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Fire Management Working Papers

Global Forest Resources Assessment 2005 – Report on fires in the South Asian Region

by
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The purpose of these papers is to provide early information on on-going activities and programmes, and to stimulate discussion.

Comments and feedback are welcome.

FOREWORD

Fires impact upon livelihoods, ecosystems and landscapes. Despite incomplete and inconsistent data, it is estimated that 350 million hectares burn each year; however, the nature of fires determines whether their social, cultural, environmental and economic impacts are negative or positive. Up to 90 percent of wildland fires are caused by human activities primarily through uncontrolled use of fire for clearing forest and woodland for agriculture, maintaining grasslands for livestock management, extraction of non-wood forest products, industrial development, resettlement, hunting and arson - thus any proactive fire management needs to adopt integrated, inter-sectoral, multi-stakeholder and holistic approaches. The situation varies markedly in different regions of the world.

As a supplement and complement to the Global Forest Resources Assessment, 2005, this working paper is one of a series of twelve prepared by regional and country contributing authors to provide a greater depth of data and information on fire incidence, impact, and management issues relating to the twelve UN-ISDR Regional Wildland Fire Networks around the world.

The working paper series assesses the fire situation in each wildland fire region, including the area extent, number and types of fires and their causes. The positive and negative social, economic and environmental impacts are outlined. Prediction, preparedness and prevention as key elements in reduction of the negative impacts of fire, rapid response to extinguish fire incidents and restoration following fires are addressed.

The working paper series also addresses institutional capacity and capability in wildland fire management, including the roles and responsibilities of different stakeholder groups for prevention and suppression, particularly the unique role of community-based fire management.

From these working papers, a FAO Forestry Paper on Fire Management will synthesize the highlights from each region, but also provide a global summary of important lessons that can be used in fire management in the future. These papers are a valuable resource in the process to prepare the Fire Management Code, the Global Strategy to Enhance International Cooperation in Implementing the Fire Management Code and associated capacity building.

ACKNOWLEDGEMENTS

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1.   Background

Following the release of the Global Forest Resources Assessment 2000 (FRA 2000) report in 2001, the global FRA process has now entered its next reporting cycle. FAO's Committee on Forestry (COFO) 2003 confirmed the directions of global FRA's that the Kotka IV Expert Consultation recommended in July 2002. Recommendations included the preparation of an update of the global FRA-data in year 2005 and to increasingly involve countries directly in the assessment and reporting, in particular to submit national reports on the status and trends of a range of forestry parameters. More information about FRA 2005 is available at www.fao.org/forestry/fra .

FRA 2005 also included thematic studies, including e.g. one on forest fire, forests and water, and mangroves. The thematic study on wildland and forest fire in 2005 is built on regional reviews on forest fire management in the UN International Strategy for Disaster Reduction's (UNISDR) Global Wildland Fire Networks (GWFN) The current report is a contribution and makes a review of the UNISDR South Asian Region.

This Working Paper FM/14/E has been written by A.M. Benndorf and J.G. Goldammer and does not reflect any official position of FAO.

2.   Introduction

This report covers the fire situation in South Asia and refers to Sri Lanka, India, Nepal and Bhutan. These countries belong to a group of countries which are preparing the formation of a Regional South Asia Wildland Fire Network under the umbrella of the UNISDR Global Wildland Fire Network. The delimitation of this network is determined by currently existing networks – the Regional Southeast Asian Wildland Fire Network (identical to the area covered by the ASEAN (Association of South-East Asian Nations) Regional Agreement on Transboundary Haze Pollution) and the Central Asia Wildland Fire Network (with China bordering in the North, and Pakistan in the West). [1]

This region expands from mountain forest of Himalayas in the north, to tropical evergreen forests in south India and Sri Lanka. South Asia differs very much in its geographical and climatic features, resulting in a high diversity of different ecosystems and forest types having diverse fire regimes and vulnerabilities.

In all countries fire is used by the rural population as a common tool to clear agricultural land. Furthermore, fire is used to facilitate non-timber forest products (NTFPs) gathering as well as hunting, and is applied by grazers to produce a new flush of grass in order to feed their cattle. Those kinds of fire use often have the potential to cause major damage. Uncontrolled fires are common in regions with a long and intense dry season.

In this report the information given on Nepal, Bhutan and Sri Lanka comes mainly from seven reports published in UN-ECE/FAO International Forest Fire News (IFFN):

- Forest Fire in Nepal (Sharma,1996),
- Fire Situation in Nepal (Bajracharya, 2002),
- Forest Fire in Terai, Nepal. Causes and community management interventions (Kunwar and Khaling, 2005),
- Nepal: Participatory Forest Fire Management: an Approach (Sharma, 2005),
- Seasonality of Forest Fires in Bhutan (Chhetri, 1994),
- Forest and Land Fire Prevention in Sri Lanka (Ariyadasa, 1999), and
- Forest Fire Situation in Sri Lanka (Ariyadasa, 2002).

