/Working Plan in the prescribed format,"* and that no national-level Action Plan has been formulated for the wholesale replacement of Chir Pine with Deodar, Oak, or other broadleaf species.

8.7 The Committee also enquired about the possibility of a dedicated National Mission for intensive afforestation of Deodar and Oak in the Himalayan States.

The Ministry informed that afforestation and ecological restoration activity in these States currently proceeds under the Green India Mission, CAMPA-funded works, and State-level afforestation programmes, and that no separate National Mission exclusively for Deodar–Oak plantation has been approved.

8.8 The Committee recognises the soundness, in principle, of a site-specific approach anchored in Working Plans rather than a blanket national prescription — Himalayan forest ecology is heterogeneous, and uniform replacement targets could well cause more ecological harm than good. However, the Committee observes that there is no dedicated national mission or Action Plan, when read alongside the evidence of Chir Pine's active expansion into oak habitats, where cross-State coordination and dedicated financial outlay are required. The Green India Mission and CAMPA, being general-purpose afforestation instruments, were not designed with the specific objective of arresting conifer encroachment into broad-leaved forest. The Committee, therefore, recommends that the Ministry should launch a dedicated programme specifically targeted at broad-leaved forest restoration in Chir Pine-dominated micro-sites of the Western Himalaya, with clear, measurable targets and dedicated budgetary allocation, rather than leaving such restoration to be addressed incidentally through general afforestation schemes.

The Long-Term Imperative: Calibrated Ecological Enrichment

8.9 On the long-term question of species replacement, the Committee was presented with a considered scientific position that cautions against large-scale substitution of Chir Pine with broad-leaved species. FRI informed the Committee that Chir Pine is itself a native species, well adapted to the dry, exposed conditions of the lower and middle Himalayan slopes, and that it performs important functions of vegetation cover, slope stabilisation, carbon storage, and livelihood support

through resin, fuelwood, and pine-based products. Wholesale replacement was accordingly not recommended. Instead, the evidence favoured gradual ecological enrichment — the introduction of native broad-leaved species such as Oak and Deodar restricted to site-appropriate moist microsites, valley portions, protected patches, and already-degraded mixed forests, rather than blanket replacement across the Chir Pine belt.

8.10 The Committee finds this graded, site-sensitive approach scientifically sound and considerably more defensible than an administratively convenient but ecologically indiscriminate replacement programme.

8.11 The Committee also examined the possibility that Chir Pine be replaced by Chilgoza Pine (*Pinus gerardiana*) as an economically superior alternative, given the high commercial value of its edible nuts. The Ministry's evidence was unambiguous in rejecting this proposition. Chir Pine occurs naturally at lower elevations, in the range of 450–2,300 metres, whereas Chilgoza Pine is a dry-temperate, north-western Himalayan species confined largely to dry valleys at 1,800–3,350 metres with weak monsoon influence — the two species occupy substantially different ecological niches. Moreover, Chilgoza Pine suffers from restricted natural distribution and poor regeneration on account of over-exploitation and habitat degradation, and is classified as Near Threatened on the IUCN Red List, as against Chir Pine's status of Least Concern.

8.12 The Committee therefore concurs that large-scale substitution of Chir Pine by Chilgoza Pine in the lower Himalaya would be scientifically unsound, though it sees merit in the promotion of Chilgoza Pine within its own suitable dry-temperate habitats, for both livelihood and conservation purposes. The Committee is also in agreement with the scientific consensus against blanket species replacement and recommends that any enrichment planting undertaken under Working Plans be preceded by site-suitability assessment, so that broad-leaved species are introduced only where soil moisture, aspect, and microclimatic conditions genuinely favour their establishment.

8.13 UNEP in its written submission to the Committee acknowledged that restoration should not mean large-scale planting. It needs to consider areas where natural regeneration is adequate, areas requiring assisted natural regeneration, severely burnt areas, erosion and landslide prone areas, fire sensitive habitats and areas where invasive species need to be controlled. Locally appropriate native species and diverse planting material should be prioritized. Restoration plans should protect watersheds, habitat connectivity and future climate resilience.

Management of Invasive Alien Species and Highly Flammable Vegetation

8.14 The Committee also sought details of the invasive species of trees in the Himalayas States and steps being taken to get rid of them. FRI furnished the following list of documented invasive species.

S. No.	Name of Plant	Family	Native	State
1.	<i>Acacia dealbata</i> Link	Fabaceae	Australia	Uttarakhand, Himachal Pradesh
2.	<i>Acacia farnesiana</i> (L.) Willd.	Fabaceae	South America	Uttarakhand, Himachal Pradesh
3.	<i>Acacia mearnsii</i> De Wild	Fabaceae	Australia	Uttarakhand, Himachal Pradesh
4.	<i>Triadica sebifera</i> (L.) Small	Euphorbiaceae	Central & S. China to Vietnam	Uttarakhand, Himachal Pradesh
5.	<i>Leucaena leucocephala</i> (Lam.) De Wit	Fabaceae	Trop. America	Uttarakhand
6.	<i>Pinus greggii</i> Engelm. ex Parl.	Pinaceae	NE & Central Mexico	Uttarakhand
7.	<i>Pinus patula</i> Schiede ex Schltdl. & Cham.	Pinaceae	Mexico	Uttarakhand
8.	<i>Robinia pseudoacacia</i> L.	Fabaceae	E. Central & E. U.S.A.	Jammu & Kashmir

8.15 FRI further informed the Committee that invasive and highly flammable vegetation can increase fire risk by creating dense and continuous fuel layers. Species such as *Lantana camara*, *Ageratina adenophora* and other aggressive understorey weeds often suppress native regeneration, increase dry biomass and alter fuel structure. It has been established beyond doubt that invasive plant species and forest fires have an intricate relationship, where invasive herbs and shrubs increase fuel load and fuel continuity, thereby contributing to frequent forest fires. The study also emphasized that forest fires promote further invasion by creating canopy openings, reducing competing vegetation and producing favourable post-fire soil conditions for invasive species establishment. Invasive species such as *Lantana camara* and *Eupatorium adenophorum/Ageratina adenophora* have been reported to increase fuel load, alter fire regimes and intensify fire frequency and severity in forest ecosystems. Their management is therefore an important component of forest fire mitigation. Invasive plant control should be integrated with assisted natural regeneration, soil moisture conservation and community-based monitoring. FRI, however, informed the Committee that it has not conducted any study on measures to be taken to get rid of above listed invasive tree species.

Promotion of Native and Fire-Resilient Vegetation

8.16 The FRI, in its submission, strongly advocated that promotion of native and fire-resilient vegetation is essential for long-term reduction of fire vulnerability. Degraded forests, open canopies and heavily disturbed areas often support dry grasses, weeds and invasive species that increase fire risk. Restoration with locally adapted native species can improve canopy cover, retain soil moisture, reduce surface temperature and restore ecological balance. In Himalayan pine-dominated landscapes, enrichment with suitable native broad-leaved species can help improve litter quality, increase moisture retention and reduce surface fuel flammability over time. However, species selection must be based on local ecology, altitude, slope, soil, rainfall and community needs. Such ecological restoration contributes not only to fire mitigation but also to biodiversity conservation, carbon sequestration, watershed protection and livelihood security.

8.17 The Committee notes that despite the presence of documented invasive tree species across Uttarakhand, Himachal Pradesh, and Jammu & Kashmir,

no scientific study has been undertaken by FRI to determine appropriate containment or eradication measures. The Committee, therefore, recommends that the Ministry undertake a dedicated scientific study assessing the ecological spread and fire-risk contribution of all the invasive species, and prepare comprehensive invasive species management plans incorporating containment and eradication measures.

8.18 The Committee further recommends that the Ministry launch a dedicated programme for the eradication of invasive species in the forests of the Himalayan region, with clear, measurable targets, defined timelines, and dedicated budgetary allocation.

Forest Cover, Composition and Regeneration:

8.19 The Committee desired to know the extent of forest cover in the Union Territory of Jammu and Kashmir. The Committee was informed that out of the total geographical area, the reserved forest, as per the records of the Forest Department, J&K, constitutes 20,194 sq. km. The forest and tree cover constitutes about 54% of the total geographic area. As per India State of Forest Report (ISFR) 2023, the forest cover of J&K increased by 398.12 sq. km. and growing stock by 144.327 million cubic metre, in a decade, as given under:

S. No.	Parameters	ISFR 2013	ISFR 2023	Change	Change %
1.	Forest Cover (in Km ²)	20,948.27	21,346.39	398.12	1.90
2.	Growing Stock in Recorded Forest Area in Million cubic metre	232.181	376.508	144.327	62.16

8.20 The Committee sought details of forest cover in the State of Himachal Pradesh. The Committee was informed that the area classified as 'Forest' is 68.16% of the total geographical area of the State, of which large areas are alpine meadows

or lie above the tree line, leaving an effective tree cover of 15,580.35 km². Area under Chil Forest is 2759.62 km², whereas area under scrub Forest is 308.69 km².

8.21 The State Government of Himachal Pradesh further informed that it is engaged in (a) bringing more area under forests through afforestation to increase the Forest cover in the State from the present 27.99% to 30% by 2030, and (b) to increase the density of forests through enrichment plantations in the existing forests. The geographical distribution of forests in the State is as under:-

Geographical distribution of Forest in Himachal Pradesh as per FSI report 2023

Forest Type	Area in sq. km.	Area in percentage
Geographical Area of State	55,673	100.00 %
Forest Area (Legal)	37,948	68.16%
Forest Cover	15,580.35	27.99%
Area under Permanent Snow	16,376	29.40%
Culturable Forest Area	20,657	37.10%
Area under PA Network	8,391	15.07%
Chil Forest Area	2759.62	17.86% of FC
Scrub Forest	308.69	2.08% of FC

8.22 The Committee enquired with the State Government of Himachal Pradesh regarding breakdown of forest types (e.g. chir pine, oak, deodar, alpine pastures) and their respective areas in the State. The State Government replied that the management of forests in Himachal Pradesh is organised at the level of Forest Divisions, each governed by its own Working Plan which is a scientifically prepared, legally approved document that prescribes the management objectives, silvicultural treatments, and harvesting norms for that Division. As per the Champion and Seth Forest Type Classification (1968), as mapped in ISFR 2023, the major forest types found in Himachal Pradesh are as follows:

- ❖ **Chir Pine Forests:** The Lower or Shivalik Chir Pine Forest (9/C1a) covers 1,532.58 km² (7.50% of total mapped area) and the Upper or Himalayan Chir Pine Forest (9/C1b) covers 1,414.32 km² (6.93%), together constituting the most fire-prone forest type in the State. These forests, dominated by *Pinus roxburghii*, are concentrated in the lower and middle hills and are characterised by a thick accumulation of highly inflammable pine needles.

- ❖ **Western Mixed Coniferous Forest:** Covering 2,902.25 km² (14.21% of total mapped area), this forest type comprising spruce, blue pine, and silver fir is the most extensive forest type in the State and is found across the temperate middle and upper hills.
- ❖ **Moist Deodar Forest:** Covering 2,168.03 km² (10.62%), the deodar (*Cedrus deodara*) forests are ecologically and economically among the most significant forest types in the State, concentrated in the upper temperate zones of districts such as Chamba, Kullu, Shimla, and Kinnaur.
- ❖ **Northern Dry Mixed Deciduous Forest:** Covering 2,604.66 km² (12.75%), this type is found predominantly in the lower elevation areas and foothills.
- ❖ **Ban Oak Forest:** The *Quercus incana* (Ban oak) forest type covers 821.92 km² (4.02%).

8.23 The Committee also enquired regarding the details of forest land diverted for non-forestry purposes (roads, hydel projects, tourism) in the last five years in Himachal Pradesh. The Committee was informed that during the last five years, 2,916.467 hectares of forest land have been diverted for non-forestry purposes in 310 cases under the provisions of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980 involving 194,872 trees. The category-wise breakup of diversion cases is as under:

Category	No. of Cases	Area (in ha.)
Roads (PWD)	159	904.5949
Roads (Others)	0	0
HEP (Hydro Electric Projects)	24	955.051
Mining	8	260.4209
Railway lines	0	0
Irrigation	17	27.9955
Transmission Lines	16	133.6918
Others	86	634.715
Total	310	2916.467

8.24 The Committee further enquired regarding the total area afforested under CAMPA and other State schemes in the same period and their survival rate. The State Government furnished the following details:

Total area afforested under CAMPA and other State schemes					
2020-21 (In Ha.)	2021-22 (In Ha.)	2022-23 (In Ha.)	2023-24 (In Ha.)	2024-25 (In Ha.)	Grand Total (In Ha.)
2267.00	1971.00	2206.00	3887.00	3336.00	13667.00
Survival Percentage	2020-21	2021-22	2022-23	2023-24	2024-25
54% (third party monitoring)			Under process		

8.25 The survival percentage for plantations raised in 2020-21 has been assessed at 54%, which, while providing a baseline, also underscores the inherent challenges of establishing plantations in the steep, rocky, and climatically variable terrain of the Himalayan landscape. Survival assessments, through third party monitoring, for subsequent years is currently under process.

8.26 The Committee enquired with the State Government of Uttarakhand regarding the area under different forest types (sal, chir pine, banj oak, kharsu oak, sub-alpine). The State Government replied that the total forest area under the control and management of the Forest Department is 25,138.18 sq km. It also furnished the following data:

Forest Type / Land Use	% of Total Reserved Forest Area
Sal	12.80%
Chir Pine	15.45%
Banj / Oak	11.43%
Teak	0.90%
Deodar	0.86%
Fir & Spruce	2.63%
Sub-Alpine / Other Forest	29.64%

Forest Type / Land Use	% of Total Reserved Forest Area
Barren Land	26.29%
Total	100.00%

8.27 In response to the Committee's query regarding extent of deforestation in Uttarakhand over the last five years, the State Government replied that diversion of forest land for non- forestry purposes is undertaken strictly in accordance with the provisions of the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980, as amended in 2023, and only after obtaining the requisite approval of the Central Government. Over the past five years, 3,594.698 hectares of forest land has been diverted for various public and developmental purposes following due statutory scrutiny and approval. No significant deforestation resulting from encroachment on forest land has been reported during the same period.

8.28 The Committee also enquired regarding details of afforestation done during the last five years and their survival. The State Government furnished the following data:

Area brought under afforestation and survival rates in the past five years

Financial Year	Area Planted (Ha)	Survival %
2021–22	40,678.04	49.36%
2022–23	36,342.27	47.69%
2023–24	36,006.27	Under assessment
2024–25	40,095.90	—
2025–26	40,912.50	—
Total	1,94,034.98	—

8.29 The Committee further enquired regarding steps taken to restore oak forests. The State Government replied that broadleaf species including oak have been accorded highest priority by the Forest Department. Oak species plantation and

ANR activities are being carried out systematically across the State. The details of Oak plantation over the past three years are as under:

Year	Area Planted (Ha)
2023–24	4,927.77
2024–25	2,781.57
2025–26	898.72
Total	8,608.06

8.30 The Committee notes that the current pace and species-composition of afforestation efforts in the Western Himalayan region are inadequate to address the vulnerability of the Himalayan forest ecosystem. The Committee also notes that Oak and Deodar regeneration are still being treated as just one part of the general afforestation target, rather than as a distinct programme with its own funding and monitoring. The Committee is of the opinion that Oak and Deodar cannot be expected to hold their own within a general target when competing against Chir Pine, which is easier and quicker to plant. A dedicated Mission, with its own ring-fenced funds, its own targets, and separate reporting, is needed to achieve real results on the ground. The Committee accordingly recommends that the Ministry, in close and sustained coordination with the concerned State Governments, launch a Himalayan Oak and Deodar Regeneration Mission for Oak and Deodar regeneration across the Western Himalayan region.

8.31 The Committee notes that even as afforestation is being scaled up, Himachal Pradesh and Uttarakhand together diverted 6,511.165 hectares of forest land for non-forestry purposes over the last five years. The Committee

is of the considered view that a Mission to expand Oak and Deodar cover would be substantially undermined if diversion of exactly such mature, ecologically valuable forest continues unchecked in parallel. The Committee accordingly recommends that the Ministry apply stricter scrutiny, under the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980, to any proposal to divert Oak, Deodar or mixed coniferous forest. The Committee further recommends that compensatory afforestation for any diversion of Oak or Deodar forest be planted mandatorily with the same or an ecologically similar species, and at a higher area ratio than applies to general compensatory afforestation. The Committee is of the view that this two-pronged approach — pushing Oak and Deodar regeneration forward under a dedicated Mission while tightening the rules on diverting exactly these forest types — offers the most coherent way to ensure that development in the region does not undo, with one hand, the gains being built with the other.

CHAPTER – 9

PINE NEEDLE MANAGEMENT AND UTILIZATION: BUILDING A PARALLEL 'PIRUL' ECONOMY

9.1 One indispensable connection observed by the Committee during its discussion and deliberations with the various stakeholders, is that the Fire occurs only when three essential elements are present, known as the '**Fire Triangle**'- **Fuel, Oxygen and Heat**, and it has been established beyond doubt that it is the accumulated leaf litter and biomass that provides the forest fires the necessary fodder to flare it up.

9.2 The Committee inquired about the regional variation in the types of biomass which cause forest fires. In response, the Government of Uttarakhand, in its background note, informed the Committee that while the Central India's dry deciduous forests are particularly vulnerable because of heavy accumulation of **dry leaf litter**, the Himalayan region faces additional risks due to steep slopes and highly flammable **pine needle litter**. The Western stretch of the Himalayan region is characterized by steep slopes, difficult terrain, and extensive forest cover dominated by highly vulnerable species for forest fire such as **Chir Pine (*Pinus roxburghii*)**, which contributes significantly to fire susceptibility through the **accumulation of dry pine needles** (locally known as "pine litter" or "**pirul**"). In addition, the dependence of local communities on forest resources further increases the risk of both accidental and anthropogenic fire events.

9.3 The Government of Uttarakhand further informed the Committee that the Himalayan States with extensive Chir Pine and temperate forests, have a long history of forest fire occurrences. Historically, local communities practiced controlled burning to remove dry pine needles and promote grass growth. Forest fire has been occurring since time immemorial. **Late Pandit Govind Ballabh Pant** in his book '*The Forest problem of Kumaon*' writes-

"The practice of setting fire to the forestlands was in vogue in Kumaon from time immemorial. The village people have an invincible faith in the utility of firing the forest judiciously. In unfired forests pine needles are

piled so thickly that neither men nor cattle can move on the hillside and the growth of grass is also smothered. The burning of the forest at seasonable times is believed to be helpful to the growth of grass without causing any injury to the trees.”

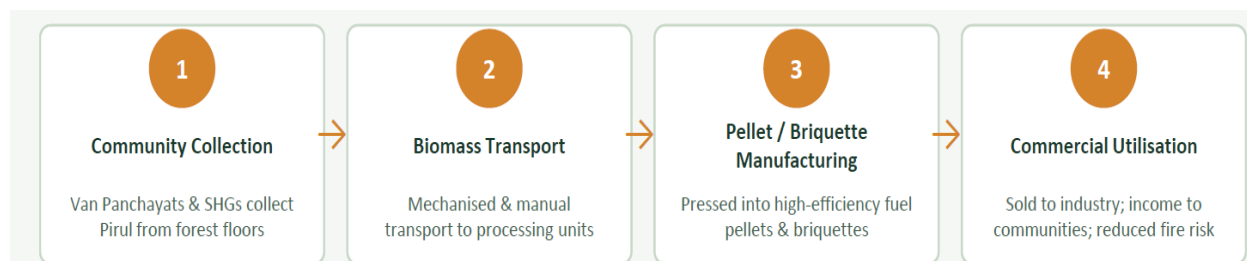
9.4 The Committee was further informed that in summers when leaf fall occurs in chir trees and moisture regime in the soil touches its minimum, the forests become vulnerable to frequent fire occurrence. Therefore, **Chir Pine Forest is the most fire prone forest type**, particularly in Himalayan States, due to accumulation of highly inflammable dry pine needle litter on the forest floor. This can be augmented by the fact put forth by the Government of Uttarakhand wherein it informed the Committee that during the last fire season, the Chir Pine-dominated areas have seen 125 fire incidents whereas Oak-dominated areas suffered only 4 fire incidents and the reason for this disparity is that Chir Pine sheds large quantities of dry needles which accumulate as a highly inflammable litter layer, igniting readily during the dry season. On the other hand, Oak forests retain higher soil moisture, produce less flammable leaf litter, and maintain a cooler, more humid microclimate, conferring natural fire resistance.

9.5 Thus, given the ever increasing severity of forest fires, it becomes imminent that a proper mechanism for biomass management, particularly pine needles, be put in place. The interesting fact is that pine needle (pirul) management has dual impact: on one hand it drastically reduces forest floor fuel load thereby directly cutting fire risk, and the other it creates sustainable biomass energy value chain thereby generating income for local community institutions & SHGs. Keeping this in view, States of Uttarakhand and Himachal Pradesh, which are some of the worst hit States by forest fires, have formulated policy measures/guidelines for pine needle management and been implementing it for removal and utilization of Pirul and other dry biomass, in order to reduce fuel load. These policies are worth mentioning and if found feasible, they may be rolled out on a regional level under the overall supervision of MoEFCC:-

The Chir-Pirul Intervention by the State of Uttarakhand:

9.6 The Government of Uttarakhand, during the meeting held on 17th June, 2026, informed the Committee that it has put in place a comprehensive mechanism

viz. “**State Guidelines for Chir Pine needle (Pirul) collection and biomass utilisation**” for scientific fuel load management, wherein systematic collection of fire-prone Chir pine needles from forest floors is converting a fire hazard into fuel pellets & briquettes. It has developed a well-defined supply chain from collection to utilization.



9.7 The community engagement in the chir pine dominant forest areas in terms of *chir pirul collection and utilization* for the prevention and control of forest fire has been ensured through policy intervention of the State Government. Fresh pine needles are available during the fire season for its collection, and its subsequent removal reduces the fuel load from the forest areas. There is a provision for collection and stocking of pine needles by local community institutions *in lieu of* upfront payment of Rs 10/- per kg by the Forest Department. The pine needle, so collected, is utilized for the manufacture of **pine needle briquettes, bio-char** and also being used as source of bio energy by the local entrepreneurs. The collected pine needles are also used for **handicrafts/household article production**. This scheme on one hand ensures removal of fuel load from the sensitive forest areas and helps in prevention of forest fire incidents, while on the other hand it generates employment and strongly supports local livelihood.

9.8 The Government of Uttarakhand further informed the Committee that this scheme has been widely recognised and well appreciated by the MoEF&CC, Government of India. For enhancing collection of Chir pirul in Pine-dominated Forest divisions in the State, various collection centres are being established. Chir pirul is being collected and brought to the collection centres through local Van Panchayats, Mahila self-help groups, mahila/yuva mangal dals etc.

The details of Chir pirul collected in the last 04 years

Year	Chir Pirul Quantity collected (MT)	Amount paid to communities (Rs Lacs)
2022	1260.00	25.21
2023	2381.50	71.45
2024	3829.95	113.54
2025	5532.11	542.73

9.9 As per the information furnished by the Government of Uttarakhand, at present, 11 Chir pirul based Briquettes/Pellets units have been established in the State. Efforts are being made to encourage more entrepreneurs for establishing at least one briquette unit in the identified 57 sensitive ranges.

The location of pine needle briquette units

Sr. No.	Name of District	Number of Units
1	Uttarkashi	02
2	Nainital	01
3	Pauri Garhwal	01
4	Tehri	01
5	Almora	05
6	Champawat	01

9.10 Moreover, the Government of Uttarakhand has also put in place a control mechanism to prevent pine needle recycling back into forests wherein payment to collecting communities is made only after verification of forward linkage to a utilisation unit (briquette/pellet plant). Also, Field units/Ranges maintain traceability and verification records. A robust Standard Operating Procedure (SOP) is being developed to formalize and strengthen these controls and eliminate residual risks.

9.11 However, the **major challenge**, as highlighted by the Government of Uttarakhand, **pertains to total duration of collection of pine needles** from forest areas, which is presently confined to approximately 3-4 months due to the following reasons:

- (i) In Chir Pine (*Pinus roxburghii*) dominated forests, pine needles suitable for collection and commercial utilisation naturally shed during March to June as

part of the species' normal life cycle. Economically viable collection activities are largely restricted to this period;

(ii) Access to forest areas is regulated during ecologically sensitive periods to minimize disturbance to wildlife and to prevent illegal activities such poaching, encroachment, and unauthorized extraction of forest resources;

(iii) During the monsoon season, pine needles absorb significant moisture, resulting in reduced calorific value and diminished commercial utility. Their collection also becomes operationally difficult and poses safety risks;

(iv) Extension of collection activities throughout the year would necessitate substantial strengthening of monitoring, supervision, and regulatory mechanisms to ensure compliance and prevent misuse of collection permissions; and

(v) Pine needle biomass remaining on the forest floor performs ecological functions including nutrient cycling, soil protection, and moisture conservation. Large-scale or year-round removal would require detailed scientific and environment assessment to ensure ecological sustainability.

