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CONTENTS

EDITORIAL	1
AFRICA FIRE SPECIAL	2
<i>Bénin</i>	
Fire Situation in Bénin	2
<i>Central African Republic</i>	
Fire Situation in Central African Republic	5
<i>Ethiopia</i>	
Fire Situation in Ethiopia	7
<i>Kenya</i>	
Fire Situation in Kenya	12
<i>Morocco</i>	
Forest Fire Situation in Morocco	14
<i>Mozambique</i>	
Fire Situation in Mozambique	22
<i>Namibia</i>	
Fire Situation in Namibia Fire Environment, Fire Regime and Ecological Role	27
The Namibia-Finland Forestry Programme	37
Impact of the Integrated Forest Fire Management Program on Rural Livelihoods in East Caprivi Region, Namibia	39
Namibia Round Table on Fire Windhoek, 10-11 November 1999	57
National Guidelines on Forest Fire Management in Namibia	73
<i>Sénégal</i>	
Fire Situation in Sénégal	102
<i>South Africa</i>	
Fire Situation in South Africa	105
Santam / Cape Argus Ukuvuka Operation Firestop	111
<i>Sudan</i>	
Fire Situation in Sudan	115
RECENT PUBLICATIONS	117
Global and regional wildland fire monitoring from space:	117
Year of the Fires	117
Mapping Wildfires Hazards and Risks	118

→ Due of the timelag between editing and print/distribution of IFFN, readers interested in meeting announcements are kindly requested to visit the Internet version of this issue for update and short-term announcement of meetings (continuously updated) on <<http://www.uni-freiburg.de/fireglobe>>

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All IFFN contributions published between 1990 and this current issue are accessible through 61 country files and other special files on the GFMC website.

Call for contributions

Readers of the International Forest Fire News are warmly invited to send written contributions to the editor at the above address. These may be in the form of concise reports on activities in wildland fire management, research, public relations campaigns, recent national legislation related to wildfire, reports from national organizations involved in fire management, publications, personal opinions (letters to the editor). Photographs (black and white) and graphs, figures and drawings (originals, not photocopies, also black and white) are also welcome. Contributions are preferably received by **e-mail (text as non-encoded ASCII file, Word Perfect 5.1 or Word 6.0, Word97/8; graphic files saved as *.JPG, *.GIF or similar) or on diskettes**. Hard copies of figures and photographs should be submitted by mail (please do not submit by fax).

The deadlines for submitting contributions to the bi-annual issues are: **15 May and 15 November**.

EDITORIAL

In the Editorial of the previous issue of International Forest Fire News (No. 24, April 2001) the rationale and a short overview of the FAO Forest Resources Assessment (FRA) 2000 had been presented. The report "FAO Global Forest Fire Assessment: 1990-2000" of the FRA 2000, prepared for the FAO by the *Global Fire Monitoring Center* (GFMC) and *Fire Management Applications* (USA), has been finalised recently by the FAO. The report summarises the results of questionnaires and contacts with countries to obtain wildfire data and narrative information regarding the fire situation in the 1990s. The report is organised according to FAO's six geographical regions: Africa, Asia, Europe, Oceania, North and Central America and South America. In-depth fire situation profiles or short overviews are presented for 59 countries. Much of the information was either prepared by the correspondents of International Forest Fire News (IFFN), including the IFFN archive, and the GFMC or taken from the IFFN archive.

If printed the first global fire report would comprise of more than 530 pages. Thus FAO opted for publication on CD ROM (available ca. September 2001) and additionally on the FAO Website. Since a large number of country profiles has been authored by IFFN/GFMC correspondents most of the full reports will be published in the IFFN issues 23 to 26. The readers of IFFN are kindly reminded that all 72 IFFN forest fire country notes that have been collected between 1990 and 2000 are accessible in the GFMC archive on the Internet:

<<http://www.ruf.uni-freiburg.de/fireglobe/iffn/country/country.htm>>.

This IFFN issue provides an *Africa Fire Special*, the second after IFFN No. 19 (September 1999). Besides the most recent updates from ten African countries a special focus is on the fire programme in Namibia. Dedicated reports cover (i) the Namibia-Finland Forestry Programme, (ii) an evaluation of the *Integrated Forest Fire Management Programme on Rural Livelihoods in East Caprivi Region*, and (iii) the results of the *Namibia Round Table on Fire* that has been conducted in Windhoek, 10-11 November 1999, with the support of the GFMC. The National Guidelines on Forest Fire Management in Namibia merit special attention and are therefore provided in full length. The National Guidelines have been developed by closely viewing at the ITTO *Guidelines on Fire Management in Tropical Forests*. The Namibian guidelines suggest to analyse how and to what extent the ITTO guidelines are applicable to Namibia.

In the coming years the fire problems in Africa will deserve to receive more attention from by the international community. At present a large number of African countries has only limited capabilities in fire management and access to sources of information and technologies. During the recent years it has been observed that economic constraints, unstable political conditions and wars, and often a lack of public or governmental commitment have led to a decline of capabilities to proactively address fire problems both at the academic and management levels. On the other hand, the African continent provides a wealth of experience of successful integration of people in community-based forest and fire management systems. In addition there is abundant expertise in the use of fire in ecosystem management in Africa which unfortunately is missing appropriate application.

Recognising the shortcomings of information and proper fire management training in most of Subsahara Africa the GFMC has received funding from the German government for compiling a systematic approach to fire management south of the Sahara. The book volume *Fire Management Handbook for Subsahara Africa*, a joint effort of the GFMC and SILVA Forest Services, Bredasdorp (South Africa), is currently in its final production stage and will be announced soon.

Freiburg, July 2001

Johann G. Goldammer

Post Scriptum

Another major synthesis has been published this month. The Fire Group within the *Global Observation of Forest Cover* (GOFC) under the Committee of Earth Observation Satellites (CEOS) has done its homework. A dedicated book volume *Global and Regional Vegetation Fire Monitoring from Space: Planning a Coordinated International Effort* synthesises and analyses the state of the art of remote sensing for operational and scientific purposes, and for policy support. Information on that publication is found at the end of this issue of IFFN. The contributions of the book were initially presented at a GOFC Fire Workshop held at the Joint Research Centre, Ispra, Italy. The volume is a contribution by the GOFC Forest Fire Monitoring and Mapping Implementation Team to the *Interagency Task Force, Working Group on Wildland Fire* of the *UN International Strategy for Disaster Reduction* (ISDR).

AFRICA FIRE SPECIAL

BÉNIN

Fire Situation in Bénin

Introduction

Located between 6°30'-12°30'N and 1°00'-3°40' E, Bénin is a small country situated in West Africa with an area of 112 622 km². It has a total population of about 5.5 million inhabitants. Sixty-five percent of the country is covered by vegetation dominated by savannah woodland (9 percent) and tree savannah and shrub (56 percent). The country straddles three main climate zones: a tropical coastal Guinean climate in the south part (6°30'-8°00'N) with two rainy seasons. The northern part is tropical Sudano-Guinean (8°00'-9°00'N) climate and Sudanian (9°00'-12°00'N) climate with one rainy season. These last two zones represent more than 70 percent of the total area of the country. This percentage is more or less the same for most countries in West Africa and constitutes the ideal environment for wildfires.

Fire environment, fire regimes, ecological role of fire common to country

In Bénin, and particularly in the northern part of the country, burning represents a cultural tradition, which is not easy to overcome. Used as a work tool generally by rural populations, fires serve for land clearing for agricultural purposes, pasture management for breeding, and animal tracking for hunters. These practices are common to most countries in West Africa covered by dry forests, or savannah from Guinea to Nigeria. Concerning Bénin, it has been noted that 95 percent of wildfires in forestland are human-caused. The habitual period for lighting fires is between November and May. The majority of damaging fires are observed from January onwards, due to the high temperatures during this period (30 to 35 °C) and also to the influence of the hot and dry *Harmattan* winds flowing from North to South between December and March. However, the importance of fire varies from one zone to another. Therefore, the area situated above the latitude 8°15' N in Bénin is more exposed to wildfires, mainly because of cotton and yam production. These two crops require high soil fertility and more space, so farmers clear new forestland each year.

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

The most important impacts of wildfire are ecological. In fact, for a long time, and particularly in the latest decade, increasing occurrence of wildfires has devastated and reduced the area of forest lands and caused the disappearance of sensitive species, exposure of soils to wind and water erosion, and destruction of wildlife habitats. In Bénin, because of the high proportion of dry forest lands, about 75 000 km² of forestlands are exposed to fires each year. In 1991-1998, there has been an increase of agricultural land and reduction of forest and woodlands area as shown in Table 1. In the same time, there has been an increase of about 30.96 percent of fuel-wood and charcoal production (FAO 2000). These situations are mainly favoured by fires used for clearing and shifting cultivation.

Tab.1. Change of forest area between 1990 and 1998

Land use	Years Area (in 1000 ha)		Increment (%)	Main annual increment (%)
	1990	1998		
Agricultural area	2 270	2 400	5.72	0.64
Forest and wooded lands	3 470	3 400*	-2.02	-0.40

* Available data for 1994

Source: FAO (2000)

The economic and social impacts of wildfire concern the destruction of living conditions and harvests (cotton, yam, maize, sorghum, etc.) in rural land. Also, the perturbation of fruit production of spontaneous and planted species occurs which represents an important income. Such food sources include *Vitellaria paradoxa*, *Parkia biglobosa*, *Anacardium occidentale*, and *Adansonia digitata*. Besides these impacts, the annual loss of wood products, medicinal plants, wildlife, nuts, wild fruits, and honey is high but could not be quantified.

Operational fire management organisations and fire database

Since bush fires are one of the main causes of land desertification and the degradation of natural resources, several governments in Bénin have supported fire control projects. At present four major government organisations take an interest in wildfire problems:

- * Direction of Forests and Natural Resources (DFRN). This institution is decentralised at province (or department) and commune (district) level. The main tasks of this organisation, through forest projects, concern the monitoring of fires events, organising local populations, and development of tools for fire prevention and suppression, mainly in the state forests (natural forests and plantations).
- * Regional Centre of Action for Rural Development (CARDER). This agency is the equivalent of the Ministry of Rural Development at the province level. It is decentralised at the commune and village levels and has the same mission as DFRN. The main difference is that this organisation is connected to the local level and takes into account all forestlands (state forests and other ownerships). It directs the activities of *Local Fire Committees* and provides information to rural populations through networks at the local level.
- * Forest Research Unit (URF) of the National Institute for Agricultural Research of Bénin (INRAB). The main activity of this organisation concerns the development of strategies and tools for sustainable management of forestlands by providing scientific information to the users concerned.
- * Bénin Environment Agency (ABE). Its wildfire activity is focused on the dissemination of information.

Outside these organisations, some Non-Governmental Organisations (NGOs) are also focused on the fire problems. However, their activities are very marginal compared to the importance and frequency of wildfires.

All these organisations are facing common problems: lack of coordination of efforts and actions, low resources and reliability for monitoring and evaluation, and insufficient resources (financial, materiel, and human) for wildfire and forest fire projects. A statistical database of the country is not available.

Very few fire research projects are present in Bénin today. There is one project concerned with diagnosing the impacts of fires on natural regeneration; and developing a reliable schedule by agro-ecological zones for the use of early burning for forest management.

Use of prescribed fire in the region to achieve management objectives

Taking into account the socio-economic situation of Bénin, it has been apparent for some time that absolute forest protection against bush fires in dry forests, although possible, will eventually cause an undesirable accumulation of combustible material; and may increase the risk of diseases and insects. Therefore, early burning is prescribed in order to reduce the combustible material with least damage to tree growth and natural regeneration. The philosophy of this practice is that the early burning (burning at the end of rainy season) is the best tool to prevent destructive wildfires during the critical dry season. The practice of early burning is widely used in Bénin as well as in many countries in West Africa.

The recent research result from Côte d'Ivoire, Burkina Faso, and Bénin suggest that early burning in dry forestlands has positive impacts on natural regeneration, tree growth, and the regulation of the density of harmful insects and parasites.

Sustainable land-use practices to reduce wildfire hazards and wildfire risks

The construction of firebreaks and fuelbreaks is an important practice. However, due to the high costs involved, this practice is mainly used to protect plantation forests and agricultural lands. Breaks are produced by roads, paths, or planting vegetation strips, e.g. two or three lines of *Gmelina arborea* around *Tectona grandis* plantations in South Bénin, or the use of *Mucuna altilis* as cover vegetation in *Anacardium occidentale* orchards in North Bénin.

Also, agro-forestry practices are promoted in which crop production, forestry objectives, and the creation of pasture zones for breeders and nomadic herders are combined.

In addition to these practices, *Local Fire Committees* have been created in the villages for fire prevention, detection, and suppression in collaboration with forest rangers and local agricultural officers.

Public policies concerning fire

For a long time, wildfires in Bénin have been considered a major problem for environmental stability. Since the colonial period, many laws have been initiated to regulate fire use by populations. The most recent legislative acts are Law N° 93-009 of 2 July 1993 (Articles N° 56 and 57) and Decree N° 96-271 of 2 July 1996 (Articles N° 76 to 79) which stipulate that the setting of bush fires is forbidden in the whole country except for the use of early burning to prevent wildfires. Modalities for early burning, particularly the time period, have to be defined each year by a joint decision of responsible ministries.

The problem with this legislation is that the laws concern populations that are largely illiterate and poor. The second difficulty concerns the lack of materials and human resources for informing populations about the law and training them on the prescribed methods to manage fires. These are the major constraints of implementing policies that address wildland fires in Bénin.

