

Forest Fire Situation in Nepal

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Fire environment, fire regimes, and ecological role of fire

Nepal is a small country of 14.7 million hectares and 23 million people situated in the central Himalayas, covering the northern edge of the Indian Gangetic plain to the high Himalayan ridges bordering the Tibet region of China. The country has topographic variation from 150 meters above sea level at the southern border to the highest mountain in the world (Everest at 8 848 m) in the north. Due to the east-west orientation of the mountain ranges, the country has a tropical climate in the south and temperate and alpine climates in the north. Accordingly, **there are many different forest types in Nepal.**

The Terai-Bhabar Region

The southernmost physiographic region of Nepal, called the Terai-Bhabar region, has an average altitudinal range between 150 and 300 m above sea level. It has a tropical climate with the main forest type comprised of sal (*Shorea robusta*) with smaller proportions of moist evergreen forest, dry deciduous forest, and khair-sisoo (*Acacia catechu/Dalbergia sissoo*) forest. The total forest area in this region amounts to about 475,000 ha within a total regional area of 2.11 million ha. There are also some 111,000 ha of shrubland and grassland.

In this region, **the accumulated glabrous sal leaf litter is burned every year and during the process naturally regenerated sal seedlings and other herbs and shrubs are burned.** However, larger green trees are usually not damaged and neither are the root systems of the sal seedlings, although the aerial parts are burned. **Sal forests appear to be able to regenerate only when there are no surface fires.**

The Siwaliks Hills and the Inner Terai Region

The next northern physiographic region includes the Siwaliks Hills and the Dun valleys (also called the Inner Terai in Nepal) and has an altitudinal variation between 300 and 1000 m. It is characterized by a subtropical climate. The major forest types in this region include *Schima-Castanopsis* forests on the northern slopes of the Dun valley; the subtropical pine (*Pinus roxburghii*) forests on the Siwaliks ridges, dry scrubby forests on the southern slopes of the Siwaliks and moist *Lauracea* forests in the northern moist localities along with patches of sal forest. This region has

1,438,000 ha of forests and 104,000 ha of shrubland, grassland, and other non-cultivated woodlands within a total regional area of 1,886,000 ha.

Here, too, the vegetation along the southern drier slopes is burned during the dry season starting in March. Occasionally, bamboo brakes and grassy areas are destroyed, but the larger trees are usually spared. Nevertheless, the smoke created by forest fires and from agricultural burning make the valleys and the countryside very hazy and drab throughout the dry season.

The Middle Mountain Region

From 1000 m along the southern foothills of the Mahabharat Range (ridge tops up to 3000 m) to the hills of Nepal to an altitude of 2500 m is called the Middle Mountain Region. It has mostly lower temperate forests. These are mainly broadleaved forests with *Pinus roxburghii* up to 2000 m and *Pinus wallichiana* at the higher elevations. The river valleys in this region may be as low as 400 m. and sal forests (also called hill sal, a somewhat less luxuriant variety of *Shorea robusta*) and other subtropical broadleaf forests can occur here. The region has a total area of 4,442,000 ha with 1,811,000 ha of forests and 1,349,000 ha of shrubland, grassland and non-cultivated woodland.

Usually the pine forests and pine plantations, which are more susceptible to fire due to resin content, are frequently burned. As a result, the extensive chir pine (*Pinus roxburghii*) forests, which grow in the main habitat zone between 1000 to 2000 m, have become greatly fragmented.

The High Mountain Region

This region extends from 2000 to 3500 m above sea level, mostly with upper temperate forests of *Quercus semicarpifolia*, other broad-leaf forests composed mainly of *Rhododendron* spp., as well as coniferous forests of *Pinus wallichiana*, *Abies pindrow* and *Picea smithiana*. There is also a narrow belt of *Tsuga brunoniana*. This region has 1,630,000 hectares of forests together with 832,000 ha of shrubland, grassland and non-cultivated woodland within a total regional area of 2,960,000 ha.

In this region, coniferous forests are susceptible to extensive fire damage during the dry season, especially on windy days.

High Himal Region

This region mainly has alpine forests of birch (*Betula utilis*) as well as bushy rhododendrons and junipers. The total area of the region is 3,350,000 ha with only 155,000 ha of forests but with some 953,000 ha of shrubland and grassland. There is little cultivation here and a lot of snow- and rock-covered barren lands.

In all cases, the fire problems are acute for three to four months during the dry period between March and June every year. In most cases fires are caused by negligence. Sometimes grazers burn dry grassy areas purposely in order to get young shoots immediately after the first few pre-monsoon showers.