In the review process, recent wildland fire reports from the Himalaya region were evaluated.

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[1] See regional reviews published in FAO Forest Fire Management Working Papers 10 (Southeast Asia) and 15 (Central Asia). Note: For technical reasons Pakistan has been included in the Central Asia report. A future Regional South Asia Wildland Fire Network may include Pakistan as a member.

The sources regarding the fire situation in India are a little more diverse and higher in number:

- Controlling forest fire incidences by generating awareness. A case study from Nilgiri Biosphere Reserve, Coimbatore, India (Srivastava, 1999a).
- Forest fire and its prevention by generating environmental awareness in the rural masses (Srivastava, 1999b).
- Forest fire prevention and control strategies in India (Bahuguna, 1999).
- Forest fire causing poor stocking of *Santalum album* and *Terminalia chebula* in Southern India (Srivastava, 2000).
- Forest fire and biotic interferences - A great threat to Nilgiri Biosphere (Srivastava, 2002).
- Fire situation in India (Bahuguna and Singh, 2002).
- Forest fire, haze pollution and climate change (Srivastava and Singh, 2003).

3. Fire Situation in the Region

3.1 Extent number and types of fire/forests burned

The latest and only compatible data on forest fires in the region is provided by FRA 2005 country profiles (Data National Reporting Table T8). In 1990 the average area in South Asia affected annually by fire was 1.43 million ha, excluding the Kingdom of Bhutan since no data has been reported before 1992. In 2000 the annual approximate area was 4.11 million ha, of which 90% was in India. However, no information is available on fires on other wooded lands.

Bhutan's fire statistics show that, for the period 1981-85, an average number of 58 fires occurred annually, damaging an average area of 7.38 ha.

Sri Lanka's reported number of fires ranges from 50 to 200 per year, as shown in Table 1. Fires occur up to 55% in pine forest and up to 20% in eucalypt plantations and the average surface burned is 10 ha. The most vulnerable are young plantations (maximum 5 years old), in which 60% of the fires occur.

Fires are usually suppressed within 3 to 10 hours and only a few last longer than a day. Most of the fires are surface fires while crown fires are rare.

Table 1. Forest fires in Sri Lanka reported during 1990-1999.

Year	Total No. of Forest Fires, Other Wooded Land & Other Land No.	Total Area Burned on Forest, Other Wooded Land, & Other Land ha
1990	114	549
1991	100	186
1992	234	259
1993	58	174
1994	60	191
1995	126	372
1996	136	271
1997	205	610
1998	114	204
1999	47	417
Average	119.4	323.3

Source: Ariyadasa (2002)

In a country-wide study in 1995, Forest Survey of India estimated that about 1.45 million ha of forest are affected by fire annually. According to an assessment of the Forest Protection Division of the Ministry of Environment and Forests, Government of India, 3.73 million ha of forests are affected by

fires annually in India (Bahuguna and Singh, 2002). According to a study of Srivastava (1999b), 17 852 wildfires were registered in India between 1980 and 1985, affecting an area of 5.7 million ha.

Moist deciduous forest is the most vulnerable forest ecosystem to fire in India. Nearly 15% are frequently disturbed by fires and even 60% are occasionally affected by it, 9% of fires occur frequently in wet/semi- evergreen forests and 40% of the fires burn occasionally. In the whole North-eastern Region of India, frequent forest fires occur even up to 50% of the surface.

Table 2: Susceptibility and vulnerability of Indian forests to wildfire.

	Type of Forests	Fire frequent (%)	Fire Occasional (%)
1	Coniferous	8	40
2	Moist Deciduous	15	60
3	Dry Deciduous	5	35
4	Wet/Semi-Evergreen	9	40
5	Northeastern Region	50	45

Source: Bahuguna and Singh (2002)

Furthermore, the coniferous forests in the Himalayan region, notably *Pinus roxburghii* stands, are very fire prone. Many wildfires occur during the winter drought. The 2005-2006 winter is a typical example: numerous fires burned in high-altitude forests and shrublands of Bhutan, Nepal and Sikkim (India). In neighbouring Tibet a major wildfire burned for almost two weeks at the foot of Mount Qomolangma (Mt. Everest) and destroyed valuable bushland in Tibet's Tingri county. [2]

3.2 Reasons

Reasons for forest fires in the region are for over 90% related to human interactions. Fires are set deliberately and are connected with socio-economic conditions of the rural population. There are only very few cases known where fires started due to a natural cause such as lightning.

