



**PARLIAMENT OF INDIA
RAJYA SABHA**

**DEPARTMENT-RELATED PARLIAMENTARY STANDING COMMITTEE
ON SCIENCE & TECHNOLOGY, ENVIRONMENT & FORESTS**



TWO HUNDRED NINETY THIRD REPORT

**“FOREST FIRES AND ITS EFFECT ON ENVIRONMENT, FORESTS,
BIO-DIVERSITY AND WILDLIFE AND REMEDIAL/PREVENTIVE MEASURES”**

(Presented to the Rajya Sabha on 16th December, 2016)
(Laid on the Table of Lok Sabha on 16th December, 2016)

**Rajya Sabha Secretariat, New Delhi
December, 2016/ Agrahayana, 1938 (Saka)**

**Website : <http://rajyasabha.nic.in>
Email: rsc-st@sansad.nic.in**

PARLIAMENT OF INDIA RAJYA SABHA

DEPARTMENT-RELATED PARLIAMENTARY STANDING
COMMITTEE ON SCIENCE & TECHNOLOGY, ENVIRONMENT & FORESTS

TWO HUNDRED NINETY THIRD REPORT

“FOREST FIRES AND ITS EFFECT ON ENVIRONMENT, FORESTS,
BIO-DIVERSITY AND WILDLIFE AND REMEDIAL/PREVENTIVE MEASURES”

(Presented to the Rajya Sabha on 16th December, 2016)
(Laid on the Table of the Lok Sabha 16th December, 2016)



Rajya Sabha Secretariat, New Delhi
December, 2016/ Agrahayana, 1938 (Saka)

CONTENTS

	PAGES
1. COMPOSITION OF THE COMMITTEE	(i) – (ii)
2. INTRODUCTION	(iii)
*3. ACRONYMS	
4. REPORT OF THE COMMITTEE	
*5. RECOMMENDATIONS/OBSERVATIONS-AT A GLANCE	
*6. MINUTES OF THE MEETINGS	

* To be appended at printing stage

COMPOSITION OF THE COMMITTEE

(2016-17)

(Constituted on 1st September, 2016)

1. Shrimati Renuka Chowdhury — *Chairperson*

RAJYA SABHA

2. Shri Prasanna Acharya
3. Shri S.R. Balasubramoniyam
4. Shrimati Vandana Chavan
5. Shri C.P. Narayanan
6. Shri Parimal Nathwani
7. Shri Rangasayee Ramakrishna
8. Dr. T. Subbarami Reddy
9. Shri Ronald Sapa Tlau
10. Shri Ch. Sukhram Singh Yadav

LOK SABHA

11. Shri Badruddin Ajmal
12. Shri Muzaffar Hussain Baig
13. Shri E.T. Mohammed Basheer
14. Shri Prabhatsinh Chauhan
15. Shri Pankaj Chowdhary
16. Kum. Sushmita Dev
17. Shri Ninong Ering
18. Shri Laxman Giluwa
19. Dr. K. Gopal
20. Shri Daddan Mishra
21. Shri Chirag Paswan
22. Shri Shivaji A. Patil
23. Shri Nanabhau Falgunrao Patole
24. Shri Nagendra Kumar Pradhan
25. Shri Harinarayan Rajbhar
26. Shrimati Sandhya Roy
27. Shri Kirti Vardhan Singh
28. Shri Nagendra Singh
29. Shri Vikram Usendi
30. Shrimati M.Vasanthi
31. Shri Prabhubhai N. Vasava

SECRETARIAT

Shri M.K. Khan, Joint Secretary
Shri Narmadeshwar Prasad, Joint Director
Shri Mohd. Salamuddin, Deputy Director
Shri Rajiv Saxena, Assistant Director

INTRODUCTION

I, the Chairperson of the Department-related Parliamentary Standing Committee on Science & Technology, Environment & Forests, having been authorized by the Committee to present the Report on its behalf, present this Two Hundred and Ninety-third Report on “Forest Fires and its Effect on Environment, Forests, Bio-diversity and Wildlife and remedial/preventive measures”.

2. In its meeting held on the 31st May, 2016 the Committee heard the views of the Ministry of Environment, Forest & Climate Change and National Disaster Response Force (NDRF) on the subject. The Committee also undertook a study visit to Mussoorie, Katra and Shimla from 6th to 11th June, 2016 and discussed the subject with the representatives of Union Ministry of Environment, Forest and Climate Change, NDRF and State Governments of Uttarakhand, Jammu & Kashmir and Himachal Pradesh and some NGOs/members of civil society at these places.

3. The Committee expresses its thanks to the officers of the Ministry of Environment, Forest & Climate Change; NDRF, State Governments of Uttarakhand, Jammu & Kashmir and Himachal Pradesh and members of Civil Society/NGOs for placing before the Committee the required material and replying to the clarifications sought by the Members on the subject.

4. In its meeting held on 15th December, 2016 the Committee considered the draft report and adopted the same.

(RENUKA CHOWDHURY)

Chairperson,

*Department-related Parliamentary Standing Committee
on Science & Technology, Environment & Forests,
Rajya Sabha.*

New Delhi:

December 16, 2016

25 Agrahayana, 1938

Report

INTRODUCTION

Uncontrollable and devastating forest fires during February-April 2016 caught the attention of the entire country. In Uttarakhand, forest fire smashed nearly 4,000 hectare of forest cover across 13 districts and killed 9 and injured 17 people besides damaging the biodiversity and forest ecosystems beyond repair. The frequency of forest fire in Uttarakhand during April 2016 was much higher and widespread as compared to April 2015. As forest fires took a heavy toll in Uttarakhand, Himachal Pradesh and Jammu and Kashmir weren't far behind as large tracts of forests in both States were engulfed by flames. As many as 378 forest fires had broken out in different parts of Himachal Pradesh this summer. Similarly, Jammu & Kashmir also suffered the same problem in a big way. Fire broke out in the forest area of Reasi district of Jammu and Kashmir while other incidents of forest fires were also reported from the Bathuni and Gambhir areas of Jammu and Kashmir.

2. Forest fires had seldom been as rampant as they were in the Himalayan States this year, affecting the fragile ecosystem of these States and destroying invaluable forest resources and causing extensive damage to biodiversity including wildlife sanctuaries. In view of the enormity of the forest fires this year in the Himalayan States of the country, resulting in loss of lives and

extensive damage to the flora and fauna, the Department-related Parliamentary Standing Committee on Science & Technology, Environment & Forests decided to take up the subject titled 'Forest Fires and its effect on environment, forests, bio-diversity and wildlife and remedial/preventive measures' for examination and report.

3. At the outset, the Committee heard the Secretary, Ministry of Environment, Forest and Climate Change on the subject in its meeting held on the 31st May 2016. The Committee also undertook a study visit to Mussorie, Katra and Shimla from 6th to 11th June 2016 to have an on-the-spot study of some of the areas affected by forest fires at these places this year and to have discussion with the representatives of the concerned Central and State Government organisations on the subject. The Committee visited some of the forest fire affected areas near Mussoorie and Dhanaulti (Uttarakhand) on 6th June 2016, Trikuta Hills and Nomain forests in Katra (Jammu and Kashmir) on 8th and 9th June 2016 and areas near Shimla (Himachal Pradesh) on 10th and 11th June 2016. The Committee also held discussion with the representatives of Civil Society/NGOs and the concerned Central and State Government organizations at Mussoorie, Katra and Shimla on the 7th, 9th, and 11th June 2016 respectively to have benefit of their views on the subject.

4. In a background note submitted to the Committee, the Ministry of Environment, Forest and Climate Change informed the Committee that 'Forest' is a concurrent subject in the Seventh Schedule of the Constitution of India. Therefore, while policy, planning and financing are the key responsibilities of the Central Government, management of forests, including forest fire control and management, primarily lies with the State Governments. Further, the Ministry had been designated as the nodal ministry to deal with forest fires in the country.

5. The Committee was further informed by the Ministry that the Ministry also sends alerts to States/Union Territories before onset of fire season every year for adequate preparedness. Further, Forest Survey of India (FSI), Dehradun, an organization under the Ministry of Environment, Forest & Climate Change, has developed an indigenous methodology to detect forest fires from the given fire spots (including within and outside forest regions) from Web Fire Mapper under a project named "Forest Fire Monitoring in India". In this exercise, the coordinates of active fire locations are daily downloaded from Web Fire Mapper. The active Fire spots are the location of fire affected areas irrespective of forest or non-forest land. The downloaded positional coordinates for the total fire locations, are projected on the forest cover map of India prepared by FSI to select active fire locations within forest cover. The active forest fire location is further validated using other reference information available with FSI. The objective is to disseminate only those signals where higher level of threat is observed. The information is then disseminated through SMS and emailed to the State Forest Department's registered users. The same is also available on the website of FSI.

6. In addition, Government of India provides financial and technical assistance to the State Governments as per their specific needs and availability of resources. Approximately, one third of the allocation under the Centrally Sponsored Scheme i.e. Intensification of Forest Management, has been earmarked for forest fire prevention and control. The various activities funded under this component include:

- (i) Creation of Fire Lines
- (ii) Maintenance of fire lines
- (iii) Construction of watch towers
- (iv) Engagement of fire watchers
- (v) Assistance to Joint Forest Management Committees (JFMCs)
- (vi) Construction of water storage structures
- (vii) Setting up of fire fighting cells
- (viii) Procurement of firefighting equipments
- (ix) Fire mapping and preparation of fire management plans
- (x) Training & awareness

7. The details of funds released to the States and UTs under Centrally Sponsored Scheme namely, Intensification of Forest Management, during the last five years is as below:

Financial Year	Actual release (Rupees in Crore)
2011-12	63.36
2012-13	51.05
2013-14	51.06
2014-15	53.57
2015-16	43.84

8. **The Committee observes that the funds released by the Ministry of Environment, Forest and Climate Change to the States and UTs under Centrally Sponsored Scheme namely, Intensification of Forest Management, have shown a declining trend during the last few years, as is evident from the figures provided by Ministry of Environment, Forest and Climate Change. The Committee is at a loss to understand as to why, when most of the concerned States have been asking for additional funds under this scheme, the Ministry has not given priority to this sector. In view of the devastations caused due to the forest fires, particularly this year, the Committee recommends that the Ministry of Environment, Forest and Climate Change should enhance its budgetary allocation under the Scheme and provide increased allocations under the Scheme to the affected States to enable them to take the requisite measures for prevention and mitigation of forest fires.**

Understanding Forest Fires, Causes, Prevention & Mitigation Strategies

9. Fire is an integral part of the functioning of numerous forest ecosystems. Humans have used fire for thousands of years as a land management tool. Fire is one of the natural forces that have influenced plant communities over the time and as a natural process, it serves an important function in maintaining the health of certain ecosystems. However, in the latter part of the twentieth century, changes in the human fire dynamics and an increase in El Niño frequency have led to a situation where fires are now a major threat to many forests and the biodiversity therein. Tropical rain forests and cloud forests, which typically do not burn on a large scale, were devastated by wildfires during the 1980s & 1990s in India.

10. A forest fire is simply an uncontrolled fire that wipes out large fields and areas of land. These fires sometimes go on for days and weeks. They pose a threat not only to the forestwealth but also to the entire regime of fauna and flora seriously disturbing the bio-diversity and the ecology and environment of a region. During summer, when there is no rain for months, the forests become littered with dry senescent leaves and twigs, which burst into flames ignited by the slightest spark. Forest fires have become more intense and more frequent in the last few decades in India. These fires have been springing up in many other countries of the world too.

11. India has variety of dense forests in tropical south, Himalayan Mountains and the wet north-east regions. Forest vegetation ranges from tropical evergreen forests (Western Ghats / Eastern Himalayas) to alpine forests (Himalayas in north) to semi-evergreen, deciduous, sub-tropical broad-leaved hill forests, sub-tropical pine forests and sub-tropical montane temperate forests.