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CENTRAL AFRICAN REPUBLIC

Fire Situation in Central African Republic

Vegetation and fire environment

In the Central African Republic (RCA), there are three major vegetation formations as defined by UNESCO (White 1983): *Sudanian*, *Guineo-congolia/sudania*, and *Guineo-congolia*. These three formations form lateral bands covering the dry savannahs in the north, the wet savannahs in the centre and the humid forests in the south. The Sudanian region is predominantly open woodland savannahs.

The transition zone of the Guineo-congolia/sudania consists of secondary savannahs and woodlands with some open forest. These savannahs are deemed to be fire-maintained. In areas where there has been a decline in population, a regrowth of woody biomass has occurred. In the southern part of this transition zone, mosaics of dense forest and secondary savannahs are found.

The Guineo-congolia region is predominantly dense humid semi-evergreen forests (both *terre firme* and flooded), which are rarely subjected to fire, and of included savannahs. These included savannahs are very important in terms of biodiversity. Running north-south, the central Plateau of Ouadda is dominated by remnant forest. A more detailed partition of the vegetation types has been undertaken by Boulvert (1986). Fire activity starts in the northeast of the country around November, and moves southwest following the Harmattan winds, reaching a peak in late December, or early January. The onset of rains in March terminates the fire season.

Major fire impacts

While there are no official data available, there is a perception at government levels that vegetation fires have various detrimental impacts. Since the economy relies heavily on small-scale agricultural production, the accidental destruction of cultures is of major concern. The intensive use of fire throughout the region for agricultural practices, hunting and pastoralism threatens the sustainability of natural resources. Soil erosion on the hills around the capital, Bangui, has been linked to cultivation and intensive burning. Visitors to Bangui will note the poor air quality due to smoke particles in the dry season. The deposition of acid rain over the forests downwind of RCA's savannahs has been linked to the burning of savannahs.

Fire database

Little or no data exist to document the impact of fire over the last 20 years. A suite of scientific experiments was carried out in the mid-1990s on the sources of atmospheric pollutants in the regions. Under this initiative, EXPRESSO (Experiment for Regional Sources and Sinks of Oxidants), a satellite receiving station capable of receiving the NOAA-AVHRR data and detecting fires, was installed at Bangui. Data were collected for the 1993-94 and 1995-96 dry seasons. For the 1994-95 dry season, a study by Eva and Lambin (1998) using satellite data estimated that just over 43 percent of *Sudanian* savannahs burned and 58 percent of *Guineo-congolia sudanian* savannahs burned. This corresponds to an area affected by fire of 86 000 km² and 191 000 km², respectively. The 1994-95 dry season is considered to represent an average fire season.

The area of forest affected by fires is difficult to assess in the absence of a suitable forest database. The work done by Eva and Lambin (1998) detected 2 486 cases of fires in "forested" areas. However, a close inspection of the data revealed that all these fires were on the edge of the forest domain. Some were likely for the purposes of establishing coffee cultures. It is not, however, possible to quantify these in terms of area of forest burned.

Operational fire management

Fire management is undertaken at the local level, where the decision to burn certain areas is decided at the village level. This usually covers areas within five kilometres of the road network. The government has tried to encourage a conservative approach to burning by the use of radio campaigns. Realising that lack of knowledge was one of the main obstacles to effective fire management, the RCA government, with the help of the ADIE (Association pour le Développement de l'Information Environnementale) and the EU Joint Research Centre, has installed a permanent satellite receiving station at Bangui. The objective is to work with the CNLIFBAC (Comite National de Lutte contre les Incendies, Feux de Brousse et Autres Calamités) to document the occurrence of fires in different vegetation strata, and to predict regions at risk of fires.

The data will be used to sensitise public opinion to the problems of fire using TV and radio campaigns and to organise prescribed burning. At the same time, the data can be used to better organise the campaign against illegal hunting. Under the same initiative, a study will be carried out on the economic effects of fire on the country.

Use of prescribed fire

Fire is used extensively across RCA. There are three main activities.

- * **Large scale poaching:** This has its greatest impact in the north and north east of the country. The open savannahs of the Northeast, on the Sudan border, see large fire fronts (50 km) every year, moving southwest as the season progresses. The fires start on the frontier with Sudan in November and move southwest, arriving at Bakouma in February. These are thought to be due to large scale poaching activities. A similar process occurs in the north of the country on the frontier with Chad. Fires of several km's size advance down towards the Massif des Bongo during November, December, and January. This area is comprised of several national parks. The fires are smaller than those found in the Northwest as the landscape is more fragmented with rivers and woodlands. The Plateau of Ouadda, south of the Massif, sees many large hunting fires later in the season (January to March). This remnant forest area is a home to bush game.
- * **Pasture management:** Fires are used to stimulate re-growth for cattle in the dry season. This occurs around the town of Bambari (central RCA) and on the routes from Northwest RCA (a livestock breeding area) to the markets in the south. The herdsmen light fires along the route both to stimulate regrowth and to facilitate passage. These fires tend to be at least five km from the road network. The fires are small in size and start in December and continue until March.
- * **Agricultural fires:** These small fires occur across the country in December and January, but are predominantly close to the road network, being lit to prepare the fields for agriculture. At the same time, farmers burn the area around their crops and villages earlier in the season to avoid accidental fires caused by the passage of pastoralists. The conflict between the two groups, pastoralists and villagers, is a well-known one.

The CNLIFBAC intends to propose a "fire calendar" to the population to manage the spread of fire across the country.

Sustainable land-use practices employed in the country to reduce wildfire

Burning around villages before the migration of cattle through the areas is carried out to reduce the threat of wildfires.

Public policies concerning fire

The government's policies are persuasion rather than enforcement, making use of television and radio campaigns. At present, the lack of information on the presence and impact of fires is the major obstacle to an effective national policy. The current initiative to develop an information system to document the occurrence of fires is a first step. At the same time, the receiving station is one of a network of sites contributing to the World Fire Web, organised by the GVM unit of the European Commission's Space Application Institute. This will enable the country's fire activity to be documented in the regional and global perspective.

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ETHIOPIA**Fire Situation in Ethiopia****Introduction**

Agriculture is the dominant sector of the Ethiopian economy, accounting for about 45 percent of GDP and 76 percent of export revenue. It is estimated to provide livelihood for 85 percent of the total population. There are more than seven million predominantly subsistence farm families who, on average, have a holding of 1.5 ha or less per family to cultivate. These farmers produce about 90 percent of the agricultural output, including most food crops (cereals, pulses and oilseeds), coffee, and virtually all livestock.

The primary task of economic development in Ethiopia is to reduce poverty. Substantial progress in poverty reduction can only be achieved through economic growth, and that will depend on growth in the agricultural sector, which in turn is closely related to how land and other natural resources are used (EFAP 1994). Over the last two decades the Ethiopian economy has performed poorly, with agriculture showing declining rates of growth. Both agricultural and economic growth were constrained by the deteriorating natural resource base of the country, especially in the Ethiopian highlands where 80 percent of the population lives. Agricultural productivity in the highlands is severely threatened by land degradation involving both soil erosion and declining soil fertility. This threat stems from the depletion and degradation of the vegetation cover of the country, especially forests, and exploitative farming practices. The clearing of forests is driven by the demand for crop and grazing land and for fuelwood, both spurred by a high rate of population growth. With a decline in fuelwood availability, animal dung and crop residues are increasingly used as household fuel instead of serving as natural fertilizers for the soil, thereby further depressing agricultural yields.

Arresting deforestation and expanding forest resources are, therefore, vital elements of a development strategy addressing poverty in Ethiopia. The new economic policy of the Federal Government of Ethiopia (FGE) identifies, among other things, deforestation, land degradation and diminishing agricultural productivity as key problems.

At present, however, deforestation has accelerated to the extent that only about two percent (2.4 million ha) of the closed natural high forest remains from the 40 percent of a century ago (EFAP 1994). Deforestation is estimated to take place at the rate of 200 000 ha/year. These closed forests are an important timber source and are confined to inaccessible areas in the southern and southwestern parts of the country. These forests are comprised of broad-leaved rain forests, with an estimated area of 2.3 million ha, and 0.1 million ha of coniferous forests that dominate the highlands (WBISPP 1995).

The woodland/savannah type of vegetation, which originally covered about 30 percent of the country in the semi-arid and sub-humid regions, has now been reduced to 7.5 percent of the total area. This vegetation formation had a biomass stock of 30 m³ per hectare, which has now been reduced to 10 m³/per hectare as a result of continuous cutting of trees for fuelwood, construction purposes and frequent forest fires. Some of the plants have adaptive mechanisms that allow them either to survive fire or to regenerate after a fire.

Fire environment and fire regimes in Ethiopia

Ethiopia has a total land area of about 1.1 million km². There is a strong correlation between temperature and altitude. The rainfall pattern is strongly influenced by two moist air streams: the southwest monsoon originating in the Atlantic, and the southeast monsoon originating in the Indian Ocean. There are three rainfall patterns identified.

A bimodal pattern with short duration rains in March-April and long duration rains from June-September is found in northeastern and central eastern Ethiopia. A bimodal pattern with seasons of equal length, or with long duration rains in March-May and short duration rains in October-November, is found in southeastern and southern Ethiopia. A unimodal pattern with rains between April and October is found in southwestern and western Ethiopia. Rainfall is generally higher in the unimodal rainfall area and increases with altitude up to about 3 500 m above sea level.

Temperature is inversely related to altitude, with mean annual temperatures of 22° C to 27° C in the lowlands and between 10° C to 22° C in the highlands up to about 3 000 m a.s.l. This information is very important for planning forest fire control operations.

There are no forest fire statistics permitting an analysis of the causes, risks and extent of damage. However, general information on the causes and season are available that could reveal information concerning the timing of forest fires, which depends on the climate.

Every year, just before the short rainy season starts, very large areas of lowland woodland and grassland formations are affected by fires, particularly in the drier parts of the country.

The effects of forest fires differ depending on environmental factors and the type of vegetation. People start most fires. In the eastern and northeastern parts of the country, the natural vegetation ranges from desert to grassland and woodland formations. Grazing is the dominant form of land use. The vegetation is deliberately burned in order to induce sprouting of fresh vegetation for cattle grazing. Sixty-five percent of the land area is subjected to this practice. Use of fire as an aid to hunting, to control tsetse fly and manage tick populations are among the other major causes of forest fires in the lowland areas.

In the highlands, where there is rapid population growth, fires are used as the major tool to clear forest land and convert it to agricultural use. Smoking out wild bees in order to gather honey is also another cause of forest fires. The traditional practice of using fire as a means to prepare land for agriculture and the enormous demographic growth exacerbate the impact of forest fires.

In general, the causes of forest deterioration by fire are rooted in (1) poverty caused by a high rate of population growth and economic depression, (2) low agricultural productivity, (3) the insufficient attention of government policies to the long-term implications of a deteriorating natural resource base, and (4) the use of many of the forest areas as a common property resource regardless of their suitability to sustain agriculture.

Major wildfire impacts on people, property and natural resources that occurred historically

Fire is mainly used to clear land for cultivation, and the timing is synchronized with the dry season before the onset of rains in March-April. Fire is used at least once a year in January and February so that the land is ready for planting in April. Honey collection takes place in April/May and October/November. Fire is used in the lowland areas, where livestock raising is an important part of the economy, to control tsetse fly or ticks, or to induce sprouting of fresh grazing or browsing vegetation and grasses. Fire is also used to smoke bees out of the hives in the process of harvesting honey.

In Ethiopia, accumulation of fuel load and flammability attain peak values in January and February of each year.

The timing of forest fires and the extent of effects depend on the type of economic activity of the area and the type of forest formation. Pastoralists usually set fires in their rangeland in order to produce fresh grazing and browsing material for their livestock. Thus, fire is used as a management system in the lowland areas where the woodlands and bushlands are located. It is used for the protection of animals from ticks and tsetse fly.

There were forest fires in early 1984 that affected a considerable forest area. The forest area affected by type is summarized as follows:

* High forest:	209 913 ha
* Bush land:	41 785 ha
* Plantation forests:	2 600 ha
* Bamboo forest:	33 316 ha
* Woodlands:	20 584 ha

Major wildfire impacts in the 1990s

There were no major wildfire reports for the 1990s (Table 1). A major wildfire episode affected the afro-montane forests in 2000, mainly in Oromiya Regional State. The total forest area affected by fire was ca. 95 000 ha. The firefighting operations in March-April 2000 involved more than 169 589 people (villagers, army, volunteers from Addis Ababa) and a group of foreign experts (Goldammer 2000, Goldammer and Habte 2000).

The Borana and Bale Administrative Zones reported the following losses of non-forest resources:

- * 1 226 hectares of wild coffee
- * 112 houses of the farming community who live in the natural forest
- * 12 quintals of coffee
- * 12 storage facilities of farmers for grain
- * 8 029 bee hives
- * 352 domestic animals (300 sheep, 32 hens, 9 cattle, 10 camels, etc.)
- * 335 wild animals (antelope, lion, colobus monkeys, etc)

Fire management organization

At the federal level, forest protection, including fire issues, falls within the responsibilities of the Forestry and Wildlife Conservation Team of the Natural Resources Management and Regulatory Department of the Ministry of Agriculture. The federal responsibilities are not to supervise the regions' actions, but rather to develop policies that will give the framework under which regions can develop their own regional policies. Consequently, policies could vary between regions. The federal government can give help upon request (technical assistance).

At the regional level, the regional Bureau of Agricultural Development is responsible for forest fire protection. However, there are no special arrangements for fire management. It is at the regional level that actual operations for forest protection are undertaken. The regions manage their own budget, but there is federal funding for emergencies.