The main reasons why fires are set are due to:

- Grazers, to invoke a new flush of grass for the cattle,
- Agricultural activities, shifting cultivation,
- Facilitation of hunting and NTFP gathering.

Furthermore, nearly half of the fires are provoked because of people carelessness, by throwing cigarette butts away and by workers burning debris.

Bhutan

Bhutan's climate conditions during winter (freezing temperatures, lack of rainfall, and high wind velocities) very much favour ignition of fires. Also, the end of the dry winter season is used to prepare the fields with burnings and it is very common that these fires escape and cause damage.

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[2] For 2005-2006 winter fires, see GFMC situation reports in the list of references

Table 3: Causes of fire starts in Bhutan.

| Fire Cause	%
Debris burning (i.e. escaping from field)	40
Cattle grazing (burning for new grass)	30
Uncontrolled camp fire, cooking fire, warming fire and road maintenance	25
Smokers	5

Source: Chhetri (1994)

Nepal

Extracts of a comprehensive analysis of causes of forest fires in Nepal, by Kunwar and Khaling (2005), are provided below. The reasons for burning are quite similar in the neighbouring countries, notably India.

Intentionally set forest fires
Analysis revealed that 58.06% of the total causes of forest fires were deliberate (Figure 1), followed by negligence (22%) and accidental (20%). With growing human populations having moved into forest-urban interface areas, the increasing number of fires was human-induced, inadvertently caused, for example, by discarded cigarette butts of illegal loggers, passers-by, cattle herders and grazers, non-timber forest products (NTFPs) and fuelwood collectors. Forest fires were started deliberately by livestock owners, shepherds, grazers who ignite forest to promote new green flushes of growth for their animals which was a key threat in the Terai. All these causes are linked with agriculture.

Figure 1. Forest fires in Nepal by causes.
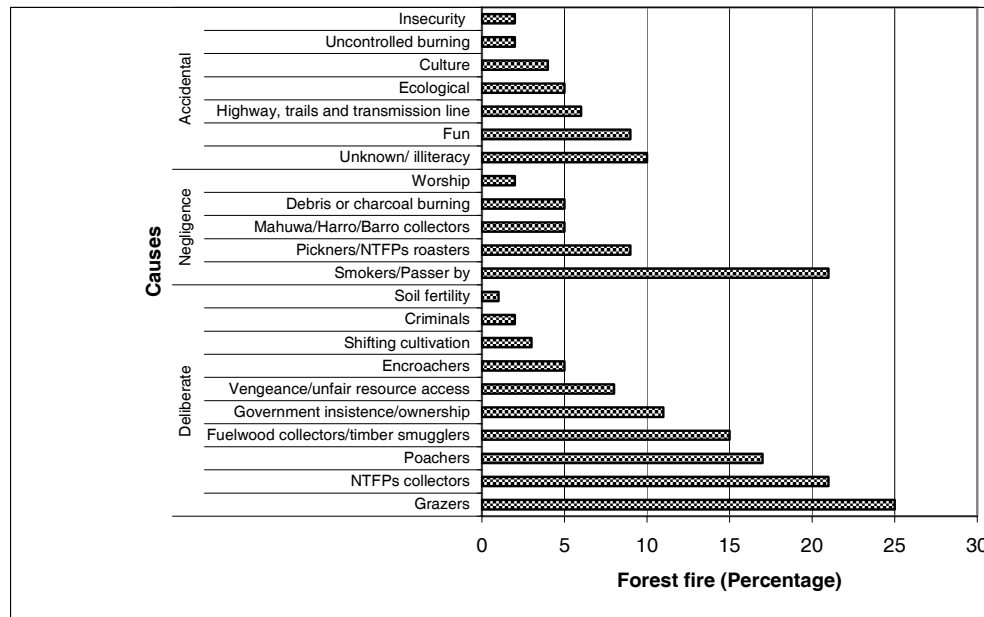
Source: Kunwar and Khaling (2005)

Some forest fires are set by hunters and poachers to clear vegetation for a better sight of prey, namely wild pig (*Sus scrofa*), hare (*Lepus nigricalis*), deer (*Axis axis*), wild fox (*Cuon alpinus*), etc. Fire is also set for the growth of tender shoots which entices the wildlife. It has been used to drive wild animals, to reduce the risks from snakes, mosquitoes and insects, to clear footpaths and to

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control pests. Other reasons behind deliberate burning are the removal of plant species in competition with desired timber species and control of soil-dwelling pathogens and weeds.