12. With a variety of forests, the forest fires also are common in India but usually they don't get much coverage in media. Forest fires are a recurrent phenomenon during fire season which is from January to mid-June, with peak season of 3rd week of February to 1st week of June, and every year, close to 20,000 forest fire incidents are reported in the country. As per a Forest Survey of India report, on an average, 54% of country's forests are prone to fires, about 1.2% of the total forest areas is prone to heavy, 6.28% to moderate and 45.27% to mild fires. In 1995, around 3.75 lakh hectares of area was affected in Uttarakhand (a region of the then Uttar Pradesh State); in 1999, around 80,000 hectares of forest was destroyed in Ganga-Yamuna doab region; in 2008, the forest fires in Melghat in Maharashtra affected some 10,000 hectares of forests. In

2010, about 19,000 hectare forests were affected by Fire in Himachal Pradesh. Sikkim, Uttarakhand and Himachal Pradesh are among the most forest fire affected States of India. As per the India State of Forest Report, 2015, in the year 2015, a total of 15,937 forest fires were reported across the country. The highest number of fires were reported in Mizoram (2,468), followed by Assam (1,656) and Odisha (1,467). As compared to fires reported in 2014, a decline of 3,117 in the number of fires incidents was reported in 2015. However, in the year 2016, the scale and extent of forest fires in India escalated and became really alarming, as is evident from the following comparative figures of forest fire spots detected in the years 2015 and 2016, provided by the Ministry of Environment, Forest and Climate Change:

Forest Fire spots detected in the year 2015 & 2016		
STATE/UT	2015	2016
ANDAMAN & NICOBAR ISLANDS	1	24
ANDHRA PRADESH	1075	1699
ARUNACHAL PRADESH	358	293
ASSAM	1656	1766
BIHAR	45	321
CHANDIGARH	0	0
CHHATTISGARH	1272	2808
DADRA & NAGAR HAVELI	0	0
DAMAN & DIU	0	0
DELHI	0	2
GOA	0	10
GUJARAT	117	262
HARYANA	6	43
HIMACHAL PRADESH	22	199
JAMMU & KASHMIR	13	217
JHARKHAND	457	740
KARNATAKA	295	830
KERALA	91	165
LAKSHADWEEP	0	0
MADHYA PRADESH	294	2675
MAHARASHTRA	721	1874
MANIPUR	1286	1105
MEGHALAYA	1373	966
MIZORAM	2468	1318
NAGALAND	722	678
ODISHA	1467	2763
PUDUCHERRY	0	0
PUNJAB	7	45
RAJASTHAN	90	66
SIKKIM	3	0
TAMIL NADU	95	113
TELENGANA	1110	1154
TRIPURA	476	346
UTTAR PRADESH	130	691
UTTARAKHAND	207	1501
WEST BENGAL	138	142
Total	15937	24817

Types of forest fire:

13. As per the background note furnished by the Ministry of Environment, Forest and Climate Change, there are following three types of forest fire:-

- (i) **Ground Fires:** Fires that burn organic material in the soil are called ground fires. This is a slower burning fire, usually under litter or under vegetation. They burn by glowing combustion.
- (ii) **Surface Fire:** A forest fire may primarily burn dry leaves, broken twigs and branches and other materials on the ground and engulfed by the spreading flames. These fires spread quickly. This type of fire is very common in Uttarakhand forests.
- (iii) **Crown Fire:** Crown Fires burn with huge flames and has intense heat and power. They burn from tree top to tree top and spread very quickly with the wind and heat. It is even worse, if they are exposed to steep slopes. Crown fires are very rare in India.

Causes of Forest Fire:-

14. The Ministry in their background note informed the Committee that the causes of Forest fires can broadly be divided as under:

- (i) **Natural causes:** Many forest fires start from natural causes such as lightning which set trees on fire. However, rain extinguishes such fires without causing much damage. High atmospheric temperatures and dryness (low humidity) offer favorable circumstance for a fire to start.
- (ii) **Man made causes:** Fire is caused when a source of fire like naked flame, cigarette or bidi, electric spark or any source of ignition comes into contact with inflammable material. The ignition sources may be intentional or due to negligence.

15. During the study visit of the Committee, the State Governments of Uttarakhand, J&K and Himachal Pradesh also informed the Committee about the state-specific causes of forest fires in those States. The Govt. of Uttarakhand *inter-alia* informed the Committee that Uttarakhand is a forest and biodiversity rich Himalayan State with 45.32% of its geographical area under forest cover. It is the only north Indian State to have more than 33% of area under forest cover. On including the alpine pastures and permanently snowbound areas most of which are recorded as forests, the total area recorded as forests is as high as 71.05%. The State witnessed widespread forest fires that year and till 31st May, 2016, a total of 2060 forest fire incident had been reported across the State, affecting an area of 4412.45 ha. In terms of percentage, the fire affected area amounted to about 0.1% of the Uttarakhand forests. Of the 13 districts, the most affected districts were Pauri-Garhwal, Nainital, Almora, Chamoli, Tehri and Dehradun. Besides, there was a loss of 7 human lives and 7 domestic animals and 31 human injuries due to forest fires in the State.

16. It was also informed that the main reasons behind recent Forest Fires in Uttarakhand State were as under:

- (i) **Lack of Moisture in the Forests:** While most parts of the State receive nearly 1500 mm of annual precipitation, it is mostly concentrated over the three monsoon months leaving a very long period of nearly nine months of scanty precipitation. It is this long dry spell and the deciduous nature of the forests, which make them vulnerable to forest fires. The rains/snow in winter months is thus crucial in maintaining moisture levels on the forest floor which helps in preventing forest fires from becoming large conflagrations. The winter and spring of 2015-16 was practically devoid of precipitation which made the forest floor biomass too dry and extremely vulnerable to fires. Even the monsoon during the year 2015 was below normal further leading to low moisture in forest floor.
- (ii) The hills of Uttarakhand are dotted with villages more so in the Middle Himalayan zone between 1000 and 2000m with high dependence on forests for their basic needs. This happens to be the sub-tropical region which is the driest and often has large expanses of Chir Pine forests (constitutes around 26% of total forests of Uttarakhand). As a traditional annual practice, people living in these villages have been burning the forest

floor near their villages and pasture lands to get rid of the dry leaf litter particularly the slippery Chir Pine needles, and to ensure fresh grass growth for their livestock. In a normal year, sufficient ground moisture and intermittent showers through the winter and spring ensure that such fires usually do not go out of control but in the current year, many of these fires went out of control.

Fires also sometimes escape from agricultural fields where burning of agricultural biomass residue is a common practice not only in Uttarakhand but the entire country. Near urban and semi-urban centres, burning of garbage which is often dumped close to forest areas is a regular practice and sometimes fires spread into forests from such dumps which keep smouldering for hours, often days.

- (iii) The hilly mountainous terrain of Uttarakhand makes it very difficult to control fires. Reaching the site of forest fires which are often away from road-head is difficult. Many a times, there are no foot tracks/bridle paths to reach such sites.
- (iv) While with the help of satellite based technology, detection of fires is now reasonably fast but response time to reach the site is still not as quick as it should be. Most of the forest ranges have usually one vehicle to move the fire fighting crew to the site of fires but in peak fire season, there are often simultaneous multiple fires in each range making it necessary to have multiple vehicles for movement of fire-fighting crews. There are usually 5-10 crew stations in a forest range.

17. The Jammu and Kashmir Forest Department informed the Committee that the recorded forest area of the State is 20,230 km. About 59% of the geographical area of the State is under permanent snow cover, glaciers & cold desert and unable to support tree growth. The State has 3 distinct geographical regions (i) Jammu, (ii) Kashmir and (iii) Ladakh. Forests of J&K exhibit remarkable diversity ranging from sub-tropical to temperate to alpine because of the distinctive geo-climatic conditions prevalent in the State. The entire Kashmir Valley experiences temperate climate and has mostly Himalayan temperate Forests. In Jammu region, about 43.00 sq km (approximately 35% of total forest area) falls under the types: sub-tropical deciduous, Chir pine Forests, and whereas remaining about 50% forests area experiences temperate and alpine climatic conditions supporting Himalayan dry temperate, Himalayan Moist temperate and Alpine Forests. Ladakh region experiences cold desert conditions.

18. It was also informed that in the State, and Jammu region in particular, the main causes of Forest-Fires can be broadly classified under following 3 categories:

(a) **Through Human Interference:**

About 90% of fires are caused by local people intentionally with following objectives:-

1. To clean the forest floor to get good growth of grasses for Fodder/grazing in the following season
2. Burning of the undergrowth and grass to collect MFP.
3. To clear undergrowth with the ultimate aim of cultivating/encroaching the forest area.
4. Charring the stumps to destroy evidence of illicit felling.
5. Scaring away wild animals from near villages.

(b) **Un-Intentional:**

These fires are caused due to carelessness for example:

1. Un-extinguished camp fires of trekkers, nomadic graziers and labourers/tourists.
2. Sparks from transmission lines and powers transformers.
3. Careless throwing of torchwood, un-extinguished cigarettes, matchsticks.
4. Burning of agricultural fields adjacent to forests.
5. Accidental spread of fire in the forest during control burning due to negligence of staff.

(c) **Natural:**

Natural fires are extremely rare. They may occur due to:-

1. Lightning.

2. Rolling stones.
 3. Rubbing of branches.
19. As regards area affected and number of incidents of forest fires in Jammu region, the Committee was informed that about 5,000 sq km of sub-tropical Forest area of Jammu region experiences severe summer conditions starting from the month of April and lasts upto June end. The average temperature during summer months ranges between 39° C to 45° C. The average annual rainfall is 120-140 cm received mostly during monsoon season. The sub-tropical forests of Jammu region are highly vulnerable to forest fires and fire season starts from the month of March and lasts upto June end. The temperate forests of Jammu region and forests in valley face the problem of forest fires during autumn season in the month of October and November every year. During current summer season, so far 242 incidents of forest fires have occurred in different parts affecting 502 ha. area in the sub-tropical forests of Jammu region. Only few stray incidents have been reported from the temperate forests of Kashmir valley.
20. Apart from this, about 180 ha. of forests, in the Trikuta Hills of Shri Mata Vaishno Devi Shrine falling in Reasi District have been affected by recent fire-incidents. These forests are under the control of Shri Mata Vaishno Devi Shrine Board. The manpower deployed by the Shrine Board and assisted by the Forest staff of Reasi Forest Division, Police, and IAF battled for couple of days to control the Wild Fires in Trikuta Hill-Forests. Mostly these were ground fires and no major damage was caused to forest crop.
21. At Shimla, the Himachal Pradesh Forest Department informed the Committee that the Geographical area of Himachal Pradesh is 55,673 sq km² out of which an area of 37,033 sq km² is classified as forest which is about 66% of the geographical area of the State. The forests of Himachal Pradesh comprise of Chir, Deodar, Kail, Fir, Spruce, Oak, Khair, Saal, Bamboo and broad leaved species. Out of above species, forest area having Chir is highly prone to forest fires especially during summer season in view of shedding of highly inflammable chir needles. The area of chir forests in Himachal Pradesh is 1258.85 sq km, which is about 3.4% of the total forest area of the State.
22. The Committee was informed that forest fires are caused by natural as well as man-made factors/reasons, as under:-
- (a) **Natural causes**-Many forest fires start from natural sources such as lightning. High atmospheric temperature and dryness (low humidity) offer favorable circumstances for a fire to start in the forest. Friction between quartz stones also sometimes cause forest fires.
 - (b) **Accidental causes** - Forest fire is also caused when a source of fire like cigarette or beedi, electric spark or any source of ignition comes into contact with inflammable material in the forest. The other accidental causes due to activities of human beings are graziers and gatherers of various forest products leaving burning wood in the forest, the use of fire by villagers to ward off wild animals, fires lit intentionally by people living around forests for recreation or as cultural activity etc. Pine needle is a major cause of forest fires in Himachal Pradesh (H.P.).
 - (c) **Incendiarism causes**- Forests are sometimes are also burnt to conceal illicit felling and illicit resin tapping. Encroachers and poachers also cause forest fires.

Effects of Forest Fires

23. As regards effects of forest fires, the Committee was informed by the Forest Department of Jammu & Kashmir that long term assessment of the vulnerable forest areas which get affected by Forest-fires, year after year, reveals that forest-fires have been causing following adverse affects on the health of Forest-ecosystem:

(i) Damage to vegetation cover and loss of Natural Regeneration:

Shivalik Forests are characterized by good natural regeneration capacity, provided due to adequate root-stock the biotic interference is regulated. Chir-pine and broadleaved forests in Jammu region have very good natural regeneration status. However, forest fires lead to the burning of young seedlings both in closed planted up areas as well as in open (non-

closed) chir forests causing to a serious problem of absence of young recruits on forest floor.

(ii) Damage to Mature Chir-Pine Trees:

The repeated fires, weaken the boles of trees which get fallen during winds. Many chir-pine forests in Jammu region suffer from heavy wind fall of mature trees.

Due to the incidences of recurring Forest fires coupled with unregulated grazing about half of Chir-pine forests have either very poor or no regeneration. Absence of young recruits and damage to mature crop pose real challenger towards the health of chir-pine forests. About 50% of the chir pine forests have slipped into degraded category.