A recent initiative at the regional level is to prepare draft acts that will include fire management issues.

There are no people trained and equipped for firefighting and fire prevention is mainly through education of farming communities about the usefulness of the forests and the damage resulting from forest fires. Monitoring of forested areas and implementation of preventive measures has had limited effect due to weak institutional arrangements. However, for a few of the forestry projects, forest management practices such as timely pruning and weeding operations, controlled grazing, reduction of combustible materials in plantation forests before the fire season, ground patrol and construction of fire breaks are employed. There are 58 National Forest Priority Areas (NFPA) identified as potential areas for conservation and development, but only two of these are organized for fire protection. There are forest protection committees established in each administrative zone, but these are not functional and effective. There is no budget allocated for fire prevention.

From the wildfire incidence in 2000, a National Committee for Fire Management was established at the federal level and a similar committee was also established at different levels in all zones where wildfires were reported. The committees are responsible for organizing and mobilizing local and international fire suppression resources that are indispensable for firefighting.

Wildfire data base

Table 1. Forest fire statistics of Ethiopia for the period 1990-2000.

Year	Total no. of fires on forest and other wooded lands	Total area burned (ha)	Area of forest burned (ha)
1990	4		1 072
1991	2		153
1992	1		32
1993	20		3 159
1994	1		1 550
1995			
1996			
1997			
1998			
1999			
2000	> 120		95 000

Source: paper records of the Ministry for Agriculture, Addis Ababa.

Average annual number of fires: There is usually one incidence of fire in Ethiopia, which is mainly in January, February and March before the onset of the rainy season.

Average annual fire size: There is no accurate information on annual fire extent available. However, from selected studies it is known that woodland and bushlands are burned annually to a large extent. Hence, the area burned annually amounts to millions of hectares.

Fire causes: Fires started by people account for 100 percent of the total fires. Of the human-caused fires, 20 percent are classified as arson and negligence and carelessness cause 80 percent. However, there is no research conducted on fire causes. These observations are based on personal experience in the field for the last 20 years.

Use of prescribed fire to achieve resource management objectives

In the lowland pastoral areas, which cover 60 percent of the total land area, controlled bush clearing for improved community based range management is practised. In addition, control of ticks and tsetse flies, which pose a serious problem to the livestock herds, is another positive effect of prescribed burning. Some of the traditional practices of the local people regarding prescribed burning are selective bush clearing, which is used to stimulate vegetative re-growth of grasses and many shrubs and trees during the dry season. They also use prescribed burning for increasing plant biomass and to control bush encroachment and favour the growth of the herbaceous layer, which is important for the nutrition of cattle, goats and sheep. They also use prescribed fire for the control of vectors of animal diseases.

Public policies

The lack of established ownership and open access has contributed to uncontrolled, illegal encroachment and clearing of forest land by frequent fires. Institutional arrangements are weak for monitoring forested areas and implementing preventive measures. There is a lack of clear land ownership rights to help insure local cooperation in such critical matters as forest fire prevention and control.

A general federal law gives responsibilities to the regions, including protection of the forest against insects, disease, fire, etc. There is a draft forest policy currently being reviewed by the Ministry of Agriculture (first draft in 1997). This policy document does not make special reference to fire issues.

After the large wildfires in early 2000 the Government of Ethiopia, supported by the German Agency for Technical Cooperation (*Deutsche Gesellschaft für Technische Zusammenarbeit – GTZ*) and the Global Fire Monitoring Center (GFMC) organized the Ethiopia Round Table Workshop on Forest Fire Management, which was held in Addis Ababa, 19-20 September 2000. The results of the workshop point toward the development of a national intersectoral strategic programme for fire management.

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

The major cause of forest fire is poverty, which is constantly fueled by a high rate of population growth in relation to low agricultural productivity. People usually look for new productive land and clearing of forests by setting fire is a means of land preparation. In order to alleviate this, the government, through the Ministry of Agriculture, has introduced an extension package programme in different agro-ecological zones to help boost agricultural production. The programme focuses on an integrated land management strategy.

There is a need to focus on increasing productivity on agricultural lands by providing better education and information to farmers and improving their performance.

The public needs to be educated to view forest fires as a threat to the national economy, since no forest fire prevention campaign can be successful without the general support of the local communities.

Community involvement in fire management activities

The development agents of the Ministry of Agriculture provide information to farmers on the impacts of wildfire on forest resources and its relation to the production system. They are informed and updated on the possible causes of fire and on precautions to be taken during the dry season.

The government and private radio channels, which disseminate agriculture-related programmes, provide educational messages to make the local farmers aware of possible fire impacts. They are also involved in firefighting through mobilization as legislation clearly states that all citizens have the obligation to cooperate in firefighting if fires occur in their surrounding area.

Local communities participate in firefighting activities. The number of people involved in firefighting in 2000 was estimated to be over 169 589.

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KENYA

Fire Situation in Kenya

Fire environment and fire regimes in Kenya

Kenya has a total land area of 582 646 km². Highlands form most of the south-west and central parts and are well watered and fertile. More than 70 percent of Kenya is a climate condition classified as both arid and semi-arid; and characterised by low biological activity.

The country's forests are concentrated in the moist central highlands where the human population and agricultural production are also found. In the extensive semi-arid region, forests are situated on isolated hills and in discontinuous narrow bands along river beds.

Kenya gazetted forests comprise some 1.64 million hectares of land (about 3 percent of the land area). Outside the gazetted forests, there are other large tracks of forests in trustlands, i.e. national parks, national reserves and privately owned land covering about 0.5 million hectares in the following regions:

- * Coastal forest region
- * Dry zone forest region
- * Mountain forest region
- * Western Mau forest region

Because of extended degradation of the closed forests, a programme of plantation establishment was started in 1946. Cutting of the valuable natural hardwood is considered non-sustainable and has been banned. The wood industry relies on softwoods from government forests.

Forest fire management

Most of the forests, especially the highly productive ones, including both indigenous and plantations, are located in the relatively high fire-prone areas. Wildland fires continue to be one of the biggest threats to forests. A forest fire protection unit exists with the Forest Department. A conservator of forests is appointed at the Headquarters who:

- a Plans, organises, equips, trains and provides a follow up supervision of a cost-effective fire pre-suppression and suppression organization at all levels with the Forest Department.
- b Develops a comprehensive nation-wide program designed to create awareness of the need for fire protection and control.
- c Plans the implementation of risk and hazard reduction programmes.

In the field, District and Station Forest Officers organise and supervise forest fire prevention and suppression activities within their areas.

Available firefighting equipment includes, vehicles, tractors, pump units with hoses, knapsack sprayers and hand tools.

Firebreaks and forest boundaries are established and maintained on a regular basis to keep fires from spreading between plantations and from neighbouring settled reserves.

Fire detection is carried out by ground patrols and permanent stations (fire towers). A few of them have radio systems, vehicles, motorcycles and bicycles. When a fire occurs a comprehensive fire report is compiled detailing the location, area burnt, suppression cost and the actual damage to the forest.

Forest fires statistical data

Table 1. Number of fires and area burned in Kenya for the period 1990 - 1999

Year	Area burned (ha)			Number of fires
	Plantations	Indigenous Forests	Bush/grass	
1990	85	331	12 183	36
1991	1 705	236	6 697	64
1992	6 170	5 494	13 302	180
1993	1 731	515	1 718	48
1994	690	69	1 913	40
1997	4 726	2 961	7 729	121
1999	1 449	317	2 041	59

All fires in Kenya are started by people. Of these fires, 40 percent are classified as arson, 20 percent are caused by negligence and carelessness and 40 percent are due to unknown causes.

Community involvement in fire management activities

Campaigns through public meetings are organised before the declaration of the fire danger season to create awareness for the need to prevent any forest fires and action to be taken in case a fire is detected.

Fire ecology and management research

A fire research programme conducted on the *Lewa Wildlife Conservancy* since 1992 increased understanding about the effects of type and intensity of fire on savannah vegetation in the central highlands of Kenya. Techniques for assessing range condition were developed to assess the condition of the vegetation and these were used to monitor and assess the effect of the controlled burns applied on the *Conservancy* during 1997 and 1998. The vegetation in this area is in the range type called Scattered Tree-Grassland (*Acacia-Themedia*) rangeland. The study during 1998 tested the fire intensity model developed for southern African savannahs (Trollope 1998). The study also determined the effect of type and intensity of fire on the mortality and topkill of stems and branches of different tree and shrub species occurring in the aforementioned range type.

The results of the research on the fire ecology of the savannah vegetation on the *Lewa Wildlife Conservancy* led to the following general conclusions regarding the effect of type and intensity of fires on the tree and shrub vegetation:

- * Generally the mortality of trees and shrubs is very low irrespective of type or intensity of fire, i.e. 4.4 percent;
- * Generally all the bush species were highly resistant to fire and the only woody species that consistently suffered a high mortality with burning was *Acacia nilotica*;
- * Head fires burning with the wind caused a greater topkill of stems and branches of trees and shrubs than back fires burning against the wind. This difference increased significantly for bush greater than three metres in height;
- * Increases in fire intensity caused a greater topkill of bush while increases in the height of trees and shrubs resulted in a lower topkill of bush;
- * Cool fires that will cause a significantly lower topkill of bush can be obtained by burning in the late afternoon/early evening when the air temperature is <20°C and the relative humidity >50 percent;
- * High intensity fires that will cause a significant topkill of bush can be obtained by burning during the heat of the day from noon onwards when the air temperature is >20°C and the relative humidity <30 percent.

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Remark: Several facts and references were added by J. Goldammer, Global Fire Monitoring Center (GFMC).

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MOROCCO

Forest Fire Situation in Morocco

1. Introduction: The forest environment and fire regimes

The forests of Morocco cover about nine million hectares, thereof forest formations (natural forests, plantation forests) cover 5,814,000 ha and alfa grasslands 3,186,000 ha.

The forest formation is dominated by broadleaved species (63.09 % or 3,668,000 ha), followed by conifers (20.14 % or 1,171,000 ha) and secondary species (16,17 % or 974,894 ha). Forest plantations cover 530,000 ha out of which 75 % (395,500 ha) are part of the forest fund (*domaine forestier*).

The forest land is an open space where access (except rare exceptions) is free. The population, especially those living at the forest edge, lives from subsistence economy (using forests for construction wood and firewood needs, the gathering of various non-timber forests products, and pasture). Consequently, forests are under a very strong human pressure and are overexploited.

This human pressure increases the fire risk, since Moroccan forests, as all Mediterranean forests, are extremely flammable, particularly during the summer season when the fuel moisture content of plants is very low.

2. Impacts of forest fires since 1990

The impact of fires is especially severe on forests. The economic loss of forest products (timber and NTFP) are estimated with 18 million DH (dirham) per year (approx. 1.8 million \$US). However, considering the semi-arid climate conditions of a country like Morocco the impact on watersheds, soils, and biodiversity is much more significant.

3. Forest fire statistics

Number of fires and burned area

The fire situation during the years 1960 to 1999 is shown in Table 1 (number of forest fires and area burned) and Table 2 (Classification of areas burned by vegetation type and by burn size class for the period 1994-1999).

Table 1. Number of forest fires and area burned in Morocco during the period 1960-1999. For fire causes: see text. Note: The data 1994-1999 in the columns “forest burned” and “other wooded land and other land burned” were taken from Table 2. The FAO standard table format therefore has been changed.

Year	Total No. of Fires on Forest, Other Wooded Land, & Other Land No.	Total Area Burned on Forest, Other Wooded Land, & Other Land ha	Area of Forest & Other Wooded Land Burned ha	Area of Other Land Burned ha
1960	59	1 247		
1961	105	2 470		
1962	122	757		
1963	138	1 042		
1964	329	3 633		
1965	124	1 447		
1966	108	2 686		
1967	150	1 493		
1968	110	923		
1969	191	3 131		
1970	207	4 497		
1971	124	1 779		
1972	168	1 497		
1973	168	1 871		
1974	213	2 643		
1975	293	4 866		
1976	184	2 220		
1977	217	3 212		
1978	348	5 358		
1979	162	1 661		
1980	211	6 278		
1981	233	1 782		
1982	182	2 049		
1983	338	11 289		
1984	211	1 461		
1985	249	1 969		
1986	183	1 857		
1987	145	678		
1988	277	4 222		
1989	156	822		
1990	179	2 118		
1991	247	3 965		
1992	182	2 579		
1993	187	3 078		
1994	417	6 072	3 675	2 397
1995	528	7 018	3 950	3 068
1996	220	1 185	498	687
1997	391	3 845	2 325	1 520
1998	416	1 855	1 501	354
1999	385	1 688	775	913

Table 2. Classification of areas burned by vegetation type and by burn size class for the period 1994-1999

	1994	1995	1996	1997	1998	1999
1- Area burned (ha):						
* Forest and other wooded land	3 675	3 950	498	2 325	1 501	775
* Secondary species, alfa and herbaceous layer	2 397	3 068	687	1 520	354	913
- Total area affected by fire:	6 072	7 018	1 185	3 845	1 855	1 688
2- Number of wildfires by size class (S):						
S ≤ 1ha	52	189	111	174	246	226
1 < S ≤ 5 ha	58	154	58	137	106	109
5 < S ≤ 10 ha	102	99	29	35	33	22
10 < S ≤ 20 ha	32	41	8	17	9	17
20 < S ≤ 50 ha	51	14	10	12	14	7
50 < S ≤ 100 ha	12	19	3	9	6	1
100 < S ≤ 500 ha	8	9	1	6	2	2
500 < S ≤ 1000 ha	1	3	-	1	-	1
S > 1000 ha	1	-	-	-	-	-
Total number of fires	417	528	220	391	416	385

Fire causes

It is often very difficult to determine the fire cause for the following essential reasons:

- * The very criminal character of the fire setting: according to Moroccan forest law, arson is heavily fined, even with imprisonment.
- * The multitude of stakeholders in forest areas: commercial loggers, logging sites, shepherds, farmers, bee-keepers, distillers of aromatic essences, illicit charcoal production, and hikers.

