



BHUTAN

Fire Situation in Bhutan

1. Description of the fire environment, fire regimes, ecological role of fire

Bhutan occupies about 38,394 square kilometres, and is located in the eastern Himalayan region. Bhutan’s forests cover 72.5 percent of the total area of the country; the long term goals of Bhutan is to maintain 60 percent of the land under forest for all time to come. However, wildfires are a consistent threat to this objective, forest fire issues have been extensively discussed in various sessions of the National Assembly since the 1960s. The rugged topographic conditions combined with high ground fuel loads and erratic wind conditions, and constrained by lack of trained manpower increases risk of fire incidents. In a span of 13 years from 1993-2005, 868 cases of wildfires have affected 128,368 ha of pristine forest area.

Forests play a vital role in sustaining rural livelihoods and food subsistence, both of which are major source of income for the people and the most important natural wealth of the country. Further, forests in Bhutan are vital for maintaining the sustainability of hydropower industry, which is at present the main source of national revenue and also maintains the geologically fragile mountain ecosystem. There is high national concern on forest protection, conservation and its management by reducing forest fires and improving methods of fire prevention and suppression.

Bhutan places high priority on forest fire prevention programs since most of the forest fires are anthropogenic in nature. The people have rights on harvesting lemon grass (*Cymbopogon flexuosus*) for lemon oil extraction and grazing rights within Government Reserved Forests. Therefore, there exists widespread practice of burning forested areas to promote new grass growth for oil and also as cattle feed. Fires result from such practices including burning of agriculture debris, the timing of which unfortunately coincides with the fire season. Evidence from incidence records show that one of the main causes of fires is escapes from agricultural debris burning. Setting forests on fire, accidentally or as an act of arson is against the law in Bhutan and hence carries severe penalties.

1.1. Summary tables of natural and human influenced fire regimes

Table 1. Extent of natural and human-influenced fire regimes in different ecosystem types in Bhutan.

Ecosystem Type	Name / Designation ¹	Total Area of Ecosystem in the Country	Ecosystem Sensitivity ²	Typical Fire Frequency (yrs) ³	Fire Origin / Cause
Wildfires (including wildfires burning within prescription)					
Forest					
Forest 1: Not intensively managed and protected.	Coniferous Broadleaved	1,061,621 ha 1,510,661 ha	FS Fire no risk	1 0	Human-caused
Forest 2: Intensively managed and / or protected (major ecological or economic assets at risk)	Chir pine (in the east) Plantation	- 6427 ha	FT	1	Human-caused
Prescribed Burning					
Forestry, Conservation					
Ecosystem Type: Chir pine forest (managed and protected) research trial	Chir pine	5.76 (ha)	FS-FT	2	Research Trial

¹ Designation of plant association / ecosystem

² Note: **FS** (fire sensitive ecosystem: fire has a detrimental effect on these ecosystems in terms of ecological and/or economic damage), **FT** (fire tolerant ecosystem: fires have a minor impact on these ecosystems in terms of ecological and/or economic aspects)

1.2 Narrative of influences on the fire regimes of the country

Damage assessment

Bhutan is recognized as one of the 10th global biodiversity hotspots. Our forest is home to about 7000 vascular plants, 165 mammals and 770 bird species, which include two critical and eight endangered faunal species (Forestry in Bhutan Facts and Figures, 2002). Uncontrolled forest fire directly impacts the environment; damages resources, damage wildlife habitat and population, and more importantly damage property and threaten lives. Further, environmental characteristics have a major influence on the distribution of wildlife species; thus, any changes in the composition or structure of the vegetation will definitely change in the animal population and may result in the extinction of the species. It also affects the physical and chemical characteristics of soil affecting the growth rate of the ground flora and soil organisms due to intense heat released by fires. The release and leaching of soil chemicals will result in loss of soil nutrient and can be one of the factors leading to the problem of soil erosion and land slide which is very common in eastern Bhutan.

The field staffs carry out assessment on fire burnt area. They are provided with designed format for reporting which includes:

- **Description of forest type, area burnt** (plantation and government reserved forest and others)
- **Causes** (natural or human)
- **Crop damage** (trees, poles, small poles, saplings etc.) according to size / diameter class.

This information is further used to determine future course of action and rehabilitation of burnt areas.

Human activities impacting fire-sensitive ecosystems

In Bhutan, the fire season usually coincides with the dry winter, which extends from November to May. Through our field report analysis and field observation there are various forest fire causes mainly human activities: burning agriculture debris, children playing with match sticks, cow herders, lemon grass harvesters, development activities such as road workers, electricity transmission lines short circuit. The above causes are most common human activities, which has impact on fire sensitive ecosystem. The impact of fires on ecosystem in Bhutan is generally perceived as negative as discussed earlier.