(iii) Loss of Wildlife Habitat:

Burning of Forest floors and vegetation in the understory degrade the habitat of Wild animals. Many herbivore and birds species lose their homes. Change in behavior of wild animals lead to enhanced incidence of “Man-animal” conflict in such forests. Jammu Shivalik region of late is facing serious problems due to Man-Animal conflict and damage to crops by Wild animals.

(iv) Change in Micro-climate:

The affected areas face problems of enhanced temperature, loss of water-resources and bad ambience around habitations. The overall living conditions in and around such affected areas deteriorate in quality and smoky conditions enhance the respiratory diseases amongst locals and contribute to high atmospheric pollution.

(v) Loss of Biodiversity and Invasion of Weeds:

It is a major after-affect seen in the sub tropical forests of Jammu region. Due to burning of flora, there is severe loss of biodiversity in such areas. The burnt forest areas, in the ensuing months get profusely invaded by weeds like Lantana (panchphoolie), Parthenium, Agereatum and Cassiatora etc. The invasion by weeds badly impairs the natural regeneration. The thick growth of weeds like lantana has been one of the main causes of Forest fires in these Forests.

(vi) Adverse Effect on the Livelihood of Local People:

Fires damage some important None-Timber Forest Products (NTFPs) species on which local people depend traditionally for their livelihood. Some Examples are as under:

Babian (Eulolipsis) grass: Collected by local people for making ropes and which are sold by them for earning livelihoods;

Malungad (Bauhinia): leaves collected for making plates and cups to be used in wedding and other functions in rural areas.

Wild-Khajur (Palm): leaves collected by local communities to make brooms and other households items are source of their livelihoods.

Damage to these plants due to Forest-fires directly affects the livelihood of local people.

(vii) Loss of Carbon Sink and Addition of GHGs:

Thick smoke generated by Forest-fires, add high concentration of GHGs into atmosphere, adding to the problem of Global Warming and Climate Change. Burning of vegetation seriously reduces the carbon sink resource. It is pertinent to mention here that India has international commitment of enhancing the carbon sink 2.5-3 billion tons of CO₂ equivalent by 2030. Forest fires pose a serious challenge towards this commitment.

24. It was also informed that in Jammu & Kashmir, in most of the cases, the incidences have been of ground fire type, caused due to the burning of dry leaves/twigs, fallen wooden logs, grasses and brushwood in the understory of Chir-pine and broadleaved mixed forests. In chir-pine forests, there has been superficial burning of dry bark of mature chir-pine trees. However, there has been no reports of damage to the crown canopy of the forests.

25. Apprising the Committee of the adverse effects of the forest fire, the Forest Department of Himachal Pradesh said that forest fires retard plant growth and also affect the fauna, where it

occurs. It downgrades the commercial value of timber. It exposes the soil through burning of ground flora which sometimes cause soil erosion. The burning of forests releases trace gases and aerosol particles which are causative factors of climate change.

Strategies of the State Governments to deal with the Forest Fires

26. During the meeting with the State Governments of Uttarakhand, Jammu & Kashmir and Himachal Pradesh, the Committee desired to know about the preventive measures, mitigation measures and action plan for fighting forest fires by the respective State Governments. Apprising the Committee of the strategies adopted by them, the Government of Uttarakhand informed the Committee as under:

27. The directions issued by Ministry of Environment, Forest and Climate Change on forest fire dated 16.11.2005 recognized following main methods of preventions and control of forest fire, which have been included in their template of Contingency Plan for Forest Fires-

- (a) Constructions of watch towers for detection of forest fires.
- (b) Deployment of fire watchers.
- (c) Creation and Maintenances of fire lines.
- (d) Involvement of local communities.
- (e) Beating of fire with bushes and use of water to douse the fire.
- (f) Use of Remote Sensing technology and Moderate Resolution Imagine Spectro-radiometer (MODIS) satellite data for detection of active forest fires.

28. The Committee was informed that the Government of Uttarakhand strictly adhered to, and followed the template given by MoEF&CC, Government of India. Based on Ministry's directions and State's own past experiences, the Forest Department of Uttarakhand state had been practicing certain strategies to manage and control forest fires. Moreover various innovative and proactive steps were also undertaken for this particular year's fire season.

A. Pre-Fire Season Preparations:

29. Based on the above and past experience, the State forest department carried out the following operations in the pre-fire season:

- (i) **Rotational Burning/Controlled Burning of Forest Floor Litter** - During winter season, as per the prescription of the Working Plans/Management Plans, rotational burning of 152513 ha. and controlled burning of 85,341 ha. Forest areas was carried out to reduce the litter load.
- (ii) **Clearing of Fire** - Lines In the Forests-During the winter season, fires lines had been cleared as per the Management Plans/Working Plans.
- (iii) **Approval of District Fire Management Plan** - Each district prepared a comprehensive fire management plan that has to be approved by a district level committee, headed by District Magistrate well before the commencement of fires season (15th Feb to 15th June).
- (iv) **Awareness Generation Programmes** - Training/Workshop, Rallies, Street plays, meetings of Village/Block/District Level Fire Protection Committees, Distribution of publicity material viz. pamphlets, hand bills and had been taken up for awareness generation through banners, street plays, rallies, puppet shows, pad-yatras, fire-protection week, sensitization through local TV channels, use of multimedia etc. was taken up. A 30 second video was broadcasted across local television channels to enhance sensitization.
- (v) **Master Control Room (MCR)** - A Master Control Room (MCR) is a nodal forest fire information centre, and is generally located in each Forest Division Headquarter. The MCR are provided with Wireless Communication Network, Fire Fighting equipments, and serves as the base station for a fire fighting crew. The MCR is equipped with forest fire danger rating system to forecast the chances of forest fire in any area and put more attention where there are more chances of fire. The MCR is generally operated by a Ranger/Deputy Ranger, and he is

assisted by a team of Foresters, Forest Guards and a few Fire Watchers. The MCR communicates with all the other Range Control Rooms and the Headquarters, and keeps a stock of the situation. As soon as any incident of fire is detected, the MCR relays the information to the concerned Range Office. The Range Office in turn relays the message to the fire fighting crew located nearest to the area of incident, which moves to the area to combat fire. 40 such MCRs were activated across the State.

- (vi) **Crew Stations** - A Crew Station is a temporary post often created within the forest. Each Crew Station has a deployment of 4-5 Fire Watchers who reside at the post. Their lodging and food is ensured at the Crew Station. The Crew Stations are equipped with fire fighting tools and equipments and wireless communication network. The Crew Station is operated by a Forest Guard, who instructs and mobilize the Crew as and when required. This year, 1166 such Crew Stations had been established and equipped with adequate resources.
- (vii) **Watch Towers** - The watch tower serves as a view point that offers a large section of forest to be monitored for various activities. During fire season, the Fire Watchers are deployed on the watch towers to report any incident of fire or smoke from the forest. Upon the receipt of such report, the information is passed on to the Range Office and MCR which in turn directs the nearest Fire Fighting Crew to mobilize manpower and resources to the site of fire to combat it. In case more manpower or resources are needed, the same is informed and ensured. A total of 94 towers had been functional before the onset of the fire season this year.
- (viii) MCR which in turn directs the nearest Fire Fighting Crew to mobilize manpower and resources to the site of fire to combat it. In case more manpower or resources are needed, the same is informed and ensured. A total of 94 towers had been functional before the onset of the fire season this year.
- (ix) **Wireless Communication Network-** The Divisional Headquarter, MCRs, Range Offices, crew stations and field staff are equipped with wireless communication devices for effective real time communication. A total of 506 base sets, 199 mobile sets, 1631 hand-sets and 35 repeater stations had been operative before the onset of forest fire season this year.
- (x) **Satellite Based Information System-** Capacities were developed and put in place by the Information Technology & Geo informatics Centre (ITGC) of Uttarakhand Forest Department (UKFD) to receive, analyse, and derive conclusions from satellite data. A map of fire most sensitive areas were developed and circulated. With the help of Forest Survey of India (FSI), Dehradun pre fire alerts were also provided to respective divisions. Capacities were also developed for Daily near Real-Time Day & Night TERRA/AQUA MODIS and SNPP VIIRS based monitoring of active forest fire points/threats with the help of Uttarakhand BHUVAN portal that is developed in collaboration with National Remote Sensing Centre (NRSC), Hyderabad. Recently on step ahead NRSC has initiated a refine resolution for fire monitoring using, 750m and 375m for "Suomi National Pollar-Orbiting Partnership (SNPP), Visible Infrared. Imaging Radiometer Suite (VIIRS)" satellite data, over Uttarakhand Forest Bhuvan Portal. Daily fire alerts received from national Aeronautics Space Administration, Fire Information for Resource Management System (NASA FIRMS) and FSI through email were acquired and capacities were developed to analyse such data and predict forest fire vulnerable areas. Communication channels were developed to forward such findings to forest officials through Bulk SMS, Email and departmental website, so that the necessary management actions could be ensured timely. For this year in particular social media platforms such as what's App and Facebook were also used

extensively for dissemination of information and prompt response. This was in addition to the information available through traditional means.

- (xi) **Efficient Fire Fighting Tools-** Forest Research Institute had designed and developed efficient fire fighting tools. Such tools were procured by the UKFD and distributed to the Divisions. Fire-Rakes, brush hooks, Macleod, Pulaski, sabbal, water bottles, torches, helmet, dresses, wireless sets, first-aid boxes, hygrometers, thermometers, were made available with the fire-fighting personnel.

B. Forest Fire Management During Fire Season:

- (i) **Detection of Fire Incidence:** Detection of fire incidents is being done through information gathered from local sources, Fire Watchers, Watch Towers, patrolling teams, dedicated Whats-App Number (7455054828), dial 108 service, Van Mitra Sewa (9208008000), Uttarakhand Forest BHUVAN portal, SNPP VIIRS and MODIS based satellite data alerts, and other available sources. Pre-fire alerts and warnings are issued on a weekly basis after analysis of satellite data by the ITGC and the same is forwarded to the field officers by emails. The same is also sent by WhatsApp messenger, and prominently displayed on the departmental website www.forest.uk.gov.in.

Daily post fire alerts received from National Remote Sensing Center (NRSC) and Forest Survey of India (FSI) through email as well as through SMS. Forest Department is also getting daily post fire alerts directly from National Aeronautics Space Administration, Fire Information for Resource Management System (NASA FIRMS) through email, that distributes near real-time active fire data within 3 hours of satellite (TERA and AQUA) overpass from Moderate-resolution Imaging Spectro-radiometer (MODIS). MODIS is a sensor of American Satellites which passes over Uttarakhand at 10:30 AM approximately in the Morning and 12:30 PM noon daily. ITGC, established at UKFD HQ, Dehradun, downloads these fire incidences and overlaid on the administrative boundaries to identify the near exact location where the fire incident has taken place which is sent to concern Forest Division through email and WhatsApp messenger. Maps and tables are also being uploaded over departmental website for public notification. Extended weather forecast is also provided to respective officer.

- (ii) **Action by the Local Crew Station/Mobile Team:** Upon receipt of any information related to fire, near-most fire crew/mobile team is alerted and mobilized to the reported area. It also seeks assistance of local villagers if available, and ensures efforts to suppress fire with help of tools, equipments and locally available resources. After putting off the fire, a preliminary report is forwarded by the local crew station to the Divisional MCR.
- (iii) **Continuations of Awareness Campaign-**Banners, posters, handbills, stickers are being displayed or distributed at all levels. Puppet shows, Street rallies, *Pad-yatras*, Oath ceremonies/lectures in schools, signature campaigns etc. are being organized at local levels. Such campaign is an ongoing process and will continue till the end of fire season. A 30 second video clip is being shown on local television channels appealing people to prevent forest fire.

C. Recent Actions Taken:

- (i) The Governor of Uttarakhand and the Hon'ble Chief Minister, Uttarakhand monitored the forest fire issue regularly and issued instructions for prevention and control of forest fires and also monitored the actions taken by the departments regularly.
- (ii) Hon'ble Forest Minister, Additional Chief Secretary and the Principal Chief Conservator of Forests held Video Conference with all DMs, DFOs and other officers to review the situation.