In general, the analysis of information and reports on forest fires allows the following conclusions:

- * more than 50% of the fires are of unknown cause,
- * more than 40% of the fires are due to negligence (burning of fields, honey collection, camp fires, vehicle exhausts, cigarettes, etc), and
- * 10% of the fires are intentional (destruction of the forest for gaining agricultural land. This is the primary cause of forests fires in the north of the country).

It should be noted that the high percentage of fires of unknown cause renders it difficult to set up an efficient prevention policy.

4. Operational system for forest fire management

Technical measures

The current national forest fire policy is based on the following principles:

- * Reinforcement of the forest fire prevention, detection, and suppression. Within this framework, the Ministry of Forestry started following activities:
 - Procurement and installation of the following equipment
 - i. Nine rapid intervention units (with 12 vehicles) with the prospect of setting up 52 units (104 vehicles)
 - ii. 14 400 km of forest access roads
 - iii. 1 700 km of fuel breaks
 - iv. 123 fire watchtowers
 - v. 1 800 radios

- Signing of a convention with the Royal Gendarmerie for the use, in the event of a fire, of four turbo-prop planes with a water capacity of 1500 to 2000 litres each
- Establishment of a network with persons in charge of the Civil Protection equipment
- * Creation of water points in forests
- * Reinforcement of the fire surveillance system in the summer season by involving contributions of all partners responsible for forest fire fighting
- * Intensification of public awareness campaigns targeting the general public and forest dwellers, especially on preventive fire measures
- * Intensification of preventive silviculture programs
- * Adoption of a master plan for fire prevention and forest fire control in the Rif area (see appendix attached).

Administrative activities

Before the fire season, the administration starts a certain number of activities, such as:

- * Sensitising and education of the public and the forest users by:
 - the organisation of conferences on fires in central meeting places of the population in order to explain the precautions to be observed in the event of fire use in order to avoid a spreading into the forest
 - The design and broadcasting of television and radio spots, films and posters
- * The reinforcement of forest surveillance
- * The implementation of stand-by watch service at all levels, i.e., for the nine Regional Directions of the Forest Service, 49 Divisions (*Arrondissements*), 49 Primary Forest Development Centres, 198 secondary Forest Development Centres, and 685 Forest Districts
- * The organisation of forest worker camps dispersed in the forest with the objective to have personnel available for the rapid interventions (initial attack) in the event of a fire
- * The co-operation with other administrations charged with the forest fire management, namely:
 - The Ministry for Public Labour which takes part in the installation of traffic signs "ATTENTION - FIRE DANGER" along the routes which cross the forest
 - The Railway Service (ONCF) which carries out the weeding along the railway which cross forest areas. It informs the passengers of the consequences of arson (throwing burning cigarette out the train windows)
 - The civil aviation which helps to detect fires by its pilots
 - The National Electricity Office (ONE) which weeds the area under powerlines crossing forest areas
 - The Royal Gendarmerie with its aircraft (water helicopters and air tankers) takes care on the application of the law with regards to fire use
- * The National Meteorological Service which takes part at the development, during the fire season, of a special bulletin on the fire danger that is sent to the Forest Services to put the field staff in maximum alarm when the weather conditions are fire prone.

5. Use of prescribed fires in forestry

This possibility is not considered for the moment by the Ministry of Forestry due to the fact that the understorey, woody debris after logging operations and the grass in forests are used by local people and their livestock.

6. Practices employed to reduce the fire hazard and fire danger

Participation of the various services

According to Article 48 of the *Dahir* of 10 October 1917 on the *Conservation and Use of Forests* the local administration has the right of requisition and has the responsibility for all fire fighting activities. The personnel of the Forest Service, regardless their rank, must be at its disposal, assisting with all its technical know how.

This obligation does not, however, inflict on the following fundamental principle: "Any forester who notes or learns of a fire event, even a small fire, within his forest district, has the duty to reach immediately the site, while taking all necessary provisions to inform the local administration and his direct superior." The forestry personnel of the Forestry Service is obliged to remain on the fire site until the final mop-up.

Fire prevention

Starting on 1 June of each summer the following fire prevention measures are activated:

- * Posting (activation) of all fire lookouts
- * Checking of all telephone lines, telephone sets, and radios
- * Setting up a 24-hrs telephone or radio watch service at the following levels:
 - Regional Directorate of the National Forestry Commission
 - Provincial Service of the National Forestry Commission and Arrondissement
 - Primary Forest Development Centres
 - Secondary Forest Development Centres
 - Forest districts

A list of the foresters in charge of the watch service on these levels will be submitted to the Ministry of Forestry. A list of telephone numbers will be also prepared. The list must contain the telephone numbers of all levels of the same forest *Arrondissement* (from the Head of the *Arrondissement* to the district forester). The telephone numbers of the forest engineers who have an official telephone in their residence will be included. If a radio station has replaced the telephone, the frequency will be indicated.

For the entire fire season, day and night, every forester must be on constant radio or telephone alert. Thus, all ranks, as soon as they leave their office, have to inform the Forest Service where they go and how to be reached. The vacation of foresters has to be co-ordinated within the same CDF (Forest Development Centre) and the same forest district and organised to ensure permanent presence:

- For the same rank, the personnel on leave has not to exceed one third of the total staff strength during the months August, July, and September; and half for the other months.
 - The forester takes it leave only at the same time as its trooper.
 - All personnel in leave have to be in reach by telephone or radio.
- * Particular surveillance of the forests, rounds taken of the officer in charge, in the forest and along the perimeters to enforce the interdiction of lighting fires in the forest and within a distance of 200 m zone and of camp within a 100 m zone (Article 1 and 2 of the Decree of 4 September 1918 relating to the measures to be taken in order to prevent forest fires).
 - * Also the enforcement of the Article 4 of the above quoted Decree by the residents regulating the post-harvest burning of fields.
 - * Intensification of control of forest exploitation sites, in particular of those where char-coal production is authorised in summer, in order to enforce strictly the application of the authorisation (permanent surveillance of charcoal kilns and ground clearing in a radius of 30 m the kilns and around camp sites, etc). Strict application of the suspension of charcoal production where it was not authorised, for the period of 15 June to 31 October.
 - * Maintenance and provision of forest camps (for maintenance or opening of forest access roads, tree nurseries, and planting sites for afforestations) to be distributed as widely as possible and staffed moderately (10 workers for each working site). These crews are acting as first rapid intervention crews equipped with hand tools, thus being able to respond quickly and effectively.

- * Checking the hand tool deposits (caches) at the forest stations and provision of additional hand tools for fire fighting. The Districts and C.D.F., having road graders and vehicles with water tanks, will assure regular maintenance and will position these strategically for rapid intervention in fire fighting.
- * Weeding of the fire breaks along certain roads and tracks.
- * Control of work by the National Railroad Service (ONCF) of weeding along railways in forests or within 200 m (Article 3 of the Decree of 4 September 1918 on measures against forest fires).
- * Protection of the wood and cork deposits:
 - Weeding to bare soil between the piles and around the piles at a distance of at least 30 m by also using the guards of the deposits remunerated from an autonomous budget
 - Maintaining a permanent team for guarding and intervention
 - Maintaining, permanently, fire fighting hand tools in good operating condition including, particularly high-capacity fire extinguishers, filled water cisterns, water pumps, pipes, backpack pumps, shovels and Pulaski tools, and tractors with trailers
- * During the month June the organisation of conferences (*conférences d'incendies*) organised by the forest engineers, in the presence of the local administrative authorities and if required by the vigilance committees in order to remind the instructions for forest fire prevention, the obligation for everybody to take part in fire fighting and the attention of the repressive provisions of the *Dahir*, dated 10 October 1917. The forest personnel must attend these conferences. A report will have to be sent to Ministry of Forestry. In exceptional case where a conference was not organised by a forest engineer, a justification has to be formulated.

The role of the forest personnel in the case of a fire

Any forester which discovers or learns of a fire warns his direct supervisor as soon as possible. It is necessary to warn at the same time (or to assure that he will be informed) the representative of the local authority. The forester goes then immediately to the fire site. It is an absolute duty for the district forester to reach the fire, if it is within his or neighbouring district. He will gather the workers of the logging sites in the vicinity and all available people around in order to set up a first rapid intervention fire crew which will either engage in firefighting or support any ongoing fire fighting activities.

The chief of the C.D.F. must, as soon as a fire is reported to him, alarm the chief of the *Arrondissement* or his assistant who must alarm on his turn the central service immediately. The head of the C.D.F. will take all necessary steps to sent in all fire fighting equipment (hand tools, water supply, vehicles) and will go then immediately to the fire site in order to take part, under the direction of the local administrative, in the fire fighting.

When the fire is controlled, the administrative authority must ensure efficient mop-up by the fire fighters.

7. Public policies affecting forest fires

The Moroccan forest legislation contains provisions relating to the prevention of forest fires as well as to the punishment of the arsonist.

Preventive measures

There are provisions which regulate the use of fire in forest or in the vicinity during the period of summer dryness, between 1 July and 31 October:

- * charcoal production is prohibited at the logging sites of legal forest exploitations;
- * dwellings, structures, camp sites, logging sites located inside the forest or in a radius of 200 m in where fires is used for domestic or industrial purposes, must be surrounded by a fire break of 25 m width removed from any understorey or herbaceous vegetation;
- * burning of brush, grass, standing fields, between 1 July and 31 October, cannot be carried out by private individuals on areas located at a distance less than 4 km from the forest boundary;
- * from 1 November to 30 June, no burning of standing vegetation can be carried out within a radius of 500 m starting from the forest boundary without preliminary authorisation.

Punitive measures

Both the Moroccan penal code as well as the forest law envisage rather heavy sanctions against arsonists. The Moroccan legislation distinguishes between voluntary and involuntary fires. First case is punished as a crime. Any person who refuses to fight a fire is punished by law.

8. Outlook and perspectives

The perspectives relate to:

- * The elaboration of a regional master plan for forest fires protection:
 - to analyse and evaluate the requirements for basic equipment taking into account the defence of values at risk;
 - to direct the selection of fire fighting equipment by the various partners charged with fire fighting (services responsible for landscape management and direct fire fighting);
 - to establish a set of priorities in the choice of forest areas to be equipped and forest fire fighting infrastructures to be realised in function of values at risk.
- * The establishment of Civil Protection intervention units at the level of forest provinces, specialised in forest fire fighting and equipped with suitable hardware.
- * The utilisation of the C-130 planes of the Air Force, water dropping equipment for large fire fighting operations in order to reinforce the park of Turbo-thrush planes used by the Royal Gendarmerie.
- * Creation on the level of all Forest Development Centres (52) of support units (forest fire crews) for initial attack equipped with 600 litres tank vehicles.
- * The installation of a network of automatic weather stations in the principal forest areas by the National Meteorology Service in order to facilitate the calculation of fire risk indices and the fire fighting.

Annex**Master Plan for Forest Fire Prevention and Suppression in the Rif:****Provisions for the 5-year-plan 2000-2004**

The following provisions in fire management in the Kingdom of Morocco have been planned for the period 2000 to 2004

Year 2000

- * Creation and installation of the first Center of Operations based on the existing facilities of the tree nursery of Ain Rami (Chefchaouen), which will function as provisionally Center of Operations at regional level.
- * Acquisition of two new patrol and first intervention vehicles for a dissuasive surveillance in the northern parts of the region.
- * Construction of a fire lookout and a water tank with a capacity of 50,000 litres at the forest station of Bouhachem.
- * Upgrading of the forest access road to Bouhachem.
- * Equipment and training of the first twenty forest fire suppression specialists.

Year 2001

- *
- * New development and equipping of the future Regional Center of Operations located in the Province of Tétouan, which will be equipped with a weather station as it is the case of the Center of Operations located at Chefchaouen.
- * Construction of four new fire lookouts and two buildings, staffed and equipped, preferably in the Provinces of Eastern Larache and Southern Tétouan.

- * Equipping and training of ten fire crews as reinforcements which will be based in the forested zones with a fire detection system.
- * Improvement of the existing communication network by the installation of newly procured equipment.
- * Acquisition of two heavy fire suppression vehicles for the Provinces of Eastern Larache and Southern Tétouan, zones chosen for the construction of six water points for this year.
- * The repair of two water points located in the Province of Tétouan.
- * Conservation and repair of the roadway system network, preferably in the territory of Eastern Larache.

Year 2002

- * Construction and equipping of the future Provincial Center of Operations for the Province of Larache, including a weather station.
- * Construction, equipping and staffing of four fire lookouts and two buildings, which will be located preferably in the Provinces of Northern Tétouan, Chefchaouen and Mokrisset.
- * Incorporation of eight fire crews as reinforcements equipped with all necessary means to fight fires. These specialists will receive an appropriate training as well as the remainder of the personnel lately assigned to the Center of Operations. The personnel will be assigned to units that will be equipped with a detection network during this year.
- * Acquisition of a new heavy fire extinction vehicle, with all its equipment, intended for the territory of Mokrisset. Five water points will be built in the Provinces of Chefchaouen and Mokrisset.
- * Upgrading of forest roads, preferably in the Provinces of Mokrisset and Chefchaouen. The construction of a new runway for aircrafts close to the Provincial Center of Operations of Chefchaouen from where the planes of the Royal Guard will operate.
- * Installation of new communication hardware procured during this year.