Narrative summary of major wildfire impacts on people, property, and natural resources during the 1990s

Every year wildfires destroy considerable forest resources in Nepal. Such destruction includes both timber and non-timber forest products. Although quantitative information is not available, forest fires are definitely degrading biological diversity in Nepal's forests. In addition, fires cause soil erosion and induce floods and landslides due to the destruction of the natural vegetation. Occasionally, embers from forest fires also cause fires in nearby villages, especially in the Terai region where the roofs are made of thatched grass. Many villages are burned every year with loss of lives, cattle and other property.

At least one hundred villages are burned annually in Nepal, some of which are definitely destroyed by forest fires.

Fire management organisation used in Nepal

There is no organisation for fighting forest fires in Nepal. The Department of Forests does not possess any special unit or team to deal with the problem of forest fire, including firefighting or management. None of the 75 district forest offices, with a number of graduate foresters and forestry technicians, has either the capacity or capability for preventing or fighting forest fires. It is probable that these offices under-report forest fire incidences and subsequent damage. Unless forest fire surveillance and monitoring are carried out by satellite imagery it will be difficult to make a good assessment of forest fire numbers, area burned and damage.

In Nepal some 10,000 local forest user groups have been formed with a total of 600,000 ha handed over to them as local community forests. Most of these community forests are located in the Middle Mountain Region where forests are severely fragmented and surrounded by villages. Here the community forest users are able to

protect their respective forests from **cutting and grazing**. However, occasional forest fires occur due to the negligence of smoking travellers. The forest users are able to fight forest fires although they do not have proper tools and technical support. In fact, community forests are not managed properly, nor are forest fires fought in an appropriate manner.

Wildfire database

A wildfire database or other wildland fire statistics are not available. However, the magnitude of the forest area annually affected by fire is known. Sharma (1996) observed that in **1995 about 90 percent of the Terai forests were burned**. Earlier observations by Goldammer (1993) confirmed this statement. Accordingly, the forest area burned annually must be in the order of more than 400,000 ha.

Use of prescribed fire to achieve resource management objectives

Prescribed fire is **not used in Nepal** to prevent forest fires. However, pine needles are collected for cattle bedding. Similarly, forest litter in the hills is collected and mixed with cattle dung for composting.

Public policies affecting wildfire impacts

Although the government devotes considerable attention in parliamentary discussions and the politicians and bureaucrats highlight the importance of forest fire prevention and firefighting, fire events are soon forgotten after the monsoon starts in June. During the fire season, Nepal Radio and Nepal Television broadcast old clips on forest fire prevention and firefighting.

Sustainable land use practices used in Nepal to reduce wildfire hazards and wildfire risks

In the past, district forest offices **hired temporary fire guards**, even though they were not effective in forest fire prevention. Of course, these temporary staff, as well as the permanent forestry staff, cannot achieve much in terms of forest fire prevention and firefighting without appropriate tools and organization.

Community involvement in fire management activities

Community involvement in fighting forest fires exists only in the community forests that have been established. Community involvement does not exist in the state forests and national parks, which constitute 90 percent of the Nepalese forests and related wild lands.

Conclusions

Forest fires occur annually in all the major physiographic/climatic regions of Nepal, including the Terai and Bhabar, the Siwaliks or the inner Terai, the Middle Mountains, and the High Mountains regions.

The main causes of forest fires are anthropogenic due to negligence and occasionally by deliberate burning to induce succulent grass growth for domestic animals.

Forest fires occur during the dry season from February to June and the nature (surface fire, crown fire, etc) as well as the severity varies greatly depending upon fire weather, fuel conditions, and physiography. Once the monsoon is established, usually by the middle of June, the fire problem disappears.

Forest fires destroy timber and non-timber forest products, although no data are available about the number of fires, severity and the amount of loss. Fires also reduce the biological diversity of the forests to a great extent. In addition, fires degrade the soil, inducing flood and landslide damage. Forest fires make the entire countryside hazy, thereby reducing aesthetic values for eco-tourism during the dry season.

Forest fire management is not practiced in Nepal. The community forest user groups control forest fires in their own forests, although they do not have a plan for systematic prevention and control of fires.

Systematic arrangements for prevention, control, and management of forest fires can be instituted in Nepal only when scientific forest management is implemented within the Department of Forests for state and community forests.

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Forest Fire in Nepal

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Introduction:

Forest fire is considered as a problem in forest management systems. In mixed forest of sal in Terai (flat area in southernmost east to west belt of Nepal), the fire season starts from mid-March and the fires burn the forests 1-3 times till the end of May. All fires are surface fires.

In clause (b), Section 49 of Forest Act 1993, "starting a fire, or doing anything that may cause a fire accident" in National forest is prohibited. In Clause 1.(b), Section 50 of the Act, any person who commits such an offence shall be punished with a fine of not more than NRs. 10,000, or with imprisonment for a term not exceeding one year, or with both. This is the only one legal provision for fire control but it is still ineffective because it is extremely difficult to identify the offender.