9.12 Another point of concern is that the downstream sale and utilisation of these products occur through private commercial entities, for which data on their commercial utilisation is not available with the Forest Department. Also, no formal quality standards for pine needle procurement have been prescribed, nor are any certification currently issued by the Forest Department. Processing units generally require dry pine needles with minimal moisture content and without admixture of green biomass.

9.13 The Committee, taking into account the submissions made by State of Uttarakhand, strongly recommends that the intensive collection of pine needles be institutionalized on a mission mode as an annual pre-fire-season activity, backed by adequate budgetary support, procurement guarantees, single window clearance for subsidy and infrastructure for value addition, to serve the twin objectives of forest fire mitigation and rural livelihood

promotion. The Committee also recommends the Ministry of Environment, Forest and Climate Change (MoEFCC) to examine national and international best practices for developing appropriate quality standards and certification mechanisms through research, inter-governmental consultations, and exposure visits, so as to create a commercially viable circular economy by utilising pine needles (pirul).

Pine Needle Policy, 2018 by State of Himachal Pradesh:

9.14 The Committee, during the meeting held on 17th June, 2026, also had the benefit of views of Government of Himachal Pradesh. The Government of Himachal Pradesh informed the Committee that, on its part, it has published a **“Policy Document on Collection and Removal of Chir Pine Needles from Forest Land”** and been regulating the collection and utilisation of Pirul in accordance with the guidelines contained therein. The policy was formulated with the objective of encouraging removal of Chir Pine needles from forest lands to reduce fire hazards and promoting their utilization by industries as a source of fuel and other value-added products. Chir Pine forests in the State shed approximately 1.2 tonnes of pine needles per hectare annually — amounting to a staggering 1,51,062 tonnes of highly combustible biomass every year — the effective removal and utilization of pine needles is central to the State’s forest fire mitigation strategy. Pine needle-based briquettes and pellets have a high calorific value and can serve as an effective substitute for coal in brick kilns, boiler units, and other industries, making them an attractive proposition both environmentally and commercially.

9.15 The Government of Himachal Pradesh further informed the Committee that to catalyse private investment in pine needle-based industries, the Policy provided for an investment subsidy of 50% of capital cost, subject to a maximum of Rs. 25 lakhs per unit, for setting up units engaged in manufacture of briquettes, pellets as biofuel, pine needle composite boards, paper making, and other innovative products. The subsidy was disbursable in three instalments of 25%, 50%, and 25%. However, of the 38 entrepreneurs who applied under the scheme, all were approved by the Government, **though 8 subsequently withdrew**. Ultimately, only

5 units could be established — on each in Hamirpur, Dehra, Una, and 2 in Mandi Forest Divisions.

9.16 The policy also incorporates a strong financial deterrent against misuse of subsidy against the units that are abandoned, dismantled, or found not to be operating at a minimum of 25% of yearly production capacity during the five-year period following commissioning are liable to have the subsidy recovered by the DFO, with the right to recover through sale of assets if the owner refuses. This provision ensures that entrepreneurs who avail subsidies under the scheme remain accountable for the productive utilization of the infrastructure created.

9.17 Upon being asked by the Committee as to how much pine needle biomass has been utilised commercially across the State in the last few years, the Government of Himachal Pradesh informed that the grand total of pine needles collected across all five operational units in Himachal Pradesh from 2023-24 to 2025-26 stands at 1672.18 MT, with a corresponding briquette production of 1,345.3 MT. The industrial units established under the pine needle policy are subject to periodic inspection by the concerned forest official, who verifies that the quantity of raw material received at the unit is consistent with the collection records maintained at the field level.

9.18 The Government of Himachal Pradesh further informed the Committee that despite the policy framework and subsidy support, the scheme has not achieved the desired scale. The fundamental constraint has been the economics of pine needle collection. The cost of manually collecting pine needles from forest areas, stacking them at road heads, and transporting them to processing units has proved largely uneconomical, particularly for forest areas situated beyond 500 metres from motorable roads. A daily wage collecting pine needles at the current wage rate can collect only 1 to 1.5 quintals per day within 500 metres of a road, translating to a collection cost of approximately Rs. 150 per quintal — a figure that makes the enterprise financially unviable without additional support.

9.19 In order to address these concerns and utilise the potential of this scheme to its fullest, a Committee was constituted by the State Government in April, 2024, to study the efficacy and efficiency of collection and removal of Chir Pine Needles. The Committee, *inter-alia*, suggested the following measures:

(i) Present model of upfront capital cost subsidy does not incentivize industry to enhance productivity and also there is no provision in the policy that links production capacity to the quantum of subsidy.

(ii) Present policy focus on destructive use of pine needles. There is a need for providing R&D component in policy to non-destructive use of pine needles.

(iii) MGNREGA scheme may be explored for collection of pine needles.

(iv) Need to incorporate mandatory utilization of pine briquettes in big industries.

9.20 In addition to the aforementioned policy, the Government of Himachal Pradesh has also promulgated “**Fuel Policy for Industries in Himachal Pradesh**” which mandates the cement industries located in Himachal Pradesh to use 1% of their total annual fuel consumption from biomass and other combustible matter. The Government of Himachal Pradesh, in its submission, asserted that the State Government remains committed to evolving a more robust and economically viable framework for pine needle utilization that serves both the ecological goal of fire hazard reduction and the larger objective of sustainable rural livelihoods.

9.21 However, the major challenge, as highlighted by the Government of Himachal Pradesh, is that, at present, no specific national-level policy or incentive structure is in place for promoting the commercial collection and utilization of pine needles.

9.22 The Committee inquired as to why the pine needle biomass collection period is restricted to few months only and whether there is any possibility to expand this period and allow pine needle collection for few more months, to which the Government of Himachal Pradesh replied that the permission for collecting pine needles from forest areas is granted from March to the onset of monsoon. This seasonal restriction is not an arbitrary administrative limitation, but is grounded in the ecology of the Chir Pine tree itself. The primary and most prolific shedding of pine needles by *Pinus roxburghii* occurs between the months of March and June, when the trees shed the previous year's needles in preparation for new growth. It is during this period that pine needles accumulate on the forest floor in quantities that

are both ecologically significant as a fire hazard and economically meaningful as a collectible resource. During the remaining months of the year the rate of needle fall drops substantially, and the needles that are present on the forest floor are either wet, partially decomposed, or present in quantities too small to make organised collection economically viable. The seasonal permission structure therefore reflects a pragmatic alignment between ecological availability and economic feasibility.

9.23 Another major concern highlighted by the Government of Himachal Pradesh is that no specific quality standards have been specified for pine needles as a raw material for commercial procurement in Himachal Pradesh, and no certification framework has been established for pine needle-based products such as briquettes and pellets under the State's pine needle policy. In this regard, the Committee was informed that at the international level, the biomass energy sector is governed by a well-developed certification ecosystems, prominent among these are the **Sustainable Biomass Program (SBP)**, which is an independent, multi-stakeholder certification scheme providing internationally recognised certification for woody biomass used in large-scale energy production, covering legality, sustainability, and greenhouse gas emissions criteria across the entire supply chain. Similarly, the **International Sustainability and Carbon Certification (ISCC)** system provides end-to-end supply chain certification for biomass and bioenergy, with specific applicability to the **European Union's Renewable Energy Directive (RED III)** requirements. In terms of product quality standards, **ISO 17225** (solid biofuels) and the **EN plus certification scheme** for wood pellets specify parameters including calorific value, moisture content, ash content, mechanical durability, and bulk density.

9.24 The Committee, taking into consideration the submissions made by Government of Himachal Pradesh, is of the view that a dedicated national policy or incentive mechanism for pine needle utilization would provide a significant fillip to states like Uttarakhand and Himachal Pradesh that are grappling with the twin challenges of fire hazard reduction and sustainable rural livelihoods in pine forest landscapes.

9.25 The Committee, in line with the submissions made by Government of Himachal Pradesh, is of a strong view that a technical study group may be constituted at national level to study relevant international standards (ISO, EU RED, SBP, ISCC etc.) and a gap analysis be conducted between domestic norms and international benchmarks. The Committee suggests launching a voluntary pilot certification scheme for biomass processing units. Simultaneously, harmonized national quality standards for biomass fuel (briquettes, pellets, chips) be developed to strengthen/accredit testing labs for fuel quality certification and integrate adopted standards into national/state biomass and energy policies, so that biomass based products derived from pirul etc. can also be exported.

9.26 In order to have some non-governmental views in the matter, the Committee decided to have the benefit of some independent experts, who had been working in the related domains since long. Accordingly, the Committee, in its meeting held on 3rd July, 2026, heard the views of Shri Deepak Singh Varshney, Lt. Col. Monish Ahuja(Retd.) and Shri Mahadev Singh Gangadi, on the subject.

Submissions by Shri Deepak Kumar Varshney:

9.27 Shri Deepak Varshney has been working on the ground in the field of pine needle management for a long time. Upon being asked by the Committee as to how the biomass sourced from the Himalayan Region connects to forest fire risk in the region, Shri Varshney categorically stated that the connection between biomass and forest fire risk is direct. Chir pine litter is the principal fine fuel governing Himalayan fire behaviour and the one variable that can be controlled. The needle is highly resinous. It dries to very low moisture through the pre-monsoon months and settles into a loose, well-aerated mat on the forest floor. It ignites from a minor source, burns hot, and carries fire continuously across the ground and upslopes. It is the leaf litter, rather than the standing trees, which acts as the initiating fuel. Chir pine occupies roughly 3.94 lakh hectares of Uttarakhand, and it is in these stands that fire recurs year after year. Uttarakhand's removable biomass is about 2.3

MMTPA: roughly 1.9 MMTPA of pine needles and 0.4 MMTPA of other forest bio-waste. Removing the biomass breaks the fuel continuity and thus restricts the forest fires. Chir pine needle litter, which is the principal fuel, will be removed at scale only if a paying industrial demand exists for it.

9.28 Shri Varshney further shared with the Committee, his own experience in the field of pine needle management. He recalled that in December, 2021, he commissioned a pine needle pellet plant of 6,000 MT per annum capacity at Kotabagh, Almora district, Uttarakhand, drawing raw material from the chir pine forests of Almora. The plant ran from 1 April 2022 to 1 June 2022. In those two months it produced 125 MT of pine needle pellets, against a rated capacity of 1,000 MT for the same period. It was then shut down. The reason behind this was shortage of supply of pine needles and since that closure there has been no procurement of pine needles.

9.29 The Committee inquired as to what were, according to him, the main reasons behind this failure, to which Shri Varshney replied that at his Kotabagh plant, he tried two methods, simultaneously, to procure pine needles by purchasing them at the plant gate from villagers as well as through his own organised collection and transport from the Almora forests. However, neither of them delivered the volume the Plant needed to function, and as a result, the plant closed. He further informed that a subsidy of Rs 2/- per kg was available at the time through Uttarakhand Renewable Energy Development Agency (URED). But there was no standard operating procedure through which it could reliably be claimed or disbursed. In practice it reached collectors erratically, if at all. Van Panchayats were not involved in collection at that stage. Shri Varshney affirmly stated that the constraint is collection, neither the availability nor the demand. The needles are on the forest floor in abundance. The only thing is that they do not reach the plant. Further, he very categorically stated that demand is not the constraint in this sector. The constraint is in the economics of collection. Every tonne that can be collected can be sold.

9.30 The Committee further inquired as to what type of infrastructural, logistical or financial constraints limited his ability to scale up pine needle/biomass collection to which Shri Varshney replied that the collection economics was the

first and decisive constraint. At the price a Plant can pay within the ceiling of Rs. 10-12 per kg pellet, gathering the needles on a steep slope is not economically lucrative for a local villager. No amount of downstream investment can compensate if the collection model is not sustainable. In addition, the loose needle has very low bulk density, baling capacity, roadside depots and hill road vehicle size are the other bottlenecks. Pointing to the seasonality constraint involved in collection of pine needles, Shri Varshney stated that the entire year's raw material must be collected and baled in about three months, and then pelletised in a four-month production run, during which the plant runs non-stop to convert a full year's feedstock. Both the baling capacity and the covered storage must be sized for a year's material. This is a large, unavoidable capital cost that a year-round Industry would never carry. The full year's raw material is paid for within three months, while revenue accrues over twelve.

9.31 The Committee was further informed by Shri Varshney that cost of finance is another major constraint. The presence or absence of an interest subvention moves project viability materially. Over and above, lack of clarity of subsidies or schemes which exist, but their terms, eligibility and disbursement routes are not stated with the precision a lender or an investor requires. In addition to this, a secure and long-tenure land near the resource, in forest adjacent locations, remains slow and uncertain to obtain.

9.32 Shri Varshney further stated that he thought it to be pertinent to bring to the notice of the Committee the problems he faced in practice, so that the Committee may acknowledge the facts and make recommendation to incorporate necessary provisions to avoid such problems.

9.33 Upon being asked by the Committee as to what additional policy support would help expand fire-fuel-reducing biomass collection, Shri Varshney suggested the following measures:

- (i) a collection support of Rs 3-4 per kg, paid by Government, routed through the manufacturer and credited directly into the collector's bank account against verified weighment-with a notified standard operating procedure;

- (ii) a clarity and finality in the terms of eligibility, quantum and disbursement route, for the subsidy component, if any, the scheme offers;
- (iii) an interest subvention with no ambiguity;
- (iv) preference for pine needle pellets within existing co-firing procurement as Biomass co-firing is already notified and thermal stations are using bio-pellets today;
- (v) unambiguous classification of baled pine needles as freely transportable forest waste, as requirement of permission/authorization to transport pirul becomes a serious constraint, and it makes the material look like a regulated forest produce rather than the fire hazard.

Submissions by Lt. Col. Monish Ahuja (Retd.):

9.34 The Committee also had the benefit of views/submissions of Lt. Col. Monish Ahuja (Retd.), who has been working in biomass management sector since long. Lt. Col. Ahuja stated that Himalayan forest fires are fundamentally a pre-monsoon dry fuel-load problem, driven by Chir Pine needle (Pirul) accumulation. He further apprised that the current system of forest fire management is strong in satellite alerts and emergency response, but weak in fuel-load prevention, community accountability, assured offtake, storage, transport economics and stable funding. He, therefore, suggested shifting from reactive firefighting to a **prevention-led Pirul management model**, where pine needle (Pirul) are collected, geo-tagged, weighed, quality-checked, densified at road-heads and supplied to viable end-use industries. Key utilization routes include briquettes/pellets, biomass power, CBG, biochar, steam boilers, gasification and eco-cremation infrastructure. The model should be executed through a public-private-people partnership involving Forest Departments, Panchayats, SHGs, local entrepreneurs, private operators and climate/development finance. Overall, Pirul should be treated not as waste, but as a forest-fire prevention service, rural livelihood opportunity and green industrial resource.

9.35 Lt. Col. Ahuja also apprised the Committee about the Pine needle resource potential of States of Uttarakhand and Himachal Pradesh, which is about 15,20,853

MT annually, which could be immensely useful for use as alternate sources of energy given a flow chain is developed for the same.

PINE NEEDLE PROCESS FLOW CHAIN

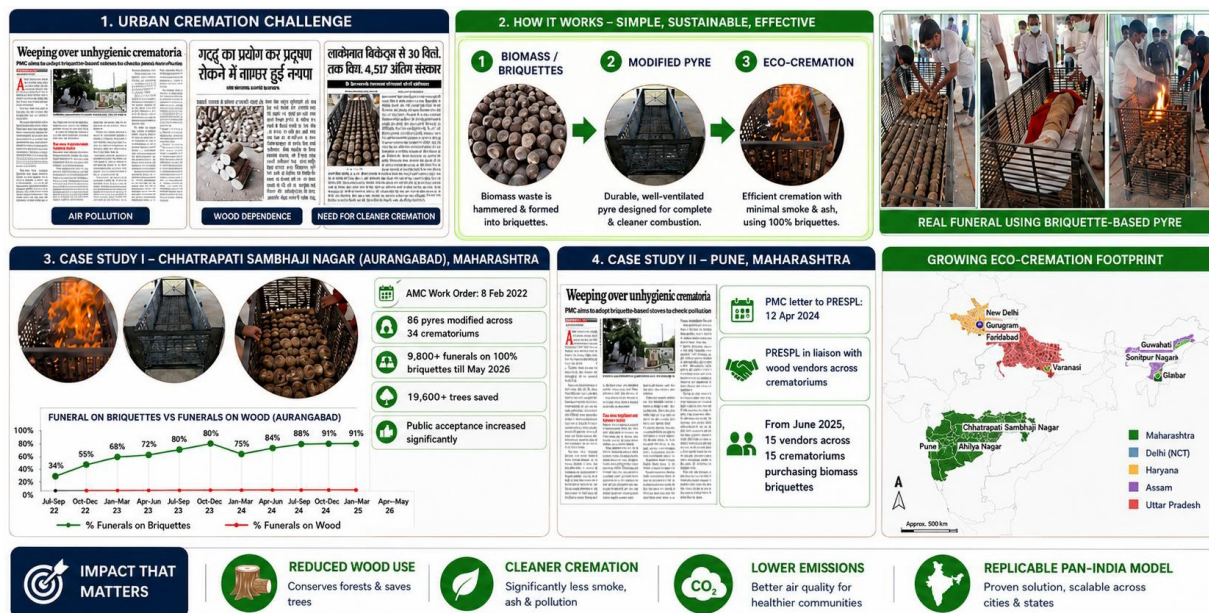


Eco-cremation:

9.36 Apart from its usage as alternate source of energy, one very unique usage of biomass, suggested by Lt. Col. Ahuja, was towards **eco-cremation** wherein the pellets/briquettes are used for performing last rites. The process endeavors towards preserving the environment by promoting Eco-Cremation. The existing process of wood-based cremation is silently and continuously eating away our tree counts in vast numbers, thereby drastically reducing the overall green cover. Mr. Ahuja informed the Committee that the briquettes based eco-cremation is being practiced in some states like Maharashtra, Delhi Haryana, Assam, Uttar Pradesh etc.

9.37 The Committee was further informed by Lt. Col. Ahuja that Biomass briquettes manufactured from agricultural residues such as paddy straw, maize cob, sawdust and other agri-residues provide a sustainable alternative to traditional firewood. Due to their higher calorific value, approximately 300-350 kg of briquettes can replace 400-500 kg of wood for cremation. The Committee was

surprised to hear that adoption of eco-cremation to the tune of 50% would save up to 8.32 million trees, which would further translate to preservation of national assets to the tune of Rs.6.22 lakh crore.



9.38 In reply to a query raised by the Committee as to why the supply chain is not being developed despite having a clear road map, to which Lt. Col. Ahuja replied that the biomass management starts from sourcing biomass from forest land which is too complicated due to permissions, permit, aggregation & transportation difficulties, long waiting period at check points, etc., and, hence, adds up to the overall cost of fuel, thereby it is not cost competitive in the market. At present, there do not exist a mature, large-scale and continuous commercial pine-needle procurement operation from notified Himalayan Forest divisions. Therefore, the current biomass operations are primarily based on agricultural and industrial biomass supply chains in its existing operating geographies.

9.39 He further stated that the risk is not only the presence of pine needles but the absence of a structured removal and utilisation system. Unless Pirul is collected before the peak fire months and moved into a traceable biomass value chain, the same material remains available for ignition every season. Therefore, pine-needle management must be seen as a prevention activity first and a biomass revenue opportunity second. Manual collection alone is not scalable. Mechanized solutions

are required for aggregation, baling, loading and movement from forest slopes to road-heads and then to densification or processing plants.

9.40 He also highlighted that the main constraint responsible for the problem is the absence of a bankable upstream supply-chain framework for Pirul. Key issues include seasonal availability, low bulk density, difficult hill terrain, limited road-head access, high first-mile transport cost, lack of covered storage, moisture variation, contamination risk and absence of mechanised collection/baling systems suitable for slopes. Apart from this, regulatory and institutional constraints include forest access permissions, uncertainty over ownership and revenue sharing, different rules across forest divisions, protected-area restrictions, slow approvals and lack of a single nodal agency. Financial constraints include working capital for community payments, capex for balers/storage, transport viability gap and uncertain long-term offtake. Without assured buyers, predictable pricing and Government-backed facilitation, pine-needle collection remains a small seasonal activity and cannot scale to fire-risk-reduction levels. Moreover, current pricing does not adequately reflect collection difficulty, distance from road-head, moisture level, material quality, quantity collected and terrain variation. Due to low bulk density, loose pine needles (Pirul) are difficult and costly to transport. Baling or compression near the collection point is essential to reduce volume, improve loading efficiency, and make transportation economically viable.

9.41 As a measure to overcome these constraints, a complete economic supply-chain model should be developed for Pirul collection, aggregation, densification and industrial off-take. The objective is to make fuel-load removal financially attractive for local communities before fire season, rather than depending only on emergency firefighting after ignition. In his submission, Lt. Col. Ahuja demonstrated before the Committee, a detailed break-up of supply chain management from pirul collection to its end use. In the upstream component, he highlighted the important aspects to be collection at source, sorting, drying, stocking up at a designated village collection point. For the Midstream, the important aspects highlighted were grading, baling, chipping, densification etc. Finally, in the downstream component, the bales and densified biomass are to be transported to processing plants wherein it was converted to pellets, briquettes, biochar etc.





9.42 For bulk collection of Himalayan pine needles at source, the proposed priority States under this proposed Supply Chain Model are Uttarakhand and Himachal Pradesh because of high Chir Pine concentration, repeated fire risk and practical urgency. Other potential replication regions may include Jammu & Kashmir, parts of North Bengal/Darjeeling, Arunachal Pradesh and other Himalayan belts, subject to forest permissions, road access, offtake economics and State partnership. The collection ecosystem should involve Van Panchayats, Joint Forest Management Committees, SHGs, rural youth, local entrepreneurs and transporters. Payments should be linked to verified quantity and quality, with additional consideration for distance from road-head, slope difficulty, moisture content and cleanliness of material. Digital geo-tagging and “report-to-earn” style recording can create transparency in source, quantity, collection date and worker payment. Workers / SHGs should be paid based on collection efficiency, assigned collection area, distance from road-head, moisture level and quality of pine needle collected. Accordingly, it is suggested to begin with one district cluster each in

Uttarakhand and Himachal Pradesh and then scaling only after verified collection, cost and fire-risk-reduction data are established.

9.43 Collection planning should be linked with FSI alerts and hotspot mapping to prioritise high-risk locations. Dedicated Himalayan Pine needle (Pirul) Management Mission for high-risk Himalayan States should be incepted with annual pre-monsoon fuel-load removal targets. Collected pine needle (Pirul) should be brought to storage centres near road connectivity. Static balers can be deployed to prepare bales of approximately 20–25 kg or 50–60 kg, improving handling and transport economics. Baled material should be moved through modified trolleys, compact hill trucks, EV-based transport where feasible, and larger trucks from road-heads to briquette plants, CBG plants, biochar units, biomass power plants, steam boilers and gasification facilities. Single-window forest permission system for collection, storage, transport and utilization should be put in place. Government support is required for balers, storage sheds, collection centres, moisture meters and weighing systems. Pine needle-based briquettes, pellets and biomass fuel should be linked to boilers, gasifiers, power plants, biochar and eco-cremation use. Indicative technology options include 100 MT/day briquetting hubs, decentralised baling units, biomass boiler fuel substitution, small gasification where viable, biochar production after feedstock testing, and eco-cremation fuel where quality standards are met.

9.44 Pine needle collected in a State should preferably be processed and used within the same State to reduce logistics cost. Industries using Pine needle-based green fuel should receive tax benefits, subsidy support or green procurement preference. Geo-tagging, digital weighment, moisture records, payment tracking and end-use reporting should be mandatory.

9.45 Large-scale funding through CAMPA, CSR, climate funds, multilateral agencies and private investors will be essential. Capital support may come from multilateral institutions, development finance agencies, philanthropic funds, WWF-type conservation funds, carbon funds, central & state government schemes, banks and private investors. Cross subsidized support from state governments, *in*

lieu of traditional electricity generation replacing fossil fuels with per ton pirul briquettes for electricity generation to save flora and fauna.

9.46 **The Committee noted that the foremost concern in the overall pine needle management is the insufficient uptake of biomass sourcing from forest land and the lack of adequate incentives driving it.** In this context, the Committee asked Lt. Col. Ahuja whether he could propose a standard costing model to ensure that collectors are paid an appropriate price for pirul collection. In response, Lt. Col. Ahuja apprised the Committee about a standard costing model to boost pine collection and delivery at the factory gate. He stated that a sustainable pricing mechanism should not be a flat biomass purchase rate alone. The fair price for Pirul should include collection labour, distance from road-head, terrain difficulty, moisture level, cleanliness, quantity, storage requirement and first-mile transport. He, accordingly, recommended a formula-based payment system: **“Collection Cost + Densification/Storage Cost + Transport Cost = Factory Gate Delivered Cost”**.