Year 2003

- * Construction and equipment of the Center of Operations of the Province of Tangier. A weather station will be included.
- * Construction and equipment of four fire lookouts and two buildings in the Provinces of Bab Berred, Bou Ahmed, and Tangier.
- * Incorporation of seven new fire crew reinforcements perfectly trained and equipped. These will be deployed in the zones equipped with fire detection systems.
- * Acquisition of a heavy fire suppression vehicle equipped with suitable hardware as well as the remainder of the other vehicles already mentioned above. Its personnel will be trained and located in the Territory of Bab Berred, where five water points with a capacity of 50,000 litres will be constructed.
- * All means recently deployed to the Centers of operations will be equipped with compatible communication systems.
- * The upgrading of the roadway network will be concentrated in the Provinces mentioned above during this year.

Year 2004

Construction and equipping of the last Center of Operations in the Province of Tétouan, which, once operational, will carry out the tasks of a Regional Center of Operations. Finally, the network of weather stations will be completed and the stations will be interconnected.

Construction of a helicopter port in the Provincial Center of Operations of Chefchaouen. The precise future rendez-vous points for reinforcement forces of the area will be determined.

During this last year, three fire lookout towers and annex buildings will be built and equipped in priority in the Provinces of Western Larache and Tangier.

The last five reinforcements of forest fire crews will be implemented this year in the Territories previously mentioned. As during previous years, the reinforcements will be equipped with all necessary standardized tools and staffing, including training courses.

The provincial units of Chefchaouen will receive a new heavy fire suppression vehicle and will then be a unit perfectly equipped and trained. There will remain only five water points to be built as scheduled.

All forest fire suppression forces will be equipped with radio communication equipment.

During this year, the repair work of the roadway system will be carried out in the Provinces of Tangier and Tétouan.

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MOZAMBIQUE

Fire Situation in Mozambique

Fire environment, fire regimes and the ecological role of fire

The natural vegetation cover, which accounts for 78% of the country's area, varies from evergreen to deciduous, from mountainous, to lowland, gallery and mangrove and from forest to edaphic grasslands. In a comprehensive description of fire effects on the major vegetation types in Mozambique (de Campos Andrada 1951), six eco-types are recognised, namely:

- * Moist (hygrophile) forests in Milange, Gurué, Tacuane, etc. The forest in this moist environment used to be thick and well developed but now openings promote fire events.
- * Mesophile forest at medium altitude characterised by a habitat, which is neither very moist nor very dry. Vegetation is composed principally of *Brachystegia* and *Julbernardia globiflora* and it is commonly open with frequent meadows where grass grows tall and thick. Fires in these openings can be very destructive, particularly to young regenerations when frequent burning occurs in late dry seasons. Older trees are frequently partially burnt and sometimes entirely.
- * Low altitude dry (xerophile) vegetation is found relatively close to the littoral zone where the habitat is characterised by strong droughts. The timber rich forest in places such as Derre and Buzi is deciduous. Fire is very destructive to the forest due to the amount of grass.
- * Dry to arid forest of *Colophospermum mopane* and/or *Acacia* spp. is associated with low and scarce to non-existing annual grass. Forest fires there are less frequent and less damaging.
- * Plateau of Angonia with little or no forest
- * Edaphic grass in Marromeu and Chinde districts of Sofala and Zambezia

Mozambique is dominated by two main seasons. The hot and wet season lasts from November to April and is followed by the cool and relatively dry period between May and October. Forest fires are linked to the seasons and sporadic fires start in April each year at the beginning of the dry season, increasing in intensity by late August to October when the vegetation is completely dry, until the first rains in November or December. The size of burning also follows a similar trend. The average size of early fires from April to June is relatively small compared to that of late dry season due to the high water content of the still green vegetation; as grass layers and leaf litter become drier, burning intensifies and spreads.

According to satellite interpretation in November 1996 (Taquidir 1996) 39.6% of the country are affected by fire every year. The northwestern and central parts of the country are the most affected. 73.6% of these areas are burnt annually. The coastal strip with its evergreen to semi-evergreen coastal vegetation has the lowest burning intensity in the country (4.6%).

The study shows also that fires have been affecting the low and open woody vegetation such as shrub (57.4%), wooded grassland (44.5%), thicket (41.2%), agriculture lands (49.7%). Burning in the forestry formations classified as LF1, LF2 and LF3 oscillates between 27.5 and 37.6% annually.

The data on forest burning quoted above is comparable to that of 40% reported in the "Manual de Legislação Florestal". The latter information was gathered from a sample of aerial photographs taken at different dates in Mozambique, while the recent data were measured on coverage of Landsat TM images recorded between 1989 and 1992.

Both data sets possibly under-estimated the real size of annual burning, since the early fires are not easy to detect in remote sensing material.

The countryside in Mozambique is poorly managed due to resource constraints and has a very low road density. The natural forest has never been put under any sort of management. The road network is insignificant and firebreaks do not exist. Between rivers and streams, the forest is often composed of single blocks ranging from few hundreds to many thousands of hectares. When a fire is set in a forest area, it sweeps the whole area until a river opening halts it. The extent of a fire in any area depends, therefore, on the month of burning, the extent of a single block of vegetation, the wind speed and direction and on other weather conditions such as rain and temperature. Depending on these conditions, a single fire can burn from a few hectares to many thousands of hectares.

With the increase of populations in Mozambique, the requirement for agriculture land as well as for forestry and wildlife products had drastically increased thus increasing pressure on limited resources. Fires have become one of the main tools of man for land clearing for cultivation and house construction, hunting, timber exploitation, acquisition of other goods and services from the forest including charcoal production and honey collection, and for protecting resources from wild animals. These activities, as well as accidents with cigarettes, may lead to uncontrollable wildfires.

Narrative summary of major wildfire impacts on people, property, and natural resources

The scarcity of natural regeneration and the rapid population growth in the rural areas associated with an increased intensity of agriculture activities in the field are indications of a mounting trend of forest fires.

Fires have an unmistakable destructive role on natural vegetation and on bio-diversity as whole. They affect a wide range of aspects of environment as well as peoples welfare.

Loss in standing timber, very much needed by the national economy, is significant (no figures available).

Natural regeneration is affected by fires, which occur yearly and at increasing rates and if natural regeneration is not sufficient due to increasing fire intensity and logging, a number of species will be threatened e.g. *Pterocarpus angolensis*, *Millettia stuhlmannii*, *Milicia excelsa*, *Androstachys jonsonii*, *Erythrepleum suaveolens*, *Burkea africana*, *Dalbergia melanoxylon*, etc.

Indications are that forests are becoming less rich in species diversity, more fragmented and poor species associations are taking place. The remnants of forests, are also in the process of losing their characteristics, various sites are now fragmented forests intermingled with other forms of vegetation. The forests may be shrinking due to the loss of trees by burning incursions. Climbers are disappearing and grass and other herbs are invading the ground. The opening created in the forest canopies exposes shade demanding plants and trees to more light and consequently to physiological disturbances and death. Pioneer trees, which germinate under intensive sunlight, invade the space created after elimination of shade demanding trees by fire.

Impoverished soils produce less biomass and render natural regeneration less successful. Less grass cover exposes the soil surface to torrent runoff and erosion of upper layers. Less water infiltration keeps the water table deeper, which makes the growth period shorter and eliminates drought susceptible vegetation. Impoverished vegetation cover also disturbs wildlife habitat.

Vegetation species in Miombo woodland have developed survival strategies against forest fires but there is a threshold of tolerance. Intensive and frequent fires exceed the defensive capacity of any vegetation. Perennial plants can have their root system alive for years while above ground parts are constantly burnt.

In Cheringoma area for instance, the forestry vegetation exhibits different physiognomies including: (a) forests with multi-layers, climbers and lack of grass layer; (b) woodland with open canopy having less than three layers and abundant grass layer and; (c) all appearances in between. The succession from forest to woodland in this area is widespread and apparently a result of fires. For edaphic reasons, woodlands may also occur in the area independently of fire effects.

Fire management organization

Although fire has been recognised as a serious problem affecting social, economic and environmental levels, the Government institutions, especially those specialised in forestry research, have not yet taken any action to study and contain this problem. While the forestry administration has been strengthening itself over the last two decades, forest fires continue to ravage the resources and contribute to significant changes in the ecosystems.

Wildfire database

Table 1 provides a summary of the land area affected by wildland fires. The data are based on the aforementioned case studies and assessments.

Tab.1. Wildfire database for Mozambique 1990-1999 based on case studies and other reports (Saket 1999)

Year	Total No. of Fires on Forest, Other Wooded Land, & Other Land No.	Total Area Burned on Forest, Other Wooded Land, & Other Land ha	Area of Forest Burned ha	Area of Other Wooded Land and Other Land Burned ha	Human Causes No.	Natural Causes No.	Unknown Causes No.
1990		38-40%	28-38%	41-57%	~90%	~5%	~5%
1991		“	“	“	“	“	“
1992		“	“	“	“	“	“
1993		“	“	“	“	“	“
1994		“	“	“	“	“	“
1995		“	“	“	“	“	“
1996		“	“	“	“	“	“
1997		“	“	“	“	“	“
1998		“	“	“	“	“	“
1999		“	“	“	“	“	“
Total		38-40%	28-38%	41-57%	~90%	~5%	~5%

Trends of forest fires

Data collected on forest fires using aerial photographs taken during the period of 1950 to 1970 is comparable to that from Landsat images recorded in 1989-92. Both studies were carried out to determine the extent of annual fires. The two periods were characterised by similar political events. The first period covers the liberation war when a large

proportion of the local population had left their areas of origin. The second was marked by the civil war, which affected all the country and disrupted population distribution, with displacement of the rural population to refugee camps along security safe corridors and to neighbouring countries. In spite of the exodus of the local people from their areas of origin during the eighties, wildfires continued to sweep over 40% of the country. The question now is what will be the trend of forest fires after the return of the local people has been completed to their areas of origin?

Information on forest fires from the previous decades is not available or is scarce and poor. A few sporadic publications are available in DNFFB from colonial times but these only served to create public awareness.

Fire Management and use of prescribed fire to achieve resource management objectives

In a recent report on the fire situation in Mozambique Saket (1999) stresses that fire management is the most important component in any technical proposal for forest management planning in Mozambique, owing to the degree to which fire is conditioning the flora and to the damage it causes annually. The role of the local people in fire management is also central to any Government fire control strategy or plan, if sustainable timber exploitation may be reached and the forest will continue to provide the people's needs in various forestry products and services.

Complete exclusion of fires from the forest is very likely an unachievable attempt. In the fire-conditioned forestry ecology, complete exclusion of fire will probably lead to different species mix, especially in the littoral and more particularly in the Cheringoma area, where forest physiognomy will likely regain ground.

Controlled fires in the Cheringoma, by reducing their frequencies and limiting their occurrences in early dry season (May-June) are also likely to lead the natural flora to new compositions and new vegetation associations with different limits. It will save large proportion of the new regeneration from destruction.

Thus, the following fire management directives are recommended:

- * The forestry services at national, provincial, district and locality levels should campaign for control of fires every year before the end of the wet season. Meetings with local community leaders and farmers should be held every year in February-March to expose the fire consequences on the people's well being and the Government strategy for the combat of fire, introduce the fire control techniques and inform of the legislative implications.
- * Legislation should encompass fire control measures as well as punitive measures in case of infractions and recidivism.
- * Use of fire around households and cultivation fields within or in the vicinity of the forest should be limited to wet seasons and to early dry seasons (January-June).
- * Areas set on fire should be separated from the forest by firebreaks not less than 5m wide and should be monitored by the person who set it until its full extinction. Fires propagated to the forest from where it was set should be communicated to the local authorities for records. Any fire which reached the forest and expanded in it and not reported to the relevant authorities should be investigated and its author be kept responsible for it according to the legislation in force.
- * Making fire in the forest during the period extending from July to December should be completely forbidden. Fires in that period expose their authors to judiciary measures in accordance with the legislation in force.
- * Making fire out of the fire period for any reason (timber exploitation, stimulate germination of fire demanding seeds, etc.) should be authorised by the forestry and wildlife authorities. Intervals between two successive fires on the same area should not descend below a minimum of 8 years. Fire should be restricted to the area of interest.
- * All forest roads should be graded in May-June every year to play the role of fire breaks.
- * Limits of timber as well as wildlife concession areas should follow natural boundaries (rivers, streams, water divide, etc). Concessions not separated by natural openings such as rivers should be delimited by 10 meters artificial firebreaks graded or weeded annually.
- * Fire Control Units should be set up with the mandate to campaign for forest fire control, apply legislation when is necessary and implement the fire prevention techniques.

- * Natural forest should be put under management system, where management plans have to be prepared where fire management should be incorporated that includes subdividing the area into compartments separated by firebreaks. The participatory and integrated management plans will alleviate the state responsibilities in fire control by involving the private sector and local communities.

The need to integrated the use of prescribed fir in forest and other vegetation management is underscored by Saket (1999) who recommends prescribed burning at the levels of a concession area (Tab.2).