From general observations in the Rautahat district (Terai) in 1995, it was found that about 90 percent of the forested area in the plain was burnt out. This condition is more or less similar in all Terai districts.

Broadleaved stands and mixed stands comprise mostly deciduous forests. Normally, they appear in drier areas such as in Terai, Siwaliks, on mountainous slopes where soils are relatively dry with distinct dry season.

During the dry season (March to May) most tree species in Terai totally shed their leaves. The great amount of dry leaves and small twigs which accumulate on the forest floor accompanied by grass and under-growth species which turn dry during the time serve as fuel for the outbreak of forest fires.

Forest fire problems / constraints:

There is no single fire control plan in Nepal yet. There is no proper accounting of fire. In the annual programme of District Forest Offices (Terai) they have some fire control programmes which are insufficient and some which are ineffective. Every year in the dry season (March - May) fires invade the forests and burn uncontrolled. They are due to:

- lack of resources;
- lack of extension education for the local people;
- lack of specific fire control rules and regulations; and

- lack of specific fire control organization.

Causes of forest fires:

There are no statistics on fire in Nepal yet. By the experience of key persons, an attempts is made to give the general picture of the quantity of fires by individual causes in Figure 1.

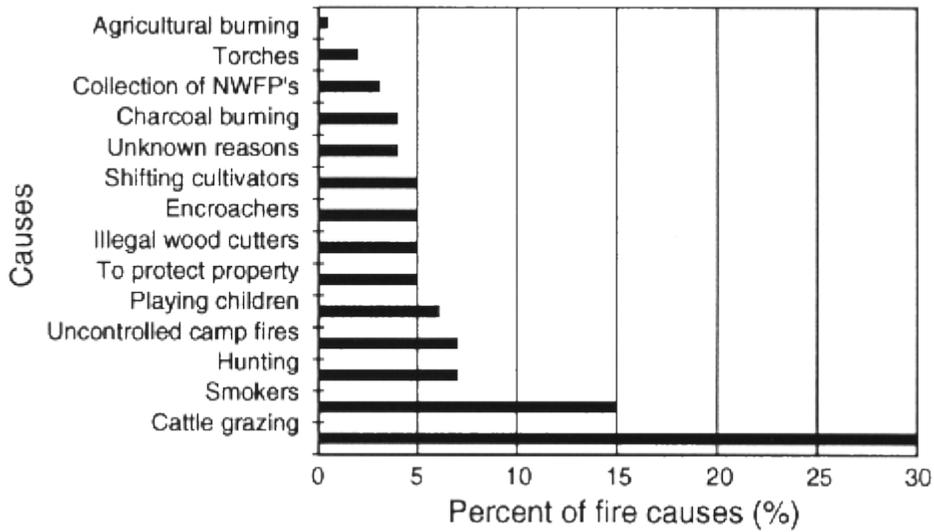


Fig.1. Distribution of causes of wildfires in Nepal.

Explanation of some categories:

- Cattle grazing: burning for stimulation of new grass
- Illegal wood cutters: burning of stumps to hide evidence
- NWFPs: collecting non-wood (minor) forest products, e.g. honey, trophies, etc.
- Torches: burning of wood or rubber, for travelling by night
- Agricultural burnings: escaped fires

Cattle grazing for new grass and smokers alone share about 45 percent of fires among all known causes of forest fires. Natural causes (e.g. thunderstorms) of fire are not reported. About 64 percent of fires are set by people intentionally, about 32 percent of fires are due to accidental/carelessness, and about 4 percent by unknown causes.

Economic Impact of Forest Fires:

When fire burns it has a number of effects which are negative to the economy which will eventually affect the people and the nation as a whole, as described in the following lines: It kills the regeneration. It destroys non-wood forest products (NWFPs). Sometimes it reaches villages causing huge losses in properties and life. Some District Forest Offices (DFOs) of Nepal issue licenses for hunting like DFO, Rautahat. When the forest is burned, the number and kinds of wildlife will be reduced.

There are plenty of fallen and standing dry trees in the forest. At present, this is the main source of royalty from the forestry sector. The fire burns this national property. Sometimes it burns wooden bridges in the forest. It destroys the natural beauty of the forest. It accelerate the consequences of soil erosion.