- (iii) During the peak fire period, Chief Secretary and Additional Chief Secretary briefed the press everyday regarding status of forest fires.
- (iv) The incidents of fire had suddenly seen a spurt on 27th and 28th April, 2016. Taking immediate action, decisions were taken at the highest level and necessary directions were forwarded to the DMs, SPs, DFOs and other officers of the State.
- (v) The Forest Department increased the numbers of Fire Watchers on ground from about 3000 to over 6000 (almost doubled). These were deployed mainly in hilly regions and were used for fire suppression activities.
- (vi) One team of SDRF and 3 teams of NDRF were deployed in Nainital, Almora, Gauchar (Chamoli) and Pauri respectively for helping the departmental Crews in fire suppression activities.
- (vii) 500 employees from fire fighting department were engaged for forest fire protection in urban and sub-urban areas.
- (viii) In each district, District magistrates deployed 100-150 PRD (*Prantiya Raksha Dal*) Jawans for protection of revenue (civil) forests.
- (ix) Three MI-17 helicopters with Bambi Buckets of 4000 to 5000 litres capacity from the Ministry of Defence were deployed for controlling forest fires in Nainital and Pauri districts.
- (x) Water tankers were engaged for supplying water to the water holes in the Protected Areas like Rajaji National Park, Corbett National Park, Sanctuaries and other wildlife rich areas. Instructions were given to all Protected Areas to ensure water availability in the water holes, water tankers be employed, if necessary.
- (xi) Four Wildlife Rescue Rapid Response Squads were deployed at Rajaji National Park, Corbett Tiger Reserve, Nainital Zoo and Nandhaur Wildlife Sanctuary. These squads are equipped with a van with wireless connectivity, a veterinary doctor, and assistant, two forest frontline staff, tranquilizing guns and medicines, nets, spotlights and other necessary equipment and are well trained to deal with wildlife rescue operations. Their mobile numbers were aptly popularized among the public.
- (xii) In Rudraprayag, army helped forest department in dousing forest fires.
- (xiii) All the Panchayats/Van Panchayat, Mahila Mangal Dals, Self Help Groups and Youth Mangal Dals, Vanagni-Prahari and Gram-Prahari were mobilized to control the forest fires in their respective areas.
- (xiv) All the District Magistrates and Superintendents of Police engaged available police jawans, Home Guards, PRD Jawans, Fire Service Personnel, PWD Gangs and Eco Task Force staff (wherever available) to combat forest fires.
- (xv) Every District established a District Forest Fire Control Room for monitoring and DMs were monitoring forest fire cases on daily basis.
- (xvi) The District Magistrates appointed Sector Magistrates at Nyaya Panchayat level involving officers from different line departments. They also provided vehicles to the forest department for swift mobilization of crew teams.
- (xvii) Extended weather forecast for next 15 days was also uploaded on department's website.
- (xviii) State Emergency Operation centre number- 9557444486/0135-2710334 was functional at Dehradun
- (xix) The State Government released funds to the extent of Rs.21.75 Crores for the control of forest fires.
- (xx) State Government remained in touch with the PM Office, Cabinet Secretariat, Ministry of Defence and MoEFCC, Government of India, who all have assured and rendering whatever help as sought by the State Government.

- (xxi) The Director-General of Forests, MoEF&CC, Government of India held a meeting of State Forest Officers on 29th April, 2016 on forest fires. He expressed satisfaction on the actions being taken by the Forest Department for preventing and controlling forest fires. He also assured that all possible central assistance shall be provided to the state.
- (xxii) A Forest Fire Control Centre was made operational at the Forest Department Headquarters at Dehradun.
30. As regards the future strategy for preventing forest fires, the Committee was informed as under:
- (i) Timely availability of funds is the prime requirement of forest fire management. Funds are required between October and December for pre-fire season preparations and between February and June for combating forest fires.
 - (ii) The field staff, Fire Watchers and all the units on the ground will be kept fully equipped and on high alert throughout the fire season.
 - (iii) Awareness programmes will be carried out by all possible media with greater intensity.
 - (iv) The sudden rise in the number of Forest Fires this year is one of the manifestations of the climate change. To combat it in the long term, the department proposes to provide for large soil and water conservation initiatives which will replenish the ground water and increase soil moisture content.
 - (v) Plantation activities will be undertaken in the impacted forest areas as per requirement.
 - (vi) The department also proposes to make Biological Check Dams using Pine Needles for moisture conservation which will also reduce the biological fuel load in the Pine Forests. A project is being formulated and will be sent to Government of India for sanction of funds.
 - (vii) A proposal has already been sent to Government of India, MoEF&CC for removal of trees for clearing fire-lines above 1000 meters and to reduce the biological fuel load in the Pine forests including a proposal for thinning in reserve forests areas.
 - (viii) Post fire assessment of the burnt forest areas is proposed to be done with the help of NRSC and FSI.
31. The Government of Jammu & Kashmir informed the Committee as under:
- Measures adopted by Forest Department to Control the Situation:**
- (a) **Clearing of Forest Floors & maintenance of Fire-lines:**
Every year, in vulnerable forest areas, the forest floors are cleared of dry leaves, twigs and weeds to reduce the quantum of inflammable material. During current year about 551 ha. of forest floors were cleared in different division of Jammu region employing local people on Daily-wage basis. Similarly 142 kms old forest fire lines have been maintained by way of bush clearances, removal of debris etc. Very few Fire lines of standard specifications have been created in the forests of Jammu region. Mostly the forest roads, Nallahs, bridle paths and other such natural features act as Fire lines which are cleared of litter as per availability of budget.
During current year, an initiative has been taken for creating permanent Fire lines in vulnerable forests. As a modest beginning, 94 km of 30 feet broad Fire lines were created in Jammu, Udhampur, Billawar, Nowshera, Kathua, Poonch, Ramnagar and Reasi Divisions-During February/March this year and have proved quite effective.
- (b) **Setting up of control Rooms:**
From April to June, forest control rooms were established at strategic locations which work round the clock. Each control room is manned by field staff of Territorial Forest Department assisted by Forest Protection Force personnel and forest-watchers who are the local people engaged during fire season to assist the field staff. Each Control Room has 10-15 persons working in 3 shifts of 8 hours each. They are provided with fire fighting equipments and vehicles wherever available as per availability of

resources. The manpower from nearest control room reaches the place of incidence first and if required additional manpower is deployed from adjoining control rooms. During current fire season, 145 control rooms were working in different divisions of Jammu regions, wherein 1215 officials of Forest Department, 162 FPF officials and 572 fire watchers engaged on part time basis were working round the clock.

(c) **Extension Activities to get Co-operation of Local People:**

Awareness generation camps are organized at various locations to solicit assistance and co-operation of local people and Gram Panchayats. Pamphlets are also displayed at prominent places to create awareness amongst public to deal with the situation.

Methodology adopted to control the fires:

32. Department mostly relies on traditional methods of “Control Burning, Counter Fires and Fire beating” using brooms of local material. Some improvised tools and equipments have also been provided to field staff. In areas connected with roads, services of fire services are also requisitioned but such areas constitute less than 5% of the total affected areas. In forest areas located along LoC in Poonch and Rajouri districts, army personnel also play an important role in extinguishing the fires. During current season an active support and assistance by Jawans and officers of Indian Army has been rendered in Menhdar and Nowshera border belts.

Major Constraints

33. The Committee was also informed that the Department was facing the following major constraints in ensuring effective control of Forest fires:-

1. Inadequate infrastructure:

- Mobility of staff to fire affected areas alongwith tools and equipments and other logistics is a major constraint. In almost all territorial divisions, staff do not have reliable transport facility to reach the affected areas within shortest possible time.
- Hardly 5% of field staff have residential quarters in their jurisdictional areas and thus field staff face problems of comfortable stay after day’s hectic work.
- Field Staff do not have fire resistant dresses, head gears, and other accessories to deal with the situation affectively and professionally.

2. Training and Capacity Building:

The field staff is not adequately trained and exposed to scientific and modern practices of Fire control. They have been using the traditional methods of “Fire-beating” using local tools/ equipments. It reduces the efficiency and effectiveness of fire fighting operations.

3. Extent of Fire-Prone Areas and Activities undertaken under Fire Management Plan:

About 50000 Ha. Forests are highly vulnerable to forest fires and need comprehensive Forest Fire management practices in the form of regular disposal of combustible litter, maintenance and creation of fire lines, creation and maintenance of water points, enhanced infrastructure and logistic support. Within given resources, they had been able to treat only 700 to 800 Ha. of vulnerable forests annually against forest fire hazards.

The annual availability budget for forest fire management works is as under:

- From normal State plan :Rs.8.00 Lacs.
- From CAMPA budget :Rs.55-60 Lacs
- From IFM-(CSS) :Rs. 94.00 Lacs. became available during 2015-16 and Rs.56.00 Lacs during 2013-14.

For current year i.e. 2016-17, a comprehensive works programme under IFM to the tune of Rs.1278.00 Lacs involving both preventing and control measures has been submitted.

34. The representative of Mata Vaishno Devi Shrine Board also informed the Committee about the following steps taken for greening of forest area and fire prevention measures:-

- (i) Annual Greening Plan is prepared and implemented in the Board area for management of forest. The plan for 2016-17 is of Rs.1.75 crore covering various aspects of Forest management such as Plantation, Protection work, Fire prevention measures, Lantana and weed clearance etc.

- (ii) A High Tech Nursery has been set up by the Board, with the investment of Rs.2.0 Crore. The Nursery has a capacity to produce 4.0 lakhs saplings and seedling every year.
- (iii) Since 2006 more than 20 lakhs plants have been planted in the Shrine area. During current year there is a target to plant around 2.5 lakhs plants. The survival rate of the plants is more than 70% which is being achieved by scientific management and protection measures.
- (iv) All shrine area has been fenced with Chain link fencing to protect it from encroachment and unwanted intrusion. Around 48 km of fencing has been erected on boundary of Shrine Board's land.
- (v) Every year fire lines are created and fire watchers are deployed to contain the forest fire in the Shrine area.
- (vi) With efforts of the Board the greening has increased substantially in the Shrine area.

35. The representatives of Government of Himachal Pradesh informed the Committee as under:

Strategy for Fire Prevention and Control Management in H.P.: Forest fire has been categorized as disaster under Disaster Management Act, 2005. The National Policy on Disaster Management, 2009 prescribes Disaster Management Cycle or Contingium in managing any disaster. The steps in this regard are as under:-

Prevention: It is important to prevent Forest fire accidents and if they occur, then to check it instantaneously from spreading. The essence of forest fire prevention is in breaking the fire triangle composed of fuel, air and ignition source. The HP Forest Department has identified forest fire sensitive beats and the main thrust was in the Fire sensitive areas of Dharamsala, Mandi, Bilaspur Nahan and part of Chamba (Dalhousie Forest Division) Forest Circles due to appreciable areas of Chir Forests in these circles. Routine measures as prescribed in Working plans like clearing of the Fires Lines, control burning, etc. are also taken before the fire season starts in order to minimize the inflammable material, which helps in prevention of forests fires.

Mitigation: Chir pine needles are inflammable causing forest fires in H.P. These needles can be used in preparation of fire bricks due to their high calorific value and can be used in kilns of various industries. Although start has been made in some divisions in the State but efforts are being made to finalize the programme for collection of the pine needles where the local people through their JFMCs will be involved to collect the needles which can then be sold to various industries etc. to be used as a fuel. This will minimize the needle load in the forests and reduce the risk, chances and intensity of the Forest Fire.

36. The Committee was also informed that the following preparatory steps are taken before the initiation of fire season every year.

- (i) Fire watchers and forest workers are deployed during fire season which starts from 15th April to 15 June or till the onset of monsoons every year exclusively for the purpose of forest fire management.
- (ii) The Fire Alert Messaging System (FAMS) through the Satellite is in place in H.P. for early detection of forest fire incidences. On detection by the satellite, messages are sent to Forest Guard level to become active.
- (iii) Daily Fire reporting of all forest fires has been adopted for better management strategy in future.
- (iv) Forest Fire control rooms are set up in division and circle headquarters for proper monitoring of Forest Fire Management system.
- (v) Forest staff is in continuous liaison with PRI & JFMC of the area for help and assistance, if any required.
- (vi) Forest field staff is on duty 24X7 during this period and no leave is sanctioned.

- (vii) Before the start of fire season, Gram Sabha meetings are attended by the Forest Guards and Deputy Rangers every year in the month of March and April to sensitize people and seek their help in forest fire control and management.
- (viii) Award has been kept from this year to be given to Panchayat and JFMC who does not allow forest fire to occur in their areas.
- (ix) DFO/CFs also tour the areas for better action where required.
- (x) Half monthly video conference is taken by Principal Chief Conservator of Forests (HoFF) for getting insight into position of the field and if need be devising better strategy.