Tab.2. Recommendations for fire management (fire control and prescribed burning) at the levels of a concession area (Saket 1999)

Forest types	Fire management
Closed forest	No fire. In case it happens extinguish as soon as possible
Open forest	Periodic burning is desirable
- Natural regeneration	Burn every 8 years in early dry season
- Late sapling and thicket height	Burn every 4 years in early dry season
- Fire declared in shorter period in open forest should be extinguished as soon as possible	
Grassland	Burn annually in early dry season. Elimination of grass reduces the fire hazards in the surrounding forests

Public policies affecting wildfires and fire management

From the early forties, the foresters in Mozambique have joined their colleagues in other parts of Africa in the long debate on social and environmental roles of the bush fires. They have expressed concern on the trends and sequels of fires and they put forward ideas for their regulation and control. It has then been suggested that:

- * fires should only be started when there is urgent need for it;
- * fires should be only started with permission from the relevant authorities;
- * farmers and local people should take appropriate measures to avoid fires from encroaching into the forest areas;

The 1921 forestry legislation prohibited making fires and clearing forestry vegetation under the shifting cultivation system. In a decree of 1928 the Governor of Mozambique underlined the prohibition of use of fire in the forests but with apparently less emphasis. Article13 of the decree stipulated that the local authorities should avoid, whenever possible, big fires and itinerant agriculture.

However, forest fires are not properly featured in the Government policy for the sector. The forestry legislation, which is the first level resources management tool for Government policy implementation fell short of expectations with respect to concrete measures to be taken for the nation-wide combat of fires and setting up a widely accepted and effective fire control system.

Acknowledgements

The country brief is based on a report by Saket (1999) in which additional bibliographic sources are provided.

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NAMIBIA

Fire Situation in Namibia Fire Environment, Fire Regime and Ecological Role

Introduction

Namibia lies in the west of Southern Africa, bordering Botswana and South Africa to the east and the Atlantic Ocean to the west, and covers an area of approximately 824 000 km.

Large areas burn each year, with more than 3 million hectares estimated to have burned in 1997 alone. Excessive, indiscriminate burning is having highly negative effects on some ecosystems, while in other areas fire frequencies are more in equilibrium with requirements for long-term stability of existing vegetation communities (Goldammer 1998).

Fires burn during Namibia's severe dry season from April to October. The vast majority occurs as surface fires that spread in the grass and shrub layer. Crown fires and ground fires occur over only limited geographical areas. The amount and connectivity of the predominant grass and shrub fuel is highly variable spatially and temporally, controlled by a severe rainfall gradient oriented in an approximately SW to NE direction. This means that the most frequent, intense and extensive fires occur in the north and particularly in the Northeast, while in the south and west fires rarely occur. Figure 1 shows a burned area map of the fire-prone areas of Namibia (derived from remote sensing) and demonstrates how the size and extent of burned areas increases from SW to NE.

Lightning fire is the most significant natural cause, but accounts for a small percentage of all fires. The majority of fires are ignited by people, either deliberately or accidentally.

Table 1 describes the broad fire environment and fire regimes for six different zones (Figure 2). The zoning into different fire regime areas in Figure 2 is based on the GIS-based analysis of different maps of land use, rainfall, vegetation and maps of burned areas (e.g. Figure 1).

Ecological Roles of fire in the six zones

In Zone 1, the desert fringe of western Namibia, fire is so infrequent that its ecological role can be discounted.

In Zone 2, the fuel load is so low and fires are so infrequent that fire plays a limited but positive role in removing material.

In Zone 3, fires are generally not desired as the resulting loss of fodder may constrain pastoralism. Therefore, in cases where fires occur, coordinated efforts are made to put them out quickly. This means fires rarely spread over very large areas. However, decades of fire exclusion have contributed to severe bush encroachment over extensive areas.

In Zone 4, the Etosha National Park, fire is managed according to a block burning strategy designed to promote the maintenance and, in special cases, to increase the biotic diversity. Fires prescribed by management result in reduction of moribund material, regeneration of palatable grasses, control of bush encroachment and prevention of severe fire hazard by reducing the fuel load (Du Plessis 1997).

In Zone 5, fires are perceived negatively, although few coordinated efforts are made to put them out. In years with sufficient fuel load and continuity, fires can spread over very large areas. High livestock density and grazing pressure maintain the fuel load at relatively low levels that limit fire intensity. Ecological impacts are therefore small and tend to do little more than prevent moribund material from accumulating in the herbaceous layer. Fire does not pose a serious threat to forested or wooded areas within this zone.

In Zone 6, high fire frequency and high shrub/grass biomass pose a serious threat to the large areas of wooded land and forest present by converting important areas of forest and wooded land into shrubland with very few mature trees. Succession of the shrubland to mature wooded land and the survival of many seedlings is prevented by subsequent high frequency fire. In Mopane/*Terminalia* woodland, fire tends to prevent bush encroachment. In areas of Other Land, fire plays an important role in the regeneration of grasslands.

Wildfire impacts

Important impacts occur mainly in zones three to six. In Zone 6, large areas of wooded and forested land have been damaged by high frequency fire, with a significant reduction in areas of commercial and non-commercial timber

resources, loss of habitat, reduction in woodland biodiversity, and losses of wood resources for domestic use. The high fire frequencies also promote the establishment of fire-resistant, but often less useful woody species, such as *Dichrostachys cinerea*. Fires have also killed large mammals, with peat ground fires in the Malangalenga area of Caprivi killing 170 buffalo in 1996 alone. (Mendelsohn and Roberts 1997). During the height of the dry season, large smoke plumes and high levels of background smoke are present, although any effects of reduced air quality upon public health are yet to be quantified. In Zones 3 and 5, the removal of pasture by fire is a highly undesired impact that can threaten survival of livestock. This situation is compounded during years when rains fail after burning. In Zone 4, the active management of fire aims to promote beneficial impacts, and adverse impacts are rare.

In exceptional cases, people are trapped and receive fatal burns. Centralised figures on the different impacts are unavailable.

Fire database

Fire statistics are not yet compiled or aggregated to the national level, and resources for obtaining fire statistics in the field are limited. By far the most comprehensive surveys of active fires and areas burned have been made using image data from the Advanced Very High Resolution Radiometer (AVHRR) sensor onboard the U.S. NOAA (National Oceanic and Atmospheric Administration) satellite series (Cracknell 1997). Maps and statistics have been compiled for north-central and northeast Namibia (primarily Zones 4, 5 and much of Zone 6), with the whole of Namibia mapped for just 1997 (Trigg 1997, 1998; Le Roux *pers. com.*). Based on AVHRR data, fire frequency maps have been prepared for much of Zones 5 and 6 and all of Zone 4.

Fire numbers

Due to difficulties in determining independent ignitions from active fires detected using AVHRR, there are no reliable statistics on fire numbers.

Area burned

AVHRR-based burned area maps are available for five consecutive burning seasons (1994-1998 inclusive) for all of Zone 4 area and for the majority of the most fire prone area of Zone 5. They are also available for the most fire-prone part of Zone 6, for four consecutive burning seasons (1996-1999 inclusive). Figures three to six are all based on these remotely sensed data.

Figure 3 shows the areas that burned each year in the different zones. Zones 4 and 5 are characterised by high variability between years. In zone 6, fire is much less variable, with large areas burned every year.

Figure 4 shows that in zones four and five, only a small percentage of the land burned during the years under consideration, whereas in zone six, some 40 to 60 percent of the land has burned every year.

Examination of an image showing how many times Zone 6 burned during the four year period 1996-1999 (Figure 5), reveals that some 10 percent of the land area burns every year, and that most of the area burned between two and four times. The small unburned areas are coincident with areas of high population pressures and high livestock numbers, and consequently little combustible biomass. As mentioned, the high return period of fire poses a serious threat to the survival of the large areas of wooded land and forest remaining in Caprivi.

It is evident from figure 6 that the vast majority of Zones 4 and 5 did not burn in the five year period under consideration, with a distribution skewed towards relatively low fire frequency. The more normal distributions in the two sub-areas of zone 6 illustrate that fires occur much more frequently, with more than 10 percent of the area to the east of 21°E having burned every year (Figure 6D).

Causes of fire

In Zone 6, people light the majority of fires for many reasons. Those reasons include: to stimulate the growth of fresh grass for cattle, to attract game, to flush out game that can then be hunted, to clear vegetation around waterholes and honey-gathering areas, to clear land for cultivation, or to promote the regeneration of grasses used for thatching. Arson also occurs. As most fires occur at times with no convective thunderstorm activity, it is clear that lightning plays a relatively minor role (Mendelsohn and Roberts 1997).

In Zones 3 and 5, fires originate either as a result of lightning strikes during convective storms at the beginning or the end of the burning season, or are started accidentally during charcoal making or from inadequately supervised camp

fires, or careless use of cigarettes. In zone five, large areas are sometimes burned accidentally as the uncontrolled extension of fires deliberately lit to clear new fields.

In Zone 4, fires are ignited mainly by lightning and park management and occasionally by accident.

In Zones 1 and 2, the rare fires that occur are started mainly by accidental ignition and lightning.

Operational fire management systems and/or organisations

Fire is managed over the full extent of Zone 4 (Etosha National Park) by the Directorate of Resource Management of the Ministry of Environment and Tourism. Part of East Caprivi within Zone 6 is managed by local communities mobilised by the Directorate of Forestry. In Zones 2 and 3, farmers' associations are concerned with fire suppression, although their links to central government is yet to be formalised.

Fire prevention

Large scale fire prevention occurs only in Zones 4 and 6. In Zone 4, Park management actively prevents fires from entering the Park from neighbouring areas. The Park itself is divided into fire management blocks separated by well-maintained fire breaks. Fires naturally occurring within any block are actively contained within that block. In Zone 6, communities mobilised by the Directorate of Forestry, with support from the Finnish government, make a network of fire lines to prevent the spread of fire into important forest reserves. This contribution has resulted in a reduction in areas burned.

Fire early warning, detection and monitoring

Staff at the Etosha Ecological Institute (within Zone 4) collect NOAA AVHRR satellite data at approximately 12 hour intervals every day. These data are used operationally to provide early warning of approaching fires, to detect and monitor the progress of active fires within the zone and to map burned areas. AVHRR data are also used to map fires operationally in Zone 5 and in part of Zone 6.

Suppression

Undesired wildfires are suppressed where possible in most of zone 2, all of zone 3 and 4 and in some areas of Zones 5 and 6. In Zones 2 and 3, fires are suppressed by members of the farmers' association. In Zone 4, Park management staff from the Directorate of Resource management suppresses wildfires. In parts of Zone 5, local officials from the Ministry of Agriculture assist community members in combating certain fires. In part of East Caprivi in Zone 6, the communities mobilised by Directorate of Forestry have also been equipped and trained to suppress wildfires. Table 2 summarises the main organisations involved in the different fire-related activities.

Main research issues

In eastern Caprivi (Zone 6), research has developed simplified techniques for assessing range condition for controlling burning. This will provide a practical means of applying ecologically acceptable controlled burning for different systems of land use in East Caprivi. It is intended that the simple criteria developed can be used by non-rangeland specialists as an objective basis for deciding whether rangeland needs to be burned or not (Trollope et al. 2000).

Research is also being conducted with the primary aim of improving the accuracy with which burned areas can be mapped using remote sensing. This involves consideration of potential improvements from new satellite sensors such as MODIS (Moderate Resolution Imaging Spectroradiometer), launched December 1999 (Trigg and Flasse 2000), as well as the development of techniques to improve the accuracy assessment of resultant burned area maps. The latter step is seen as an important step in improving the reliability and accuracy of techniques for the remote sensing of burned areas.

Use of prescribed fire in the region to achieve management objectives

Trollope and Trollope (1999) state that the main land-use types relevant to prescribed burning in East Caprivi (within Zone 6) are:

- * Livestock farming
- * Nature Conservation

- * Forestry in the State Forest
- * Production of thatching material in communal lands

By considering the reasons for burning within each land use type and by understanding the effects of different fire regimes, they have formulated guidelines for prescribed burning in each land use category. The techniques for range condition assessment (described briefly above) are a more detailed extension of this work. The guidelines also reflect the need to continue measures to prevent and exclude fires from the forest and wooded land that is currently under threat from excessively frequent fire. These studies will form the basis for fire management that is adapted to and specifically focused on the promotion or maintenance of land for specific uses.

Prescribed fire is used to achieve management objectives in the Etosha National Park (Zone 4) as described above. In Zone 6, small fires are prescribed to prepare land for agriculture.

Sustainable land-use practices employed to reduce wildfire hazards and wildfire risks

In Zone 6, communities mobilised by the Directorate of Forestry, with support from the Finnish government, have been trained and equipped to cut firebreaks to prevent the spread of fire in important forest reserves. This contribution has resulted in a reduction in areas burned.

Public policies concerning fire

The formulation of policy and regulations concerning fire is an ongoing process. The Directorate of Forestry has prepared a document on the Development of a National Fire Policy and Guidelines on Fire Management in Namibia (Goldammer 1998). This builds on the Namibia Forestry Strategic Plan, which provided the basis for fire policy and management planning. The Strategic plan recognises many of the complexities of fire, including; the need to reduce the occurrence and severity of uncontrolled and accidental forest fire, while still allowing controlled fire under specific circumstances; that community participation is desirable in the protection of forest resources; and that different policies could, in theory, be adopted in different parts of Namibia as necessary.

A Round Table Meeting on Fire was held in Windhoek on 10-11 October 1999 (Goldammer 1999) towards further definition of fire policy and the coordination of responsibility for fire management (Goldammer 1999). Draft proposals for regulations on bush fire management have been prepared recently (Piepmeyer 2000).

Namibia has ratified the UN convention on Climate Change, and is consequently required to provide quantitative assessments of free-burning vegetation fires (Goldammer 1998).

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Increasing occurrence and intensity of wildfires in Eastern Caprivi have caused deterioration of Zambesi Teak (*Baïkea plurijuga*).