9.47 He further stated that pirul collectors should receive payment for verified kilograms/tonnes, with quality-linked incentives for dry and clean material. This creates a direct income reason for communities to remove pine needles before peak fire season. Where local labour alternatives are limited, even seasonal collection income can become a meaningful fire-prevention incentive. For scale, Government support may be needed to bridge the gap between community collection cost and industrial fuel affordability.

Submissions by Shri Mahadev Singh Gangari:

9.48 In his submissions before the Committee, Shri Mahadev Singh Gangari who is a retired government teacher and at present, an entrepreneur in the field of pine needle management and utilization. Shri Gangari after his retirement has started a project under the name **“Gangari Pine Needle Power Plant”** located in Chakon Dhanari village in Uttarakashi District of Uttarakhand. Established in September, 2020, it is a 25kW electricity-cum-briquette generation plant, in line with the Pine Needle Policy, 2018, piloted by Government of Uttarakhand.

9.49 Shri Gangari informed the Committee that he has worked very extensively in the field of forest fire mitigation through pine needle management. On being asked by the Committee about his opinion on the inter-relation between pine needle accumulation and forest fires, Shri Gangari affirmly replied that pirul accumulation has proved to be the single most prominent factor behind rampaging forest fires. Removing pirul, therefore, drastically decreases the probability of forest fires. Moreover, it becomes a win-win situation as on one hand, the possibility of forest fires reduces and on the other hand, the same pirul is used as alternate source of energy in the form of pellets/briquettes which in turn provided regular employment, assured income support and security of livelihood to villagers thereby further tackling the problem of employment related migration.

9.50 Shri Gangari further informed the Committee about his economic model wherein the electricity generated at his plant is purchased by the Government at Rs.7.54/-per unit and in turn revenues are generated for remuneration purpose. His effort has been well acknowledged by the State Government of Uttarakhand and various other stakeholders.

9.51 On being asked by the Committee as to what policy measures he would like to suggest in order to have a more comprehensive and dynamic pine needle management, to which he replied that firstly, pirul should become the basis of rural economy of hill states in particular; secondly, Hilly States have no dearth of pine needle biomass, the only thing warranted is to mobilise financial and mechanical resources in this direction; and thirdly, pirul generated and collected at a site should be used locally itself so as to cut down the cost of transportation thereby increasing the revenue yield. This will translate into long term sustainable employment to the villagers thereby alleviating the problem of migration.

The Short-Term Imperative: Commercial Utilisation of Pine Needles

9.52 The evidences tendered before the Committee established that dry Chir Pine needles constitute a continuous, highly combustible fuel layer on the forest floor and are a principal proximate cause of the recurring fire incidents in Uttarakhand and neighbouring hill States. FRI-associated research placed before the Committee estimated that Uttarakhand alone possesses approximately 3,99,329 hectares under Chir Pine forest, generating close to 15 million tonnes of pine-needle biomass

annually (Government of Uttarakhand, 2018). If left unmanaged, this volume of litter accumulates as standing fire risk year-on-year.

9.53 The Committee was informed during the submissions that the Government of India has instituted a number of policy measures to promote removal and productive utilization of forest biomass, including pine needles, as one of its components thereby reducing forest fire risk while supporting renewable energy generation and rural livelihoods:

(i) National Action Plan on Forest Fires (2018): The Ministry of Environment, Forest and Climate Change has emphasised reduction of forest fuel load through forest floor biomass management as an important strategy for forest fire mitigation.

(ii) Forest Fire Prevention and Management (FFPM) Scheme: The Government of India provides financial assistance to States for fire prevention, preparedness, fuel-load management, and strengthening of fire management infrastructure.

(iii) CAMPA-supported Interventions: CAMPA funds support forest fire mitigation activities, including fuel-load reduction, biomass management, fire line creation, and preventive measures that facilitate removal of pine needles from forest floors.

(iv) Green India Mission (GIM): The Mission promotes sustainable forest management, ecosystem restoration, biomass management, community participation, and forest-based livelihoods, providing an enabling framework for biomass-based livelihood initiatives.

(v) Biomass Co-firing Policy, Ministry of Power (2023): Coal-based thermal power plants are mandated to undertake biomass co-firing at a minimum of 5% from FY 2024-25, increasing to 7% from FY 2025-26. Pine needles are recognized as an eligible feedstock for pellet manufacturing and co-firing.

(vi) SAMARTH Mission, Ministry of Power: Facilitates development of biomass supply chains, aggregation, pellet manufacturing, transportation, and

utilization in thermal power plants, strengthening commercial demand for biomass resources.

(vii) National Bioenergy Programme (MNRE): The Ministry of New and Renewable Energy provides Central Financial Assistance for biomass pellet/briquette manufacturing units and biomass-based energy projects, promoting value addition and commercial utilization of forest biomass.

(viii) MSME and Institutional Finance Support: Biomass based enterprises, including pellet manufacturing units, are eligible for MSME registration and Government incentives. Biomass pellet manufacturing is also recognized under Priority Sector Lending, thus, improving access to institutional finance.

9.54 Having thoroughly gone through the submissions made by the independent subject-experts, the Committee is of the strong opinion that every pine needle left on the forest floor is both a fire hazard and a wasted energy resource. Also, it has been established beyond doubt that systematic removal of pine needles converts a recurring liability into a sustainable renewable energy circular economy. The Committee strongly advocates that Pirul model should not be treated only as a biomass procurement activity, rather it should also be seen as a forest-fire prevention service plus biomass value-chain model, where collection payments create livelihoods by industrial off-take, thereby converting fire-risk material into economic value.

9.55 At the same time, the Committee is also careful of the fact that pine-needle removal has to be undertaken in a systematically effective means. The Committee accordingly endorses a regulated, zone-specific approach: collection concentrated in identified fire-prone zones such as roadsides, fire-lines, forest edges, settlement-adjacent areas, and slopes with a history of repeated burning.

9.56 The Committee notes with interest the range of productive uses to which collected pine needles may be put — bio-briquettes, pine-peat, biochar, biomass energy, compost, handicrafts, and packaging material — each of which carries the dual advantage of reducing surface fuel load while generating supplementary income and employment for local communities, thereby aligning fire-prevention objectives with livelihood generation. Moreover, community participation secured through economic incentive is likely to prove more durable and effective than fire-prevention measures reliant on departmental enforcement alone.

9.57 The Committee, therefore, is of the firm view that the pine needles possess a huge commercial potential that needs to be harnessed. The Committee, accordingly, recommends to establish a fixed minimum procurement rate per unit weight (e.g. per kg or per quintal) of collected pine needles, paid directly to collectors, through a transparent mechanism, to encourage sustained community participation. Apart from that, there is a strong need to promote the establishment of decentralized units for converting pine needles into briquettes, pellets, biochar, handicrafts, and packaging material, enabling local employment and additional revenue streams. Moreover, private entrepreneurs and start-ups be encouraged to set up pine-needle-based power generation or briquette units, supported through subsidies, low-interest loans, or capital grants.

9.58 The Committee noted that the present policy framework is strong on fire detection, alerts and emergency response, but still weak on pre-season prevention, fuel-load removal and long-term community ownership. Key gaps remain in assured pine needle (Pirul) offtake, stable funding, Panchayat-level accountability, fire-watcher protection, prescribed-burning clarity and inter-

state replication. In view of this, incentives should be provided for fuel-load removal and forest aggregation, while penalties may be considered for negligent burning or unmanaged fire risk on private/community forest lands. Also, each Himalayan state should appoint a nodal agency for Pirul management, PPP development, capacity building and replication of proven models.

9.59 The Committee also recommends that time-bound, village-level collection drives before the onset of the fire season (typically February–May), be made mandatory and the same be coordinated by the Forest Department of respective States in partnership with local self-help groups, van panchayats, and community forest management committees. IEC (Information, Education, Communication) activities must be undertaken to sensitize communities on the fire-prevention and income-generation benefits of pine needle collection. The Committee strongly recommends that the intensive collection of pine needles be institutionalized as an annual pre-fire-season activity, backed by adequate budgetary support, procurement guarantees, well defined subsidies, if any, and infrastructure for value addition, to serve the twin objectives of forest fire mitigation and rural livelihood promotion.

9.60 The Committee has very carefully gone through the practical problems and challenges faced by the independent domain experts on the ground and notes that the collection of the pine needles and economics involved therein is the determining factor for designing a sustainable pirul economy. The Committee observes that the collection and baling at village level to raise transport density; weighment against receipt at a depot; payment at a declared per-kilogram rate credited directly into the collector's bank account, with no Intermediary and no discretion; aggregation through Van Panchayats

and self-help groups which hold the community mandate over these forests; hired haulage rather than an owned fleet; and a collection window of about three months, coinciding with the fire season are some of the aspects that need to be focused upon.

9.61 The Committee is of the strong opinion that a dedicated Himalayan Pirul Management Mission with per-kg collection incentive, road-head infrastructure support and single-window permissions would be the most enabling intervention. The Committee, accordingly, recommends for a prevention-led “Himalayan Biomass Management Framework”, as a policy measure, where Pine needle management is recognized as a formal forest-fire mitigation activity. Overall, Himalayan forest-fire management must shift from a reactive suppression model to a prevention-led, livelihood-linked and biomass-monetization model.

9.62 The Committee notes that the Government has notified biomass co-firing for thermal power stations and the plants are using bio-pellets today. Pine needle pellets, at 5,500 kcal/kg, are eligible and competitive within that demand. The Committee also notes that although the Central Government is currently promoting biomass collection and management as a component of various ongoing schemes, a dedicated national policy or incentive mechanism for pine needle utilization is the need of the hour. The Committee recommends that the Ministry, in coordination with State Governments, formulate a “National Pine-Needle Utilisation Policy” that (i) identifies and prioritises fire-prone collection zones on a scientific basis; (ii) provides fiscal and market-access incentives, including minimum support arrangements or subsidised collection infrastructure, to encourage community-based collection enterprises; and (iii) prescribes ecological safeguards to ensure that litter

removal does not fall below the threshold required for soil and nutrient function.

9.63 The Committee observes that the problems related to pine needle management are recurring in nature, namely: insufficient collection of pirul at source, the absence of an integrated pine needle supply chain, the lack of certification standards, and the absence of a national-level policy. The Committee is further of the view that a national-level regulatory body would address all the concerns more transparently and efficiently. Accordingly, the Committee recommends the MoEFCC to establish a National or Regional Pine Needle Management Board, for the overall supervision, coordination, implementation, and standardisation of pine needle management thereby fostering an integrated and sustainable supply chain for the affected States.

9.64 The Committee is also of the opinion that in order to have an efficient and effective forest fire mitigation strategy, the supply side constraints of the pine-needle based enterprises need to be addressed on priority. Accordingly, the Committee recommends the MoEFCC to examine the following policy, regulatory and market interventions, in consultation with the concerned State Governments, to further mitigate this problem:

(i) Pellets are the by-product; a cleared forest floor is the objective. Pine needle removal be treated as fire mitigation, not as a bioenergy scheme. Hence, it may be funded from forest protection budgets and judged by fire outcomes;

(ii) assured pirul collection & supply to the plant gate, as the feedstock uncertainty is the single biggest reason lenders refuse biomass projects;

(iii) notifying a collection support of Rs 3-4 per kg, paid by Government, routed through the manufacturer and credited directly into the collector's bank account against verified weighment with a published standard operating procedure. The finished pellets must land with the end user at ₹10-12/kg price at which sawdust pellets are already available. A support of ₹3-4/kg keeps pirul competitive, as without it the pine needle based pellets would be unsellable;

(iv) stating the terms of every scheme with finality, eligibility, quantum, disbursement route so that support can be financed against. A subsidy that a lender cannot count is not a subsidy. Central (MNRE CFA) and State subsidies are generous on paper but cannot be “banked” as stacking is unclear, claims are multi-window, and disbursement timing is discretionary. Written and time-bound confirmation as to which subsidies apply to pirul pellet plants, that too *via* a single-window mechanism with a defined disbursement timeline, is crucial;

(v) unambiguously classifying baled pine needles as forest waste, rendering it freely transportable without letters and permits;

(vi) providing interest subvention and a seasonal working capital line, recognising that a year's raw material must be bought in three months;

(vii) weighbridge-linked, geo-tagged recording of tonnage removed and mapping it against subsequent fire incidences so that the policy is evaluated on evidence;

(viii) uninterrupted power throughout the season to ensure the Plant running for approximately 20 hours a day across a-100-day season. An

assured night-time grid supply (priority feeder/no load-shedding) for the plant during the 4-month window, plus a reasonable industrial tariff and net-metering;

(ix) leasing suitable land (forest/van panchayat/revenue) near the resource to the manufacturer for 10 years, as buying the land inflates capital expenditure, locks the already scarce equity and subsidy into a non-earning asset;

(x) pellets originating from fire-prone Himalayan belts be preferred within that existing demand; and

(xi) pirul collection could also be listed as "extreme-weather-mitigation" work, in new VB-G RAM G Act (replacing MGNREGA) and subsequent guidelines, shifting part of the labour cost to central allocation; and

(xii) industries operating in the western Himalayan region be mandated to use atleast 20 per cent of their power requirements through pirul briquettes.

CHAPTER – 10

MITIGATION STRATEGIES FOR THE EASTERN HIMALAYA

10.1 Forest fires in the Eastern Himalaya present a markedly different profile from the fire regimes of the Western Himalaya. The fuel base is not a single dominant conifer but a mix of bamboo, moist deciduous forest and dense leaf litter; the terrain is if anything more difficult, with steep, densely forested hill tracts and limited motorable access; and the causation is overwhelmingly human, driven in large part by a centuries-old agricultural practice — shifting, or Jhum, cultivation — that continues to sustain the food security of significant tribal populations even as it remains the single largest contributor to fire incidence in the region. Effective mitigation in the Eastern Himalaya therefore turns less on containing an inherently flammable forest type, as in Chir Pine tracts further west, and more on managing the human behaviour and livelihood pressures that give rise to fire in the first place, while building the institutional, technological and financial capacity to detect and respond to what does occur.

10.2 The Committee held interaction with the representatives of State Government of Arunachal Pradesh and Manipur in its meeting held on 3rd July, 2026. In its background note submitted to the Committee, the Government of Arunachal Pradesh furnished the following information:-

10.3 The State Government of Arunachal Pradesh has adopted policy, institutional, technological and community-based measures for forest fire prevention and management under the National Action Plan on Forest Fires (NAPFF), the Centrally Sponsored Scheme on Forest Fire Prevention and Management (CSS-FPM) and the Arunachal Pradesh State Action Plan on Forest Fire (2023–2028). Forest fire management is implemented by the Department of Environment, Forest and Climate Change through its territorial and wildlife field formations. The State Action Plan provides the framework for prevention, preparedness, suppression, restoration and monitoring, supported by the National Action Plan's emphasis on technology, community participation and institutional strengthening. The Forest Survey of India (FSI) supports forest fire management through the Forest Fire Alert System and Van Agni Geo-Portal, which use MODIS and SNPP-VIIRS satellite data to provide near real-time fire alerts, fire-proneness maps and geospatial information for timely response. Forest fire management

emphasizes risk-based planning, maintenance of fire lines, deployment of trained personnel, early warning, community participation and provision of fire-fighting equipment. Post-fire management includes damage assessment, assisted natural regeneration, soil and moisture conservation, rehabilitation of affected areas and monitoring through field verification and satellite-based systems. Overall, Arunachal Pradesh has adopted an integrated forest fire management framework combining technology-enabled monitoring, institutional coordination, community participation and ecosystem restoration to strengthen forest fire prevention and resilience.

10.4 It further informed the Committee that despite significant progress in forest fire prevention and management, several operational and logistical challenges continue to influence the effectiveness of forest fire management in Arunachal Pradesh. The key challenges identified in the Arunachal Pradesh State Action Plan on Forest Fire (2023–2028) are as follows:

Difficult Terrain and Accessibility: - The State's rugged terrain and extensive forested landscapes limit accessibility to remote areas, affecting timely movement of personnel, equipment and fire suppression efforts.

Institutional Coordination and Community Participation: - Strengthening coordination among government agencies, local institutions and communities remains important, particularly in community-managed forests where local participation is critical for effective prevention and response.

Prevention, Preparedness and Capacity Building: - Continued emphasis is required on community awareness, pre-fire season preparedness, and availability of trained frontline personnel, modern fire-fighting equipment and sustained capacity building.

Technology, Communication and Infrastructure: - Further strengthening of fire-risk mapping, impact assessment, communication networks and decision-support systems will enhance early warning, monitoring and coordinated response, particularly in remote areas.

Sustainable Financing: - Given the State's vast forest area and difficult terrain, sustained financial support remains essential for strengthening prevention, preparedness, fire suppression, restoration and community-based forest fire management.

10.5 The State Government of Arunachal recommended the following strategic interventions:-

Strengthen Technology-enabled Fire Management: - Enhance fire risk assessment, early warning and decision-making through satellite-based monitoring, geospatial technologies and wider utilization of the Forest Fire Alert System (FFAS) and Van Agni Geo-Portal.

Strengthen Community Participation and Preparedness: - Promote sustained community participation, awareness, capacity building and pre-fire season preparedness to reduce anthropogenic fire incidences and improve rapid response.

Enhance Institutional Capacity: - Strengthen frontline capacity through improved infrastructure, communication systems, modern fire-fighting equipment and coordinated response mechanisms.

Promote Ecosystem-based Forest Fire Management: - Integrate forest fire management with ecosystem restoration, watershed conservation, soil and moisture conservation, and climate adaptation initiatives to enhance long-term forest resilience.

Ensure Research, Coordination and Sustainable Financing: - Promote scientific research, strengthen inter-agency coordination and ensure sustained financial support for effective forest fire prevention and management.

10.6 The Committee has taken note of the challenges and suggestions put forward by the State Government of Arunachal Pradesh. The Committee recommends that the Union Ministry of Environment, Forest and Climate Change, in consultation with the State Governments of all the Eastern Himalayan States, undertake a coordinated programme of forest-road and helipad development in the most fire-prone Divisions across the region, rather

than leaving terrain and accessibility to be addressed by individual States acting alone within their own budgetary means.

10.7 The Committee also recommends that the Ministry prescribe a common protocol, applicable across the Eastern Himalayan States, setting out the roles, reporting lines and response timelines governing the relationship between State Forest Departments and community-managed forest institutions, so that the strengthening of coordination in the region is pursued on a uniform basis rather than through separate, State-specific arrangements of varying rigour.

10.8 The Committee further recommends that the Ministry establish a region-wide, multi-year training and capacity-building calendar for frontline forest personnel across the Eastern Himalayan States, delivered through shared training infrastructure where feasible, so that the general commitment to sustained capacity building found in individual State Action Plans is translated into a fixed, jointly resourced schedule rather than being pursued unevenly, State by State.

10.9 The Committee also recommends that the Ministry ensure timely release of funds against the approved Annual Plans of Operation of all Eastern Himalayan States under the Centrally Sponsored Scheme, so that forest fire management effort across the region is not constrained by delayed or partial disbursement.

10.10 More broadly, the Committee notes that the strategic interventions proposed by the State Government of Arunachal Pradesh mirror priorities that recur, in substance, across the Eastern Himalayan States. The Committee is of the view that these are, at their core, regional rather than State-specific

challenges, and accordingly recommends that the Union Ministry of Environment, Forest and Climate Change convene the Eastern Himalayan States to draw up a single, time-bound regional action plan addressing the challenges jointly, with defined milestones, rather than requiring each State to arrive at its own separate strategy for problems that are substantially shared.

10.11 In its background note submitted to the Committee, the State Government of Manipur furnished the following information:-

10.12 Manipur holds one of the largest forest areas in the country, with 78 per cent of its total geographical area under forest jurisdiction and nearly 74 per cent under actual forest cover. Forest fire management operates under the Manipur State Action Plan on Forest Fire (2022–2027), with the Principal Chief Conservator of Forests and Head of Forest Force, acting through a designated Nodal Officer for Forest Fire, providing overall policy direction and monitoring. Circle-level officers supervise preparedness within their jurisdictions, Divisional Forest Officers plan, coordinate and execute fire prevention and suppression measures within their divisions, and Range Forest Officers, Beat Officers and frontline field staff, supported by 168 Joint Forest Management Committees and 560 Village Forest Fire Committees, undertake field-level surveillance, detection, prevention and suppression. Standard Operating Procedures are revised and publicised through local media before every fire season, and during the six-month dry season from October to April, frontline staff maintain temporary camps at vulnerable locations equipped with wireless sets and fire-extinguishing equipment. Daily foot patrols are conducted throughout the year by each Forest and Wildlife Division, with Divisional Forest Officers uploading geo-tagged patrol photographs to a departmental coordination group as a monitoring mechanism.

10.13 The State Government of Manipur further informed the Committee that Forest fires in Manipur are overwhelmingly anthropogenic: an estimated 90 to 95 per cent are human-induced, with short-cycle Jhum cultivation identified as the principal driver, aggravated by the accumulation of dry leaf litter and grasses on the forest floor, prolonged seasonal dry spells, and strong regional winds that cause fires to spread rapidly once ignited.

10.14 Ground verification of FSI Anavaran satellite data for the period September 2024 to November 2025 corroborated this pattern: of 511 active fire sites detected and verified on the ground during this period, 335 — nearly two-thirds — were directly attributed to Jhum cultivation. Beyond Jhum burning, the State has identified a range of secondary causes, including intentional fires connected to encroachment disputes, smouldering material or unattended embers left by honey collectors, fires associated with hunting and poaching activity, fires originating from roadside construction work, and, in recent years, fires linked to episodes of ethnic conflict in the State. In Manipur's hill areas, the vegetation identified as the principal catalyst for fire spread and intensity is dwarf bamboo at higher altitudes, bamboo forest more generally, a small number of segregated pine patches, and dry leaf litter within deciduous forest stands. Over the period January 2021 to May 2026, the Forest Fire Alert System of the Forest Survey of India recorded 3,588 fire events in Manipur, burning approximately 12,650 hectares across East Himalayan Sub-Tropical Wet Hill Forest, East Himalayan Moist Mixed Deciduous Forest, Dwarf Bamboo Forest and Cachar Semi-Evergreen Forest.

10.15 The Committee notes that a single causal factor — Jhum cultivation — accounts for close to two-thirds of verified fire incidence in Manipur, and is of the considered view that no mitigation strategy for the Eastern Himalaya can be regarded as adequate unless it treats the regulation and progressive substitution of Jhum as its central objective, rather than as one item among several in a broader prevention programme.

10.16 Both the States i.e. Arunachal Pradesh and Manipur draw on the national baseline provided by the Forest Survey of India, whose Forest Fire Alert System and Van Agni Geo-Portal use MODIS and SNPP-VIIRS satellite data to generate near-real-time fire alerts, fire-proneness maps and geospatial information. Manipur has layered a set of State-specific systems on this foundation. A total of 6,967 personnel, comprising frontline field staff and members of the Village Forest Fire Committees and Joint Forest Management Committees, are registered on the FSI portal to receive automated SMS alerts directly. The Forest Department has established a twenty-four-hour toll-free helpline together with dedicated WhatsApp

coordination groups through which satellite fire points are shared instantly for rapid deployment, supplemented by walkie-talkie links between the Forest Headquarters control room and all Divisions. The Department has also entered into collaboration with the North Eastern Space Applications Centre, a body under the Indian Space Research Organisation, for the development of a dedicated forest resource monitoring system, deployment of Internet-of-Things-based sensors in fire-prone patches to detect heat anomalies and smoke in real time, and drone-based aerial surveillance of inaccessible, high-risk areas during the fire season.

10.17 Prevention efforts in both States rest on risk-based planning and fuel management: fire lines and fuel breaks are created and maintained across vulnerable forest divisions, dry biomass and invasive weeds — notably *Lantana camara* — are removed mechanically and manually, and strategic controlled burning is undertaken in selected high-fuel areas to reduce wildfire intensity. Water tanks, ponds and check dams are constructed or rejuvenated in fire-prone forest beats, and solar-powered fire watch towers have been installed at strategic hilltops and forest entry points, with Division-wise fire risk mapping using remote sensing and GIS informing the prioritisation of these interventions.