Many time people set fire for NTFPs collection which contribute to rural people's livelihood, such as bidipatta (*Diospyros melanoxylon*), mushrooms, mahuwa (*Madhuca indica*), etc. Collectors of bidipatta set fire in summer to promote a better flush of leaves. Fire is also set by ethnic groups to collect phutki mushroom (*Schleroderma* sp.), vegetables, bankas (*Eulaliopsis binata*), khajuri (*Phoenix humilis*), etc. People ignite fire for encouraging a lush growth of grasses, facilitating the collection of mahuwa flowers, clearing land for cultivation, smoking out beehives, cooking and keeping warm.

Shifting cultivation, locally known as *Khoria*, has been and continues to be a way of life for many ethnic groups both in hilly areas and in northern Terai of Nepal since the time immemorial. Particularly, it is common in Chitwan, Dhading, Makwanpur, and hilly areas of Palpa district. Since the period for slash and burn generally coincides with the dry and windy months of the year, incidences of fire spreading beyond the boundaries of designated plots into the adjoining forests are not uncommon. It is the leading cause of forest destruction and firing in the northern parts of India (Saigal, 1990).

Farmers also use fire to eliminate crop residues, and to convert the forest into agricultural land. Fire removes the organic matter and provides an ash bed, which facilitates the growth of grasses. Therefore, local people set fires to gather ash, which is locally used as manure. They also set fires for hunting and masking illegal logging.

Forest fires due to negligence
Collectors of mahuwa (*Madhuca indica*) flowers, sal (*Shorea robusta*) flowers, harro (*Terminalia chebula*), barro (*Terminalia bellirica*), tata (seed of *Bauhinia vahlii*), etc., burn dry leaves under the trees to get a clean patch of floor to facilitate desired NTFPs collection. While the intention is only to clear the small underneath patch of single trees, an uncontrolled fire can escape. Since the collection of NTFPs is done during March-May, the hot and dry season aggravates the situation further.

Traditional communities use fire as a tool for burning organic matter and agricultural residue to prepare the ground for next crop cultivation. Such fire can spread from agricultural lands to the forest, from the forest to agricultural lands, or from the forest or agricultural lands to villages, and *vice versa*. Abandoned cooking fire in the forest and burning garbage have also been reported by local people and concession staffs to have set forest fire. Annual roadside clearing and debris burning (usually from March to June) can also cause forest fire.

Accidental forest fires
Some forest fires of the Terai are also associated with fixed installations (highways, transmission lines, trails) and some are directly related to human activity. Security problems and burning for fun also contributed to the forest fire. Least income and unemployment, which is as high as 80-90% in the Terai (Shrestha *et al.*, 2003) compel people to resort logging, fuelwood collection, hunting and most importantly the collection of NTFPs. All these activities increase the number of deliberate and accidental forest fires.

The intensity of uncontrolled fires increases substantially with the invasion of fire-prone aliens. Uncontrolled, these aggressive plants tend to reproduce rapidly (Kunwar, 2003), pile up the fuel for fire outbreak and become impenetrable to firefighters, multiplying the risk of danger. Neighbourhood and tribal communities visit the temples situated in forests to offer prayer and sometimes they do not put out the fire properly after cooking, which then spreads when the wind blows.

India

India gives an example of a case study area (Nilgiri Biosphere Reserve in Coimbatore) where successful fire management had been practised for a long period, but where it all of a sudden started to fail (Srivastava, 1999a). The reasons for the failure were a reduction in means and capital for fire prevention and control, the continuous encroachment by grazers and NTFP collection, and the increasing lack of local people feeling responsible in participating in fire control.

3.3 Damages

Consequences of uncontrolled forest fires in South Asia are serious degradation of forests, ecological changes as well as deterioration of social and economical conditions.

According to published reports from the region, the main ecological damages occur in form of destruction of biodiversity, extinction of plants and animals, deterioration of soil ecosystems resulting in erosion and loss of soil fertility, loss of wildlife habitat and depletion of wildlife, degradation of watershed zone resulting in loss of water, as well as destruction of natural regeneration leading to forest reduction.

Additionally, changes in microclimates appear in form of changes in soil moisture balance and increased evaporation. Furthermore, scientists from the region underscore that the destruction of forests favours global warming since an important carbon sink is lost, leading to an increase of carbon in the atmosphere. Moreover, the smoke haze is polluting the environment and endangering people's health (Srivastava and Singh, 2003).

Economical and social losses due to fire destruction include losses of valuable timber resources, NTFPs, fuel wood and fodder. A loss of employment has been claimed, as well as accidental destruction of property and losses of lives when fires reach villages.

As already mentioned, an annual forest destruction in South Asia concerns 4.11 million ha surface, of which 90% occurs in India (FRA 2005 country profiles).