Ecological Impacts of Forest Fires: Fires disturb ecological cycle and adversely affect the bio-diversity in the particular ecosystem by the following impacts:

- **Soil nutrients:** Some nutrients are volatile and burnt off by a fire and these either evaporate or are leached.
- **Soil texture:** Rises and falls of temperature may change soil texture. It affects the water holding capacity of the soil. Rises of soil temperature may kill the soil micro-organisms.
- **Repeated fire** may change species composition creating fire hardy species.
- Fire kills undergrowth and sometimes pole size trees also. It creates a gap in age gradation the in younger age group.
- Fire may trap small wild animals and kill them. It may lead wild animals to escape from the site in question. In addition, it kills infants, destroys eggs resulting in a narrower base in the population structure and may lead some species to extinction.
- Fire burns and kills most of the microflora and microfauna within the top soil layer which have a function of nutrient recycling. Hence, the nutrient cycle is jeopardised.
- Fire burns most of litters on the forest floor. It reduces organic matter leaving ashes in the soil.

Fires in the forest and other vegetation of the tropics and subtropics and the changing tropical land-use have an increasing regional and global impact on the environment. The smoke plumes from tropical biomass fires carry vast amounts of atmospheric pollutants, including CO, NO_x, N₂O, CH₄, non-methane hydrocarbons, and aerosols. Smog-like photochemistry produces ozone concentrations comparable to those found in the industrialised regions.

Findings From a Study

This study was conducted in Manahari in Makwanpur district (inner Terai). The area is situated at an altitude of 300 m a.s.l. The method used was experimental burning in small areas and observations were made in uncontrolled burning areas as well during March - April. Three samples of fuel were randomly collected from the burning area, and the green weight was measured immediately and the samples were sent to laboratory for calculating the oven dry weight. Discussions were held with forestry professionals and rural people to compile their knowledge and experience.

Fires set by cattle grazers for stimulating new grass growth and careless smokers alone account for about 45 percent of all known causes of forest fires. Natural causes (e.g. thunderstorms) of fires are not reported. About 64 percent of fires are caused by people intentionally, about 32 percent by accidentally/carelessness, and about 4 percent by unknown causes. Preventive measures could be the solution for a fire control programme.

The fuels are mostly continuous, and one to four layers of leaves of sal (*Shorea robusta*) and other species comprise about 95 percent of the volume, of which sal leaves account for about 90 percent. Other surface fuels are twigs and grasses. The volume of the available fuel was found to be 10.7 tonnes oven dry weight per hectare (air dry weight of 11.7 t/ha). The moisture content of the fuels at the time of analysis was found to be 10 percent. The fuel type (i.e. forest cover type) is mixed forest comprising 70 percent sal, 10 percent asna (*Terminelia alata*), and 20 percent other species. The fuel type pattern is more or less homogeneous with some natural (streams, small rivers, etc.) and cultural (roads, foot trails, etc.) barriers. The rate of spread of the fire in experimental burnings in Manahari forest area (Terai) in the given conditions was found to be about 0.25 m/min and the form was found to be elliptic. The flame height was found to be about 25 cm.

Recommendations

It is recommended that the Department of Forests of Nepal should immediately prepare a district level Forest Fire Management Plan (FFMP). More than 90 percent of

the activities should be based on fire prevention activities and the rest on fire suppression activities, research and accounting of fire.

Within the Forest Department a functional organization should be established. The organization be responsible for fire prevention, human resource development, law enforcement, and fire research. Collection of fire statistics should include:

- number of fires and area burned (yearly)
- number of fires by each cause
- area burned by each cause
- fire distribution by forest vegetation zones
- size distribution of forest fires
- duration of forest fires
- monthly distribution of forest fire incidents throughout the year

Because of the limited resources and poor communication infrastructures, prevention activities, which are the most economic way of reducing fire damages and losses, could be the most important function of fire control services for Nepal. The most important elements of fire prevention would be:

- Primary school education
- Extension programmes - general public education;
- Workshops among political leaders and members of administrations;
- Enforcement of laws, regulations, rules, and restriction for fires and their communication through sign boards and warning notice boards;
- Fuel management - fire line construction and control burning along the firelines and forest tracts and roads; and
- Clear demarcation of forests.

Conclusions

This study is entirely focused on the Terai situation. In Terai the main species is sal mixed with asna and other species. The fire season begins in mid-March, and the fires burn the forests 1-3 times till the end of May. All fires are surface fires.

The Department of Forest of Nepal is the responsible governmental organization for fire control. However, due to the lack of resources, lack of specific fire control rules and regulations, lack of extension education for the local people, and lack of a specific fire control organization within the frame of the Department, it is not functioning well with regard to the fire control activities. Preventive measures could be the solution for the fire control programme. That is why local NGOs and other groups should be utilized for extension activities. Village Fire Control Group (VFCG) should be formed

and motivated by a responsible organization. Statistical information and research activities are almost nil in Nepal. Such data are most important for fire control planning.

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