Fire causes

The occurrence of wildfires has always been a persistent threat to sustainable management of forests in Bhutan. Its severity and impacts have won the attention and concern of all the individuals from different walks of life and accordingly, strategies for effective fire prevention and suppression programmes have been intensified. Since 1990s with existing data it's been observed that the fire incidences are decreasing. This is due to innovation of modern facilities in the rural communities such as education, television, clearer radio facilities where the department can timely announce and advertise providing prevention program (awareness).



Figure 1. Blue Pine (*Pinus wallichiana*) forests are highly susceptible to fire.



Figure 2. Fire scars in old Blue Pine stands reveal a long history of fire – and the tolerance of mature trees in these pine stands to surface fires of low intensity.

Table 3. Causes of wildfires in Bhutan.

	Causes	Percent %
1	Intentional burning for new grass for cattle	60
2	Agriculture debris burning	
3	Lemon grass harvesters	
4	Smokers	20
5	Children playing with ignition source	
6	Road side workers	
7	Picnickers	
8	Camp fires	15
9	Accidental cases	
10	Unknown reasons	5

Fire season

Forest fires usually occurs when the vegetation is dry and ground fuels are abundant during the winter months, it also (fire season) differs based on geographical locations such as tropical, sub-tropical, temperate and climatic conditions like length of dry season and frequency of rainfall. In the eastern Bhutan the fire season is between January and June. In the West the fire season is between November and May.

2. Fire statistical database: Wildfire and prescribed burning statistics for the period of 1988-2004

Table 4. Wildfire database 1988-2004. Data of the two 5-yr periods 1988-92 and 1998-2002 are highlighted because these periods are of key interest for FRA-2005 (Source: Forest Fire Management Section, SFD, 2004).

Year	Total Number of Fires on Forest, Other Wooded Land, & Other Land	Area of Forest Burned (ha)
1988	46	NA
1989	66	NA
1990	50	NA
1991	38	NA
1992	38	NA
1993	84	72957.44
1994	36	5601.96
1995	56	49069.31
1996	62	27030.26
1997	48	24633.30
1998	72	16218.20
1999	112	33839.88
2000	104	33638.34
2001	81	23314.20
2002	64	14644.16
2003	45	5723.49
2004	39	2561.36

3. Narrative summary of major wildfire impacts on people, property, and natural resources between 1988 and 2004

According to forest fire record of the past (1988-2004), 1993 has the major damage on forest resources. It has been observed that there was no damage on property/infrastructure. However, the forest fire recorded in Trashigang District (eastern district) in 2006 was a major one, which burnt about 1000 ha of forests; similarly in 2006-2007 record of forest fire Wangdue district (one of the western district) has burnt about 15,000 ha by a single case. In the year 2007 major forest fire outbreak occurred along the Tsirang-Wangdue National Highway damaging 5000 ha of Chir pine (*Pinus roxburghii*) forest and other vegetation. It was reported that as a consequence of these fires the road was blocked due to landslides and falling stones.

4. Application of prescribed burning in the region to achieve management objectives (purposes, extent, results)

Prescribed burning trials were carried out in the year 2005 in the eastern Bhutan. The objectives of the study are to explore the effects of fire in Chir pine forest ecosystems with special reference to regeneration ecology of Chir pine, the fire induced yield of lemon grass and other competing ground vegetation, and economics benefits/drawbacks resulting from forest fires in connection with lemon grass harvesting for the local population.

5. Operational fire management system(s) and organization(s) present in the country or region

To prevent forest fire and support sustainable management of the country's forest, different level of organisation has their area of responsibility as follows:

Government agencies (national level) are involved in designing and implementing a nationally coordinated forest fire awareness programme and enhancing people's awareness about forest fire. Develop training modules and technical manuals to backstop the district (dzongkhag) forestry sectors. Further, liaising with the media in informing and educating the public about forest fire prevention; training the field staff and community in fire prevention and suppression. Currently the program is delegating forest fire management to grassroots level through formation of village level fire management groups.

At District level community education is addressing basics in forest fire prevention and suppression. The District is responsible for coordination of firefighting. Members of local communities, businesses, students, and private organisation actively participate in forest fire suppression.

Table 5. Responsibilities of different stakeholders in fire management at various levels in Bhutan. Acronyms used: FP - fire prevention, FS - fire suppression, Edu – education.

	Government Organisations / Agencies	Non-Government Organisations	Private Sector	Local Communities	Academia	Other
National	FP, FS, Edu	FS	FS	FS		
Provincial	FP, FS	FS	FS	FS		
Municipal	FS					
Local	FS					
Other						

Fire management organization

During fire incidents or in large fire situations the Department of Forests plays the lead role and arrange and coordinate the suppression activities. A large part of the manpower includes volunteers from the armed forces; Royal Bhutan Army, Royal Bhutan Police, Royal Body Guards and near by communities.

All fire incidences should be reported to Social Forestry Division (National level coordination office) of the Department of Forests, through District Forest Office or the Divisional Forest Office. In line with the decentralised forestry policy, the District Forest officers have the lead role in forest fire management at local level in close collaboration with local communities.