According to the FRA country profile 2005 of India, 3.7 million ha of forest are currently affected annually by fire, creating a financial damage of Rs 440 crores (US$ 107 million)[3] (Bahuguna and Singh, 2002).

Table 4. Forest land area affected by fires (in million ha).

	1985	1987	1996	1997	2000
Affected Forest Area	0.986	1.034	0.100	0.072	3.700

Notes:
1. The above figures present reported information and may not capture all forest fires in the country.
2. Figures for 1985, 1987, 1996 and 1997 represent "reported" area of forest affected by forest fires (ICFRE, 1997, 1998 and 2002). The figure for 2000 is "estimated" area of forest that is annually affected by forest fires (Bahuguna and Singh, 2002).

However, information varies according to different sources, e.g. referring to a country-wide study in 1995 carried out by the Forest Survey of India. It was estimated that about 1.45 million ha of forest are affected by fire annually. Other numbers from earlier years (1980-1985) state that an annual average of some 1.14 million ha (Sangal, 1989) was affected and a different data collection by the Forest Survey of India says that the area annually affected by fires may be as high as 37 million ha (Ministry of Environment & Forests, 1987). The total reported loss from the states of the union is around Rs 35 crores (US$ 7.3 million) annually.

In 1995 severe fires occurred in the hills of Uttar Pradesh and Himachal Pradesh. An area of 677 700 ha was damaged and timber of the value of approximately Rs. 17.50 crores (US$ 4.3 million) was destroyed. Other large fires were reported in the period 1994-1996 causing a damage of US$ 20 million behind. Additionally one fire incident in the state of Tamil Nadu caused a loss of about US$ 43 million in sandal wood forest in 1996-1997.

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[3] Rs. 1 crore = 10 million rupees

Bhutan has an annual area affected by fire in the year 2000 of 10 540 ha (FRA 2005, country profile). In the years 1981-85, 232 fires were reported, affecting an area of 29 516 ha and causing a damage of US$ 19.2 million (Chhetri, 1994).

Table 5. Forest fire statistics of Bhutan for the period 1981-1985.

Year	Number of Fires	Area Burned (ha)	Damage in Nugultrun (US$1= NU12)
1981-82	74	12 843	111 104 400
1982-83	64	5 487	54 531 700
1983-84	47	7 243	42 337 000
1984-85	47	3 943	22 041 000

Source: Chhetri (1994)

In Nepal annually 400 000 ha forested area are affected by fire (FAO, FRA 2005). In 1995 it was surveyed that 90% of the plain of the Rautahat district (Terai) was burned (Sharma, 1996). It must be noted that fires in the Terai sal (*Shorea robusta*) forests are burning as low-intensity surface fires and do not necessarily destroy the forests. However, according to the Nepal report of the Global Wildland Fire Assessment 2004 (Kafle and Sharma, 2005), the damage of the regeneration of *Shorea robusta* is quite significant. According to the report, the average annual loss of saw logs and fuelwoods in Bara district expressed in market price is around US$ 370 000. Fire also causes significant damages to non-timber forest products (NTFPs) like leaves of sal (*Shorea robusta*), bhorla (*Bauhinia Valhi*), Tendupatta (*Diospyrus melanoxylon*) and grasses for thatch and fodder. Smoke is considered to make shoots of fodder trees non palatable to cattle.

Sri Lanka has had in 2000 a loss of 26 ha due to forest fires (FAO, 2005). In the years from 1994-98, 641 fires have been reported burning an area of 1 648 ha and leaving an estimated damage of Rs 7 724 553 behind.

Table 6. Forest fires and economic damage in Sri Lanka, 1990-2000.

Year	Number of fires reported	Area burned (ha)	Estimated damage (US$)
1990	114	549	9 788
1991	100	186	15 245
1992	234	259	6 861
1993	58	174	8 204
1994	60	191	18 588
1995	126	372	19 458
1996	136	271	21 465
1997	205	610	44 958
1998	114	204	7 480
1999	47	417	42 227
2000 (up to May)	8	36	3 645

Source: Ariyadasa (2002)

3.4 Economic and Social Benefits

According to the Nepal report of the Global Wildland Fire Assessment 2004 (Kafle and Sharma, 2005), firewood collectors prefer *dola daura* (round fuelwood of saplings killed by fire and dried) compared to axed firewood because it burns slowly and produces higher heat yield.

To increase the fertility of agricultural land, farmers welcome first post-monsoon flash floods from the burned forest to their lands because they carry organic matter, available phosphorus, potash and nitrogen from the burned areas.

Fires boost the formation of fresh palatable shoots as important cattle fodder. The collection of minor NTFPs like sal seeds, niguro (edible ferns), mushroom, kurilo (*Asparagus racemosus*) is facilitated by fire which results in better visibility of the non-wood forest products (NWFPs) and accessibility of the forest.