37. The Committee was also informed that if efforts made in preventing forest fire do not succeed and fire actually occurs then the following response mechanism in place is put in action:-

- (i) The Forest Watchers and Forest Workers try to extinguish fire.
- (ii) Where they do not succeed gang of forest field staff take up position and with the assistance of local people help in extinguishing the fire.
- (iii) In severe cases help of fire brigade is taken.

Evacuation, Rescue and Relief: This is also part of the cycle but, such an eventuality has not arisen in H.P. However, in case of loss of life or property assistance is given as per H.P. Relief Manual through Revenue Department.

Rehabilitation: Such an eventuality has also not arisen in H.P. But if it arises it will be as per norms for rehabilitation as per the Relief Manual.

Remedial Measures: The loss and area affected by forest fires are inspected and remedial measures like afforestation and Patch sowing are taken during the rainy season to make the loss good.

38. Himachal Pradesh Forest Department also informed the Committee that forest fires in H.P. follow 3-4 year cycle. This year was part of this cycle but the following effective steps helped in improved management of forest fires in the State with the result that there was no loss of life or property during 2016.

- (a) Introduction of Mobile gangs of field staff which continuously moves around in vehicles.
- (b) Satellite based SMS system of giving fire alerts to field staff right upto Forest Guard.
- (c) Communication network with linkage of officers and staff through mobiles for effective strategic management.
- (d) Monitoring of Forest Fire Management by CFs/DFOs through control rooms.
- (e) Video-conferencing with field DFs/DFOs on half monthly basis by Principal Chief Conservator of Forests.

ROLE OF OTHER CENTRAL AGENCIES

39. During the meeting of the Committee held at Mussoorie on the 7th June 2016, the Committee desired to know about the role of Indian Council of Forestry Research and Education (ICFRE) in conducting research in the field of forest fires. The Committee also desired to know the steps taken by ICFRE to make Uttarakhand State Forest Department aware of the affects of El- Nino and its relationship with the wide spread forest fires. The Committee also desired to know about the role of the other central agencies/institutes conducting research in the field of forest fire.

40. In response, the Director General, ICFRE informed the Committee that El-Nino had been the bane in India as it a main reason for the unusually warm and dryer winter season. He also stated that El-Nino might be playing role in wide spread forest fire in Uttarakhand and other region of the country. Further, in their background note, the Forest Research Institute, ICFRE, informed the Committee as under:-

41. The importance of taking up systematic research in the field of forest fire protection was realized as early as in 1956 when the first expert committee of FRI headed by Prof. Champion, made a very specific recommendations regarding the need to study and monitor forest fire in the

country. Accordingly, a scheme was formulated in 1959, but it could not be sanctioned. Moreover, the ninth and tenth Silviculture Conferences held in 1956 and 1961 at FRI, Dehradun, recommended that FRI should take up research and development studies to strengthen knowledge related to forest fire management in India. The Forest Research Institute, a centre of excellence with multidisciplinary strength, has played significant role in conservation and management of forests throughout the country. Over the years, FRI has prepared working plans, management plans of several forest divisions of the country by adopting the National Working Plan Codes. Additionally, FRI has carried out several activities with respect to forest fire management and some of the major initiatives are given below:

(a) **Awareness creation among different stakeholders:** Several visitors (students, researchers, forest department personnel, technologists) are visiting FRI to gain knowledge with respect to forest resource management. The institute also organizes mass awareness programs at FRI and also in remote locations for dissemination of knowledge and creates awareness. The institute also houses a National Forest Information Centre and a Library which is one of the largest collections of forestry related books, journals, etc. The institute also has six specialized museum, viz., Forest Pathology, Silviculture, Forest Entomology, Non-Wood Forest Products, Timber, and Social Forestry museum to create awareness with respect to forest management, issues such as forest fire, pathogenic infestations, etc.

(b) **Capacity building of forest departments and other stakeholders:** As an important mandate, FRI has conducted several workshops and trainings to enhance capacity of the forest departments for science based management of forests and conservation of biodiversity. These training programmes have modules with respect to forest fire mitigation. Furthermore, a training programme on 'Forest Fire Disaster Mitigation' for forest department officials of various states organized by Forest Research Institute, Dehradun, in 2015 in collaboration with the National Institute of Disaster Management, New Delhi.

(c) **Research and development for better management of forests while combating forest fire:** As a scientific research and capacity building institute, FRI has taken up several projects/studies covering different thematic areas to enhance knowledge about the different ecological processes, forest management issues and developed technologies for better management of forest resources of the country. FRI has also carried out few more specific studies related to forest fire ecology. The institute has enough experience in developing tools and techniques to combat forest fire related disasters such as pathogenic outburst, forest fire mapping, genetic engineering, etc.

(d) **Piloting technologies for mitigating forest fire:** The multi-disciplinary forest research and management institute FRI has developed several technologies for better management of forests. These technologies have been provided to different stakeholder organization to enhance forest management. Considering the disastrous impacts and difficulty in controlling the forest fire, the institute has developed an in-house forest fire extinguishing kits which has been given to forest department personnel for controlling forest fire in difficult terrains. The institute has capability to further such types of technologies and is in the process to acquire more scientific and latest techniques.

(e) **Development of forest management plans:** As premier institute in the field of forestry research and management planning, FRI has prepared management plans and working plans for several forested areas of different state forest departments. As an important strategy, management plans developed by FRI have included prescriptions on forest fire management and controlling mechanism.

(f) **Scientific Back Stropping of Forest Department for Forest Fire Management:** The research based recommendations/suggestions will be provided to the forest department to minimize forest fire and its associated impacts on the biodiversity and forest ecosystem services.

(g) **Development of Knowledge Products (Scientific Reports, Technical Documents, etc.):** The field research based scientific reports, theme plans and knowledge dissemination; publications will be developed and shared with the various stake holders.

42. As regards the further activities of FRI, the Committee was informed that FRI proposed to take up the following activities:-

(i) **Establishment of Centre for Forest Fires Management (CFFM):** The centre for forest fire management will be created at Forest Research Institute, Dehradun in collaboration with the National Disaster Management Authority, Ministry of Home Affairs. In this regard, a proposal has already been submitted. This centre will undertake activities like research, monitoring forest fire, capacity enhancement and awareness creation. The centre need to be equipped with specific equipments related to forest fire monitoring, documents and research. Also, a team of scientific and management personnel need to be created. The overall activities of the centre will be supervised by the Director of the centre (Director, FRI, Dehradun). The three major activities are human resource development, forest fire geo-informatics and training and capacity building unit. The details are as under:

- **Forest fire mapping and modeling for predication and early warning:** For the monitoring of fire incidences, field visits will be carried out to record forest fire incidences for the development of prediction modeling and early warning.
- **Research and development for managing forest fire:** Considering the poor knowledge on causes and factors of forest fire, research activities will be taken up with respect to developing an understanding on the factors responsible for forest fire in Uttarakhand state.
- **Capacity enhancement through organizing trainings and workshops:** A number of training and workshops will be organized in consultation with the state forest department on various themes related to forest fire for different target groups.
- **Strengthening and management of knowledge:** Consultative workshops and brainstorming sessions will be organized for sharing knowledge and creation of knowledge network.

(ii) **Training modules on forest fire management for Army and paramilitary personnel and village community in Uttarakhand:** In the current year 2016, forest fire have affected large tracts of forests in Uttarakhand causing loss of property, biodiversity, animal and human lives. NDRF, ITBP, Army, Police, Air-force and local community provided support to Forest Department Officials in controlling the forest fires. These personnel who were involved in controlling the fire are not fully equipped in forests fire control and mitigation especially in the hilly terrain. FRI has, therefore, submitted a project proposal to Uttarakhand Forest Department to organize training programs for officers and front line staff of paramilitary, army and police as well as village communities so that they are better equipped to mitigate the disaster.

43. **The Committee has been given to understand that Forest Research Institute, one of the oldest forestry institutions in the country, has been undertaking basic research in forest management. However, there seems to be a huge disconnect between the research done by FRI and its usage by the State Forest Departments and other agencies. This has been corroborated by the fact that NDRF, when deployed in Uttarakhand to control the forest fire, complained of having used very rudimentary equipments, whereas FRI claims of having designed and developed efficient fire fighting tools. Therefore, the Committee recommends to FRI to publicise among all State about the equipments developed by them with a view to control forest fires, so that the concerned States could procure the equipments and use them in case of forest fires.**

44. The Director General, Forest Survey of India, while apprising the Committee about the activities and efforts of FSI with respect to forest fire mapping and monitoring, stated that FSI was monitoring forest fire hotspots throughout the country since the year 2004 using Remote

Sensing and GIS technology with the objective of detection of active forest fires at nascent stage and to inform State Forest Departments about the forest fire incidences on near real time basis.

45. The Committee was further informed that from year 2012, the time duration between satellite pass and the time of dissemination of forest fire signals by FSI has been reduced to nearly 2 hours, thus making the mechanism of signal reception, processing and dissemination on a real time mode. This has considerably minimized the reaction time towards remedial and preventive measures on ground by the state forest departments. FSI has been using Moderate Resolution Imaging Spectro-radiometer (MODIS) data having on-board Terra and Aqua satellites providing data at every 6 hours thus helping in close period monitoring of forest fire.

46. FSI is also receiving the co-ordinates of active fire spots or hotspots locations irrespective of forest or agricultural land from NRSC. These coordinates are then projected on the forest cover map of India prepared by the Forest Survey of India to select active fire locations within forest cover called forest fire locations. Attributes like state, district, Survey of India toposheet's numbers are then attached with each coordinate of the forest fire locations so as to enrich the information carried forward by each fire location. The entire processing at FSI takes approximately 1 hour's time. The processed forest fire information is then e-mailed to the appointed nodal officers of each state. The concerned SFDs are able to precisely locate the position of hotspot (active forest fire location) at compartment level with the Google-Earth picture at the backend. The information generated in the form of Table and Maps are also uploaded on the official website of FSI daily 3-4 times a day. In addition, the same information is also disseminated through SMS to the State Forest Department's registered users to our website (www.fsi.nic.in) for confirmation as well as quick remedial measures. FSI also intimated that the total fire points disseminated to SFDs during 2015 and 2016 were 15937 and 24651 respectively. The total number of fire alerts sent to Himachal Pradesh, J&K and Uttarakhand between the period 1st February, 2016 to 2nd June, 2016 are as under:

Period	Fire alerts sent to Himachal Pradesh	Fire alerts sent to J&K	Fire alerts sent to Uttarakhand
1 st February, 2016 to 2 nd June, 2016	190	102	1498

47. FSI also informed that it is using an advance system for processing and dissemination of fire signals using this kind of monitoring. FSI has recently started sending pre fire warning alerts to SFDs based on the information on forest cover, forest types, climatic variables, recent fire signals etc. The system sends warning to the state where forest areas are having higher risk of fire in the coming days. The pre-fire alerts are disseminated to SFDs at division and range level, thus providing information at the base administrative level of the SFD's. This information is helpful for SFDs to take necessary preparation prior to incidence of fires. FSI also informed that the burnt area extent assessment gives a closer picture of the biodiversity loss to a greater extent. At present, the data and maps on extent of forest area burnt annually in the country is not available. However, FSI has started estimation of Burnt areas on an experimental basis from 2015 onwards using AWiFS imagery.

48. The Committee desired to know from the representatives of MoEF&CC whether there was any mechanism to have advance warning of forest fires so that the State Governments may take necessary precautions in the matter. In response, the Inspector General, MoEF&CC, informed that the Ministry is in the process of developing early forest fire prediction mechanism with the support of NRSC, Hyderabad at FSI, Dehradun and the early warning system will be ready by next year i.e., 2017. It was also stated that the fire prediction system will be able to provide information with reliable accuracy (90%) to the state forest departments (SFD) leading to preventive measures.

49. The Committee desired to know whether any crisis management plan existed in Uttarakhand forest department and what were the budgetary provisions for the forestry sector? In

response, the Committee was informed by the representative of the State Government that the State Government has monitoring mechanism under which control centres are established at all level, of management (block, range, division etc.) with respect to forest fire prevention and control. He also informed that there was a mismatch between the budget provided for the purpose and the actual budget requirements for taking necessary actions. The Committee was also informed that the State Government is carrying out Jan Jagran (awareness creation program) on regular basis throughout the state where there is a problem. He said the number of signages will be enhanced in fire hotspot areas. The tourists and visitors will be sensitized throughout the yatra season in most fire prone areas. He also said that the State Government is organizing public rallies, yatras and disseminating information on do's and don'ts to local communities through short films, banners, brochures, etc. He further informed that Uttarakhand is the only state where Van Panchayats are involved in managing significant amount of forest area of the state. The Principal Chief Conservator of Forests (PCCF), Uttarakhand informed that about 3,000 meetings were conducted before fire in different places.