10.18 In Manipur, the concerned Department has created 333 kilometres of fire line between 2021-22 and 2024-25 under the Centrally Sponsored Scheme, though maintenance funding in 2025-26 covered only 65 kilometres of this network; a further 162 kilometres and 175 kilometres of fire line were created under the State Plan in financial years 2024-25 and 2025-26 respectively, across ten Forest Divisions, though irregular and untimely funding in subsequent years has constrained continued maintenance. Frontline field units are equipped with fire beaters, rakes, shovels, axes, billhooks, sickles and, where available, leaf blowers, together with personal protective equipment, and are supported by four-wheel-drive Bolero campers and motorcycles at the divisional and range level. Against this, 440 frontline field staff and community-institution members have received specific training in forest fire prevention and control, a figure that lags well behind the 6,967 personnel enrolled on the FSI alert system.

10.19 The most significant capacity constraint identified by the State Government of Manipur concerns frontline staffing itself: the State Forest Protection Force is

currently operating at approximately 45 per cent of its sanctioned strength, with a single Range Forest Officer responsible for an average forest area of about 235 square kilometres and a single Forest Guard for about 37 square kilometres.

10.20 The Committee finds it a matter of concern that a Department otherwise well served by satellite alerts, community institutions and a functioning early-warning architecture should be operating at less than half its sanctioned field strength, and is of the considered view that no expansion of technology or infrastructure can substitute for the frontline manpower required to act on the alerts that technology generates. The Committee recommends that a time-bound recruitment and deployment plan for frontline field staff in fire-prone Divisions be put in place without further delay, and that training coverage be closed through a phased, multi-year calendar so that the present gap between personnel trained and personnel enrolled for alerts does not persist indefinitely.

10.21 The Committee was further informed by the State Government of Manipur that given that Jhum cultivation accounts for close to two-thirds of ground-verified active fire sites in Manipur, the State's strategy for addressing it merits close examination. The Government of Manipur has deliberately adopted a substitutive rather than a prohibitive approach, recognizing that the practice remains a food-security and livelihood necessity for a significant tribal population, and that outright restriction without a viable alternative would be neither equitable nor enforceable.

10.22 The strategy rests on three linked strands. The first is livelihood diversification away from short-cycle Jhum: value addition and marketing support is extended under the PM Van Dhan Vikas Kendra scheme, implemented through Self-Help Groups under TRIFED, with several Kendras being progressively upgraded into Mini-Trifoods to strengthen market linkages for non-timber forest produce, and horticulture and agro-forestry alternatives are promoted under the Sub-Mission on Agro-forestry and the Rashtriya Krishi Vikas Yojana, offering

tree-based and perennial cropping systems as a substitute for the short rotational cycle that drives repeated forest-floor burning.

10.23 The second is direct, targeted rehabilitation of Jhumia families through dedicated State Plan budgeting: in financial year 2025-26, Rs. 19.04 lakh was utilised for agro-forestry plantation and the distribution of beekeeping boxes as an alternative income source.

10.24 The third is geographic phasing: from 2026-27 onward, one specific Jhum area has been identified in each forest division for rehabilitation, marking a shift from scattered, demand-driven support toward a planned, division-wise reduction in active Jhum acreage. The Village Forest Fire Committees and Joint Forest Management Committees, together with the State's incentive schemes for fire-free villages, function as the enforcement and monitoring layer for this strategy at the community level, being best placed to distinguish fires originating from Jhum burning that has escaped control from fires attributable to other causes, and to channel affected villages toward rehabilitation rather than punitive action alone.

10.25 The Committee appreciates the State Government of Manipur's substitutive approach to a practice that is deeply embedded in tribal livelihood and cannot realistically be addressed through prohibition alone. The Committee, however, notes that the scale of budgetary commitment to this strategy is not in proportion to the scale of the problem it addresses: an allocation of Rs. 19.04 lakh in dedicated Jhum rehabilitation funding for a single year, set against a causal factor responsible for roughly two-thirds of all fire incidents in the State, suggests that livelihood substitution is being pursued at a pace well below what the underlying fire-reduction objective would require. The Committee also recommends that the incentive scheme for fire-free villages, presently described only in general terms, be formalized with a transparent disbursement formula linked specifically to reductions in Jhum-related fire incidence within the village's jurisdiction, so that the

scheme reinforces the substitution strategy directly rather than rewarding fire-free status as a general outcome.

10.26 Community participation forms a central pillar of fire management in Eastern Himalayan States. Manipur has constituted 560 Village Forest Fire Committees and strengthened 168 Joint Forest Management Committees, alongside Community Volunteer Fire Brigades, with this institutional network continuing to expand. The mobile numbers of village committee heads and local youth leaders have been enrolled on the FSI portal to decentralize the early-warning system, local tribal villagers are engaged in seasonal employment for the creation of fire lines and as active firewatchers, and localized awareness campaigns, block-level mock drills and the distribution of handheld firefighting equipment are conducted regularly.

10.27 The Manipur Forest Department functions as the nodal agency for forest fire prevention and suppression within the State, operating under Standard Operating Procedures consistent with the Threshold SOP Guidelines issued by the National Disaster Management Authority. During major fire incidents, the Department maintains close coordination with the State Disaster Management Authority, District Disaster Management Authorities, District Administration, Police Department, Fire Service, Home Department and Health Department. Where a fire exceeds the response capacity of the State, assistance is sought from the National Disaster Management Authority and the National Disaster Response Force, and the Forest Department shares information on major incidents with the Union Ministry of Environment, Forest and Climate Change. Fires occurring along interstate forest boundaries are addressed through direct coordination between the concerned Forest Departments and District Administrations, with information on fire location, spread and suppression measures exchanged to prevent fires crossing administrative boundaries.

10.28 The Committee recommends that the coordination arrangements be formalized into a standing regional protocol for the Eastern Himalayan region, with points of contact and escalation procedures pre-identified rather than assembled afresh at the time of each cross-border incident.

10.29 Manipur lies within one of the world's recognized biodiversity hotspots and hosts a network of Protected Areas comprising two National Parks, Wildlife Sanctuaries and other ecologically significant forest landscapes, all of which face recurring threat from forest fire during the dry season. Fire impact is concentrated at the forest floor — grasses, herbs, shrubs, leaf litter and natural regeneration are principally affected — and recurrent fires can suppress the regeneration of native tree species, alter forest structure, and open the ground to colonization by invasive species; the infestation of *Ageratina adenophora* and *Lantana camara* has been reported to be rising in fire-affected parts of the State as a direct consequence, with fire-degraded areas losing ground cover, food resources and shelter for wildlife and, over repeated cycles, becoming fragmented with correspondingly reduced habitat quality.

10.30 The Committee notes with concern that fire-driven degradation in Manipur's Protected Areas is compounding itself through invasive colonization, with *Ageratina adenophora* and *Lantana camara* establishing in exactly those patches that most need native regeneration to succeed. The Committee is of the view that this warrants a response distinct from general post-fire restoration, since an area left to natural regeneration under continuing invasive pressure is unlikely to recover in the manner the State's restoration data assumes. The Committee accordingly recommends that fire-affected Protected Areas be subject to mandatory invasive-species removal as a first step in restoration, ahead of or alongside assisted natural regeneration, rather than as an incidental activity folded into general weed management.

10.31 The Committee further recommends that the Ministry of Environment, Forest and Climate Change should launch a dedicated, time-bound mission for the removal of invasive species across the forest landscapes of the Eastern Himalayan region, rather than leaving invasive-species control to be addressed piecemeal within individual State restoration programmes. Given

that *Ageratina adenophora* and *Lantana camara* are reported to be spreading across fire-affected forest in Manipur and are not confined to that State alone, the Committee is of the considered view that the scale and cross-border character of the problem calls for a coordinated, region-wide response with dedicated Central funding, clear multi-year eradication targets, and a mechanism for monitoring reinvasion, rather than a series of disconnected State-level efforts that leave regenerating forest vulnerable to decolonization from neighbouring, untreated tracts.

10.32 Post-fire restoration in Manipur follows an integrated sequence funded through the Forest Fire Prevention and Management Scheme, CAMPA, State Plan Afforestation, and KfW (German state-owned development bank) project activities. Burnt areas are first assessed jointly by field staff through ground verification and satellite-based alerts, with the extent of damage incorporated into the subsequent Annual Plan of Operations. Low-intensity surface fires are addressed through assisted natural regeneration, protecting affected sites from repeated fire, grazing and other biotic pressure; more severely degraded patches are restored through afforestation and gap planting using native and endemic species, with an emphasis on ecological restoration rather than monoculture planting. Soil and moisture conservation works, including contour and staggered trenching and check dams, support regeneration, and restored areas are protected through renewed fire lines, enhanced patrolling and continued community participation.

10.33 The State Government of Manipur apprised the Committee that because most fire incidents in the State are low-intensity surface fires that do not cause permanent damage to mature forest stands, the majority of affected areas recover satisfactorily, with an average natural regeneration success rate of around 70 to 75 per cent.

10.34 Under the Centrally Sponsored Scheme for Forest Fire Prevention and Management, which operates on a 90:10 Centre-State funding basis, the position of funds proposed and released for Manipur is as follows:

Financial Year	Proposed Annual Plan of Operations (₹ lakh)	Central Share Released (₹ lakh)	State Share Released (₹ lakh)	Total Released (₹ lakh)
2024-25	227.00	92.47	10.27	102.74
2025-26	578.60	50.87	5.65	56.52
2026-27	305.27	Yet to be released	—	—

10.35 In addition, Rs. 21.97 lakh was released in 2025-26 under the State Plan for the procurement of fire-control equipment, and Rs. 70 lakh was released in financial year 2024-25 under CAMPA to form and strengthen Village Forest Fire Committees. A Project Report seeking central assistance of Rs. 27.51 crore for a Mitigation Scheme for Forest Fire Risk Management was submitted to the National Disaster Management Authority in August 2025, with formal approval and release of the requested funds still awaited.

10.36 The Committee notes that Manipur has, in each of the last two financial years, received far less central funding than it had proposed under its Annual Plan of Operation — with only about forty per cent of the amount proposed for 2025-26 released so far. The Committee recommends that the Ministry release a larger share of the approved funds against Annual Plans of Operation. The Committee also recommends that NDMA process the pending proposal of Rs. 27.51 crore without further delay.

10.37 The State Government of Manipur has sought financial support from the Centre for the procurement of specialized four-wheel-drive all-terrain vehicles suited to steep hill operations, modern personal protective equipment and mechanized firefighting tools, better road connectivity to forest fire prone areas, and unmanned aerial vehicles of higher payload and endurance; technical support in the form of institutional collaboration with the Forest Survey of India for annual, high-resolution burn area assessments specific to the State's terrain; support for water-harvesting structures at high altitude; continuation and strengthening of incentive schemes for fire-free villages; infrastructure support for frontline staff,

including barracks and Range and Beat offices; and support for research and development toward fire-resistant tree species.

10.38 The Committee recommends that the Ministry of Environment, Forests and Climate Change should favourably consider providing the Eastern Himalayan States with specialized four-wheel-drive vehicles, modern protective gear and mechanized firefighting tools suited to hill terrain, together with the ground-based sensors, AI-enabled camera towers and long-endurance unmanned aerial vehicles that States in the region have identified as gaps in their present technology base. Given that such gaps are likely to recur across the Eastern Himalayan States rather than being confined to any one of them, the Committee recommends that these equipment and monitoring capabilities be procured and deployed through a common regional programme covering the Eastern Himalayan States, rather than through isolated, State-level procurement; and that communication infrastructure in remote fire-prone forest divisions be funded as core fire-management infrastructure in its own right, rather than addressed incidentally through general rural connectivity programmes.

10.39 The Committee further recommends that the Ministry support the Eastern Himalayan States on regular, high-resolution assessments of burnt areas, and on the construction of water-harvesting structures in high-altitude areas, given their usefulness in fire control.

10.40 The Committee also recommends that schemes rewarding fire-free villages be continued and strengthened across the region, since they directly encourage community participation in fire prevention; that adequate infrastructure — including barracks and offices for Range and Beat staff —

be provided to frontline personnel; and that research into fire-resistant tree species be supported, so that the region's forests are made more resilient to fire over the long term.

10.41 The Committee recognises that several of the challenges faced by the North Eastern States are inherent to Himalayan geography and cannot be eliminated outright, but can be substantially mitigated through targeted infrastructure investment, sustained and predictable financing, and — above all, given the causal weight of Jhum cultivation — a decisively scaled-up livelihood-substitution programme. The Committee accordingly recommends that the Ministry, in consultation with the State Governments of the Eastern Himalayan region, treat the mitigation of Jhum-related fire risk as the foremost priority within the wider forest fire management effort for the Eastern Himalaya, with frontline manpower restoration, predictable Central financing, and shared regional technology platforms as the supporting pillars on which that priority effort must rest.

CHAPTER – 11

MANAGEMENT FRAMEWORK: POLICY, LEGAL AND INSTITUTIONAL DIMENSIONS

11.1 An effective forest fire management framework requires three mutually reinforcing pillars: policy and regulatory instruments that translate national priorities into field-level standard operating practice; a legal framework capable of assigning clear statutory responsibility and enforceable accountability; and institutional machinery — spanning the Ministry, its technical research arm, and the State Forest Departments that bear day-to-day operational responsibility — through which policy intent is actually carried onto the ground.

Policy and Regulatory Measures

11.2 In response to a query, the Ministry informed the Committee that it has circulated Standard Operating Procedures (SOPs) to all States/Union Territories on forest fire prevention, mitigation and response, calibrated separately for Tropical Dry Deciduous, Tropical Moist Deciduous, Tropical Semi-Evergreen, Sub-Tropical Pine and Sub-Tropical Broad-Leaved Forests. Recognising that fire behaviour, fuel load and terrain characteristics differ markedly across these forest types, this differentiated approach represents a departure from a one-size-fits-all suppression model toward ecologically calibrated preparedness, prevention, early warning, suppression and post-fire restoration protocols.

11.3 The Ministry further informed the Committee that it has developed a Forest Fire Preparedness Index (FFPI), conceived in alignment with the National Action Plan on Forest Fire (NAPFF), to assess and benchmark the preparedness and response capacity of individual Forest Divisions. The Ministry also apprised the Committee regarding standardisation of forest firefighting equipment to bring uniformity to procurement and deployment across States. The Ministry also informed that it is finalising Joint Convergence Guidelines under the Viksit Bharat-Guarantee for Rozgar and Aajeevika Mission (Gramin) (VB-G RAM G) Act, 2025, for undertaking forest fire prevention and mitigation activities through convergence of relevant schemes and programmes. The proposed framework seeks to strengthen community participation, creation of fire prevention infrastructure,

soil and moisture conservation, fuel load management and restoration of degraded forests.

11.4 The Committee welcomes the Ministry's move away from a one-size-fits-all approach, but is of the view that the value of these SOPs will be tested when actually put to use. The Committee recommends that the Ministry convert these SOPs into short, field-usable formats — laminated cards or an offline-capable mobile application in local languages — so that frontline staff on terrain without network connectivity can actually apply them, rather than the SOPs remaining lengthy documents confined to Divisional offices. The Committee further recommends that familiarity with the SOPs be made a component of annual refresher training and staff performance appraisal, so that compliance is incentivized rather than assumed, and that SOP-based mock drills be adopted as the standard method of testing these procedures under realistic field conditions.

11.5 On the Forest Fire Preparedness Index, the Committee is of the view that an index which is computed but not acted upon serves only as a diagnostic exercise rather than an instrument of governance. The Committee recommends that FFPI scores be directly linked to fund allocation under CAMPA and the NCSFFM, such that Divisions recording the weakest scores receive priority in equipment and manpower allocation for the following fire season, rather than allocation remaining a matter of administrative discretion. The Committee further recommends that FFPI scores be made public in the form of a Division-wise or State-wise comparative table, in the belief that public visibility will drive improvement more effectively than internal review alone.

11.6 On the standardization of firefighting equipment, the Committee recommends that the Ministry establish centralized rate contracts for standardized firefighting equipment, on the pattern of the Government e-Marketplace, so that States with weaker fiscal capacity are not compelled to procure inferior equipment at higher cost than better-resourced States. The Committee also recommends that the local manufacture of low-cost tools be supported through a simple quality-certification mechanism, enabling village-level cooperatives and small manufacturers to produce standardized equipment locally rather than every State depending on slow central procurement.

11.7 On the Joint Convergence Guidelines under the VB-G RAM G Act, 2025, the Committee views this as a potentially significant vehicle for embedding forest fire prevention within rural livelihood and employment guarantee architecture. The Committee recommends that a fixed minimum share of convergence funds be ring-fenced specifically for fire-prone districts, rather than the allocation being left entirely to the State discretion. The Committee further recommends that the Ministry examine formalizing seasonal fire-watching and fire-line clearance as recognized job-card work under the employment guarantee framework. The Committee also recommends that release of convergence funds be tied to verified physical output — such as kilometres of fire-line cleared or fuel-load removed, cross-checked against satellite imagery — rather than to fixed budgetary allocation, so that funds intended for fire prevention are not diverted to unrelated purposes at the State level.

Legal Framework

11.8 In response to a query on whether the Indian Forest Act, 1927 needs amendment to include specific provisions making forest fire prevention and management a statutory duty of State Governments, the Ministry informed the Committee that forest fire prevention and management are presently addressed through the National Action Plan on Forest Fire, approved Working Plans, State Forest Acts and Rules, CAMPA interventions and the Disaster Management framework, and that the Ministry continuously reviews policy and legal mechanisms relating to forest management.

11.9 The Committee desired to know as to whether the Forest Conservation Act, 1980 needs to be amended to mandate a fire risk assessment and fire management plan as part of every forest land diversion proposal, the Ministry replied that diversion proposals are presently examined under the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980, the rules made thereunder, and the guidelines issued by the Central Government, through a comprehensive appraisal process covering ecological, environmental, scientific and forest management aspects. The Forest Advisory Committee (FAC) constituted under the Act examines such proposals on merit, taking these provisions, rules and guidelines into account, while fire prevention as such continues to be addressed separately through approved Working Plans and State-level frameworks rather than as a mandatory component of the diversion appraisal itself.

11.10 Responding to the Committee's query on whether a new central law, such as a National Forest Fire Management Act, is needed to create a legal framework for early warning systems, minimum firefighting infrastructure and penalties for negligence by State agencies, the Ministry stated that forest fire management is presently addressed through the NAPFF, State Forest Acts and Rules, approved Working Plans, CAMPA interventions and the Disaster Management framework, that institutional arrangements and policy measures are continuously reviewed, and that emphasis is presently being placed on effective implementation of existing mechanisms and strengthening inter-agency coordination rather than new central legislation.

11.11 The Committee looked closely at the existing laws that govern forests in India. These include the Indian Forest Act, 1927, the Forest (Conservation) Act, 1980 now renamed the Van (Sanrakshan Evam Samvardhan) Adhiniyam through the 2023 amendment, the Wildlife (Protection) Act, 1972, the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, and the Biological Diversity Act, 2002, together with subordinate instruments including the National Forest Policy, Joint Forest Management guidelines, and the Compensatory Afforestation Fund system. These laws were made at different times, for different reasons, and do not fit together well today. The Committee is of the view that this scattered approach is no longer suitable for present needs.

11.12 The Committee notes that the Indian Forest Act, 1927 was made by the British mainly to control timber and protect Government revenue from forests. Its basic idea was that forests belong to the Government. The Committee is of the view that this old idea does not match how we understand forests today, where a forest is seen as a living system that provides many benefits beyond timber. The Committee notes with concern that the 1927 Act still focuses mainly on policing, offences, and seizure of forest produce, rather than on restoring and caring for forests.

11.13 The Committee observes that India does not have a clear, simple legal definition of what counts as a "forest." For many years, courts have had to decide this instead of the law itself. A recent amendment has narrowed this further, so that many patches of land that look and function like forest, but were never formally recorded as such, may now fall outside legal protection. The Committee is of the view that this narrowing of definition introduces material uncertainty into forest governance, particularly in ecologically

sensitive Himalayan and North Eastern landscapes where large tracts of forest remain outside formal classification despite meeting every ecological criterion of forest.

11.14 The Committee notes that decisions to allow forest land to be used for other purposes are presently based mainly on development needs and on the promise of planting trees elsewhere to make up for the loss. The Committee is of the view that this approach does not draw any firm outer limit, so that in principle almost any forest can eventually be considered for clearance if the development need is thought to be pressing enough. The Committee is of the considered opinion that certain forests are simply too valuable, and in many cases too difficult or impossible to recreate, to be judged on a case-by-case basis in this manner.

11.15 The Committee examined how compensatory afforestation works at present. When forest land is cleared for another use, the law requires new plantation to be raised elsewhere, even thousands of kilometres away, to make up for it. The Committee is of the view that this system focuses only on matching the area of land, not on whether the new plantation actually does what the lost forest did. A row of planted trees of one species is not the same, in ecological terms, as an old, mixed, natural forest, yet the law presently treats them as equal. The Committee recommends that new planting be matched to the kind of forest lost as closely as possible, that only local and native species be used, that the survival and growth of the new forest be checked regularly over many years, and that the results be made public rather than measured only by the number of saplings planted.

11.16 The Committee notes that the absence of a dedicated statutory framework for forest fire management, particularly given the escalating frequency and severity of forest fire incidents across the Himalayan region. The Committee also notes that forest fire management presently rests entirely upon scheme-based executive funding rather than upon any statutory obligation, and that forest fire is not presently notified as a disaster category under the Disaster Management Act, 2005, with the consequence that the institutional coordination and financial mechanisms available under that Act cannot be readily invoked in response to large-scale forest fire events.

11.17 The Committee opines that all the gaps discussed above point to one common underlying problem. The forest laws of India were built, in the first instance, mainly to allow Government control over forest land. Over the years, these laws have been changed here and there to allow more development, but the changes needed to protect people's rights, the health of forests, and the climate have not kept pace. Such changes have largely been left to courts and executive orders to work out as best they can, rather than being written clearly into the law itself. The Committee is of the view that this system leaves the protection of forests and forest communities dependent on individual judgments and administrative decisions, rather than on a settled and dependable law. The Committee accordingly recommends that the Government undertake a full and careful review of the existing forest laws, so that forest governance in India rests on a clear and modern legal foundation, one that properly protects the rights of forest communities, safeguards the health of forest ecosystems, and equips the country to deal with a changing climate.

Technical Support

11.18 In its background note submitted to the Committee, FRI informed the Committee that, in collaboration with the Indian Institute of Technology, Roorkee, and under the All India Coordinated Research Project on Forest Fire Research and Knowledge Management (AICRP-14), it has designed locally manufacturable firefighting hand tools — the fire broom or Jhapa for suppressing low-intensity surface fires in pine-needle and litter-covered terrain, arrow-tooth and peg-tooth rakes for fuel-line clearance, the Pathal or modified sickle for cutting undergrowth, and an adjustable rod — and has shared a technical brochure with manufacturing specifications with State Forest Departments to enable local fabrication. Following field testing at the Mussoorie Forest Division and the FRI campus, FRI informed the Committee that two Jhapa units were deployed in 2025 to each of five States, namely Uttarakhand, Madhya Pradesh, Odisha, Tamil Nadu and Mizoram.

11.19 FRI also informed the Committee that, working with the Centre for Fire, Explosive and Environment Safety (CFEES), DRDO, it has developed firefighting safety gear comprising helmets, protective clothing, gloves and footwear, designed to protect frontline personnel against heat, sparks, abrasion and terrain-related injury. FRI further informed the Committee that CFEES-DRDO has transferred this technology to four firms to widen production and that one set of safety gear has similarly been deployed to the same five States for field evaluation.

11.20 The Committee notes that the deployment of these tools and safety gear to only five States, of which only Uttarakhand represents the Himalayan Region, is inadequate given the scale of fire incidence across the Western and Eastern Himalayan States. The Committee recommends FRI to substantially widen the field deployment of the Jhapa, rakes, modified sickle and CFEES-DRDO safety gear to cover all Himalayan States, on a priority basis, and that the technical brochure for local manufacture be actively disseminated to Van Panchayats and Joint Forest Management Committees, and not confined to Forest Department headquarters only.

11.21 FRI's background note also described a post-fire eco-restoration model developed specifically for fire-affected sub-tropical pine forests, which, in the Himalayan context, are overwhelmingly Chir Pine-dominated. The Institute informed the Committee that the model moves beyond simple re-plantation to an integrated framework combining fuel-load management through pine-needle and litter removal, soil and moisture conservation measures such as contour and staggered trenches and check dams, restoration of soil fertility and microbial activity through mulching and organic matter addition, assisted natural regeneration and gap plantation with fire-hardy native species, and control of invasive and fire-adapted weed species that would otherwise re-establish the fuel cycle.