3.5 Prevention

Among the South Asian countries, only India and Sri Lanka have information on forest fire prevention. Bhutan and Nepal seem to have no preventive methods at all due to lack of capacity and capability of authorities and manpower.

Preventive proceedings in India and Sri Lanka consist mainly out of traditional practices such as creating fire lines and fire tracks, making prescribed burnings, and hiring fire watchers during the fire season. Villagers in the vicinity of forest areas often have the permit to gather dead wood free of charge in order to reduce the fuel load. They are also expected to, if not even legally supposed to, assist forest authorities in fire extinction.

Sri Lanka has little approaches towards fire prevention. At the governmental level, management plans do not include activities to prevent forest fires. The activities consist mainly out of training programs of local level officers and villagers in fire fighting. Also a few projects have been launched to develop community involvement.

The Indian Ministry provides financial assistance in the scope of a "Modern Forest Fire Control Methods" plan to state governments for fire prevention and control. The financial support is used to buy hand tools, fire-resistant clothes, fire fighting tools, radios, fire watch towers, and to pay fire finders. Furthermore the money is used for the creation of fire lines, as well as for research, training and awareness raising. This plan has been implemented in more than 70 percent of the forested area of India.

Additionally projects and programmes, such as the Joint Forest Management (JFM) Programme, the UNDP-project (1985-90) and the project in Coimbatore Forest Division, Western Ghats in 1994, have been launched and implemented for raising awareness among villagers and increasing local communities' participation in fire prevention and forest conservation. The results have been quite successful as fire incentives decreased up to 90% in some regions (Forest Fire Prevention and Control Strategies in India (Srivastava, 1999a)).

4. Stakeholder / Actors Situation

4.1 Institutional and other capacities

In most of South Asian countries the destructive agent of forest fires is well known and accepted in governmental authorities. Most of the politicians are aware of the necessity of practicing fire prevention and having a functioning fire extinction system. The debate on those issues, however, is often forgotten as soon as the monsoon season starts. Nevertheless, most countries have a forest law, which contains at least a clause, prohibiting the setting of fire under certain conditions. This is often the only legal provision for fire control and prevention. The enforcement of those laws, on the other hand, is rather difficult.

The Social Forestry Division of the Bhutan's Government recently started first actions in order to prevent and fight fires through awareness campaigns and building up capacities for prevention and extinction (Forest Resources Development Division, Department of Forests, Bhutan, 2004).

Activities launched by the Nepalese Government towards fire prevention are confined to TV and radio broadcasts, since the Nepalese Department of Fire has neither the capacity, nor the capability of preventing forest fires. The involvement of volunteer firefighters, however, is increasing and promoted by the Firefighters Volunteer Association of Nepal (FAN). [4]

In Sri Lanka the Forest Department is in charge for all forest fire prevention and suppression activities, which are carried out by the provincial level District Officers. The governmental support is provided through programmes promoting community involvement, under which fire management plans have been created. The new forest policy was introduced in 1995, but was not implemented before 1999. Under the old forest policy framework, local people were obliged to help in preventing and suppressing forest fires.

India had already in 1988 a quite visionary National Forest Policy, which focused on the protection of forests against fire and called for improved and modern management practices adopted to deal with forest fires. The Ministry of Environment and Forests came up with a National Master Plan for Forest Fire Control, which introduced a fire management plan focusing on education, research and development.

In India the FAO/UNDP-sponsored project "Modern Forest Fire Control", which was operational between 1984 and 1989, laid the foundation for the use of advanced fire control methods. Based on this experience the Ministry of Environment and Forests, Government of India, launched the national project "Modern Forest Fire Control Methods" in 1992-93, which provided financial assistance to the state governments. The Central Government is also maintaining an Air Operation Wing to transfer fire fighters and equipment. This Wing is considered to be closed down, but at the same time a component of close monitoring of fires and a data base will be created to gain more information on forest fires for improvement of planning and managing.

Additionally, the Joint Forest Management (JFM) programme has been implemented to call upon the people's interest and for their support in forest fire fighting and fire fighting operations.

The Indian Government has also set up guidelines for national forest fire prevention and control. The main features of those guidelines are: identification of vulnerable areas on maps, creation of a data bank on forest fires, fire danger and fire forecasting system, provisions for the crisis management group, involvement of JFM committees and efficient enforcement of legal provisions.

In the future, India has the intention of creating a National Institute of Forest Fire Management equipped with the latest forest fire fighting technology using satellites. Furthermore, it will carry out research, training of personnel and technology transfer on a long-term basis to gain sound information on forest fires in India in order to improve management planning on forests.