50. The Committee also desired to know the status of watch towers in the States and the utilization of funds for developing watch towers. In response, the Committee was provided the details of watch towers and informed that the government was in the process of establishing some more watch towers at strategic locations, which could not initially be erected due to delay in release of funds.

51. **The Committee observed that a large number of posts of front line forest staff were lying vacant and expressed doubt about the preparedness of the state forest departments to combat forest fires. The Committee also observed that the recent forest fires may have resulted in adverse impact on many species and desired to know the efforts made by the Government in minimizing the loss. The Committee was informed that the Department was conducting regular surveys with respect to floral as well as faunal species conservation in the state and will undertake more studies focused towards areas where forest fires had been reported. The Committee was also informed that the State Forest Department was taking up soil and water conservation measures in affected areas to check possible negative impact on forests and water resources of the state. Further, a range of local species have been reserved which will be planted to minimize soil screened along with the cantour trances.**

52. The Committee also desired to know the role of the organizations like Survey of India (Department of Science & Technology), Indian Institute of Remote Sensing (Department of Space) and Geological Survey of India (Ministry of Mines) in forest fire management.

53. The Committee was informed by the representative of Department of Science & Technology that SoI is generating maps with high resolution and they are being provided to state forest department whenever required. He further said that SoI maps contain forest fire lines and other clear demarcations which can be used by the forest department for various purposes.

54. The representative of Geological Survey of India informed the Committee that GSI is not directly involved in managing forest fire in the country. He informed that GSI was working on mapping and monitoring glaciers and landslide vulnerable areas in the state. He said GSI is monitoring 968 glaciers in Himalayan landscape.

55. The representative of ISRO, while apprising the Committee about the ISRO's efforts in forest management, informed that ISRO through its institutes such as NRSC and IIRS has provided various facilities such as satellite data, thematic maps and capacity building activities. He said that IIRS which was located in Dehradun specialized in satellite data, thematic maps and capacity building activities and its services can be utilised by Uttarakhand Forest Department. IIRS further brought out the following:-

- Under its Disaster Management Support (DMS) Programmes, Indian Space Research Organisation (ISRO) supports the disaster management activities in the country by

means of providing - (i) Aerial and Space based data & information services and (ii) Satellite based emergency communication services.

- For providing near real time support to various agencies, ISRO has set up a Decision Support Centre (DSC) in 2005 at National Remote Sensing Centre, Hyderabad for providing data, value added products and information services in near-real time to concerned Central and State departments. The DSC presently supports the needs of various natural disaster such as Cyclone, Flood, Earthquake, Tsunami, Landslide and Forest Fire. It provides near-real time active forest fire locations information to Forest Survey of India and in turn to all State Forest Departments. All Fire alerts are also published on ISRO's BHUVAN geo-portal on near real-time with a provision to download location information.
- With regard to activities related to Forest Fire, Satellite data based temperature anomalies are used for the detection of active fire locations. Active forest fire detection is based on flagging fire pixels, based on thermal anomaly, using middle infrared & thermal infrared data. The active fire alerts generated using satellite data are delivered within 30 minutes of satellite data acquisition.

56. It was further informed that IIRS, being in Dehradun proactively discussed with concerned state officials and carried out case studies on these forest fire incidents. The brief details are as under:

- Hot spot occurrence of Forest Fire for Uttarakhand. The analysis was done on 2.5 km grid for the entire state of Uttarakhand. The daily forest fire occurrence from satellite data was aggregated for last 15 years (2000-2015) and regions prone to forest fire were identified as number of fire occurrence in a grid during the past 15 years.
- Burnt Area Analysis of the National Wild Life Forest protected zones (Rajaji Tiger Reserve and Corbett Tiger Reserve) using IRS imagery was done.

Some of the Salient Observations of the studies are as under:-

- (a) Significant burnt area patches were observed inside the Rajaji National Park and Corbett Tiger Reserve forests.
- (b) Burnt areas also covered Biological Richness zones which will in turn affect wild life habitats and medicinal herbal zones.
- (c) The highest burnt areas were recorded in the vegetation types dominated by pine followed by gregarious Sal, Sal mixed moist deciduous forest and Dry deciduous scrub.

57. IIRS has also suggested some Technology driven Remedial/Preventive Measures, which are as under:-

- Hot-spots of fire occurrences or high probable Fire Alert Zones can be used to monitor vigorously to avoid future Forest Fire.
- There is a need to set up Network of Automated surveillance or watch towers/ observation posts at strategic locations to provide regularly in real-time data for forest fire alerts for timely intervention of fire incidences.
- Geospatial technology (GST) can be used effectively to monitor in real-time with the help of dedicated Location Based Services. Specific tools like mobile apps, GIS based buffering and routing etc. are to be worked out.
- Removal of Pine dried needles can greatly minimized the triggering of fire.
- Construction of rain water harvesting structures in the hot-spot regions for timely attending the forest fire at initial stages.

IIRS also suggested the following measures for disaster risk reduction:-

- (i) Impart training to forest rangers as well as local community (including school children and villagers) on the use of Geospatial tools and location based services with the help of local NGOs.
- (ii) Periodic rigorous Training of Trainers (local leaders, school teachers, Divisional Forest Officers) can be taken up in a programmatic manner.
- (iii) Mock-up drill exercises need to be taken up for effective disaster risk reduction and management.

58. The Committee desired to know the effect of Forest Fire on Wildlife. The response of the Wildlife Institute of India, Dehradun has been brought out in the following paragraphs.

59. Forest fire impacts wildlife habitat by altering the three main requirements of animals i.e. food, water, and shelter. The forest fire in India is mainly ground fire and this affects the understory plants and shrubs that provide food and forage and this loss often results in wildlife moving away to areas where food, water and shelter are more readily available.

60. The biggest effect fire has on wildlife is the change in the composition of ground flora with more hardy species replacing the palatable species. Fire changes the proportion, arrangement and characteristic of habitats across the landscape. Fire can cause temporary loss of food and shelter and animal populations may shift to adjacent unburned areas. However, on first rain shower, the vegetation sprouts and new tender fleshy shoots supply the much needed forage resources.

61. The burned and unburned areas form a mosaic of habitats with a range of vegetative conditions from which wildlife can find food and cover. In the winter months, just before onset of summer in the cool season controlled fire is very beneficial for sprouting of new flush of leaves and enhances the foraging resources of the habitat.

62. Herbivores and species that prefer herbaceous vegetation for cover, prefer the grass/forb habitats or broad-leaved forests that often become established after a burn. Depending on the vegetation type, burning can increase or improve forage for wildlife for a few years. In some cases, the nutritional content and digestibility of plants will temporarily increase as well. In the short term, dead wildlife becomes food for scavengers, bears, eagles, and herbivores. Fire-killed trees become food for millions of insect larvae and/or snags that provide perches for raptors. Snags and downed woody debris also provide important habitat for cavity nesters, reptiles, small mammals and even large mammals such as bears.

63. Wetlands are less likely to burn and when they do, they burn less severely than upland sites. Wetlands provide a refuge from fires for many species of wildlife and activities such as breeding by aquatic species may be carried out with little interruption. Fire in wetlands usually increases areas of open water and stimulates an increase in forage.

64. Invertebrate populations tend to decrease after a fire because eggs, food supplies, and/or shelter are destroyed. Flying insects are especially vulnerable because they are attracted to fire by heat or smoke and are incinerated in great number. Surface insect populations, such as grasshoppers, also tend to decrease. Other insect populations, especially bark beetles, increase after a fire, as trees damaged or killed provide large amounts of suitable habitat.

Restoring Habitat

65. Fire may cause extensive damage to seedling, sapling and pole crop, which forms the mosaic of habitat, provides edge effect and ecotone. Riparian areas if burnt are especially critical to wildlife habitat. Restoration work includes amelioration of the vegetation and compensating the vegetative loss by artificial regeneration and assisting natural regeneration. Vegetating the banks of streams, rivers and ponds will help minimize erosion and also help keep water quality high and temperatures cool, which is especially important for fish.

Prescribed Fire for Wildlife Habitat Improvement

66. Prescribed burning can benefit grassland habitat and savannah. The grasslands, herbs and shrubs will accumulate lot of coarse unpalatable material and for rejuvenation a light burn is prescribed. Fire can help rejuvenation of forest, depending on the nature of the ecosystem, the

water and the amount of fuel load available on forest floor. Fire helps in the following ecological processes.

- 1) Reduce the build-up of fuel and thus the intensity of future burns.
- 2) Recycle nutrients bound up in litter.
- 3) Reduce competition, allowing existing trees to grow larger.
- 4) Create forest refuge to provide nesting spots for wood peckers and other birds.
- 5) To remove unpalatable growth remaining from previous seasons.
- 6) To stimulate flush of new growth of palatable leaves.
- 7) To stimulate seed production or opening of cones and prepare seed beds for seeding, either naturally or artificially.
- 8) To establish fire breaks in a system of protection from wildfire.
- 9) To induce good growth of Tendu leaves (*Diospyros melanoxylon*).

67. For successful use of fire as a management tool in sustainable forestry practices, it is necessary to carry out fire-prevention measures in frequent fire-prone areas as integrated element of forestry in accordance with scientific norms, improve airborne forest fire monitoring and ground-based fire detection and patrolling.

WII was also of the view that the following post fire restoration work is essential:

- Establish plantations by using fast-growing species in order to speed up carbon sequestration.
- Restoration of riparian forest.
- Soil and water conservation works.
- The use of GIS technology for forest fire simulation allows the integration of all the data on a single platform simplifying the modeling and analysis of potential forest fires.
- The use of Remote Sensing technology for forest fire detection and evaluation of the intensity and losses.

68. **The Committee notes that Indian Institute of Remote Sensing and Wildlife Institute of India have made some very useful suggestions regarding remedial/preventive measures for forest fires, disaster risk reduction, restoration of habitat, wildlife habitat improvement and post fire restoration work. The Committee recommends that the Ministry of Environment, Forest and Climate Change and the concerned State Government should take these suggestions into consideration while formulating strategies for prevention, mitigation and fighting the forest fires as well as post fire restoration work.**

ROLE OF NATIONAL DISASTER RESPONSE FORCE (NDRF)

69. The Committee observed that NDRF was deployed in Uttarakhand to douse forest fires as it had gone out of control of local SDRF and other agencies. During its meeting held on the 31st May 2016, the Committee also heard the Director General, National Disaster Response Force, on the role of NDRF in combating forest fires. In response, the Director General, National Disaster Response Force informed the Committee that NDRF is a multi-disciplinary, multi-skilled and high tech response force, dedicated completely to deal with all kinds of national disasters, alongwith CBRN emergencies i.e. Chemical, Biological, Radiological and Nuclear emergencies. They had never been called to douse forest fires in its ten year of existence. However, assessing the gravity of the situation, for the first time the Government decided to deploy the NDRF for the forest fire fighting operations. As such this was the first time that they had to deal with fire. As such it was challenging task for all of them. They were asked to respond to the raging forest fires in three districts of Uttarakhand, i.e. Pauri, Chamoli and Almora, and these areas already had history of forest fires every year, but fuelled by the extraordinary dry situation, climatic conditions prevailing in the area and with almost no rains, the fires took a very gigantic task. The dry foliage also abetted the fire and started to spill over to other parts of the State. They neither had any equipment nor any trained manpower for the purpose but they responded in whatever manner they felt comfortable and instructed by the State authorities. He also stated that

normally, they are a technology-based response agency and carry all kinds of sophisticated, state-of-the-art equipment to deal with earthquake, flood, cyclone, Tsunami or chemical biological response. But, for forest fire, they had absolutely no equipments. He also brought out the non-availability of maps of the operational area and fire proximity suits. Further, the kind of equipment used by them for fighting forest fire was very rudimentary.

70. He further stated that if NDRF has to be involved in such further endeavour, their manpower should be adequately trained for such assignments. He also suggested the inclusion of more equipments in the NDRF inventory to fight forest Fire. He also stressed the need for assessing other systems for fighting forests fires such as chemical fogging systems being used in other countries. He also stressed the need for community involvement in fighting forest fires and stated that NDRF conducted community awareness programmes and community empowerment programmes. They were not only fighting disasters but also educating the people. He expressed the need to develop support with the people not only to train and sensitise them but also to make them owners of the forests. He stressed that NDRF should be brought into the loop for alert, satellite imagery and other things normally associated with NDRF for the natural disasters.