11.22 The Committee takes note of the post-fire eco-restoration model developed by the Forest Research Institute for fire-affected sub-tropical pine forests, which in the Himalayan context are overwhelmingly dominated by Chir Pine (*Pinus roxburghii*). The Committee notes, however, that the very features that make this model ecologically sound — pine-needle and litter removal, construction of contour and staggered trenches and check dams, mulching, and sustained weeding to prevent the re-establishment of the fuel cycle — are labour-intensive and require multi-season follow-through rather than a one-time treatment. The Committee is of the view that a model of this nature cannot be operationalized through the plantation-and-handover approach typically funded under afforestation heads, and that its success will depend entirely on whether an institutional mechanism exists to sustain site-level labour and monitoring over the two-to-three fire seasons that assisted natural regeneration typically requires. The Committee accordingly recommends that the FRI model be adopted as the standard post-fire treatment protocol for Chir Pine-dominated landscapes under the FFPM scheme and CAMPA-funded restoration works.

11.23 The Committee further recommends the FRI be entrusted with developing site-specific treatment prescriptions and monitoring protocols for each State, and that outcomes of restoration under this model be tracked against a fixed set of ecological indicators — survival and growth of gap-planted native species, reduction in ground fuel load, and recurrence of fire at treated sites — so that its performance can be evaluated.

Research Infrastructure, Funding and Manpower

11.24 In response to a query on the current status of its research infrastructure, funding and human resources dedicated specifically to Himalayan Forest fire studies, FRI informed the Committee that it presently has no dedicated research infrastructure, assured funding or permanent manpower exclusively for Himalayan Forest fire studies, that the ICFRE plan budget is inadequate to conduct dedicated, long-term and field-intensive forest-fire research at the required scale, and that forest-fire research at FRI is consequently carried out largely on a project basis through external funding agencies such as CAMPA and the Ministry. FRI informed the Committee that its forest-fire research is presently being carried out through the National Collaborative Scheme on Forest Fire Management (NCSFFM), the parameters of which are summarised below.

Component	Implementing Agency	Funding Source	Duration/Budget
National Forest Fire Monitoring Portal, Forest Fire Knowledge Network, forest-type SOPs, climate-vulnerability studies, post-fire restoration strategy, community-based fire management	ICFRE–FRI, Forest Survey of India (FSI) and Directorate of Forest Education (DFE), under the National Collaborative Scheme on Forest Fire Management (NCSFFM)	CAMPA	₹22.31 crore 2022–2026 (4 years)

11.25 FRI further informed the Committee that the most urgent gap it faces is the lack of continuity in fund flow, which hampers ongoing activities, affects field data collection, delays engagement of contractual manpower and limits long-term

monitoring, in addition to the absence of dedicated fire-behaviour laboratories, inadequate long-term ecological monitoring plots, limited field-verified data on fire extent and severity, insufficient fuel-load mapping, weak post-fire assessment protocols, limited ground validation of vulnerability maps, and constraints in real-time data sharing with the Forest Survey of India and State Forest Departments.

11.26 The Committee notes with concern that FRI, the institution possessing the scientific expertise to design forest-type-specific SOPs, indigenous firefighting tools and post-fire restoration models for the Himalayan Region, operates on project-tied, time-bound funding that terminates in 2026, with no dedicated Himalayan fire-research infrastructure or permanent manpower behind it. The Committee opines that this represents a structural mismatch between the scale of institutional reliance placed on FRI and the resources placed at its disposal. The Committee recommends that the Ministry ensure uninterrupted continuity of funding for Himalayan forest-fire research beyond the current NCSFFM cycle ending in 2026, and examine the creation of a dedicated, adequately staffed Himalayan Forest Fire Research Cell within FRI with assured multi-year, rather than project-tied, budgetary support, so that fire-behaviour research, long-term ecological monitoring and ground validation of vulnerability maps are not repeatedly disrupted by funding disruptions.

On Ground Execution

11.27 The Committee examined the detailed institutional accounts furnished by the State Governments of Uttarakhand and Himachal Pradesh. Both submissions reveal elaborate, multi-tiered command structures built up over time largely through administrative orders and State-level strategy documents, in the continued absence of the central statutory backing. Read thematically, the two submissions also reveal significant differences in the depth of technological adoption and

assured funding available to each State, which the Committee considers instructive for the Himalayan Region as a whole.

11.28 Administrative and Command Structure: The State Government of Uttarakhand informed the Committee that organised fire management in the State dates back to 1861, when scientific forestry first introduced the practice of clearing 16 to 30 metre wide fire lines and suppressing fires with the assistance of villagers. The State Government informed the Committee that the Principal Chief Conservator of Forests (Head of Forest Force) is the administrative head of the Department, that a Chief Conservator of Forests (Forest Fire and Disaster Management) functions as the dedicated Nodal Officer for fire management, mitigation and control, and that Nodal Officers have similarly been designated for 13 fire-sensitive districts. The field-level structure through which this command is exercised is summarised below.

Administrative Unit	Total
Forest Circle	11
Forest Division	43
Ranges	283
Beat	2,393

11.29 The State Government of Himachal Pradesh informed the Committee that its administrative mechanism is built around a designated Forest Fire Nodal Officer responsible for planning and coordinating fire prevention and control, liaising with the Ministry for Annual Plan of Operations (APO) approval and release of funds, liaising with the State's Disaster Management Cell, coordinating with Deputy Commissioners, Superintendents of Police and Panchayati Raj Institutions for field-level support, and guiding annual awareness campaigns. Beneath this apex position, Himachal Pradesh has established a four-tier command chain: a State Level Central Forest Fire Control Room at Bilaspur, operating 24×7 with a toll-free helpline from 15 April to 30 June each year; a Circle Level Master Forest Fire Control Room at every Forest Circle, responsible for approving and monitoring

Divisional Forest Fire Management Plans; a Division Level Rapid Forest Fire Fighting Force (R4F), constituted at every fire-sensitive Division headquarters for the extended season of 1 December to 30 June, tasked with preparing and implementing the Divisional Plan, relaying satellite-based alerts, and coordinating with district administration, health services and the Fire Brigade; and Range Level Rapid Response Teams responsible for fire-line clearance, prescribed burning, village liaison, crew deployment and maintenance of the Fire Register and Forest Fire Map.

11.30 In similar context, the UNEP in its submission informed the Committee that the Food and Agriculture Organisation (FAO) has prescribed an **Incident Command System (ICS)** as a standardized on-scene structure capable of tackling such situations on ground. The UNEP, accordingly, suggested the Committee that **ICS** or any other compatible operational structure should be explored and adopted for major forest fires so that command, communications, logistics, safety and resource deployment are clear even where several departments and jurisdictions are involved.

11.31 The Committee agrees to the fact that major forest fire incidents in Himalayan and other forested states typically require simultaneous involvement of the Forest Department, State Disaster Management Authority, District Administration, Fire Services, Police, local Van Panchayats, and at times Defence/NDRF resources. In the absence of a unified command structure, overlapping or uncoordinated action is a real risk, leading to delayed response, duplicated efforts, or gaps in resource deployment. Since forest fires often spread across administrative or even state boundaries, a common, pre-agreed operational framework such as ICS would ensure that responding agencies from different jurisdictions can integrate into a single command structure rather than operating in silos.

11.32 The Committee, while endorsing the UNEP's suggestion, recommends that the Incident Command System, or a functionally equivalent, nationally/state-adapted operational structure, be formally adopted as the standard on-scene management framework for major forest fire incidents. Necessary protocols should be integrated within the State Disaster Management Plan and Forest Fire Management Plans, with a clearly designated authority (e.g., a trained Incident Commander from the Forest Department or Disaster Management Authority) empowered to assume command upon activation. A standardized communication and reporting protocol be established under the ICS framework, ensuring interoperability of radio/communication equipment across departments. Pre-identified resource inventories (fire-fighting equipment, manpower, vehicles, aerial support where applicable) be mapped in advance at division/district level, to be activated seamlessly under the Logistics function of ICS during an incident. Clear, pre-defined criteria/thresholds (e.g., area affected, number of active fire points, terrain risk) be established for when ICS is to be activated, to avoid ambiguity in escalation. The framework may first be piloted in high fire-incidence divisions (such as Chir pine-dominated belts) before scaling up state-wide, with lessons incorporated into subsequent rollout. Every major fire incident managed under ICS should be followed by a structured after-action review to refine the system based on ground experience.

11.33 Technology-Based Detection, Alert and Communication Systems: Uttarakhand has deployed the Forest Fire Uttarakhand mobile application, which receives satellite-based fire alerts and transmits them to field personnel in near real time — replacing an earlier system in which alerts often reached staff several hours later by SMS — displays fire locations on GIS maps for GPS-based navigation by response crews, enables geo-tagged citizen and staff reporting, and is monitored

centrally through an Integrated Control and Command Centre (ICCC) that also operates a 24×7 helpline. The State Government of Uttarakhand informed the Committee that this command network is further supported by an Incident Command System at the district level, 40 Master Control Rooms at Division headquarters, and 1,438 Crew Stations — including 40 Model Crew Stations — that serve as field-level operational bases and first-response points.

11.34 The State Government of Himachal Pradesh informed the Committee that its equivalent alert mechanism relies on satellite-based fire information received from the Forest Survey of India and disseminated through the Forest Fire Alert Management System (FAMS), which transmits SMS alerts to the registered mobile phone numbers of field staff posted in sensitive beats, with the Bilaspur Control Room and the Divisional R4F responsible for relaying this information onward through mobile-based alerts, e-mail and telephone.

11.35 The UNEP, in its submission, also acknowledged that FSI's satellite-based fire detection and alert systems provide an important national foundation and it may be complemented by locally calibrated fire-danger rating systems that combine weather, topography and fuel conditions and issue graduated preparedness levels before extreme fire-weather periods. The UNEP also informed the Committee that FSI has previously piloted pre-warning systems in Uttarakhand and Himachal Pradesh, providing a basis for further strengthening Himalayan applications.

11.36 The Committee notes that while both States rely on the same underlying FSI satellite detection layer, Uttarakhand has built a dedicated, purpose-built mobile application with GIS navigation and an integrated command dashboard, whereas Himachal Pradesh relies on a more conventional SMS-and-telephone relay chain without reference to a comparable dedicated application.

11.37 The Committee accordingly recommends that the Ministry, in consultation with FSI, examine the feasibility of extending a common,

centrally supported fire-alert mobile application — built on the demonstrated Uttarakhand model — to all Himalayan States, so that GIS-based navigation, geo-tagged citizen reporting and integrated command-centre monitoring are not confined to States that have independently developed such systems. The Committee also notes with serious concern that although Uttarakhand has a fire alert mobile application but its utility on the actual ground level is bare minimum, undermining the very purpose for which the technology was introduced. The real-time detection and response to forest fire incidents continues to rely heavily on manual reporting, traditional watch-and-ward systems, and delayed escalation resulting in sustained year-on-year increase in instances of forest fires. Possible contributing factors include poor network connectivity in forest and hill terrain, lack of awareness or training among field staff and local communities, non-integration with frontline firefighting response mechanisms, and absence of a robust feedback/verification loop between the app and ground teams. The Committee, therefore, recommends that the Government of Uttarakhand urgently examine and address the operational gaps in the fire alert application's ground-level implementation and undertake corrective measures viz. conducting a field-level audit of the app's usage, identifying pine-abundance and fire-prone zones with poor mobile network coverage, establishing a GIS enabled real-time State-level or Division-level monitoring dashboard, instituting a mechanism for periodic review of the app's performance metrics especially during peak fire season and ensuring the community level involvement etc. so that the technological investment translates into a measurable and timely reduction in fire response time and damage.

11.38 Manpower, Community Participation and Social Security: The State Government of Uttarakhand informed the Committee that the total field-level functionary strength directly engaged in fire control, comprising forest rangers, foresters and forest guards of various ranks, stands at 4,839, supplemented by around 2,000 casual workers engaged in nurseries, plantations and other forestry worksites, and by approximately 5,600 seasonal fire watchers engaged from local villages and Van Panchayats during the fire season of 15 February to 30 June — taking the total effective manpower deployed for fire management to around 12,000. It informed the Committee that each engaged fire watcher is provided social security coverage in the form of life insurance to the extent of ₹10 lakh, and that the mobile application further enables participation by Self-Help Groups, Mahila Mangal Dals, Yuva Mangal Dals, Van Panchayats and Gram Pradhans in fire reporting and initial suppression.

11.39 The State Government of Himachal Pradesh informed the Committee that its awareness and community-engagement architecture operates through annual campaigns conducted in February–March under the DFO (Publicity), involving training-cum-awareness programmes, rallies, street plays and nukkad natak, village-level meetings with Panchayat functionaries, training in safe handling of fire, and distribution of leaflets alongside radio and local television outreach, with Range-level Rapid Response Teams directly enrolling village community support.

11.40 The Committee considers the Uttarakhand life insurance model as sound practice worthy of emulation and recommends that the Ministry encourage and, if necessary, co-fund life insurance coverage for seasonal fire watchers and community volunteers engaged in frontline fire suppression duties across all Himalayan States. The Committee, however, recommends that an independent audit mechanism be devised in order to ensure that the purpose intended to be served by this insurance model is actually being realised on the ground.

11.41 **Financial Resources:** The State Government of Uttarakhand informed the Committee that fire management in the State draws on a diversified set of funding streams: the State Sector Scheme and CAMPA as the principal sources; Central

Sector Scheme (CSS) funds for the command system, communication network and additional manpower; an NDMA-assisted forest fire mitigation scheme launched in the current financial year across six fire-prone districts, namely Pauri, Tehri, Nainital, Almora, Champawat and Dehradun; the World Bank-assisted Uttarakhand Disaster Preparedness and Resilience Enhancement (UPREPARE) project, under which personal protective gear, fire tenders, fast-mobility fire crew vehicles and digital wireless sets have been procured and carbon-finance projects are being prepared; and supplementary assistance from the State Disaster Response Fund (SDRF).

11.42 The State Government of Himachal Pradesh's submission, by contrast, described funding chiefly in terms of the Annual Plan of Operations routed through the Ministry, and specifically flagged that the Department's sanctioned fleet strength of official vehicles is very limited, necessitating short-term hired-vehicle arrangements that are themselves contingent on fund availability.

11.43 In this context, the UNEP informed the Committee that the public expenditure, earmarked for forest fire mitigation and control, should progressively shift from emergency suppression towards prevention, preparedness and recovery. The UNEP's further informed the Committee about its **Indicative Fire Ready Formula** which prescribes directing approximately two-thirds of wildfire expenditure towards planning, prevention, preparedness and recovery, with approximately one-third for response.

11.44 The Committee notes that Himachal Pradesh's limited strength of official vehicles has direct operational consequences: quick deployment of Rapid Response Teams to a fire site cannot be assured if vehicle mobility itself depends on ad hoc hiring rather than a dedicated fleet. The Committee accordingly recommends that the MoEFCC facilitate access for Himachal Pradesh and other Himalayan States to dedicated firefighting vehicle fleet, so that rapid-response capability is not left contingent on short-term hired transport arrangements.

11.45 The Committee has also taken a considered view of the suggestion given by the UNEP regarding its fire ready formula. The Committee acknowledges the fact that the current forest fire budgets in most Himalayan and forested states are overwhelmingly weighted towards reactive, seasonal suppression measures — fire-fighting crews, equipment mobilization, and emergency response — with comparatively limited, often ad-hoc, investment in year-round prevention (fuel-load management, fire-line maintenance, community engagement) or post-fire recovery (afforestation, soil and watershed restoration). The Committee also agrees to the fact that investment in prevention and preparedness substantially reduces the scale, frequency, and cost of suppression operations in subsequent years — making the shift not merely an environmental imperative but a fiscally prudent one.

11.46 The Committee, therefore, finds it to be in the larger interest to endorse UNEP's suggestion and observes that forest fire-related public expenditure be progressively reoriented more towards prevention, preparedness, and recovery through a phased, monitored, and budgetary transparent transition. The Committee, accordingly, recommends the MoEFCC to carry out feasibility analysis of the proposed two-thirds/one-third allocation ratio as an indicative benchmark while formulating annual and multi-year forest fire budgets. A dedicated post-fire recovery fund/mechanism may also be institutionalized, covering afforestation, soil and water conservation works, and livelihood restoration in severely fire-affected areas.

11.47 Fire-Line Maintenance: The State Government of Uttarakhand informed the Committee that the State maintains a total of 13,085.03 km of fire lines that control burning and fire-line maintenance are carried out under working plan

prescriptions during the pre-fire winter period, and that realignment of fire lines alongside newly constructed forest roads is under active consideration.

11.48 The State Government of Himachal Pradesh informed the Committee that it maintains approximately 2,750 km of fire lines, and that prescribed or controlled burning is employed as a silvicultural method to reduce forest-floor fuel load, alongside systematic collection of fire hazard material — dry grass, fallen leaves, twigs and wood.

11.49 The Committee recommends that Uttarakhand's idea of aligning fire lines along new forest roads be adopted by all Himalayan States, since a road already acts as a natural break against fire. Combining the two would save money on maintaining separate fire lines and also give fire-fighting teams faster access to the forest. While the Committee recognizes the underlying logic and potential cost/access benefits of this approach, it cautions against a blanket, one-size-fits-all adoption across all Himalayan States without a more rigorous, evidence-based evaluation. The Committee is of the view that treating a road as an adequate substitute for a dedicated fire line could create a false sense of security as its effectiveness depends on a number of factors viz. fire behavior, type of forest, litter composition, slope gradient, fire dynamics, vehicular movement, roadside vegetation, and human activity along forest roads (bidis, cigarettes, campfires, vehicle sparks) etc. In fact, aligning fire lines directly along roads may inadvertently increase, rather than decrease, fire incidence. Also, roads themselves require continuous maintenance (landslide clearance, monsoon damage repair, vegetation encroachment control) which may offset assumed savings, particularly in fragile Himalayan terrain prone to slope instability. Therefore, expanding this model uniformly, without site-specific Environmental Impact Assessment, risks conflating a fire-safety objective with unintended ecological costs. In light of the above, the

Committee recommends that the Uttarakhand model be treated as a pilot precedent for study and not for an immediate replication. Its extension to all Himalayan States should proceed only after due diligence on terrain-specific fire behaviour, ecological impact, and road maintenance realities and not as an undifferentiated, state-wide mandate. The Committee also recommends that the MoEFCC may commission a comparative feasibility study across Himalayan States to assess forest type, terrain, fire history, and road-network characteristics before adoption. State-specific customization may also be enabled into any such guideline formulated thereon, rather than prescribing a single uniform standard. Where adopted, fire lines should supplement, not merely coincide with, road alignments while retaining a cleared buffer strip beyond the road edge, particularly in resin-rich pine belts.

11.50 The Committee is of the view that control burning should not simply follow a fixed winter schedule every year. Instead, it should be timed using real fire-risk data, so that burning takes place on the safest possible days rather than on the same dates regardless of actual conditions. The Committee is also of the opinion that the dry grass, leaves, twigs and pine needles collected during fire-line clearing should be linked to local biomass collection and sale arrangements, so that Van Panchayats and JFMCs earn some income from this work. The Committee recommends that the State Governments and the Ministry examine using FFPM funds to set up such local collection-and-sale arrangements at fire-line sites.

11.51 Fire Fighting Equipment and Mock Drills: The State Government of Uttarakhand informed the Committee that Forest Divisions have been equipped with drones for aerial reconnaissance, detection and monitoring in remote and inaccessible terrain — and, notably, for identifying persons deliberately setting

fires, enabling subsequent legal action — together with water-mist technology, leaf blowers, power chainsaws and other modern suppression tools, and that 7,145 personal protective equipment kits, comprising fire-proximity suits, fire-resistant footwear, helmets, goggles and fireproof gloves, were procured this year under the UPREPARE project. It further informed the Committee that a State-wide mock drill exercise was conducted in February 2026 across 41 sites, including National Parks and Wildlife Sanctuaries, involving departmental staff, daily wage workers, fire watchers, Van Panchayats, Self-Help Groups, NDRF and SDRF personnel, and local villagers and tourists.

11.52 The State Government of Himachal Pradesh informed the Committee that its principal firefighting methods remain beating out fires, smothering with soil and water spray, though the Department is progressively upgrading its equipment inventory with backpack blowers, drones and spray pumps.

11.53 The Committee notes that the use of drones to identify persons deliberately setting forest fires deserves particular attention, since it moves fire management beyond suppression and into deterrence and enforcement. The Committee recommends that this practice be replicated across all Himalayan States. The Committee further recommends that Uttarakhand's State-wide mock drill model, which brought together departmental staff, local communities, Van Panchayats, Self-Help Groups and disaster response forces at a large number of sites, be adopted by other Himalayan States, so that preparedness is tested under realistic conditions before the fire season. The Committee also recommends for an assessment of these mock drills regarding its efficacy in actual fire conditions.

11.54 The Committee agrees with the UNEP's suggestion for consider establishing multidisciplinary Burned Area Emergency Assessment Teams for major Himalayan fires, comprising forest ecologists, soil scientists, hydrologists, geologists, engineers, disaster-management specialists, health

experts and community representatives and accordingly recommends the MoEFCC to consider establishing multidisciplinary Burned Area Emergency Assessment (BAEA) Teams for major Himalayan forest fire incidents, so as to enable prompt, well-rounded post-fire assessment covering ecological damage, soil and slope stability, water source impact, and community health and livelihood concerns. The Ministry may consider institutionalizing such teams on a standby basis, to be rapidly deployed following major fire events in Himalayan states.

11.55 The Committee also agrees with the UNEP's suggestion that the forest-fire policy for the Himalayan region be explicitly aligned with Integrated Fire Management, rather than being centred principally on suppression. For the purpose, a coordinated framework may be developed for the Indian Himalayan region, while retaining state and landscape-specific planning. The framework, as prescribed by UNEP, should establish common principles, operating protocols, data standards, training requirements and mechanisms for mutual assistance among Himalayan States and Union Territories based on the integrated fire management approach organized around five mutually reinforcing elements – the 5Rs:

- (i) Review and analysis:** understanding the causes, patterns, ecological context and socioeconomic drivers of fire;
- (ii) Risk reduction:** addressing ignitions, fuel conditions and underlying landscape vulnerabilities;
- (iii) Readiness:** strengthening forecasts, early warning, training, equipment and institutional preparedness;
- (iv) Response:** ensuring rapid, safe and coordinated action when damaging fires occur; and

(v) Recovery: protecting affected communities, repairing infrastructure and restoring fire-affected landscapes.

11.56 The UNEP, further in its submission, acknowledged that India has created most of the basic policy, financing and technological architecture for addressing wildfires. The principal weakness is not the absence of measures, but uneven implementation, limited coordination across Himalayan states and insufficient attention to public health, post-fire hazards and ecological recovery. A substantial national architecture for forest-fire prevention and management, including the National Action Plan on Forest Fire, the Forest Fire Prevention and Management Scheme, satellite-based near-real-time detection, fire-danger rating, the Van Agni Geo-portal, community-oriented measures and financing for high-risk districts are in place. However, the present opportunity is to consolidate and strengthen these measures through a Himalayan-region Integrated Fire Management approach that improves interstate coordination, ecological differentiation, community participation, public-health preparedness and post-fire recovery. The priority should not be to create new and disconnected mechanisms, but to ensure better integration, adequate and timely financing, consistent implementation, and an operational framework that builds upon and strengthens the systems India already has in place.

11.57 The Committee, while concurring with UNEP's assessment, recommends that the Ministry recognize that India's core policy, financing, and technological architecture for wildfire management is already substantially in place, and that the gap lies not in the absence of measures but in uneven implementation, weak inter-state coordination, and insufficient attention to public health, post-fire hazards, and ecological recovery. Accordingly, the Ministry should prioritize consolidating and strengthening existing systems through a dedicated Himalayan-region Integrated Fire Management approach, rather than creating disconnected mechanisms. This approach should focus on improved interstate coordination, ecological

differentiation across Himalayan states, deeper community participation, public-health preparedness, and structured post-fire recovery — backed by adequate, timely, and consistent financing and implementation across the region.

CHAPTER – 12

RECONNECTING COMMUNITIES AND FORESTS

12.1 Local communities inhabiting the Himalayan region are the first line of defence against forest fires and the most enduring stakeholders in the health of the forest ecosystem. Their proximity to the forest, intimate knowledge of terrain and fire behaviour, and dependence on forest produce for livelihood give them a capacity for early detection, rapid response and sustained vigilance that no external agency, however well-resourced, can replicate at scale.

12.2 Any strategy for forest ecosystem conservation and fire management in the Himalayan region that does not place local communities at its centre is unlikely to succeed, however sound its technical or institutional design may otherwise be.

12.3 In response to a query, the Ministry informed the Committee that it promotes community participation in forest conservation and fire management principally through Joint Forest Management Committees (JFMCs), Eco Development Committees (EDCs), Van Panchayats, Self Help Groups, village-level fire management committees and community fire squads. These bodies are engaged across the full cycle of fire management, from prevention and fuel-load reduction to reporting and active suppression.