6. Sustainable land-use practices employed in the country aimed at reducing wildfire hazards and wildfire risks

The use of fire as an agriculture tool such as burning debris/slash and burn in the agriculture field adjacent to forest is a common practise every year. However, this practise has been a major cause of forest fire (unintentional escape). Establishment of Community Forest will help in reducing such cases of forest fire. Further, in Plantation forest the Department has budget provision for creating fire line or firebreak around the planted areas. More over, the Forest Fire Management Section under the Social Forestry Division is in the process for pilot scale institutionalization of village level forest fire management group aimed at forest fire prevention and suppression.

7. Fire management / suppression technologies, training standards and facilities

In Bhutan each district has a Divisional Forest Office and District Forest Office. They are responsible for forest fire monitoring (ground) during the fire season. In some communities fire watchers (Meesup) are appointed by the villages.

The Forest Fire Management Section under the Social Forestry Division procures and distributes the equipment, e.g. walkie-talkie handsets, knives spades, rakes and backpack pumps for fighting fire. However, most of the Bhutanese villagers/forester uses branches to put of the fire due to limited numbers of fire fighting equipment. Walkie-talkie handsets are procured and distributed to fire prone areas (only to forestry personnel).

National wildland fire management planning

Forest fire prevention has become challenging and important program in Bhutan. For smooth implementation of fire management plan in order to combat forest fire effectively the Forest fire protection and management were decentralized at the district level including as one of the decentralized forestry activities. Further, the Department has developed the by laws and proposal for institutionalization of village level forest fire management group to motivate and accommodate stakeholders interest and also to entrust role and responsibilities in managing forest fires. Despite such arrangement, the nature and fire frequency has not reduced with time. This is mainly due to limited budget to strengthen the human resources capacity to coordinate, disseminate forest fire awareness program and supply of fire fighting equipment at the field level.

Wildland fire management training

Until 2002 forest fire management has not received much attention because of lack of a coordinating office. With the establishment of Forest Fire Management Section with the Social Forestry Division, forest fire training has been imparted to District Forest Officers and lecturers at the College of Natural Resources (NRTI) (15 days) thereafter. A regular training curriculum for the Diploma programme (NRTI) has been established. Subsequently, a forest fire training manual on Basic Fire Fighting (BFF), Advance Fire Fighting (AFF) and Standard Operation Procedures (SOP) has been developed with the Technical Assistant from New South Wales; Rural Fire Service, Australia with financial support from Bhutan Trust Fund for Environmental Conservation (BTSEC). The manual is been used by various agencies to train the forestry staff and community. The Forest Fire Management under the Social Forestry has been training the field staff, District Forest Officers and representative from the communities every year for 10 days. Similarly, the Social Forestry Division and District Forest Officers are also training local communities in fire-prone areas every year before the on set of fire season.



Figure 3. Steep terrain conditions poses high risk to firefighters and volunteers without adequate safety equipment



Figure 4. Army and local volunteers fighting fire with brushes and home implements.

8. Public policies concerning fire

Forest fire management has been a national concern. It has been debated over the National Assembly and it has been incorporated in the Forest and Nature Conservation Rules of Bhutan. In case of fire occurrence, it is a sacred responsibility of every citizen of Bhutan to extinguish fires. Deliberate setting of fire in national forests is a punishable offence. However, if no culprit is apprehended, then nearby local community has to rehabilitate the burnt area.

9. Wildland Fire Research

The Social Forestry Division of the Department of Forests, Ministry of Agriculture, is conducting some pilot research projects in which the application of prescribed burn is tested, particularly research on effects of fire in Chir pine forest ecosystems with special reference to regeneration ecology of Chir pine and other competing ground vegetation like lemon grass and fodder grass in pasture areas. The fire research on fire effects on Chir pine forest with lemon grass in the Eastern District in two different areas has been taken up by the Social Forestry Division, Dzongkhag Forestry Sector and RNR-RC (Research Centre) Jakar and Wengkhar with financial support from the BTFEC.

10. Gaps and deficits to be addressed

The management of forest fire in the country has become an important and challenging program. In order to combat forest fires effectively and enhance smooth implementation of fire related activities or research, there is need to get exposure to current fire management techniques and fire science being used both at national and international levels. Therefore, enhancing human resources development by capacity building will be the biggest asset for effective forest fire management in long run in the country.

The funding availability and the capability and capacity to carry out research, planning and implementation of wildfire management programs and the appropriate fire suppression equipment are lacking. There is minimal fire line organization and acute shortage of fire fighting equipment, which exacerbates risk to safety of people on the fire line.

References

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IFFN Contribution by

Tandin Dorji
Forest Fire Management Section
Social Forestry Division
Department of Forests
Ministry of Agriculture
Thimphu
Bhutan

Tel: +975-2-323138 / 329268
Fax: +975-2-328394
e-mail: bap_tandy@moa.gov.bt