71. The Committee is of the opinion that agencies like NDRF should be deployed in fighting forest fires extremely rarely. Infact, State Governments should be asked to train their fire brigade staff to fight forest fires as they will be in a better position to deal with it. The Committee was informed that Himachal Pradesh has over 600 fire brigade staff. Likewise all other states will be having their fire fighting staff who needed to be trained to suit the occasion. The Committee, therefore, recommends that Ministry of Environment, Forest and Climate Change, on priority basis through Forest Research Institute, Dehradun, organize training of fire brigade officers of all the states and equip them with proper forest fire equipments so that they can rise up to the occasion in the event of forest fires and they do not have to depend on outside agencies like NDRF which has already enough duties to perform at national level. The Committee also recommends that the Government should also approach some other fire-prone countries such as Canada, New Zealand and Australia to understand as to how they deal with the problems of forest fires and study the use of other systems for fighting forest fires such as chemical fogging that is used in these countries.

72. The Committee also held discussion with the representatives of Civil Society/NGOs at Mussoorie, Katra and Shimla on the 7th, 9th, and 11th June 2016 respectively. The representatives of Civil Society Organisations and NGOs present during the discussions at Mussoorie, Katra and Shimla brought out various preventive measures for forest fires, mitigation measures and plans for fighting forest fires.

Involvement of local community, women and panchayats in forest management

73. The representative of Rajpur Community, Dehradun Initiative emphasized upon the need to have integrated policy for forest fire management in the state and the use of traditional knowledge and involvement of local communities in forest fire management. The representative of Titli Trust Dehradun emphasized that the key issue in forest management was the execution of activities at grassroot level and the local communities are not well aligned in planning and management. He further suggested that local communities' awareness should be core to forest fire prevention and control. The representative of Develsari Environment Protection & Technical Development Society stated that if local communities are sensitized and involved in forest management they can make a huge difference in minimizing the forest fire incidences in the state. He was also of the view that since Uttarakhand has large number of Van Panchayats, they must be roped in managing the wide spread menace of forest fire. The representative of Sholi Gram Swaraj Mandal, Gopeshwar emphasized upon women empowerment and their involvement in forest management related activities including combating forest fire. He further suggested that local people should be involved and be incentivized by way of creating facilities such as school, hospital, etc depending upon the local needs. The representatives of Umang Foundtion, Shimla,

Sewahar, BCS Shimla referred to the lack of interest shown by the local villagers in fighting the forest fires and stressed that there was a need to restore the ethical commitment of the people. It was also brought out that since forest fires have become an annual feature, people have got accustomed to it and are not bothered about it. The representatives of GB Pant Institute of Himalayan Environment & Development, Kullu suggested the need for incentivizing the Panchayats which save their forests from forest fire.

74. The Committee was constrained to note that interest and participation of local villagers/people in dealing with the forest fires and related incidents have gone down. The Committee is of the view that the key issue in forest management is the execution of activities at the grass root level and hence there is an urgent need to restore the social commitment and sense of belongingness of the people towards the forests and their involvement in planning and management of the forests. The Committee is of the firm view that this would also help in minimising the forest fire incidents in the country. The Committee, therefore, recommends that the Central Government and concerned State Governments should take immediate necessary steps to involve the local communities, including women, self-help groups and members of Village Panchayats and Zila Parishads in forest management related activities. The Committee also recommends that the State Governments should also incentivise the local people/villagers by creating facilities for them such as schools, hospitals etc. as per the local requirements to motivate and encourage the people to come forward and participate in the process of saving our precious forests from forest fires.

Exposure of villagers to devastation of forest fires and awareness efforts

75. The representative of Eco-park Development Committee, Dhanolti stated that his organization was taking up awareness campaign in schools with the help of Self Help Groups (SHGs) in the area much before the forest fire season. The representative of Rajpur Community, Dehradun Initiative highlighted that often small fires lit by the villagers in forests spread and resulted in major forest fires and stated that villagers should be exposed to the devastating results of such small fires. She highlighted the need for awareness creation through visual media. She also suggested pre-forest fire efforts to educate the community, civil defence awareness in schools, sensitizing of different departments of the government with respect to forest fire control and protection. The representatives of GB Pant Institute of Himalayan Environment & Development, Kullu suggested celebrating Forest Fire Week wherein different activities on preventing forest fires such as poster competitions etc. could be organized.

76. The Committee is in agreement with the view expressed by various representatives of Civil Society that small fires lit by the villagers in forest areas can spread and result in major forest fires. The need for taking up awareness campaigns among the villagers and exposing them to the devastating and horrifying results of such small fires cannot be over-emphasised. The Committee, therefore, recommends that the Ministry of Environment, Forest and Climate Change must impress upon the State Governments to take all necessary measures in this regard such as posters, slogans, campaigns in schools, hand bill etc. Since visual media is very effective in attracting people towards a cause, it is recommended that the devastating effects of forest fires should also be shown on electronic media in the form of short films, documentaries etc. to make the people aware of the horrifying impacts of forest fires.

77. The Committee further recommends that short films/documentaries in regional languages should also be shown periodically and the campaign should be sustained at least period of three to five years so that it can impact the minds of the people and the society at large. The Committee also recommends that Corporate Social Responsibility (CSR) funds should also be used for advertisement and awareness campaigns. Further, there should be training and mock fire-drills in schools and colleges. There should also be a dedicated toll free telephone number for reporting incidents of forest fire in each state.

78. **The Committee is also of the view that people/tourists who come to the hilly areas from the plains, have little awareness about how to behave in the hills. The Committee, therefore, recommends that the State Governments should proactively work towards putting up public signages displaying the requisite messages in areas frequented by the tourists, to make them aware of the norms to be followed in forest areas.**

Availability of fire fighting equipments, kits and training to local people

79. The representative of Eco-park Development Committee, Dhanaulti requested that the concerned authorities should provide handy and efficient fire fighting equipments to the people to fight the fires in such situations. One of the representatives of the civil society brought that while trying to douse the initial fires on their own, they realized that they did not have the requisite equipments for the job. Further, they became extremely hungry and thirsty, with no source of drinking water. The representative of Himalaya Research Group, Shimla also stressed the need for updating the civil society with new technology and tools to fight forest fires that they could work hand in hand with the Government departments in such times.

80. **The Committee feels that apart from involvement of local communities in forest management and exposing them to devastations of forest fires, there is an urgent need to provide fire fighting equipments to the people. Further, all persons deployed to fight the fires should be provided some backpack kits which should contain water, packed food, fire-proof hand gloves and boots, breathing masks, first-aid kits etc. so that they could sustain themselves for longer periods while undertaking the job. Further, since fighting forest fire has its own intricacies, the local communities should be updated with new technology and trained on how to use these equipments so that they could work hand in hand with Government agencies in fighting forest fires, when required.**

Presence of Chir Pine Needles

81. The representative of the NGO SAVERA and Gandhi Global Family (GGF), Jammu stated that fires occurred because of the presence of the Chir pines which provide the fuel, which combined with the early onset of the warm season this year led to widespread fires. Gandhi Global Family (GGF), Jammu also opined that pine needles should be used in board making, briquette making etc.

82. The representatives of GB Pant Institute of Himalayan Environment & Development, Kullu also suggested the need to remove the pine needles frequently and use them in developing entrepreneurship by engaging local people. Dr. C.M. Seth, representing civil society also stressed upon the need for clearing the road sides of chir pine needles.

83. **Chir Pine needles, which are highly inflammable due to its high resin content, are a prominent factor in occurring and spreading of forest fires. The Committee is in agreement with the view expressed by representatives of some NGOs that the Chir pine needles should be removed and collected frequently. The Committee recommends that the State Governments should consider procuring sweeping machines to clear the roadsides of chir pine needles and dry leaves in vulnerable areas. Further, steps should be taken for incentivising the clearing and collection of pine needles. The Government should also try to involve school children, NCC, NGOs etc. in collection of pine needles. The local communities should also be encouraged by providing remunerative emoluments in the collection process. The Committee also recommends that broad leave trees should be planted in the forests and, after a period of five years, there should be systematic replacement of chir pine trees in the forests by broad leave trees as it has been seen that incidents of fires in latter forests are minimal as compared to chir pine forests.**

84. **The Committee is further of the view that there is high resin content in chir pine needles and there is a need to explore as to how it can be used for other purposes. The Committee recommends that the Ministry of Environment, Forest & Climate Change should take up with the concerned Ministries of Government of India to explore as to how**

best to extract resin from these needles and how, apart from burning fuel, it could be used for other purposes.

Use of MGNREGA funds

85. The representative of Eco-park Development Committee, Dhanaulti suggested that the funds under MGNREGA programme can be utilized for involving local communities in fighting the forest fire in the area. The representatives of Himalayan Research Group, Shimla was also of the view that since the Forest Department was facing acute shortage of manpower, services of people working under the MGNREGA could be utilised to douse the forest fires in times of need and they could be paid for that.

86. At Shimla, the Committee desired to know from the representatives of State Government as to whether the work relating to collection of pine needles can be undertaken under MGNREGA. In response, the Committee was informed that the State Government had requested the Rural Development Department to include pine needles collection as one of the activities under MGNREGA. However, since as per the guidelines of MGNREGA, only classified works can be taken up and the work relating to pine needles was not listed, they had made a reference in this regard to the Central Government.

87. The Committee is of the view that activities relating to collection of pine needles can not only provide employment to a large number of unskilled workers in the hilly states but also get rid of the chir pine needles which play a vital role in spreading of forest fires. The Committee, therefore, recommends that Ministry of Environment, Forest & Climate Change should take up the inclusion of work relating to collection of chir pine needles as one of the activities under MGNREGA with the concerned Union Ministry so that the State Governments can initiate further action in this regard without any hindrance.

Encroachment of Forest Land and Violation of forest conservation rules

88. The representative of Butterfly Research Centre, Bhimtal and Rajpur Community, Dehradun Initiative highlighted the problem of encroachment of forest land by the people as well as the violation of forest conservation rules and regulations by the builders in the forested areas of Dehradun. The representative of the NGO SAVERA stated that most incidents of fire were caused due to people who set fire for the purpose of encroaching on forest land or to induce growth of new grass for their livestock.

89. The Committee is dismayed to note the problems of encroachment of forest land by the people as well as the violation of forest conservation rules in Dehradun and Shimla. Some people purposefully cause fires to encroach on forest land, which sometimes spread to other areas as well. The Committee recommends that the matter needs to be administratively looked into by the concerned State Governments and ensure that there is no encroachment of forest land or violation of forest conservation rules. Municipal and town planning agencies in the States should take effective and practical steps to stop unplanned urbanization and encroachments of forest and open land. Local communities/villagers should be encouraged to report any such incidents to the concerned authorities immediately. The authorities should take prompt action in such cases. Forests are our national property and any attempt to encroach upon them and the consequent fire in forests, whether intentional or unintentional, should be strictly dealt with.

Creation of checkdams and ponds within the forests

90. Dr. C.M. Seth, representing civil society and the representative of the Gandhi Global Family (GGF), Jammu emphasized the need to reinvigorate the system of ponds and checkdams within the forests rather than planning for using helicopters for supply of water in case of fire. also emphasized on renovation and creation of ponds and water harvesting structures within the forest area and inclusion of provision of people's participation in this work.

91. The Committee feels that creation of ponds and water harvesting structures within the forest area not only reduces river bank erosion but can be a handy tool for supply of water for dousing forest fires. This would not only reduce dependence on helicopters for

supply of water but also readily provide water to the locals within the forest area for fire fighting. The Committee, therefore, recommends that Ministry of Environment, Forest & Climate Change should impress upon the State Governments the need to reinvigorate the system of ponds and checkdams within the forest areas, so that water is immediately available at hand for making efforts to douse the forest fires. This would also save crucial time which is wasted in bringing water from other far-off resources, and help try to douse the fire in its initial stages and check it from spreading further.

Use of traditional methods for forest management

92. The representatives of Umang Foundation, Shimla and some other NGOs stressed the need for strict implementation of the fire lines and drew attention to the fire incidents which occurred in forest areas where some space had been allotted by authorities for eco-tourism. The Committee was also informed by the representatives of some of the State Governments that they did not have adequate funds for clearing of the fire lines.