12.4 The evidence placed before the Committee by the State Government of Himachal Pradesh illustrates how this institutional framework can be deepened through direct economic incentives. The Rajiv Gandhi Van Samvardhan Yojana channels afforestation, maintenance and protection works through community-based organisations such as Mahila Mandals, Nehru Yuva Kendras, Self Help Groups and Village Forest Management Societies, with participating communities remunerated for their work and paid additional incentives for successful plantation establishment and for active participation in fire prevention and control. The Mukhya Mantri Van Vistar Yojana extends this model to afforestation of degraded forest and non-forest lands, engaging communities as active partners rather than passive beneficiaries.

12.5 The Committee was informed that Himachal Pradesh has also institutionalized a Van Mitra Scheme, deploying one locally selected young person

per forest beat as a frontline representative on a monthly remuneration of Rs. 10,000, whose value lies precisely in local selection, which confers familiarity with terrain, forest conditions and community dynamics that outside personnel would take years to acquire.

12.6 The Committee acknowledges the rights-and-responsibilities framework followed in Himachal Pradesh, under which local communities' well-established rights over forest resources of significant economic value are made conditional on their active participation in forest protection, particularly fire prevention. By linking resource rights directly to protection duties, this approach ties community incentives to conservation outcomes, rather than depending on awareness alone. The Committee is of the view that this is a structurally sound model which other Himalayan States would do well to examine. The Committee recommends that the Ministry, in consultation with the concerned State/UT Governments, examine the feasibility of adopting a similar rights-and-responsibilities framework across other Himalayan States, under which the enjoyment of established community rights over forest resources is linked to demonstrated participation in fire prevention and forest protection activities.

12.7 The scale of community engagement demonstrated by Uttarakhand further underscores the centrality of this approach. The State Government of Uttarakhand informed the Committee that 11,217 Van Panchayats are actively engaged in fire mitigation support in the State, supplemented by 390 village-level forest fire protection committees constituted in fire-sensitive areas, each eligible for an incentive of Rs. 30,000. The State Government of Uttarakhand also employs 5,600 seasonal fire watchers who are provided life insurance cover of Rs. 10 lakh.

12.8 The Committee was also apprised regarding the traditional festival of Aun Diwas which is leveraged to ensure completion of agricultural waste burning before 31st March, thereby averting fire incidents during the peak summer season.

Mahila Mangal Dals, Yuva Mangal Dals, Eco Development Committees and non-governmental organisations complete the institutional ecosystem engaged for forest protection in the State.

12.9 In response to a query, the Government of Union Territory of Jammu and Kashmir informed the Committee that the UT Forest Department actively engages local communities through awareness campaigns, village meetings, school programmes and social media outreach. Biodiversity Management Committees (BMCs), Panchayati Raj Institutions and beneficiaries of Jammu Forest Notice and Kashmir Forest Notice assist the department in reporting, prevention and fire suppression activities.

12.10 The Committee finds that community participation works best when it is backed by clear economic incentives and defined roles, as seen in Himachal Pradesh and Uttarakhand, where this approach has produced real, measurable engagement. Participation that relies mainly on awareness campaigns, without any accompanying incentives, risks remaining superficial. The Committee recommends that the Ministry study the incentive-based models followed by Himachal Pradesh and Uttarakhand, with a view to developing a common set of minimum incentives, such as insurance cover for fire watchers, payments for fuel-load collection, and remuneration for local forest committee members, that can be adopted by all Himalayan States through funding from the FFPM Scheme and CAMPA.

12.11 The Committee would like to draw attention of the Ministry and the concerned State/UT Governments to a form of forest protection that predates, and in many places continues to operate alongside, formal institutional mechanisms, namely the deep reverence in which local populations across the Himalayan and North-Eastern region hold their forests, expressed most vividly in the institution of sacred groves. The Committee takes particular note of the sacred groves of Meghalaya, which are preserved by Khasi and

Jaintia communities as abodes of local deities and ancestral spirits, and within which the felling of trees, hunting and even the removal of fallen wood are traditionally prohibited. The Committee observes that these groves, sustained purely through customary belief and community enforcement rather than statutory protection, have in many instances preserved old-growth forest and rich biodiversity more effectively and for far longer than formally notified protected areas, and that similar traditions of sacred or reserved forest patches, in varying forms, exist among communities elsewhere in the Himalayan region as well.

12.12 The Committee believes that this reservoir of reverence represents a latent conservation resource that formal policy has yet to draw upon adequately. The Committee recommends that the Ministry, in coordination with concerned State Governments, undertake a systematic documentation and mapping of sacred groves and similar community-protected forest patches across the Himalayan and North-Eastern region, and extend recognition and institutional support to the customary institutions, that sustain them, taking care that such support strengthens rather than displaces the customary authority underlying their protection. The Committee further recommends that the reverence embodied in the sacred grove tradition be actively invoked as a cultural resource in awareness campaigns for forest and fire protection in other Himalayan areas, so that conservation messaging draws upon an idiom of sanctity and ancestral obligation that resonates more deeply with local populations than administrative appeals alone, thereby helping to reconnect communities with their forests in a manner consistent with older, pre-modern traditions of custodianship.

12.13 The Committee would also like to draw attention of the Ministry and the concerned State/UT Governments to a wider dimension of forest conservation that lies beyond formal committees, incentive schemes and sacred groves, namely the deep, custodial relationship that Himalayan communities historically shared with their forests in the pre-colonial and early pre-modern era, when forests were governed as commons integral to community identity, livelihood and cultural practice rather than as resources administered at arm's length by the State. The Committee is conscious that decades of restrictive forest governance, however well-intentioned in conservation terms, have in many areas weakened this older, organic bond between people and forest, and holds that its restoration, in a form suited to present-day realities, ought to be treated as a distinct objective of policy rather than an incidental by-product of fire management schemes.

12.14 The Committee believes that this bond is best rebuilt through measures that make the forest a source of dignified and sustained livelihood for the local population, rather than through appeals to sentiment or tradition alone. The Committee recommends that the Ministry, in coordination with concerned State/UT Forest Departments, expand livelihood opportunities tied directly to sustainable forest produce, including non-timber forest produce collection and value addition, medicinal and aromatic plant cultivation, handicrafts and forest-based enterprises, so that communities derive continuing economic benefit from a standing, healthy forest and thereby acquire a durable stake in its protection.

12.15 The Committee enquired whether the Ministry had conducted any study to establish a link between unregulated tourism and forest fires, and whether it had considered evolving a policy, in coordination with State Governments and other

concerned Ministries/Departments, to regulate tourist activities and allied construction, such as hotels, with a view to conserving the forest ecosystem of Himalayan States. The Ministry, in reply, admitted that no dedicated national-level study has been conducted to establish a direct causal relationship between unregulated tourism and forest fires. It further stated that tourism-related activities are presently regulated through applicable environmental laws, forest management plans, eco-sensitive zone notifications, protected area regulations and State Government guidelines, and that States are advised to conduct awareness campaigns, regulate activities during fire-prone periods and strengthen monitoring in ecologically sensitive areas.

12.16 The Committee finds the response of the Ministry unsatisfactory. The unchecked growth of tourism infrastructure in the Himalayan region, including construction of hotels and resorts in and around forest areas, rising vehicular movement, and the generation of tourism-related waste, is a visible and growing pressure on Himalayan forest ecosystems, and the Committee is not convinced that reliance on general environmental laws and advisory guidelines is adequate to address a risk of this scale. The absence of any dedicated study on the link between unregulated tourism and forest fires, despite the sharp rise in tourist footfall across Himalayan destinations in recent years, points to a gap in the Ministry's evidence base that needs urgent attention. The Committee also notes that eco-sensitive zone notifications and protected area regulations, by their nature, apply only to specific designated areas, and leave a large part of the Himalayan forest landscape, including areas experiencing high tourist pressure, outside their coverage.

12.17 The Committee recommends that the Ministry commission a dedicated study, to assess the extent to which unregulated tourism and associated activities contribute to forest fire incidence in the Himalayan region. The Committee further recommends that, based on the findings of such a study,

the Ministry formulate a specific policy framework, in coordination with the Ministry of Tourism, State/UT Governments and other concerned Ministries/Departments, to regulate tourist activities and allied construction, including hotels and resorts, in and around forest areas of the Himalayan States. Such a framework should, at a minimum, provide for carrying-capacity limits for high-footfall destinations, stricter construction norms in forest-adjacent areas, and seasonal restrictions on activities that raise fire risk during peak fire-prone months, so that tourism growth in the Himalayan region does not come at the cost of the very forest ecosystem that draws such tourism in the first place.

12.18 The Committee further recommends that the Ministry, in coordination with the Ministry of Tourism, concerned State/UT Governments and other stakeholders, take measures to develop and promote sustainable eco-tourism across the Himalayan region as a means of strengthening the bond between communities and forests. Such eco-tourism should be structured so that local communities are the primary beneficiaries and operators of tourism activity, rather than being reduced to incidental service providers for outside operators. Community-owned homestays, nature trails led by local guides, and village-based interpretation centres would allow communities to directly monetize their ecological knowledge and stewardship role, while ensuring that tourism activity remains within limits that the local ecology can sustain.

12.19 The Committee also flags the need to extend ecological awareness to visitors from outside the region, who form a growing presence in Himalayan tourist destinations and whose conduct has a direct bearing on fire risk and forest health. The Committee recommends that the concerned State/UT Governments and the Ministry jointly develop visitor awareness measures,

including signage, orientation material at entry points and popular destinations, and guided interpretation, to sensitize outside tourists to Himalayan forest ecology, fire-safe conduct, and the customs and conservation practices of local communities, including the significance of sacred groves and similar customary institutions where tourism intersects with them, so that the growing tourist footprint in the region becomes an ally of conservation rather than an added pressure upon it.

12.20 The Committee enquired with the Forest Research Institute that whether it has published or has any plan to publish, field guides on eastern and western Himalayan trees intended for lay readers and ecology enthusiasts. FRI informed that no such publications have been done by it.

12.21 The Committee opines that ecological literacy among the general public is in itself a form of conservation infrastructure, and the absence of accessible identification material represents a missed opportunity to convert public curiosity about Himalayan forests into informed, lasting engagement. The Committee strongly recommends that the Ministry prepare and publish elaborative field guides for identification of Himalayan trees, prepared in simple, easy-to-use language and richly illustrated with large photographs of tree forms, leaves, bark and other distinguishing features, so that such guides are genuinely usable by interested laymen without prior botanical training.

12.22 The Committee also holds that public engagement with forest ecology must begin well before adulthood, and that the school years present the most effective window for cultivating a lasting connection with nature. The Committee is of the view that since ecological literacy has a direct bearing on the long-term stewardship of India's forests, including the Himalayan forest ecosystem, ecology should find a place as a mandatory subject in the school

curriculum. The Committee recommends that the Ministry of Environment, Forest and Climate Change take up the matter with the Ministry of Education with a view to introducing ecology as a mandatory subject at the school level. The Committee further recommends that schools be mandated to organize nature trails for students on a regular basis, so that classroom learning on ecology is reinforced through direct, first-hand exposure to forest ecosystems, thereby fostering in the younger generation a deeper and more enduring connection with nature and a stronger sense of responsibility towards its conservation.

12.23 The Committee reiterates that reviving the older, custodial bond between communities and forests, whether through the documentation and support of sacred groves and similar customary institutions, expanded livelihood opportunities, community-led eco-tourism, or sustained awareness among outside visitors, together with investment in ecological literacy through accessible field guides and mandatory ecology education for school children, must be treated as long-term complements to these institutional and financial measures, so that the base of informed and committed stakeholders in forest ecosystem conservation continues to widen across generations.

RECOMMENDATIONS/OBSERVATIONS-AT A GLANCE

FOREST FIRES IN THE HIMALAYAN REGION: EXTENT AND TRENDS

The Committee desired to know as to whether any research has been undertaken on the linkage between climate change and increasing fire frequency in the Himalayan region and put a query to this effect to the Ministry of Environment, Forest and Climate Change. In response, the Ministry stated that it recognises that rising temperatures, prolonged dry spells and increasing climate variability are contributing factors to the increasing frequency and intensity of forest fire occurrence in the region. The Ministry, however, informed the Committee that no specific research study on this linkage has, as yet, been commissioned or assigned by the Ministry.

(Para 2.17)

The Committee notes that there is no dedicated research study to establish or quantify that climate change is a contributing factor to the rising frequency and intensity of forest fires in the Himalayan region. The Committee takes note of the ongoing work under the NCSFFM at ICFRE-FRI; however, it observes that this work, being forward-looking and scenario-based in its design, is oriented towards projecting future fire vulnerability rather than towards empirically establishing the historical relationship between climate variables and past fire incidence. The Committee is, therefore, of the view that a knowledge gap persists in this regard, and that the Himalayan region, given its ecological fragility, topographic complexity and high sensitivity to climatic shifts, requires dedicated region-specific research rather than reliance on general or extrapolated findings from other forest ecosystems.

(Para 2.20)

The Committee, therefore, recommends that the Ministry should commission a dedicated, region-specific research study to establish the empirical linkage between climate change and forest fire frequency, intensity and seasonality in the Indian Himalayan Region. Such a study should, at a minimum, examine long-term trends in temperature, precipitation and dry-spell duration against historical forest fire incidence data; assess how

altitudinal and species-wise variation across Himalayan forest types affects fire vulnerability under changing climatic conditions; and generate predictive fire-risk models that can inform seasonal preparedness, resource deployment and early-warning systems. The Committee further recommends that this research be undertaken in coordination with, and to complement, the vulnerability mapping already underway under the NCSFFM, so as to build an evidence base that spans both retrospective analysis and future projection. It also recommends that the findings of such research be periodically updated and integrated into the Ministry's forest fire prevention and management guidelines, so that policy responses keep pace with the evolving climate-fire relationship rather than being based on generalised assumptions.

(Para 2.21)

REGIONAL FIRE REGIMES: WESTERN AND EASTERN HIMALAYA

The Committee observes that these contrasting dynamics — the Western Himalaya's fire threat being driven primarily by extreme pre-monsoon heat, pine-needle fuel loads and proximity-based human ignition, as against the Eastern Himalaya's more complex interplay of atmospheric dryness and cultivation-linked burning practices — demonstrate that a uniform, pan-Himalayan approach to fire prevention and mitigation would be inadequate to the distinct ecological and socio-economic realities of the two regions. The Committee is, therefore, of the considered view that mitigation and adaptation strategies must be tailored separately to each region.

(Para 3.4)

The Committee further recommends that any national or regional forest fire prevention framework explicitly recognise and provide for this West-East differentiation, so that resource allocation, early-warning systems and community engagement strategies are calibrated to the distinct climatic and anthropogenic drivers operating in each sub-region.

(Para 3.5)

ADVERSE EFFECTS OF FOREST FIRES

The Committee is of the considered view that this constitutes a significant data gap, particularly since human casualties are explicitly recognised as among the major adverse effects of forest fires. In the absence of a consolidated national record, the true human cost of forest fires across States remains obscured, hampering both accountability and evidence-based policy formulation. The Committee, therefore, recommends that the Ministry take urgent steps, in consultation with State Governments, to develop and maintain a centralised database capturing details of forest fire casualties and compensation paid, to enable systematic monitoring and informed policy interventions.

(Para 4.4)

The Committee further notes that Himalayan forests perform a critical watershed function, regulating infiltration, groundwater recharge and spring discharge on which the majority of the region's population depends for drinking water and irrigation. Forest fires, by removing canopy cover and litter and altering soil infiltration, directly compound this existing stress on spring-fed systems, particularly in shallow-soil mountain catchments where recovery is slow even without the added pressure of fire.

(Para 4.5)

The Committee, therefore, recommends that the Ministry, in coordination with the Ministry of Jal Shakti and concerned State Governments, develop a structured protocol for post-fire watershed and spring rejuvenation, comprising the following elements: first, mandatory post-fire hydrological assessment of burnt catchments, to identify springs, streams and recharge zones within or downstream of the affected area; second, inclusion of such assessments in existing forest fire damage-reporting mechanisms, so that hydrological impact is captured alongside data on area burnt and vegetation loss; third, prioritised taking-up of identified fire-affected springsheds under ongoing National and State spring rejuvenation and watershed management programmes, rather than routing them through the ordinary, non-prioritised project pipeline; and fourth, monitoring of spring discharge and water quality in fire-affected catchments following a fire event, to track recovery and inform future silvicultural and soil-conservation

interventions. The Committee is of the view that without such a structured linkage, the water-security consequences of forest fires will continue to go unaddressed, even as the underlying vegetative damage is documented and acted upon. (Para 4.6)

FOREST FIRE MONITORING AND EARLY WARNING SYSTEMS

The Committee notes that even after so many years of using the satellite technology and despite India being a leader in the space sector; the country is still relying on foreign satellites for monitoring of forest fires. The Committee also notes with concern that there is a significant diurnal observational gap i.e. no satellite pass between 01:30–10:30 and 13:30–22:30. The Committee, therefore, urges the Department of Space to prioritise the launch of a geostationary satellite capable of round the clock monitoring the forest fires. (Para 5.18)

The Committee notes the State Government of Uttarakhand's submission that only around 12.5 per cent of FSI alerts received corresponded to verified actual forest fires. The Committee is of the view that a high proportion of false positives carries the real risk of alert fatigue among field-level and nodal officers, who may over time come to treat alerts as routine rather than actionable, thereby eroding the very purpose of an early-warning system. The Committee accordingly recommends that the Ministry, in coordination with State Forest Departments, institute regular, structured training for nodal officers and field staff on the interpretation, verification and triage of FAST 3.0 alerts, including guidance on distinguishing likely forest fires from agricultural or controlled burning based on geographical, seasonal and land-use context. (Para 5.19)

The Committee notes that the Forest Fire Alert System under FAST 3.0 operates on a subscriber-registration model, reaching only those citizens who have proactively enrolled — a number that happens to be low in several highly fire-prone North-Eastern States. The Committee is of the view that a registration-dependent model is structurally unsuited to the objective of an early-warning system, since it excludes, by design, the very population that has not anticipated the need to register. The Committee notes that the

National Disaster Management Authority, in coordination with the Department of Telecommunications, has already developed and is progressively operationalising a Cell Broadcast Alert System, capable of delivering geo-targeted alerts to all mobile handsets within an affected area — irrespective of prior registration — for hazards including earthquakes, tsunamis, lightning strikes and man-made hazards. The Committee is of the view that forest fires, given their acute seasonal concentration and the demonstrated speed of alert dissemination achievable under FAST 3.0, are equally suited to this mode of delivery. The Committee accordingly recommends that the Ministry, in coordination with NDMA and the Department of Telecommunications, examine the feasibility of integrating FAST 3.0-generated fire alerts into the Cell Broadcast Alert System architecture, so that geo-targeted warnings reach all mobile users in a defined at-risk radius — including transient populations, tourists and non-registered residents — without dependence on prior subscription. (Para 5.20)

The Committee also notes that both the temperature-driven fire regime of the Western Himalaya and the atmospheric aridity-driven regime of the Eastern Himalaya are, at their core, functions of meteorological variables that fall within the domain expertise of the India Meteorological Department (IMD). The Committee is of the view that forest fire prediction and early-warning capability in the Himalayan region would be considerably strengthened through closer institutional collaboration with IMD. Accordingly, the Committee recommends that the Ministry in coordination with IMD, develop a formal collaborative framework under which IMD's high-resolution weather forecasting models, including its medium-range and extended-range prediction systems, are integrated into forest fire risk assessment and early-warning tools for the region. The Committee further recommends that this collaboration extend to the sharing of real-time data with State Forest Departments and district-level disaster management authorities, so that fire-risk advisories can be issued with sufficient lead time to enable preventive deployment of resources. (Para 5.21)

DISASTER MANAGEMENT AND RESPONSE

The Committee notes that presently only two battalions of NDRF are deployed for forest fires one each in Western and Eastern Himalayan region. The Committee also notes that six NDRF teams stand trained for forest fire duties while only three are formally earmarked, leaving three trained teams without confirmed institutional sanction. The Committee further notes that proposal for two more battalions for the Western Himalayan region is pending, inspite of the demonstrated inadequacy of NDRF's forest fire response capacity — established by the Department's own experience during the 2024 fire season in Uttarakhand and Himachal Pradesh. The Committee therefore recommends that approval to the pending proposal for three additional teams for forest fire duties may be granted at the earliest.

(Para 6.12)

The Committee welcomes the exposure of NDRF officers to international best practices but notes that such exposure has, thus far, been limited to only two officers. The Committee recommend that foreign training and exchange opportunities be systematically expanded, particularly with countries facing comparable montane and boreal fire regimes, and that a structured, terrain-specific curriculum for high-altitude firefighting — going beyond the present institutional arrangements — be formally documented and periodically updated.

(Para 6.14)

The Committee notes that the 30-minute benchmark relates only to mobilisation from the Unit Headquarters or Regional Response Centre, and does not capture the time actually taken to reach the fire site — which, in Himalayan terrain, is likely to be the more operationally meaningful metric. The Committee recommends that NDRF maintain and report, on a year-wise and State-wise basis, data on actual site-arrival times in addition to mobilisation times, so as to permit a more accurate assessment of response effectiveness specific to Himalayan conditions.

(Para 6.16)

The Committee recognises that several of these challenges are inherent to Himalayan geography and cannot be eliminated. They can, however, be mitigated through targeted infrastructure investment. The Committee

recommend that the Ministry concerned, in consultation with State Governments, identify and develop critical response infrastructure including helipads in the most fire-prone Himalayan districts, so as to reduce the practical impact of terrain and connectivity constraints on response time.

(Para 6.20)

The Committee feels that in view of NDRF's own assessment of inadequate manpower, its detailed articulation of operational lessons, and the availability of cost estimates for a dedicated Himalayan Battalion and Regional Response Centre, a dedicated, rather than a purely requisition-based and pilot, disaster response capability, for the region, is required. The Committee, therefore, recommends that the Ministry of Home Affairs and NDMA take a time-bound decision on establishing at least two Regional Response Centers dedicated to the Himalayan region — one for the Western Himalaya and one for the Eastern Himalaya.

(Para 6.24)

FINANCIAL ASSISTANCE FOR FOREST FIRE PREVENTION AND MANAGEMENT

The Committee recommends that the Ministry expedite the SFC's approval for the continuation of the strengthened FFPM scheme at the earliest since the scheme has already lapsed its five-year tenure, there is no let up in forest fire incidents and any hiatus in dedicated forest-fire funding carries direct operational risk during the fire season. The Committee is also of the opinion that till such time, the SFC comes up with any recommendation regarding renewal of FFPM, an alternate mechanism on the lines similar to FFPM, may be put in place as an interim measure. The Committee further recommends that in the renewed FFPM scheme, subsequent fund releases should be explicitly tied to quantifiable performance indicators, including measurable reductions in fire counts and burnt areas, improved average response times, and the consistent maintenance of fire lines. States should be required to submit detailed Annual Fire Management Plans, similar to CAMPA's Annual Plan of Operations, that clearly delineate physical targets against financial outlays.

(Para 7.8)

The Committee recommends that instead of relying on CAMPA funds, which are intended primarily for compensatory afforestation and allied purposes, to substantially finance forest fire prevention and control operations, the renewed FFPM scheme be adequately funded to manage the requisite finances. (Para 7.9)

BEYOND THE CHIR PINE MONOCULTURE: RESTORING THE HIMALAYAN FOREST

The Committee finds this admission significant. It indicates a gap in the evidentiary and historical-ecological record that has, for decades, allowed the "naturalness" of Chir Pine dominance to go unexamined even as its consequences for fire regimes have grown steadily more severe.

(Para 8.3)

The Committee is of the considered view that this finding recasts the problem: the challenge before the Government is not merely the management of a historically inherited monoculture, but the active containment of a still-expanding one that is displacing broad-leaved oak forests of far greater ecological and hydrological value. The Committee recommends the Ministry to commission, through FRI or an appropriate research body, a dedicated historical-ecological study tracing the changes in forest composition in the Western Himalayan belt from the pre-colonial period to the present. Without such a study, the Government's restoration strategy will continue to be formulated without a clear reference point for what constitutes ecological recovery.