Table 1. Fire environment and fire regimes for six major zones of Namibia.

Area	Fire Environment				Fire Regime		
	Land use	Vegetation	Rainfall	Biomass	Return period	Season	Intensity
1.	State land, tourism, mining	Sparse grass and shrubs, trees confined to water courses, occasional succulents	Extremely arid below 100 mm rainfall	Very low	Ten years or more	March to December	low
2.	Commercial and communal farmland	Karoo shrub, grass, trees	100 to 300 mm	low	Five to ten years	July to December	low
3.	Commercial and communal farmland	Mixed tree and shrub savanna, wooded land	150 to 550	Medium to high	Two to ten years	July to December	Low to high
4.	National Park, wildlife and Tourism	Mixed tree and shrub savanna	250-500 mm, increasing from west to east	Low to medium, increasing along the rainfall gradient	One to five years	July to December	Low to medium
5.	Communal farmland	Mixed grassland, savanna and wooded land.	250-500 mm, increasing from west to east	Low to high, increasing along the rainfall gradient	Two to five years	July to December	Low to medium
6.	Communal farmland, National Parks, State forest	Mixed grassland, savanna, wooded land and forest	500-750 mm, increasing from west to east	Medium to very high	One to three years over majority of area.	May to November	Medium to very high

Table 2. Main organisations involved in fire suppression activities.

Zone	Fire Prevention	Early warning, detection and monitoring	Suppression
1	None	None	None
2	None	None	Farmer's associations
3	None	Directorate of Resource Management, on ad hoc basis.	Farmer's associations
4	Directorate of Resource Management.	Directorate of Resource Management.	Directorate of Resource Management.
5	None	Directorate of Resource Management	Ministry of Agriculture
6	Directorate of Forestry	Directorate of Resource Management, Directorate of Forestry (National Remote Sensing Centre)	Directorate of Forestry

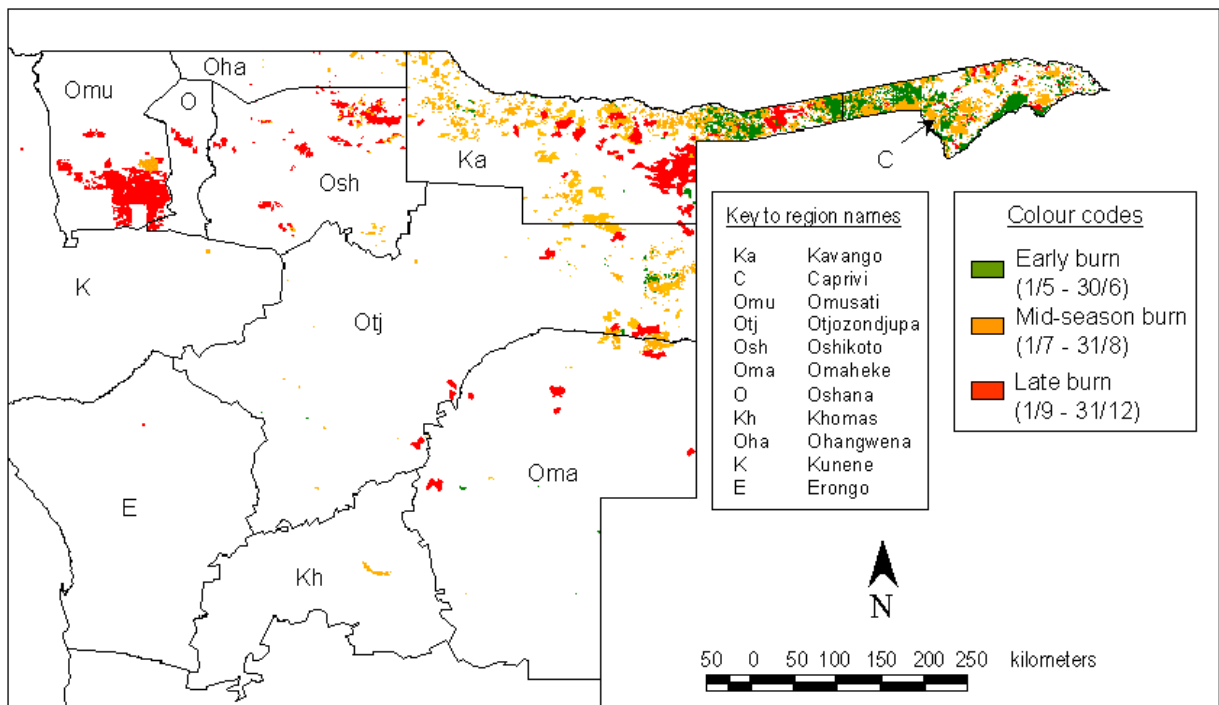


Figure 1. Fires in Northern Namibia for the 1997 burning season, colour coded according to approximate date of burn.

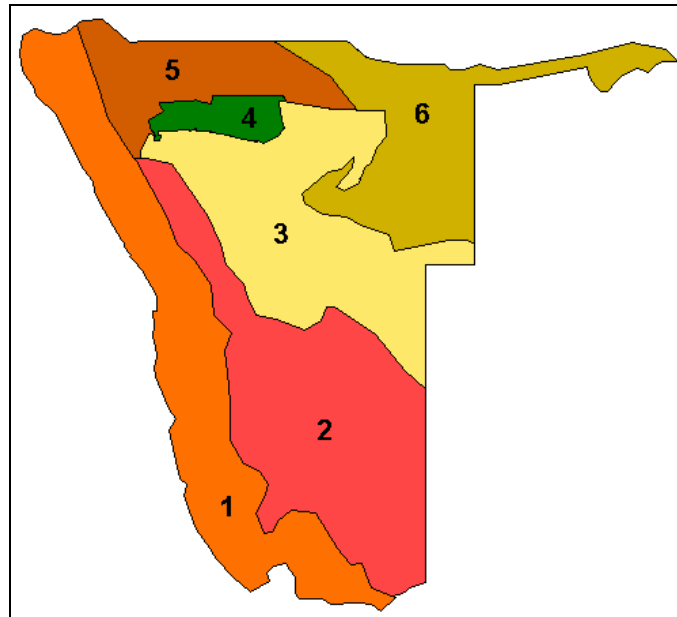


Figure 2. The six Zones used to describe the different fire regimes of Namibia.

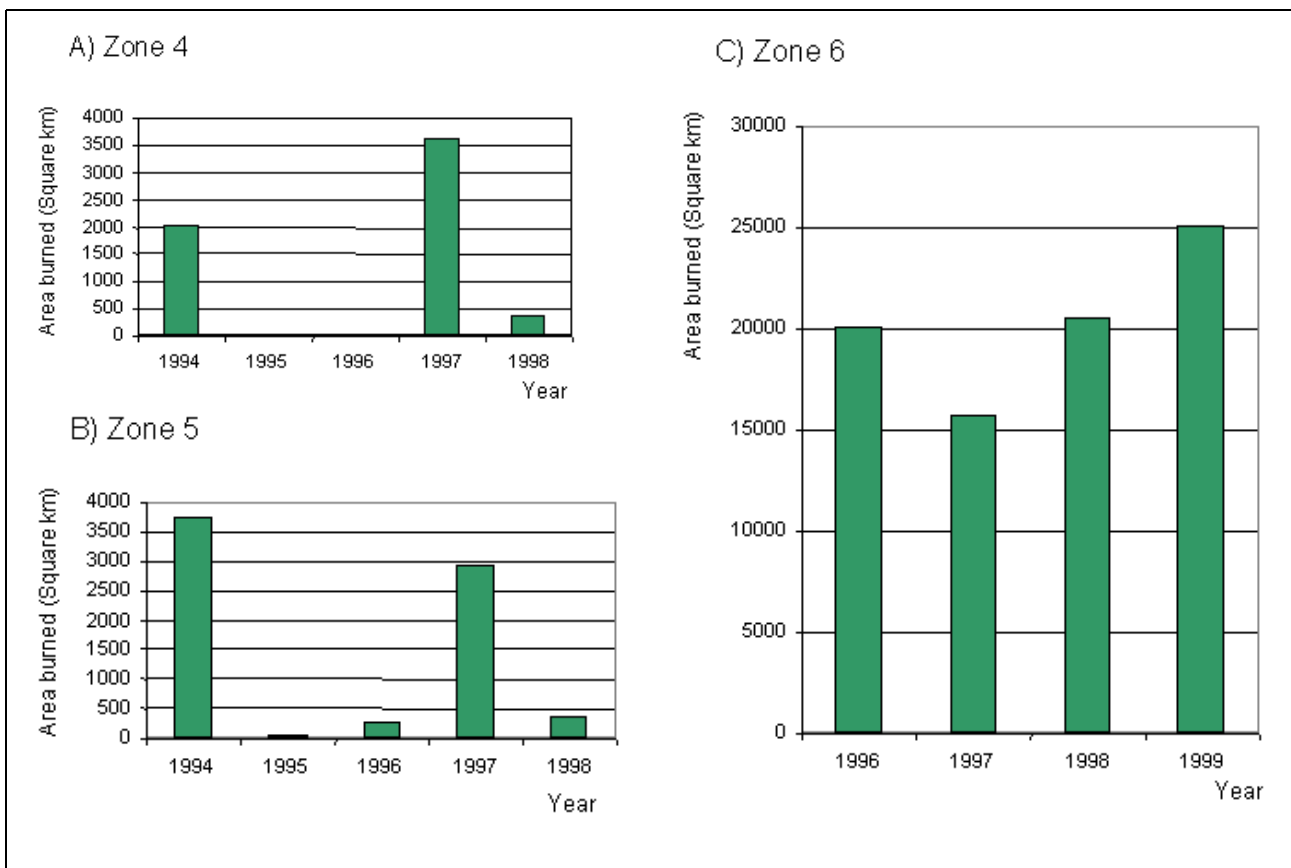


Figure 3. Areas burned in Etosha National Park (Zone 4), and the areas of Zones 5 and 6 for which burned area maps are already available. Note that A and B are for the years 1994 to 1998, whereas C is for 1996-1999 (note the very different scale of A and B compared to C).

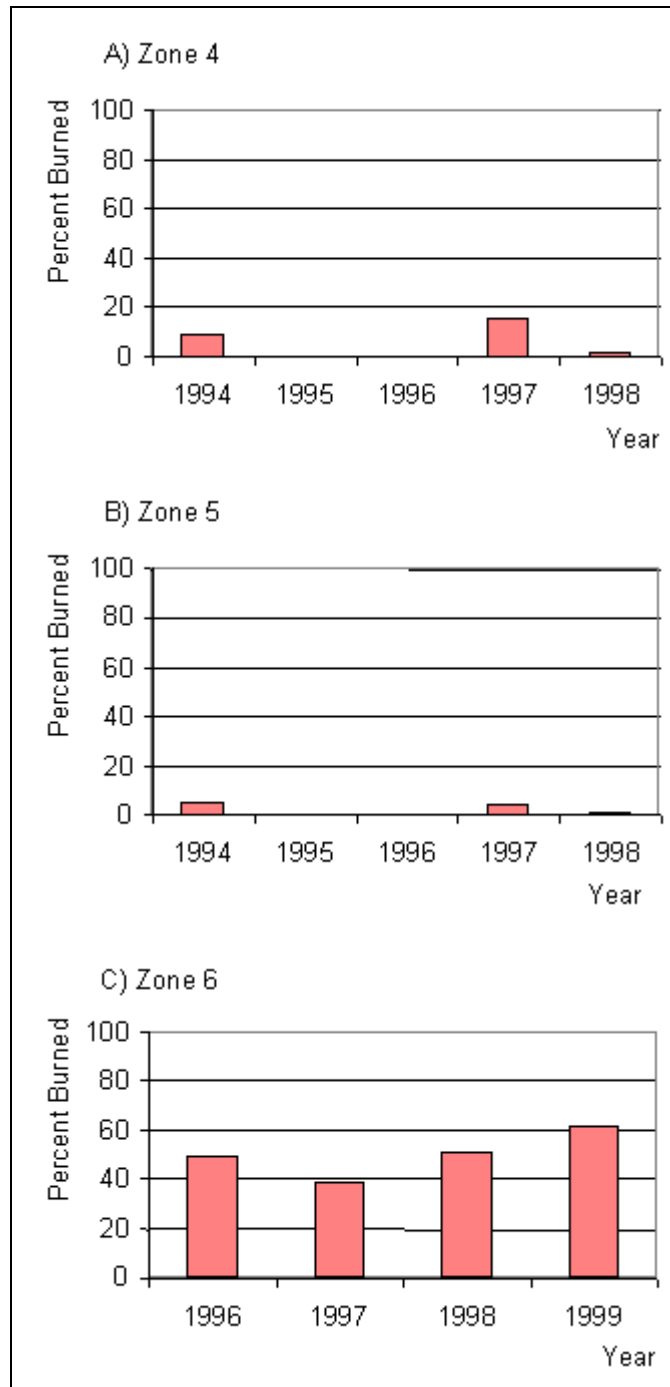


Figure 4. Percentage area burned in Etosha National Park (Zone 4), and the areas of Zones 5 and 6 for which burned area maps are already available. Note that A and B are for the years 1994 to 1998, whereas C is for 1996-1999.