93. **Fire lines are areas which are cleaned of vegetation for stopping or slowing down a fire in forest areas. The creation of fire lines is critical in wildland fire fighting, because without fire lines, a fire can quickly get out of control. The Committee is of the view that such traditional methods of containing forest fires have stood the test of time and should not be dispensed with. While use of modern technologies for fire alerts etc. is definitely a welcome step, under the present circumstances, over-dependence on technology at the cost of traditional methods should not be encouraged. The Committee, therefore, recommends that Ministry of Environment, Forest & Climate Change should emphasise upon the State Governments that the traditional forest operations for scientific management of forests including forest floor clearing, controlled burning and creation of water harvesting structures should be reviewed and utilised effectively. The Committee notes that the traditional fire lines are not being cleared due to lack of funds at the disposal of the State Governments. The Committee, therefore, also recommends that adequate budgetary allocations should be made by the Ministry of Environment, Forest and Climate Change for the purpose and State Governments should ensure that fire lines, which play a crucial role in preventing spread of fires, are cleared regularly. The Committee also recommends that seasonal training, if required, should be provided to the local people including panchayats and zila parishads for clearing of fire lines, before the onset of forest fire season.**

Use of Technology in preventing forest fires

94. Dr. C.M. Seth of Jammu laid stress on prevention of fires rather than combating fires later. He suggested the use of remote sensing and GIS technology in identifying vulnerable areas and mapping forest fire hotspots. The representative of NGO, Savera, Jammu and Himalayan Research Group, Shimla also emphasized the need for modern technologies to control the forest fires.

95. In the meetings held with the State Governments, the Committee was also informed that fire watchers and forest workers are deployed by the State Governments during the fire season i.e. from 15th April to 15th June to till the onset of monsoons every year exclusively for the purpose of forest fire management. The matter relating to installation of CCTVs in forest areas for forest surveillance was also discussed during these meetings. A view was expressed that installation of CCTVs will be of limited use since they cannot be installed in the interior dense forests.

96. **The Committee recommends that instead of fire watchers, forest workers and CCTVs, the use of Drones should be encouraged for forest surveillance and monitoring. These drones should be deployed systematically in a day three to four times, or as felt necessary. This would enable the authorities receive much faster information since the drones will be able to go into the interior of the forest areas and send updates of the happenings inside the forests. The State Governments can equip the fire watchers with new technologies so that they can detect any suspicious or untoward incidents and report them**

to the concerned authorities immediately. This would not only ease the pressure on fire watchers who are pitifully paid and have to sit observing the forests in all climatic conditions but also provide more authentic and accurate data to the Government. It would also enable the State Governments to evolve a quick response system.

Impact of forest fire on biodiversity and assessment of Biodiversity loss

97. The representative of Butterfly Research Centre, Bhimtal emphasized upon the monitoring of entomo-fauna in the forest areas to understand the impact of forest fire. He further stated that instead of plantation, efforts should be made to enhance the regenerative potential of native species. He also suggested need for studies on biodiversity assessment of insects, butterflies and other indicator species to assess the impacts of forest fire. The representative of Titli Trust Dehradun also stated that the impact of forest fire on biodiversity is grossly underestimated and the loss of wildlife was not even being accounted for. He stressed the need for a systematic study of impact of fire on biodiversity in the state and enhancing efforts with respect to regeneration of local species in forested areas of the state.

98. The Committee desired to know from Ministry of Environment, Forests & Climate Change as to whether the Ministry quantified any loss due to recent forest fires? The Committee also enquired as to whether any study has been undertaken to know losses of wildlife? In response, the Committee was provided the following details of forest fires including the estimated losses in the States of Himachal Pradesh and Uttarakhand:

Year	Himachal Pradesh			Uttarakhand		
	No. of Forest Fires	Total area affected (In ha.)	Total loss estimated (In Rs.)	No. of Forest Fires	Total areas affected (In ha.)	Total loss estimated (In Rs.)
2013-14	397	3237.52	52,31,011	245	384.05	4,39,387
2014-15	725	6726.49	1,13,26,522	515	930.33	23,57,707
2015-16	672	5749.95	1,34,77,730	412	701.61	7,94,356
2016-17	1545	13069.00	1,53,58,143	2074	4433.75	46,50,225

99. **The Committee is shocked to note the gross underestimation of losses due to forest fires. The Government estimation in Himachal Pradesh comes to Rs. 470 per acre and in Uttarakhand it is Rs. 400 per acre. The Committee is at loss to understand who will be the actual beneficiary of this gross underestimation. The Committee, therefore, recommends that an independent agency having impeccable credibility must be roped in by the Ministry to estimate the losses in real terms and properly and earmark budget for compensation.**

100. As regards the studies on wildlife loss due to fires, the Committee was informed that the State Forest Departments are undertaking assessment of wildlife and habitat loss as part of the forest fire loss assessment.

101. The Committee also desired to know whether any inventory on forest was being prepared and nursery being created, which can conserve those species of plants? The Committee was informed by Ministry of Environment Forests & Climate Change that the working plans prepared by the State Governments involve the inventorying of the forest areas including the forest fire affected areas. In order to rehabilitate the degraded forest areas due to fires, the State Forest Departments are having central and decentralized nurseries for raising the various native local forest trees and shrub species. Further the State Forest Departments are doing necessary ex-situ and in-situ conservation measures for conservation of rare, endangered and threatened species also.

102. In response to a query as to what happens to the wildlife movement when forest fires take place, the Committee was informed that burning of forest floors and vegetation in the understory degrade the habitat of Wild animals. Many herbivore and birds species lose their homes. Change in behavior of wild animals lead to enhanced incidences of "Man-animal" conflict in such forests

and damage to crops by wild animals. State Forest Departments take timely action to sensitize local population for ensuring safe passage of wildlife to non forest fire affected areas. State Departments are also ensuring creation of water holes and water bodies inside to minimize damage due to fires. The fire prevention activities also ensure minimized damage to wildlife and its habitat.

103. The Committee also desired to know from the Zoological Survey of India (ZSI) and Botanical Survey of India (BSI) whether they have conducted any post forest fire assessment of loss of flora and fauna and whether there was any plan of these organisations to prevent any loss of biodiversity in the event of forest fires. Both the organisations informed the Committee that they had not conducted any assessment of loss of flora of the areas where recent forest fires had occurred. ZSI also informed that the plans to prevent the loss of biodiversity in the event of forest fire are undertaken by State Forest Department. However, ZSI may undertake the monitoring studies on the fauna of the forest areas affected/damaged by forest fire, and evaluate the extent/intensity of damage on biodiversity in the affected/damaged forest areas. BSI stated that they may take up assessment study in areas where forest fire occurred, if the Ministry of Environment, Forests & Climate Change desires.

104. The Committee also desired to know from Ministry of Environment, Forest and Climate Change the role of National Biodiversity Authority in case of loss of biodiversity due to forest fires and measures taken for resurrection. In response, the Committee was informed by the Ministry of Environment, Forest and Climate Change that National Biodiversity Authority (NBA) is an autonomous, regulatory, statutory and advisory body established for the implementation of the provisions of the Biological Diversity Act, 2002, which regulates access to biological resources and associated knowledge and sharing of benefits arising out of the use of biological resources. Besides, the Authority performs an advisory role on the matters related to conservation, sustainable use, access to biological resources and benefit sharing. Hence, the subject matter does not directly pertain to the NBA. However, NBA can take up studies in future on the effect of natural calamities/disasters including forest fires, and remedial/preventive measures thereof on a need basis.

105. The Committee is in agreement with the views expressed by the representatives of Civil Society that the impact of forest fire on biodiversity is grossly underestimated and the loss of wildlife was not even by accounted for. The Committee is at loss to understand as to why the Zoological Survey of India and Botanical Survey of India, which are also the arms of the Ministry of Environment, Forest & Climate Change, did not take up any studies on loss of biodiversity of the forest fire affected areas. Even the Union Ministry of Environment, Forest & Climate Change did not take any initiative in this regard. Ministry of Environment, Forest and Climate Change has also stated that National Biodiversity Authority can take up studies in future on the effect of natural calamities/disasters including forest fires, and remedial/preventive measures thereof on a need basis. The Committee hopes that in future, the Ministry would take a more proactive approach in this regard and recommends that Ministry of Environment, Forest & Climate Change should ask its concerned organisations to undertake, on priority basis, assessment of loss of biodiversity due to forest fires and devise plans to prevent loss of bio-diversity in the event of forest fires so that corrective and preventive measures in this regard could be initiated at the earliest. The Committee further suggests that the Ministry should consider making National Biodiversity Authority the nodal agency for coordinating the efforts made by the different organizations in this regard.

106. The Committee is also aware of the availability of natural assets like medicinal and herbal plants in our forests. The Committee feels that there are adequate nurseries in hilly areas which are the banks of medicinal and herbal plants. The Committee is of the view that the Government can also consider incentivising the forest dwellers to grow medicinal plants in the plains. As such it would become a source of earning for local people.

Accordingly, in case of occurrence of incidents of fire, they would be worried about their source of income, as a result of which they will take care of the areas and work to ensure that there are no cases of forest fires.

Avoidance of occurrence of landslides in forest fire affected areas

107. The Committee is of the view that after forest fires, the earth around the affected areas and the roots of the trees become weak and loose. This also contributes to the landslides in the affected areas in the rainy seasons after the forest fires. The Committee, therefore, recommends that Ministry of Environment, Forest and Climate Change should impress upon the State Governments that after the forest fires have been brought under control, a quick response system should be put in action and immediate necessary steps should be taken for minimizing the occurrence of landslides in the affected areas. The Ministry of Environment, Forest and Climate Change should also issue suitable guidelines to the State Governments in this regard.

Budget Constraints

108. The representative of the Gandhi Global Family (GGF), Jammu also dwelt on the budget constraints faced by the State Forest Department and Joint Forest Management of local people and authorities for fighting and preventing forest fires. Representatives of other NGOs also stressed the need for adequate budgetary allocations for use of technology and equipment for fighting forest fires.

109. The Committee notes that almost all the State Governments have expressed resource crunch and inadequate budgetary allocations to effectively invest in protecting our forests from fires. The Committee observes that in the context of forest fires, the needs of Himalayan states are distinctly different from the other states. The whole country depends upon the services of the Himalayan region since they contribute much more to the forest cover of the country. Accordingly, the Committee recommends that the budget of all the states which are in Himalayan region should be demarcated separately from other states, with specific objectives in mind and the policies and programmes and it should not be clubbed with other states, without taking into account the specific demands of the Himalayan ecosystem. Further, there should be an accelerated system for the devolution of funds to these States to enable them to prioritize the requirements of prevention, mitigation and fighting the forest fires.

Removal of old and fallen tree from the forests

110. The Committee while visiting the states of Uttarakhand, Jammu & Kashmir and Himachal Pradesh noticed a lot of fallen chir and pine trees lying in the forests which actually enhances burning in case of a forest fire. The Committee wanted to know the reason behind non-clearance of the fallen trees. The Committee also pointed out that gregarious flowering of bamboo in other parts of the country causes a lot of concern with regard to fire protection and therefore removal of the dried flowered bamboo from the forest area was desirable to reduce the intensity of fire hazards during the summer season. In response it was informed that Hon'ble Supreme Court of India had put a blanket ban on the removal of any tree including the dead and fallen tree from the forests. On scrutiny it has been found out that the Hon'ble Supreme Court of India, in its interim order in Writ Petition no. 202 dated 12.12.96 has prohibited salvaging of dead and fallen trees from the protected forest areas i.e. National Parks and Wildlife Sanctuaries only for the conservation of biodiversities in that area. However, the Court has clearly permitted to remove or salvage the dead and fallen trees in any forest area in accordance with Working Plan as approved by the Central Government. The State Governments are obliged to make a proposal for removal of such trees and get it approved by the Central Government and then they are free to clear the forests. **The Committee strongly feels that in this background the ball is in the court of the Central Ministry of Environment, Forest and Climate Change to plan to remove dead and fallen tree even in the protected forest areas. The Committee recommends that in the light of Supreme Court order of 1996, the Central Government is bound to persuade the State**

Governments and approve their Working Plans for salvaging dead and fallen trees with a view to avoid induced forest fire in future.

General Observation

111. The Committee is of the view that forest fires have become an annual feature in the country and have a devastating effect on environment, forest, biodiversity and wildlife. The Committee feels that there is an urgent need to devise a policy with regard to prevention and mitigation of forest fires and recommends that Ministry of Environment, Forest and Climate Change should, at the earliest, come up with a national policy on the subject.