4.2   Roles and responsibilities

In South Asia forest fires are perceived by the local population, as well as by administrative authorities, but most of the times the environmental and socio-economic consequences of these fires are underestimated. The governmental environmental/forest institutions of all countries play a key role in any activity related to forest fires. In the case of fire incidences, the local forest authorities are responsible for extinction, as well as for detection. Responsibilities are only shared in areas where local people are actively participating in fire management programmes such as in India, or where the forest is community property and managed by the community like in Nepal (Kunwar and Khaling, 2005; Sharma, 2005).

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[4] http://www.fan.org.np/

In general, there seems to be a lack of feeling responsible from both sides - governmental and local population. Tackling the problematic issue of fire is being postponed by the Parliament as soon as the season changes. Since law enforcement is rarely practised, nobody feels guilty and therefore nobody feels responsible. The local people living in the Coimbatore Forest Division in India did not make any attempts to extinguish a fire because they felt it was the Forest Department's responsibility (Srivastava, 1999a).

4.3   Collaboration (local, national and international)

At present there does not seem to be much collaboration explicitly regarding fire management in the region.

Most of the international cooperation exists in general through forestry programmes of organizations such as the United Nations Development Programme (UNDP), Food and Agriculture Organization of the United Nations (FAO), United Nations Environment Programme (UNEP), International Tropical Timber Organization (ITTO), World Bank, World Wide Fund (WWF), The World Conservation Union (IUCN) and Center for International Forestry Research (CIFOR). Some regional institutions and programmes support collaboration and assist in the dialogue between different partners, for example the Asian Development Bank (ADB), South Asian Association for Regional Co-operation (SAARC), South Asia Co-operative Environment Program (SACEP) and FAO Asia-Pacific Forestry Commission (APFC).

The Global Fire Monitoring Center (GFMC) is making efforts in helping to set up a Regional South Asia Wildland Fire Network under the UNISDR Global Wildland Fire Network to enhance communication between the different countries.

Organizations that launched programmes concerning explicitly forest fires are few. The Asia Forest Partnership (AFP) is addressing the problem of forest fires and is planning to assign in future some projects to forest fire prevention. Furthermore, the Asia-Pacific Regional Workshop on Scientific Dimensions of Forest Fires in 2000 in India initiated by COSTED (Committee for Science and Technology in Developing Countries) was organized in order to discuss how science and technology can be used to improve fire prevention, fire management and mitigation.

India worked together with UNDP in 1985 in order to promote community-based fire management. Other collaborations concerning fire management were just in form of conducting case studies by one of those earlier mentioned international organizations.

Bhutan is also addressing the problem of forest fires by organizing awareness campaigns, building capacity to prevent and fight fires and developing national forest fire strategy in collaboration with various international experts (Forest Resources Development Division, Department of Forests, Bhutan, 2004).

Particular cooperation among the South Asian countries pertaining to forest fire management, as proposed by Sharma (2005), and the UNISDR Global Wildland Fire Network, is currently not in place.

4.4   Community involvement

Community involvement seems to have little importance in South Asia with the exception of India where projects and programmes have been launched to get the local people participate in forest fire management.

In Nepal community involvement and participatory approaches (Community-Based Fire Management – CBFiM) are receiving increasing interest (Kunwar and Khaling, 2005; Sharma, 2005).

In Sri Lanka community involvement in forest fire management has been on a voluntary basis, but few programmes have been developed to raise villagers' interests. A new management plan was created containing "participatory management working circle". Part of this plan is to form forest user groups. They and their communities, according to the management plan, have certain benefits such

as free dead wood collection in plantations and temporary jobs in forest activities. Other than that the plan focuses on a better dialogue between governmental bodies and local people. The intention of the government is to launch another participatory forestry management programme in order to be more efficient in fire prevention and to enhance the communication between communities and forest authority.

Community involvement in India is actively promoted through the creation of Joint Forest Management (JFM) Committees. Those committees have been founded over an area of 10.24 million ha. The JFMs are an essential component of the Modern Forest Fire Control Plan now and they have been given responsibilities to protect the forests from fire.

In the Coimbatore Forest Division in India, an innovative forest fire protection movement was started through cooperation and joint initiatives by villagers and the Forest Department in 1995. Twenty-three forest fire protection committees were formed to guard an area of 69 347 ha of tropical rainforest. The Forestry Department has been really successful in raising awareness on forest fires through educating all age groups, holding up meetings, advertisements and training. One of the major problems was that people thought it was normal that forest fires occurred to such an extent and that they did not feel responsible for either preventing or combating them. The attempts of the Forest Department fruited well and local people took their own initiatives to form forest fire protection groups themselves. Some of the communities considered setting up their own fire fighting squad to additionally support the Forest Department in fire extinction. Also, the creation of a punitive system was appreciated and additionally contributed to raise awareness towards forest fires. Furthermore, it was noticed that the villagers requested other services not offered by the Forestry Department in return for their cooperation. Those requests were e.g. regular visits by a doctor or demands for a well. This shows clearly that other socio-economic issues need to be addressed along with fire management.