(Para 8.5)

The Committee recognises the soundness, in principle, of a site-specific approach anchored in Working Plans rather than a blanket national prescription — Himalayan forest ecology is heterogeneous, and uniform replacement targets could well cause more ecological harm than good. However, the Committee observes that there is no dedicated national mission or Action Plan, when read alongside the evidence of Chir Pine's active expansion into oak habitats, where cross-State coordination and dedicated financial outlay are required. The Green India Mission and CAMPA, being general-purpose afforestation instruments, were not designed with the specific

objective of arresting conifer encroachment into broad-leaved forest. The Committee, therefore, recommends that the Ministry should launch a dedicated programme specifically targeted at broad-leaved forest restoration in Chir Pine-dominated micro-sites of the Western Himalaya, with clear, measurable targets and dedicated budgetary allocation, rather than leaving such restoration to be addressed incidentally through general afforestation schemes. (Para 8.8)

The Committee finds this graded, site-sensitive approach scientifically sound and considerably more defensible than an administratively convenient but ecologically indiscriminate replacement programme. (Para 8.10)

The Committee therefore concurs that large-scale substitution of Chir Pine by Chilgoza Pine in the lower Himalaya would be scientifically unsound, though it sees merit in the promotion of Chilgoza Pine within its own suitable dry-temperate habitats, for both livelihood and conservation purposes. The Committee is also in agreement with the scientific consensus against blanket species replacement and recommends that any enrichment planting undertaken under Working Plans be preceded by site-suitability assessment, so that broad-leaved species are introduced only where soil moisture, aspect, and microclimatic conditions genuinely favour their establishment. (Para 8.12)

The Committee notes that despite the presence of documented invasive tree species across Uttarakhand, Himachal Pradesh, and Jammu & Kashmir, no scientific study has been undertaken by FRI to determine appropriate containment or eradication measures. The Committee, therefore, recommends that the Ministry undertake a dedicated scientific study assessing the ecological spread and fire-risk contribution of all the invasive species, and prepare comprehensive invasive species management plans incorporating containment and eradication measures. (Para 8.17)

The Committee further recommends that the Ministry launch a dedicated programme for the eradication of invasive species in the forests of the Himalayan region, with clear, measurable targets, defined timelines, and dedicated budgetary allocation. (Para 8.18)

The Committee notes that the current pace and species-composition of afforestation efforts in the Western Himalayan region are inadequate to address the vulnerability of the Himalayan forest ecosystem. The Committee also notes that Oak and Deodar regeneration are still being treated as just one part of the general afforestation target, rather than as a distinct programme with its own funding and monitoring. The Committee is of the opinion that Oak and Deodar cannot be expected to hold their own within a general target when competing against Chir Pine, which is easier and quicker to plant. A dedicated Mission, with its own ring-fenced funds, its own targets, and separate reporting, is needed to achieve real results on the ground. The Committee accordingly recommends that the Ministry, in close and sustained coordination with the concerned State Governments, launch a Himalayan Oak and Deodar Regeneration Mission for Oak and Deodar regeneration across the Western Himalayan region. (Para 8.30)

The Committee notes that even as afforestation is being scaled up, Himachal Pradesh and Uttarakhand together diverted 6,511.165 hectares of forest land for non-forestry purposes over the last five years. The Committee is of the considered view that a Mission to expand Oak and Deodar cover would be substantially undermined if diversion of exactly such mature, ecologically valuable forest continues unchecked in parallel. The Committee accordingly recommends that the Ministry apply stricter scrutiny, under the Van (Sanrakshan Evam Samvardhan) Adhiniyam, 1980, to any proposal to divert Oak, Deodar or mixed coniferous forest. The Committee further recommends that compensatory afforestation for any diversion of Oak or Deodar forest be planted mandatorily with the same or an ecologically similar species, and at a higher area ratio than applies to general compensatory afforestation. The Committee is of the view that this two-pronged approach — pushing Oak and Deodar regeneration forward under a dedicated Mission while tightening the rules on diverting exactly these forest types — offers the most coherent way to ensure that development in the region does not undo, with one hand, the gains being built with the other. (Para 8.31)

PINE NEEDLE MANAGEMENT AND UTILIZATION: BUILDING A PARALLEL 'PIRUL' ECONOMY

The Committee, taking into account the submissions made by State of Uttarakhand, strongly recommends that the intensive collection of pine needles be institutionalized on a mission mode as an annual pre-fire-season activity, backed by adequate budgetary support, procurement guarantees, single window clearance for subsidy and infrastructure for value addition, to serve the twin objectives of forest fire mitigation and rural livelihood promotion. The Committee also recommends the Ministry of Environment, Forest and Climate Change (MoEFCC) to examine national and international best practices for developing appropriate quality standards and certification mechanisms through research, inter-governmental consultations, and exposure visits, so as to create a commercially viable circular economy by utilising pine needles (pirul). (Para 9.13)

The Committee, taking into consideration the submissions made by Government of Himachal Pradesh, is of the view that a dedicated national policy or incentive mechanism for pine needle utilization would provide a significant fillip to states like Uttarakhand and Himachal Pradesh that are grappling with the twin challenges of fire hazard reduction and sustainable rural livelihoods in pine forest landscapes. (Para 9.24)

The Committee, in line with the submissions made by Government of Himachal Pradesh, is of a strong view that a technical study group may be constituted at national level to study relevant international standards (ISO, EU RED, SBP, ISCC etc.) and a gap analysis be conducted between domestic norms and international benchmarks. The Committee suggests launching a voluntary pilot certification scheme for biomass processing units. Simultaneously, harmonized national quality standards for biomass fuel (briquettes, pellets, chips) be developed to strengthen/accredit testing labs for fuel quality certification and integrate adopted standards into national/state biomass and energy policies, so that biomass based products derived from pirul etc. can also be exported. (Para 9.25)

Having thoroughly gone through the submissions made by the independent subject-experts, the Committee is of the strong opinion that every pine needle left on the forest floor is both a fire hazard and a wasted energy resource. Also, it has been established beyond doubt that systematic removal of pine needles converts a recurring liability into a sustainable renewable energy circular economy. The Committee strongly advocates that Pirul model should not be treated only as a biomass procurement activity, rather it should also be seen as a forest-fire prevention service plus biomass value-chain model, where collection payments create livelihoods by industrial off-take, thereby converting fire-risk material into economic value. (Para 9.54)

At the same time, the Committee is also careful of the fact that pine-needle removal has to be undertaken in a systematically effective means. The Committee accordingly endorses a regulated, zone-specific approach: collection concentrated in identified fire-prone zones such as roadsides, fire-lines, forest edges, settlement-adjacent areas, and slopes with a history of repeated burning. (Para 9.55)

The Committee notes with interest the range of productive uses to which collected pine needles may be put — bio-briquettes, pine-peat, biochar, biomass energy, compost, handicrafts, and packaging material — each of which carries the dual advantage of reducing surface fuel load while generating supplementary income and employment for local communities, thereby aligning fire-prevention objectives with livelihood generation. Moreover, community participation secured through economic incentive is likely to prove more durable and effective than fire-prevention measures reliant on departmental enforcement alone. (Para 9.56)

The Committee, therefore, is of the firm view that the pine needles possess a huge commercial potential that needs to be harnessed. The Committee, accordingly, recommends to establish a fixed minimum procurement rate per unit weight (e.g. per kg or per quintal) of collected pine needles, paid directly to collectors, through a transparent mechanism, to encourage sustained community participation. Apart from that, there is a strong need to promote the establishment of decentralized units for converting

pine needles into briquettes, pellets, biochar, handicrafts, and packaging material, enabling local employment and additional revenue streams. Moreover, private entrepreneurs and start-ups be encouraged to set up pine-needle-based power generation or briquette units, supported through subsidies, low-interest loans, or capital grants. (Para 9.57)

The Committee noted that the present policy framework is strong on fire detection, alerts and emergency response, but still weak on pre-season prevention, fuel-load removal and long-term community ownership. Key gaps remain in assured pine needle (Pirul) offtake, stable funding, Panchayat-level accountability, fire-watcher protection, prescribed-burning clarity and inter-state replication. In view of this, incentives should be provided for fuel-load removal and forest aggregation, while penalties may be considered for negligent burning or unmanaged fire risk on private/community forest lands. Also, each Himalayan state should appoint a nodal agency for Pirul management, PPP development, capacity building and replication of proven models. (Para 9.58)

The Committee also recommends that time-bound, village-level collection drives before the onset of the fire season (typically February–May), be made mandatory and the same be coordinated by the Forest Department of respective States in partnership with local self-help groups, van panchayats, and community forest management committees. IEC (Information, Education, Communication) activities must be undertaken to sensitize communities on the fire-prevention and income-generation benefits of pine needle collection. The Committee strongly recommends that the intensive collection of pine needles be institutionalized as an annual pre-fire-season activity, backed by adequate budgetary support, procurement guarantees, well defined subsidies, if any, and infrastructure for value addition, to serve the twin objectives of forest fire mitigation and rural livelihood promotion. (Para 9.59)

The Committee has very carefully gone through the practical problems and challenges faced by the independent domain experts on the ground and notes that the collection of the pine needles and economics involved therein is

the determining factor for designing a sustainable pirul economy. The Committee observes that the collection and baling at village level to raise transport density; weighment against receipt at a depot; payment at a declared per-kilogram rate credited directly into the collector's bank account, with no Intermediary and no discretion; aggregation through Van Panchayats and self-help groups which hold the community mandate over these forests; hired haulage rather than an owned fleet; and a collection window of about three months, coinciding with the fire season are some of the aspects that need to be focused upon. (Para 9.60)

The Committee is of the strong opinion that a dedicated Himalayan Pirul Management Mission with per-kg collection incentive, road-head infrastructure support and single-window permissions would be the most enabling intervention. The Committee, accordingly, recommends for a prevention-led “Himalayan Biomass Management Framework”, as a policy measure, where Pine needle management is recognized as a formal forest-fire mitigation activity. Overall, Himalayan forest-fire management must shift from a reactive suppression model to a prevention-led, livelihood-linked and biomass-monetization model. (Para 9.61)

The Committee notes that the Government has notified biomass co-firing for thermal power stations and the plants are using bio-pellets today. Pine needle pellets, at 5,500 kcal/kg, are eligible and competitive within that demand. The Committee also notes that although the Central Government is currently promoting biomass collection and management as a component of various ongoing schemes, a dedicated national policy or incentive mechanism for pine needle utilization is the need of the hour. The Committee recommends that the Ministry, in coordination with State Governments, formulate a “National Pine-Needle Utilisation Policy” that (i) identifies and prioritises fire-prone collection zones on a scientific basis; (ii) provides fiscal and market-access incentives, including minimum support arrangements or subsidised collection infrastructure, to encourage community-based collection enterprises; and (iii) prescribes ecological safeguards to ensure that litter removal does not fall below the threshold required for soil and nutrient function. (Para 9.62)

The Committee observes that the problems related to pine needle management are recurring in nature, namely: insufficient collection of pirul at source, the absence of an integrated pine needle supply chain, the lack of certification standards, and the absence of a national-level policy. The Committee is further of the view that a national-level regulatory body would address all the concerns more transparently and efficiently. Accordingly, the Committee recommends the MoEFCC to establish a National or Regional Pine Needle Management Board, for the overall supervision, coordination, implementation, and standardisation of pine needle management thereby fostering an integrated and sustainable supply chain for the affected States.

(Para 9.63)

The Committee is also of the opinion that in order to have an efficient and effective forest fire mitigation strategy, the supply side constraints of the pine-needle based enterprises need to be addressed on priority. Accordingly, the Committee recommends the MoEFCC to examine the following policy, regulatory and market interventions, in consultation with the concerned State Governments, to further mitigate this problem:

- (i) Pellets are the by-product; a cleared forest floor is the objective. Pine needle removal be treated as fire mitigation, not as a bioenergy scheme. Hence, it may be funded from forest protection budgets and judged by fire outcomes;**
- (ii) assured pirul collection & supply to the plant gate, as the feedstock uncertainty is the single biggest reason lenders refuse biomass projects;**
- (iii) notifying a collection support of Rs 3-4 per kg, paid by Government, routed through the manufacturer and credited directly into the collector's bank account against verified weighment with a published standard operating procedure. The finished pellets must land with the end user at ₹10-12/kg price at which sawdust pellets are already available. A support of ₹3-4/kg keeps pirul competitive, as without it the pine needle based pellets would be unsellable;**

(iv) stating the terms of every scheme with finality, eligibility, quantum, disbursement route so that support can be financed against. A subsidy that a lender cannot count is not a subsidy. Central (MNRE CFA) and State subsidies are generous on paper but cannot be “banked” as stacking is unclear, claims are multi-window, and disbursement timing is discretionary. Written and time-bound confirmation as to which subsidies apply to pirul pellet plants, that too *via* a single-window mechanism with a defined disbursement timeline, is crucial;

(v) unambiguously classifying baled pine needles as forest waste, rendering it freely transportable without letters and permits;

(vi) providing interest subvention and a seasonal working capital line, recognising that a year's raw material must be bought in three months;

(vii) weighbridge-linked, geo-tagged recording of tonnage removed and mapping it against subsequent fire incidences so that the policy is evaluated on evidence;

(viii) uninterrupted power throughout the season to ensure the Plant running for approximately 20 hours a day across a-100-day season. An assured night-time grid supply (priority feeder/no load-shedding) for the plant during the 4-month window, plus a reasonable industrial tariff and net-metering;

(ix) leasing suitable land (forest/van panchayat/revenue) near the resource to the manufacturer for 10 years, as buying the land inflates capital expenditure, locks the already scarce equity and subsidy into a non-earning asset;

(x) pellets originating from fire-prone Himalayan belts be preferred within that existing demand; and

(xi) pirul collection could also be listed as "extreme-weather-mitigation" work, in new VB-G RAM G Act (replacing MGNREGA) and subsequent guidelines, shifting part of the labour cost to central allocation; and

(xii) industries operating in the western Himalayan region be mandated to use atleast 20 per cent of their power requirements through pirul briquettes.

(Para 9.64)

MITIGATION STRATEGIES FOR THE EASTERN HIMALAYA

The Committee has taken note of the challenges and suggestions put forward by the State Government of Arunachal Pradesh. The Committee recommends that the Union Ministry of Environment, Forest and Climate Change, in consultation with the State Governments of all the Eastern Himalayan States, undertake a coordinated programme of forest-road and helipad development in the most fire-prone Divisions across the region, rather than leaving terrain and accessibility to be addressed by individual States acting alone within their own budgetary means.

(Para 10.6)

The Committee also recommends that the Ministry prescribe a common protocol, applicable across the Eastern Himalayan States, setting out the roles, reporting lines and response timelines governing the relationship between State Forest Departments and community-managed forest institutions, so that the strengthening of coordination in the region is pursued on a uniform basis rather than through separate, State-specific arrangements of varying rigour.

(Para 10.7)

The Committee further recommends that the Ministry establish a region-wide, multi-year training and capacity-building calendar for frontline forest personnel across the Eastern Himalayan States, delivered through shared training infrastructure where feasible, so that the general commitment to sustained capacity building found in individual State Action Plans is translated into a fixed, jointly resourced schedule rather than being pursued unevenly, State by State.

(Para 10.8)

The Committee also recommends that the Ministry ensure timely release of funds against the approved Annual Plans of Operation of all Eastern Himalayan States under the Centrally Sponsored Scheme, so that

forest fire management effort across the region is not constrained by delayed or partial disbursement. (Para 10.9)

More broadly, the Committee notes that the strategic interventions proposed by the State Government of Arunachal Pradesh mirror priorities that recur, in substance, across the Eastern Himalayan States. The Committee is of the view that these are, at their core, regional rather than State-specific challenges, and accordingly recommends that the Union Ministry of Environment, Forest and Climate Change convene the Eastern Himalayan States to draw up a single, time-bound regional action plan addressing the challenges jointly, with defined milestones, rather than requiring each State to arrive at its own separate strategy for problems that are substantially shared. (Para 10.10)

The Committee notes that a single causal factor — Jhum cultivation — accounts for close to two-thirds of verified fire incidence in Manipur, and is of the considered view that no mitigation strategy for the Eastern Himalaya can be regarded as adequate unless it treats the regulation and progressive substitution of Jhum as its central objective, rather than as one item among several in a broader prevention programme. (Para 10.15)

The Committee finds it a matter of concern that a Department otherwise well served by satellite alerts, community institutions and a functioning early-warning architecture should be operating at less than half its sanctioned field strength, and is of the considered view that no expansion of technology or infrastructure can substitute for the frontline manpower required to act on the alerts that technology generates. The Committee recommends that a time-bound recruitment and deployment plan for frontline field staff in fire-prone Divisions be put in place without further delay, and that training coverage be closed through a phased, multi-year calendar so that the present gap between personnel trained and personnel enrolled for alerts does not persist indefinitely. (Para 10.20)

The Committee appreciates the State Government of Manipur's substitutive approach to a practice that is deeply embedded in tribal livelihood and cannot realistically be addressed through prohibition alone.

The Committee, however, notes that the scale of budgetary commitment to this strategy is not in proportion to the scale of the problem it addresses: an allocation of Rs. 19.04 lakh in dedicated Jhum rehabilitation funding for a single year, set against a causal factor responsible for roughly two-thirds of all fire incidents in the State, suggests that livelihood substitution is being pursued at a pace well below what the underlying fire-reduction objective would require. The Committee also recommends that the incentive scheme for fire-free villages, presently described only in general terms, be formalized with a transparent disbursement formula linked specifically to reductions in Jhum-related fire incidence within the village's jurisdiction, so that the scheme reinforces the substitution strategy directly rather than rewarding fire-free status as a general outcome. (Para 10.25)

The Committee recommends that the coordination arrangements be formalized into a standing regional protocol for the Eastern Himalayan region, with points of contact and escalation procedures pre-identified rather than assembled afresh at the time of each cross-border incident.

(Para 10.28)

The Committee notes with concern that fire-driven degradation in Manipur's Protected Areas is compounding itself through invasive colonization, with *Ageratina adenophora* and *Lantana camara* establishing in exactly those patches that most need native regeneration to succeed. The Committee is of the view that this warrants a response distinct from general post-fire restoration, since an area left to natural regeneration under continuing invasive pressure is unlikely to recover in the manner the State's restoration data assumes. The Committee accordingly recommends that fire-affected Protected Areas be subject to mandatory invasive-species removal as a first step in restoration, ahead of or alongside assisted natural regeneration, rather than as an incidental activity folded into general weed management.

(Para 10.30)

The Committee further recommends that the Ministry of Environment, Forest and Climate Change should launch a dedicated, time-bound mission for the removal of invasive species across the forest landscapes of the Eastern

Himalayan region, rather than leaving invasive-species control to be addressed piecemeal within individual State restoration programmes. Given that *Ageratina adenophora* and *Lantana camara* are reported to be spreading across fire-affected forest in Manipur and are not confined to that State alone, the Committee is of the considered view that the scale and cross-border character of the problem calls for a coordinated, region-wide response with dedicated Central funding, clear multi-year eradication targets, and a mechanism for monitoring reinvasion, rather than a series of disconnected State-level efforts that leave regenerating forest vulnerable to decolonization from neighbouring, untreated tracts. (Para 10.31)

The Committee notes that Manipur has, in each of the last two financial years, received far less central funding than it had proposed under its Annual Plan of Operation — with only about forty per cent of the amount proposed for 2025-26 released so far. The Committee recommends that the Ministry release a larger share of the approved funds against Annual Plans of Operation. The Committee also recommends that NDMA process the pending proposal of Rs. 27.51 crore without further delay. (Para 10.36)

The Committee recommends that the Ministry of Environment, Forests and Climate Change should favourably consider providing the Eastern Himalayan States with specialized four-wheel-drive vehicles, modern protective gear and mechanized firefighting tools suited to hill terrain, together with the ground-based sensors, AI-enabled camera towers and long-endurance unmanned aerial vehicles that States in the region have identified as gaps in their present technology base. Given that such gaps are likely to recur across the Eastern Himalayan States rather than being confined to any one of them, the Committee recommends that these equipment and monitoring capabilities be procured and deployed through a common regional programme covering the Eastern Himalayan States, rather than through isolated, State-level procurement; and that communication infrastructure in remote fire-prone forest divisions be funded as core fire-management infrastructure in its own right, rather than addressed incidentally through general rural connectivity programmes. (Para 10.38)

The Committee further recommends that the Ministry support the Eastern Himalayan States on regular, high-resolution assessments of burnt areas, and on the construction of water-harvesting structures in high-altitude areas, given their usefulness in fire control. (Para 10.39)

The Committee also recommends that schemes rewarding fire-free villages be continued and strengthened across the region, since they directly encourage community participation in fire prevention; that adequate infrastructure — including barracks and offices for Range and Beat staff — be provided to frontline personnel; and that research into fire-resistant tree species be supported, so that the region's forests are made more resilient to fire over the long term. (Para 10.40)

The Committee recognises that several of the challenges faced by the North Eastern States are inherent to Himalayan geography and cannot be eliminated outright, but can be substantially mitigated through targeted infrastructure investment, sustained and predictable financing, and — above all, given the causal weight of Jhum cultivation — a decisively scaled-up livelihood-substitution programme. The Committee accordingly recommends that the Ministry, in consultation with the State Governments of the Eastern Himalayan region, treat the mitigation of Jhum-related fire risk as the foremost priority within the wider forest fire management effort for the Eastern Himalaya, with frontline manpower restoration, predictable Central financing, and shared regional technology platforms as the supporting pillars on which that priority effort must rest. (Para 10.41)

MANAGEMENT FRAMEWORK: POLICY, LEGAL AND INSTITUTIONAL DIMENSIONS

The Committee welcomes the Ministry's move away from a one-size-fits-all approach, but is of the view that the value of these SOPs will be tested when actually put to use. The Committee recommends that the Ministry convert these SOPs into short, field-usable formats — laminated cards or an offline-capable mobile application in local languages — so that frontline staff on terrain without network connectivity can actually apply them, rather than the SOPs remaining lengthy documents confined to Divisional offices. The

Committee further recommends that familiarity with the SOPs be made a component of annual refresher training and staff performance appraisal, so that compliance is incentivized rather than assumed, and that SOP-based mock drills be adopted as the standard method of testing these procedures under realistic field conditions. (Para 11.4)

On the Forest Fire Preparedness Index, the Committee is of the view that an index which is computed but not acted upon serves only as a diagnostic exercise rather than an instrument of governance. The Committee recommends that FFPI scores be directly linked to fund allocation under CAMPA and the NCSFFM, such that Divisions recording the weakest scores receive priority in equipment and manpower allocation for the following fire season, rather than allocation remaining a matter of administrative discretion. The Committee further recommends that FFPI scores be made public in the form of a Division-wise or State-wise comparative table, in the belief that public visibility will drive improvement more effectively than internal review alone. (Para 11.5)

On the standardization of firefighting equipment, the Committee recommends that the Ministry establish centralized rate contracts for standardized firefighting equipment, on the pattern of the Government e-Marketplace, so that States with weaker fiscal capacity are not compelled to procure inferior equipment at higher cost than better-resourced States. The Committee also recommends that the local manufacture of low-cost tools be supported through a simple quality-certification mechanism, enabling village-level cooperatives and small manufacturers to produce standardized equipment locally rather than every State depending on slow central procurement. (Para 11.6)

On the Joint Convergence Guidelines under the VB-G RAM G Act, 2025, the Committee views this as a potentially significant vehicle for embedding forest fire prevention within rural livelihood and employment guarantee architecture. The Committee recommends that a fixed minimum share of convergence funds be ring-fenced specifically for fire-prone districts, rather than the allocation being left entirely to the State discretion. The

Committee further recommends that the Ministry examine formalizing seasonal fire-watching and fire-line clearance as recognized job-card work under the employment guarantee framework. The Committee also recommends that release of convergence funds be tied to verified physical output — such as kilometres of fire-line cleared or fuel-load removed, cross-checked against satellite imagery — rather than to fixed budgetary allocation, so that funds intended for fire prevention are not diverted to unrelated purposes at the State level. (Para 11.7)

The Committee looked closely at the existing laws that govern forests in India. These include the Indian Forest Act, 1927, the Forest (Conservation) Act, 1980 now renamed the Van (Sanrakshan Evam Samvardhan) Adhiniyam through the 2023 amendment, the Wildlife (Protection) Act, 1972, the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, and the Biological Diversity Act, 2002, together with subordinate instruments including the National Forest Policy, Joint Forest Management guidelines, and the Compensatory Afforestation Fund system. These laws were made at different times, for different reasons, and do not fit together well today. The Committee is of the view that this scattered approach is no longer suitable for present needs. (Para 11.11)

The Committee notes that the Indian Forest Act, 1927 was made by the British mainly to control timber and protect Government revenue from forests. Its basic idea was that forests belong to the Government. The Committee is of the view that this old idea does not match how we understand forests today, where a forest is seen as a living system that provides many benefits beyond timber. The Committee notes with concern that the 1927 Act still focuses mainly on policing, offences, and seizure of forest produce, rather than on restoring and caring for forests. (Para 11.12)

The Committee observes that India does not have a clear, simple legal definition of what counts as a "forest." For many years, courts have had to decide this instead of the law itself. A recent amendment has narrowed this further, so that many patches of land that look and function like forest, but were never formally recorded as such, may now fall outside legal protection.