The result speaks for itself: forest fires were reduced significantly. In some regions, the reduction increased by 90% (Srivastava, 1999a), local people learned that during the dry season natural fires are considerably rare. Furthermore, the acceptance of forestry authorities increased tremendously and the dialogue between villagers has improved, with the result that people were much more willing to cooperate.

Other attempts of the Indian Government to apply a fire management system have been rather negative since they have destroyed already traditionally existing community-based fire management systems as in the Mizoram region. The governmental management systems take away responsibilities and tasks from people, so they no longer feel in charge of their usual performed tasks in fire prevention. In this case, the governmental strategy of the application of administrative-made fire management plans should be revised and should cope more with the traditional systems that were functioning well (Darlong, 2002).

4.5 Needs and limitations

Most countries of the South Asian region are lacking a national focus and technical resources required for sustaining a systematic forest fire management programme.

Facing such an initial situation, it is clear that most of the needs and limitations are settled at a very low level, as the following indicate:

- institutional set-up of a division within the Forestry Department is needed, which would be in charge of all occurring fire issues,
- provision of a legal and financial base,
- law enforcement,
- lack of a forest fire management plan or forest management plan including fire management concepts,
- launching of forest fire management programmes,
- introduction of community-based fire management,
- limited institutional and technological capacities,

- capacity building, within the forestry department as well as in the local population,
- provision of basic tools and materials for fire prevention and fighting, such as gloves and shovels,
- education of the population, awareness raising campaigns,
- lack of cooperation among the South Asian countries for knowledge and data exchange,
- in general, improvement of cooperation (international, NGOs, etc.).

Additional research on fire outbreaks, suppression and fire ecology is necessary for a better forest fire management. Also modern technologies, such as remote sensing and satellite imagery, should be used for fire detection. India has already taken some initiatives to use these technologies (Srivastava, 1999a).

5.   Analysis and Recommendations

Many of the South Asian countries still have a very long way to go to reach a sound forest fire management. As long as the issue of forest fire is not given enough notice, as it seems to be now the case in Bhutan, Sri Lanka and Nepal, no major changes will be possible. India's attempts have gone already a little further and some efforts can truly be appreciated (Srivastava, 1999a).

The destructive agents of forest fires are recognized to a limited extent in all countries and little knowledge exists on how to address the problem of fires (Srivastava, 1999a; Chhetri, 1994). The question is how countries decide to tackle the issues and what support and incentives are available from outside.

Facing such a situation the recommendations below are aiming only at establishing a sound basic forest fire management system.

- In most South Asian countries, governments should first be more aware and more serious about the issue of fire prevention and fire suppression. As long as governments refuse to take into account the problematic of fires, it is very unlikely that changes will be accomplished.
- Definition of responsibilities and creation of internal structures in charge of fire-related matters within the Forestry Departments in those South Asian countries that are still lacking such a set-up (e.g. Nepal). These entities should be responsible among others for developing fire management concepts, building up capacities at all levels and initiating awareness raising campaigns.
- A legal framework is essential to initiate fire prevention and control, since it can remove incentives that encourage people to start harmful fires.
- Development of fire management plans.
- Creation of forestry programmes and fire management programmes.
- Raise awareness and create responsibilities among the rural population by campaigns using all means of media, facilitating meetings and the enrolment of villagers in forestry programmes.
- Community-based approaches should definitely be given a priority in managing forest fires by empowering local people and institutions and engaging them actively in management issues, giving them user rights.
- Building of local and national fire management capacities.
- Provision of basic tools for preventing and combating fires.
- Involvement of science for data collection on forest fires, and collaboration with the forest departments to support fire prevention, suppression, and mitigation.
- Stronger collaboration among South Asian countries is advisable for the purpose of information exchange.
- Cooperation with international organizations and NGOs should be intensified

Those points focus on the creation of a stable base for being able to practice basic forest fire management. However, if there is no awareness among the governmental levels that are playing a key role in this process, none of the other recommendations will be useful or work out.

If the basic needs for a working fire management system are met, other technologies such as remote sensing and satellite imageries for fire detection should be introduced in order to improve the efficiency of fire management.

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Sikkim: http://www.fire.uni-freiburg.de/GFMCnew/2006/01/0110/20060110_sik.htm

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