The Committee is of the view that this narrowing of definition introduces material uncertainty into forest governance, particularly in ecologically sensitive Himalayan and North Eastern landscapes where large tracts of forest remain outside formal classification despite meeting every ecological criterion of forest. (Para 11.13)

The Committee notes that decisions to allow forest land to be used for other purposes are presently based mainly on development needs and on the promise of planting trees elsewhere to make up for the loss. The Committee is of the view that this approach does not draw any firm outer limit, so that in principle almost any forest can eventually be considered for clearance if the development need is thought to be pressing enough. The Committee is of the considered opinion that certain forests are simply too valuable, and in many cases too difficult or impossible to recreate, to be judged on a case-by-case basis in this manner. (Para 11.14)

The Committee examined how compensatory afforestation works at present. When forest land is cleared for another use, the law requires new plantation to be raised elsewhere, even thousands of kilometres away, to make up for it. The Committee is of the view that this system focuses only on matching the area of land, not on whether the new plantation actually does what the lost forest did. A row of planted trees of one species is not the same, in ecological terms, as an old, mixed, natural forest, yet the law presently treats them as equal. The Committee recommends that new planting be matched to the kind of forest lost as closely as possible, that only local and native species be used, that the survival and growth of the new forest be checked regularly over many years, and that the results be made public rather than measured only by the number of saplings planted. (Para 11.15)

The Committee notes that the absence of a dedicated statutory framework for forest fire management, particularly given the escalating frequency and severity of forest fire incidents across the Himalayan region. The Committee also notes that forest fire management presently rests entirely upon scheme-based executive funding rather than upon any statutory obligation, and that forest fire is not presently notified as a disaster category

under the Disaster Management Act, 2005, with the consequence that the institutional coordination and financial mechanisms available under that Act cannot be readily invoked in response to large-scale forest fire events.

(Para 11.16)

The Committee opines that all the gaps discussed above point to one common underlying problem. The forest laws of India were built, in the first instance, mainly to allow Government control over forest land. Over the years, these laws have been changed here and there to allow more development, but the changes needed to protect people's rights, the health of forests, and the climate have not kept pace. Such changes have largely been left to courts and executive orders to work out as best they can, rather than being written clearly into the law itself. The Committee is of the view that this system leaves the protection of forests and forest communities dependent on individual judgments and administrative decisions, rather than on a settled and dependable law. The Committee accordingly recommends that the Government undertake a full and careful review of the existing forest laws, so that forest governance in India rests on a clear and modern legal foundation, one that properly protects the rights of forest communities, safeguards the health of forest ecosystems, and equips the country to deal with a changing climate.

(Para 11.17)

The Committee notes that the deployment of these tools and safety gear to only five States, of which only Uttarakhand represents the Himalayan Region, is inadequate given the scale of fire incidence across the Western and Eastern Himalayan States. The Committee recommends FRI to substantially widen the field deployment of the Jhapa, rakes, modified sickle and CFEES-DRDO safety gear to cover all Himalayan States, on a priority basis, and that the technical brochure for local manufacture be actively disseminated to Van Panchayats and Joint Forest Management Committees, and not confined to Forest Department headquarters only.

(Para 11.20)

The Committee takes note of the post-fire eco-restoration model developed by the Forest Research Institute for fire-affected sub-tropical pine forests, which in the Himalayan context are overwhelmingly dominated by

Chir Pine (*Pinus roxburghii*). The Committee notes, however, that the very features that make this model ecologically sound — pine-needle and litter removal, construction of contour and staggered trenches and check dams, mulching, and sustained weeding to prevent the re-establishment of the fuel cycle — are labour-intensive and require multi-season follow-through rather than a one-time treatment. The Committee is of the view that a model of this nature cannot be operationalized through the plantation-and-handover approach typically funded under afforestation heads, and that its success will depend entirely on whether an institutional mechanism exists to sustain site-level labour and monitoring over the two-to-three fire seasons that assisted natural regeneration typically requires. The Committee accordingly recommends that the FRI model be adopted as the standard post-fire treatment protocol for Chir Pine-dominated landscapes under the FFPM scheme and CAMPA-funded restoration works. (Para 11.22)

The Committee further recommends the FRI be entrusted with developing site-specific treatment prescriptions and monitoring protocols for each State, and that outcomes of restoration under this model be tracked against a fixed set of ecological indicators — survival and growth of gap-planted native species, reduction in ground fuel load, and recurrence of fire at treated sites — so that its performance can be evaluated. (Para 11.23)

The Committee notes with concern that FRI, the institution possessing the scientific expertise to design forest-type-specific SOPs, indigenous firefighting tools and post-fire restoration models for the Himalayan Region, operates on project-tied, time-bound funding that terminates in 2026, with no dedicated Himalayan fire-research infrastructure or permanent manpower behind it. The Committee opines that this represents a structural mismatch between the scale of institutional reliance placed on FRI and the resources placed at its disposal. The Committee recommends that the Ministry ensure uninterrupted continuity of funding for Himalayan forest-fire research beyond the current NCSFFM cycle ending in 2026, and examine the creation of a dedicated, adequately staffed Himalayan Forest Fire Research Cell within FRI with assured multi-year, rather than project-tied, budgetary support, so that fire-behaviour research, long-term ecological monitoring and ground

validation of vulnerability maps are not repeatedly disrupted by funding disruptions. (Para 11.26)

The Committee agrees to the fact that major forest fire incidents in Himalayan and other forested states typically require simultaneous involvement of the Forest Department, State Disaster Management Authority, District Administration, Fire Services, Police, local Van Panchayats, and at times Defence/NDRF resources. In the absence of a unified command structure, overlapping or uncoordinated action is a real risk, leading to delayed response, duplicated efforts, or gaps in resource deployment. Since forest fires often spread across administrative or even state boundaries, a common, pre-agreed operational framework such as ICS would ensure that responding agencies from different jurisdictions can integrate into a single command structure rather than operating in silos. (Para 11.31)

The Committee, while endorsing the UNEP's suggestion, recommends that the Incident Command System, or a functionally equivalent, nationally/state-adapted operational structure, be formally adopted as the standard on-scene management framework for major forest fire incidents. Necessary protocols should be integrated within the State Disaster Management Plan and Forest Fire Management Plans, with a clearly designated authority (e.g., a trained Incident Commander from the Forest Department or Disaster Management Authority) empowered to assume command upon activation. A standardized communication and reporting protocol be established under the ICS framework, ensuring interoperability of radio/communication equipment across departments. Pre-identified resource inventories (fire-fighting equipment, manpower, vehicles, aerial support where applicable) be mapped in advance at division/district level, to be activated seamlessly under the Logistics function of ICS during an incident. Clear, pre-defined criteria/thresholds (e.g., area affected, number of active fire points, terrain risk) be established for when ICS is to be activated, to avoid ambiguity in escalation. The framework may first be piloted in high fire-incidence divisions (such as Chir pine-dominated belts) before scaling up state-wide, with lessons incorporated into subsequent rollout. Every major

fire incident managed under ICS should be followed by a structured after-action review to refine the system based on ground experience.

(Para 11.32)

The Committee notes that while both States rely on the same underlying FSI satellite detection layer, Uttarakhand has built a dedicated, purpose-built mobile application with GIS navigation and an integrated command dashboard, whereas Himachal Pradesh relies on a more conventional SMS-and-telephone relay chain without reference to a comparable dedicated application.

(Para 11.36)

The Committee accordingly recommends that the Ministry, in consultation with FSI, examine the feasibility of extending a common, centrally supported fire-alert mobile application — built on the demonstrated Uttarakhand model — to all Himalayan States, so that GIS-based navigation, geo-tagged citizen reporting and integrated command-centre monitoring are not confined to States that have independently developed such systems. The Committee also notes with serious concern that although Uttarakhand has a fire alert mobile application but its utility on the actual ground level is bare minimum, undermining the very purpose for which the technology was introduced. The real-time detection and response to forest fire incidents continues to rely heavily on manual reporting, traditional watch-and-ward systems, and delayed escalation resulting in sustained year-on-year increase in instances of forest fires. Possible contributing factors include poor network connectivity in forest and hill terrain, lack of awareness or training among field staff and local communities, non-integration with frontline firefighting response mechanisms, and absence of a robust feedback/verification loop between the app and ground teams. The Committee, therefore, recommends that the Government of Uttarakhand urgently examine and address the operational gaps in the fire alert application's ground-level implementation and undertake corrective measures viz. conducting a field-level audit of the app's usage, identifying pine-abundance and fire-prone zones with poor mobile network coverage, establishing a GIS enabled real-time State-level or Division-level monitoring dashboard, instituting a mechanism for periodic review of the app's performance metrics especially during peak fire season

and ensuring the community level involvement etc. so that the technological investment translates into a measurable and timely reduction in fire response time and damage. (Para 11.37)

The Committee considers the Uttarakhand life insurance model as sound practice worthy of emulation and recommends that the Ministry encourage and, if necessary, co-fund life insurance coverage for seasonal fire watchers and community volunteers engaged in frontline fire suppression duties across all Himalayan States. The Committee, however, recommends that an independent audit mechanism be devised in order to ensure that the purpose intended to be served by this insurance model is actually being realised on the ground. (Para 11.40)

The Committee notes that Himachal Pradesh's limited strength of official vehicles has direct operational consequences: quick deployment of Rapid Response Teams to a fire site cannot be assured if vehicle mobility itself depends on ad hoc hiring rather than a dedicated fleet. The Committee accordingly recommends that the MoEFCC facilitate access for Himachal Pradesh and other Himalayan States to dedicated firefighting vehicle fleet, so that rapid-response capability is not left contingent on short-term hired transport arrangements. (Para 11.44)

The Committee has also taken a considered view of the suggestion given by the UNEP regarding its fire ready formula. The Committee acknowledges the fact that the current forest fire budgets in most Himalayan and forested states are overwhelmingly weighted towards reactive, seasonal suppression measures — fire-fighting crews, equipment mobilization, and emergency response — with comparatively limited, often ad-hoc, investment in year-round prevention (fuel-load management, fire-line maintenance, community engagement) or post-fire recovery (afforestation, soil and watershed restoration). The Committee also agrees to the fact that investment in prevention and preparedness substantially reduces the scale, frequency, and cost of suppression operations in subsequent years — making the shift not merely an environmental imperative but a fiscally prudent one.

(Para 11.45)

The Committee, therefore, finds it to be in the larger interest to endorse UNEP's suggestion and observes that forest fire-related public expenditure be progressively reoriented more towards prevention, preparedness, and recovery through a phased, monitored, and budgetary transparent transition. The Committee, accordingly, recommends the MoEFCC to carry out feasibility analysis of the proposed two-thirds/one-third allocation ratio as an indicative benchmark while formulating annual and multi-year forest fire budgets. A dedicated post-fire recovery fund/mechanism may also be institutionalized, covering afforestation, soil and water conservation works, and livelihood restoration in severely fire-affected areas. (Para 11.46)

The Committee recommends that Uttarakhand's idea of aligning fire lines along new forest roads be adopted by all Himalayan States, since a road already acts as a natural break against fire. Combining the two would save money on maintaining separate fire lines and also give fire-fighting teams faster access to the forest. While the Committee recognizes the underlying logic and potential cost/access benefits of this approach, it cautions against a blanket, one-size-fits-all adoption across all Himalayan States without a more rigorous, evidence-based evaluation. The Committee is of the view that treating a road as an adequate substitute for a dedicated fire line could create a false sense of security as its effectiveness depends on a number of factors viz. fire behavior, type of forest, litter composition, slope gradient, fire dynamics, vehicular movement, roadside vegetation, and human activity along forest roads (bidis, cigarettes, campfires, vehicle sparks) etc. In fact, aligning fire lines directly along roads may inadvertently increase, rather than decrease, fire incidence. Also, roads themselves require continuous maintenance (landslide clearance, monsoon damage repair, vegetation encroachment control) which may offset assumed savings, particularly in fragile Himalayan terrain prone to slope instability. Therefore, expanding this model uniformly, without site-specific Environmental Impact Assessment, risks conflating a fire-safety objective with unintended ecological costs. In light of the above, the Committee recommends that the Uttarakhand model be treated as a pilot precedent for study and not for an immediate replication. Its extension to all Himalayan States should proceed only after due diligence on terrain-specific fire behaviour, ecological impact, and road maintenance realities and not as

an undifferentiated, state-wide mandate. The Committee also recommends that the MoEFCC may commission a comparative feasibility study across Himalayan States to assess forest type, terrain, fire history, and road-network characteristics before adoption. State-specific customization may also be enabled into any such guideline formulated thereon, rather than prescribing a single uniform standard. Where adopted, fire lines should supplement, not merely coincide with, road alignments while retaining a cleared buffer strip beyond the road edge, particularly in resin-rich pine belts.

(Para 11.49)

The Committee is of the view that control burning should not simply follow a fixed winter schedule every year. Instead, it should be timed using real fire-risk data, so that burning takes place on the safest possible days rather than on the same dates regardless of actual conditions. The Committee is also of the opinion that the dry grass, leaves, twigs and pine needles collected during fire-line clearing should be linked to local biomass collection and sale arrangements, so that Van Panchayats and JFMCs earn some income from this work. The Committee recommends that the State Governments and the Ministry examine using FFPM funds to set up such local collection-and-sale arrangements at fire-line sites.

(Para 11.50)

The Committee notes that the use of drones to identify persons deliberately setting forest fires deserves particular attention, since it moves fire management beyond suppression and into deterrence and enforcement. The Committee recommends that this practice be replicated across all Himalayan States. The Committee further recommends that Uttarakhand's State-wide mock drill model, which brought together departmental staff, local communities, Van Panchayats, Self-Help Groups and disaster response forces at a large number of sites, be adopted by other Himalayan States, so that preparedness is tested under realistic conditions before the fire season. The Committee also recommends for an assessment of these mock drills regarding its efficacy in actual fire conditions.

(Para 11.53)

The Committee agrees with the UNEP's suggestion for consider establishing multidisciplinary Burned Area Emergency Assessment Teams for

major Himalayan fires, comprising forest ecologists, soil scientists, hydrologists, geologists, engineers, disaster-management specialists, health experts and community representatives and accordingly recommends the MoEFCC to consider establishing multidisciplinary Burned Area Emergency Assessment (BAEA) Teams for major Himalayan forest fire incidents, so as to enable prompt, well-rounded post-fire assessment covering ecological damage, soil and slope stability, water source impact, and community health and livelihood concerns. The Ministry may consider institutionalizing such teams on a standby basis, to be rapidly deployed following major fire events in Himalayan states. (Para 11.54)

The Committee also agrees with the UNEP's suggestion that the forest-fire policy for the Himalayan region be explicitly aligned with Integrated Fire Management, rather than being centred principally on suppression. For the purpose, a coordinated framework may be developed for the Indian Himalayan region, while retaining state and landscape-specific planning. The framework, as prescribed by UNEP, should establish common principles, operating protocols, data standards, training requirements and mechanisms for mutual assistance among Himalayan States and Union Territories based on the integrated fire management approach organized around five mutually reinforcing elements – the 5Rs:

- (i) Review and analysis: understanding the causes, patterns, ecological context and socioeconomic drivers of fire;
- (ii) Risk reduction: addressing ignitions, fuel conditions and underlying landscape vulnerabilities;
- (iii) Readiness: strengthening forecasts, early warning, training, equipment and institutional preparedness;
- (iv) Response: ensuring rapid, safe and coordinated action when damaging fires occur; and
- (v) Recovery: protecting affected communities, repairing infrastructure and restoring fire-affected landscapes.

(Para 11.55)

The Committee, while concurring with UNEP's assessment, recommends that the Ministry recognize that India's core policy, financing, and technological architecture for wildfire management is already substantially in place, and that the gap lies not in the absence of measures but in uneven implementation, weak inter-state coordination, and insufficient attention to public health, post-fire hazards, and ecological recovery. Accordingly, the Ministry should prioritize consolidating and strengthening existing systems through a dedicated Himalayan-region Integrated Fire Management approach, rather than creating disconnected mechanisms. This approach should focus on improved interstate coordination, ecological differentiation across Himalayan states, deeper community participation, public-health preparedness, and structured post-fire recovery — backed by adequate, timely, and consistent financing and implementation across the region.

(Para 11.57)

RECONNECTING COMMUNITIES AND FORESTS

The Committee acknowledges the rights-and-responsibilities framework followed in Himachal Pradesh, under which local communities' well-established rights over forest resources of significant economic value are made conditional on their active participation in forest protection, particularly fire prevention. By linking resource rights directly to protection duties, this approach ties community incentives to conservation outcomes, rather than depending on awareness alone. The Committee is of the view that this is a structurally sound model which other Himalayan States would do well to examine. The Committee recommends that the Ministry, in consultation with the concerned State/UT Governments, examine the feasibility of adopting a similar rights-and-responsibilities framework across other Himalayan States, under which the enjoyment of established community rights over forest resources is linked to demonstrated participation in fire prevention and forest protection activities.

(Para 12.6)

The Committee finds that community participation works best when it is backed by clear economic incentives and defined roles, as seen in Himachal Pradesh and Uttarakhand, where this approach has produced real,

measurable engagement. Participation that relies mainly on awareness campaigns, without any accompanying incentives, risks remaining superficial. The Committee recommends that the Ministry study the incentive-based models followed by Himachal Pradesh and Uttarakhand, with a view to developing a common set of minimum incentives, such as insurance cover for fire watchers, payments for fuel-load collection, and remuneration for local forest committee members, that can be adopted by all Himalayan States through funding from the FFPM Scheme and CAMPA.

(Para 12.10)

The Committee would like to draw attention of the Ministry and the concerned State/UT Governments to a form of forest protection that predates, and in many places continues to operate alongside, formal institutional mechanisms, namely the deep reverence in which local populations across the Himalayan and North-Eastern region hold their forests, expressed most vividly in the institution of sacred groves. The Committee takes particular note of the sacred groves of Meghalaya, which are preserved by Khasi and Jaintia communities as abodes of local deities and ancestral spirits, and within which the felling of trees, hunting and even the removal of fallen wood are traditionally prohibited. The Committee observes that these groves, sustained purely through customary belief and community enforcement rather than statutory protection, have in many instances preserved old-growth forest and rich biodiversity more effectively and for far longer than formally notified protected areas, and that similar traditions of sacred or reserved forest patches, in varying forms, exist among communities elsewhere in the Himalayan region as well.

(Para 12.11)

The Committee believes that this reservoir of reverence represents a latent conservation resource that formal policy has yet to draw upon adequately. The Committee recommends that the Ministry, in coordination with concerned State Governments, undertake a systematic documentation and mapping of sacred groves and similar community-protected forest patches across the Himalayan and North-Eastern region, and extend recognition and institutional support to the customary institutions, that sustain them, taking care that such support strengthens rather than displaces

the customary authority underlying their protection. The Committee further recommends that the reverence embodied in the sacred grove tradition be actively invoked as a cultural resource in awareness campaigns for forest and fire protection in other Himalayan areas, so that conservation messaging draws upon an idiom of sanctity and ancestral obligation that resonates more deeply with local populations than administrative appeals alone, thereby helping to reconnect communities with their forests in a manner consistent with older, pre-modern traditions of custodianship. (Para 12.12)

The Committee would also like to draw attention of the Ministry and the concerned State/UT Governments to a wider dimension of forest conservation that lies beyond formal committees, incentive schemes and sacred groves, namely the deep, custodial relationship that Himalayan communities historically shared with their forests in the pre-colonial and early pre-modern era, when forests were governed as commons integral to community identity, livelihood and cultural practice rather than as resources administered at arm's length by the State. The Committee is conscious that decades of restrictive forest governance, however well-intentioned in conservation terms, have in many areas weakened this older, organic bond between people and forest, and holds that its restoration, in a form suited to present-day realities, ought to be treated as a distinct objective of policy rather than an incidental by-product of fire management schemes. (Para 12.13)

The Committee believes that this bond is best rebuilt through measures that make the forest a source of dignified and sustained livelihood for the local population, rather than through appeals to sentiment or tradition alone. The Committee recommends that the Ministry, in coordination with concerned State/UT Forest Departments, expand livelihood opportunities tied directly to sustainable forest produce, including non-timber forest produce collection and value addition, medicinal and aromatic plant cultivation, handicrafts and forest-based enterprises, so that communities derive continuing economic benefit from a standing, healthy forest and thereby acquire a durable stake in its protection. (Para 12.14)

The Committee finds the response of the Ministry unsatisfactory. The unchecked growth of tourism infrastructure in the Himalayan region, including construction of hotels and resorts in and around forest areas, rising vehicular movement, and the generation of tourism-related waste, is a visible and growing pressure on Himalayan forest ecosystems, and the Committee is not convinced that reliance on general environmental laws and advisory guidelines is adequate to address a risk of this scale. The absence of any dedicated study on the link between unregulated tourism and forest fires, despite the sharp rise in tourist footfall across Himalayan destinations in recent years, points to a gap in the Ministry's evidence base that needs urgent attention. The Committee also notes that eco-sensitive zone notifications and protected area regulations, by their nature, apply only to specific designated areas, and leave a large part of the Himalayan forest landscape, including areas experiencing high tourist pressure, outside their coverage.

(Para 12.16)

The Committee recommends that the Ministry commission a dedicated study, to assess the extent to which unregulated tourism and associated activities contribute to forest fire incidence in the Himalayan region. The Committee further recommends that, based on the findings of such a study, the Ministry formulate a specific policy framework, in coordination with the Ministry of Tourism, State/UT Governments and other concerned Ministries/Departments, to regulate tourist activities and allied construction, including hotels and resorts, in and around forest areas of the Himalayan States. Such a framework should, at a minimum, provide for carrying-capacity limits for high-footfall destinations, stricter construction norms in forest-adjacent areas, and seasonal restrictions on activities that raise fire risk during peak fire-prone months, so that tourism growth in the Himalayan region does not come at the cost of the very forest ecosystem that draws such tourism in the first place.

(Para 12.17)

The Committee further recommends that the Ministry, in coordination with the Ministry of Tourism, concerned State/UT Governments and other stakeholders, take measures to develop and promote sustainable eco-tourism across the Himalayan region as a means of strengthening the bond between

communities and forests. Such eco-tourism should be structured so that local communities are the primary beneficiaries and operators of tourism activity, rather than being reduced to incidental service providers for outside operators. Community-owned homestays, nature trails led by local guides, and village-based interpretation centres would allow communities to directly monetize their ecological knowledge and stewardship role, while ensuring that tourism activity remains within limits that the local ecology can sustain.

(Para 12.18)

The Committee also flags the need to extend ecological awareness to visitors from outside the region, who form a growing presence in Himalayan tourist destinations and whose conduct has a direct bearing on fire risk and forest health. The Committee recommends that the concerned State/UT Governments and the Ministry jointly develop visitor awareness measures, including signage, orientation material at entry points and popular destinations, and guided interpretation, to sensitize outside tourists to Himalayan forest ecology, fire-safe conduct, and the customs and conservation practices of local communities, including the significance of sacred groves and similar customary institutions where tourism intersects with them, so that the growing tourist footprint in the region becomes an ally of conservation rather than an added pressure upon it.

(Para 12.19)

The Committee opines that ecological literacy among the general public is in itself a form of conservation infrastructure, and the absence of accessible identification material represents a missed opportunity to convert public curiosity about Himalayan forests into informed, lasting engagement. The Committee strongly recommends that the Ministry prepare and publish elaborative field guides for identification of Himalayan trees, prepared in simple, easy-to-use language and richly illustrated with large photographs of tree forms, leaves, bark and other distinguishing features, so that such guides are genuinely usable by interested laymen without prior botanical training.

(Para 12.21)

The Committee also holds that public engagement with forest ecology must begin well before adulthood, and that the school years present the most

effective window for cultivating a lasting connection with nature. The Committee is of the view that since ecological literacy has a direct bearing on the long-term stewardship of India's forests, including the Himalayan forest ecosystem, ecology should find a place as a mandatory subject in the school curriculum. The Committee recommends that the Ministry of Environment, Forest and Climate Change take up the matter with the Ministry of Education with a view to introducing ecology as a mandatory subject at the school level. The Committee further recommends that schools be mandated to organize nature trails for students on a regular basis, so that classroom learning on ecology is reinforced through direct, first-hand exposure to forest ecosystems, thereby fostering in the younger generation a deeper and more enduring connection with nature and a stronger sense of responsibility towards its conservation.

(Para 12.22)

The Committee reiterates that reviving the older, custodial bond between communities and forests, whether through the documentation and support of sacred groves and similar customary institutions, expanded livelihood opportunities, community-led eco-tourism, or sustained awareness among outside visitors, together with investment in ecological literacy through accessible field guides and mandatory ecology education for school children, must be treated as long-term complements to these institutional and financial measures, so that the base of informed and committed stakeholders in forest ecosystem conservation continues to widen across generations.

(Para 12.23)