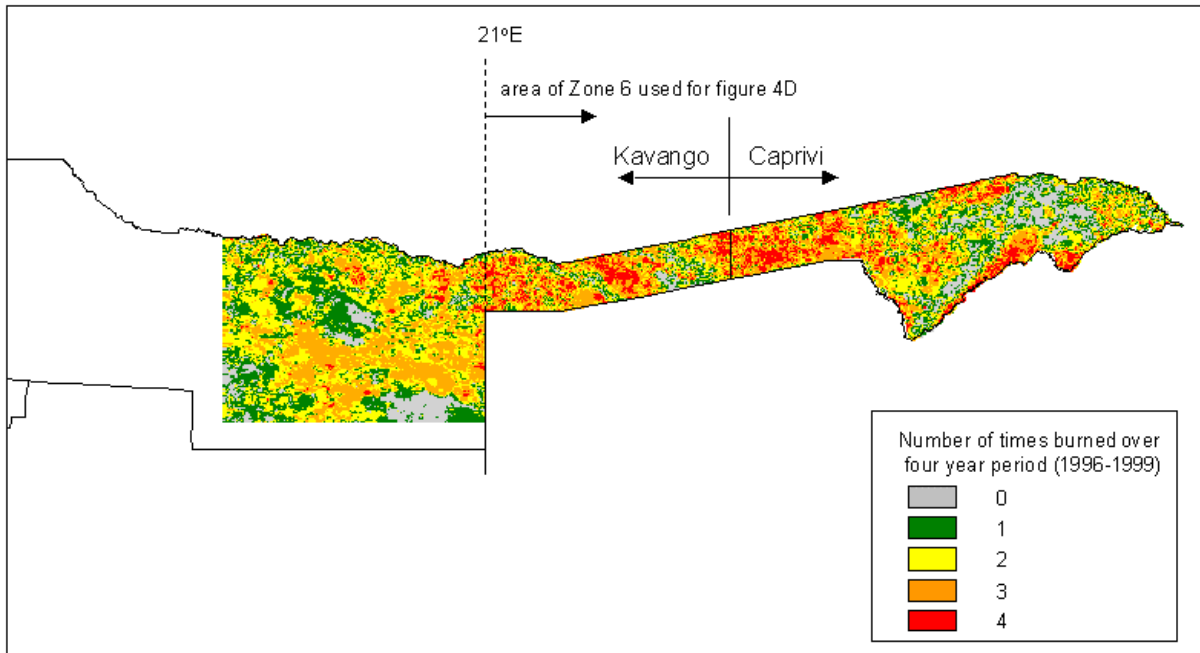


Figure 5. The number of times the areas of Zone 6 (routinely monitored by AVHRR) burned over a four year period (1996-1999).

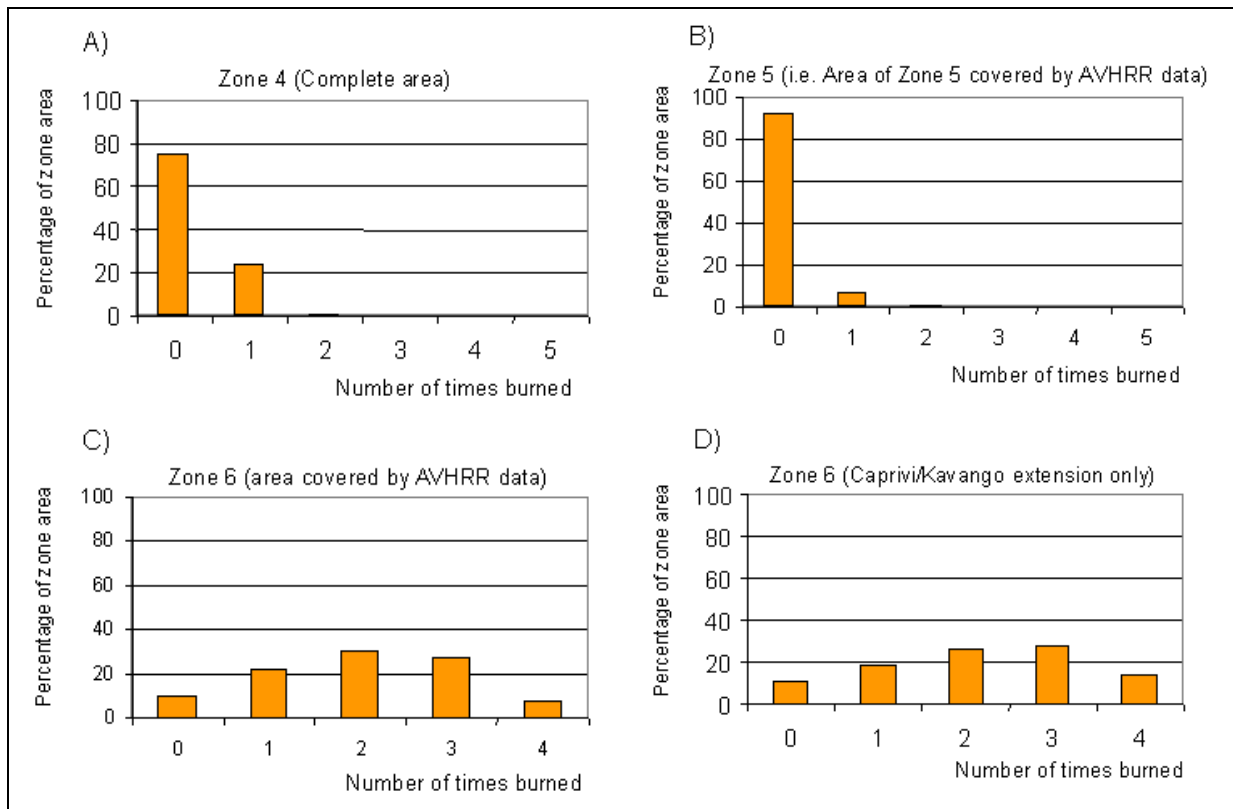


Figure 6. Percentage of land having burned different numbers of times within a set number of years. A and B show the percentage of Zones 4 and 5 that burned between 0 and five times during a five year period (1994-1998). C and D show the percentage of Zone 6 and the Caprivi-Kavango extension of Zone 6 (see Figure 5) that burned between 0 and four times within a four year period (1996-1999).

The Namibia-Finland Forestry Programme

Namibia Forestry Strategic Plan (NFSP) was formulated in 1996 by the Directorate of Forestry (DoF) as the basis for the future organisation and development efforts in the forestry sector. Namibia-Finland Forestry Programme (NFFP) was subsequently launched by the Ministry of Environment and Tourism as the main entry in the implementation of the NFSP and its first phase was implemented during 1997-2001. The overall objective of the Programme was to increase the role of forestry in the socio-economic development of Namibia through continuous development and implementation of sustainable forest management practices. The Programme comprised four components as follows: Public Sector Forestry Capacity Building (included sub-components on Institutional Development, National Forest Inventory, Forestry Training at Ogongo Agricultural College and Technical Support to the National Remote Sensing Centre), Community-level Forest Management, Environmental Forestry, and Integrated Forest Fire Management. The second phase of the NFFP is currently under implementation with a reviewed structure.

The purpose of the Institutional Development (ID) sub-component was to bring Directorate of Forestry (DoF) at an adequate level with respect to management structure, information systems, forest research and policy implementation so as to enable sustainable management and monitoring of forestry activities by all stakeholders. The review of the national forest policy was completed and national criteria and indicators for sustainable forest management subsequently developed. DoF organisation management was strengthened through the development of mission and vision statements as well as strategic objectives and milestones for their achievement. Result areas and indicators were also developed for principal staff at all organisation levels and individual annual objective setting and work planning procedures introduced for officers occupying all relevant posts.

Necessary prerequisites for rational decision-making at DoF were created through the establishment of effective management information systems. Priority systems defined were forest permit information system, forest fire monitoring system, management reporting and accounting system, user-friendly forest resource information system and local-level forest management planning system. Training needs assessment for the entire sector was completed and in-service training programmes initiated. Altogether 11 overseas scholarships for MSc and BSc studies were sponsored by the Programme. Forest research priorities were also assessed and respective research programmes are now being initiated.

The purpose of National Forest Inventory (NFI) sub-component was to produce *adequate forest resource information which is being used for forestry strategic planning and operational management*. The regional-level inventories were completed and respective forest resource data generated for the Caprivi region, and for Tsumkwe, Otjinene and Okakarara districts in the Otjozondjupa and Omaheke regions. The forest resource data for some 4-0 regions was also generated. The deteriorated security situation in Kavango and Ohangwena did not allow forest inventories in those regions. The first high-intensity inventories to support operational forest management were undertaken in the proposed community forestry reserves of Ongandjera and Uukwaluudhi, in the Caprivi State Forest and in a designated concession area of Nkurenkuru. The model on the actual operational inventories for the preparation of operational forest management plans for the designated pilot community forest areas in Omusati was developed by the community forestry component. Local capacity building to master the inventory methodology and related data processing systems was an integral part of component activities. The field teams are now led by qualified Namibians.

The purpose of the sub-component on Forestry Training at Ogongo Agricultural College (OAC) was to enable *Ogongo Agricultural College produce good quality forestry graduates*. The first new Diploma in Forestry Programme with 11 students was completed and two future forestry teachers are currently undergoing B.Sc. training in the University of Stellenbosch. Existing human resources at the OAC have been constantly developed through on-the-job training and study tours. The component also involved development of physical resources, the main investments being new vehicles, irrigation system at the nursery, tools and machinery for carpentry workshop, computers and office equipment, and new teaching and training material. During the last year the existing management system of the College was analysed and development needs identified. Networking channels have been identified by establishing regular contacts with other forestry training institutions and through study tours.

The purpose of the sub-component on Technical Support to National Remote Sensing Centre (NRSC), which was launched in August 2000 and is still ongoing, is to *establish improved capacity at NRSC to offer services on Remote Sensing and Geographical Information Systems (GIS) to all stakeholders*. The sub-component objectives include development of effective organisation management tools for planning and implementation of all NRSC activities. The human and material resources at NRSC are being developed to meet the information needs of various

stakeholders and relevant demand driven information systems established and mechanism for their updating developed. Regular and formal collaboration and networking mechanisms are being developed in collaboration with the relevant local, regional and international stakeholders.

The purpose of the Community-Level Forest Management (CF) component was to produce *applicable models of sustainable integrated forest management which are implemented in communal lands*. The forest reserves located in the Uukwaludhi, Uukolonkadhi and Ongandgera communal areas of the Omusati region were selected as pilot areas. Within these areas, five villages were subsequently identified as potential pilot communities. A model integrated land-use and forestry plan based on indigenous landscape classification was developed and integrated forest management agreements with several local communities established. Regional-level institutional and financial incentive schemes were also designed to encourage and promote community-level forest management. The component contributed significantly to the establishment of effective Forestry Extension Service in Outapi through technical and financial support. Building of the Outapi Forestry District Office was completed and equipped with furniture, vehicle, radio-communication system as well as necessary computer hardware and software.

The purpose of the Environmental Forestry component (EF) was to produce applicable methods for establishing and managing nationally strategic forests, e.g. for watershed management or biodiversity conservation. The component operated at two levels: framework building at national level, and methodology development at local level. The activities involved the national process to establish mechanisms for inter-sectoral coordination on forest conservation as well as to develop criteria for nationally strategic forests as well as their identification and mapping. The field process located in Caprivi involved selection of pilot forest areas and their social, economic and environmental characterisation. The first pilot area coincided with the Salambala conservancy and collaboration agreements with relevant stakeholders were formulated. Management objectives both from local and national viewpoints were defined and respective management schemes formulated. Local management capacities were enforced through capacity building. The process also involved development of appropriate monitoring systems so as to enable continuous improvement of the methodology.

The formerly bilateral project on Integrated Forest Fire Management (IFFM), previously called Forest Fire Control, was integrated as a supporting component into the Programme with the purpose of producing an *applicable model for Integrated Forest Fire Management*. It hoped to benefit forestry by involving local communities in wise fire management for their own benefit using Caprivi as the pilot region. The component enhanced the capabilities of all stakeholders on forest fire control and ecologically acceptable use of fire, and also aimed at changing of attitudes, cultural values and habits in relation to fire and burning. A variety of preventive fire protection field works were completed and extension message on forest fire control and management delivered through a variety of traditional and new extension channels. The continuous monitoring of the component impact has been facilitated through a GIS-based fire scar mapping procedure developed by the National Remote Sensing Centre. National fire management guidelines were also produced and are being tested during the second phase of NFFP.

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Editorial Remarks: Mr. Seppanen and Mr. Mike Jurvélius, forest fire expert and technical coordinator of the National Forest Fire Management Guidelines for Namibia (see p. 73 of this issue), returned to their home country Finland in May 2001. The Namibia-Finland Forestry Programme can be contacted through the address in Windhoek. The following papers from Namibia are outputs of the Namibia-Finland Forestry Programme.

IFFN readers are kindly reminded that earlier reports on Namibia have been published in the pages of IFFN /GFMC:

Jurvélius, M. and J. Kawana. 1998. Namibia: 30 % reduction in fire incidents in three years. *International Forest Fire News* No. 19, 67-70.

Jurvélius, M. 1999. Namibia: Reduction in fire incidents in East Caprivi. *International Forest Fire News* No. 21, 24-27.

Trigg, S. 2000. Fire monitoring and management in Namibia. *International Forest Fire News* No. 22, 49-53.

Impact of the Integrated Forest Fire Management Program on Rural Livelihoods in East Caprivi Region, Namibia

1. Introduction

Background and objective of the study

The Namibia-Finland Forestry Program (NFFP) has been implementing an Integrated Forest Fire Management (IFFM) component in East Caprivi Region since 1996. According to the project document, the main objective was to assist the Directorate of Forestry in “reducing the fires in East Caprivi in order to improve the living standards and the environment of the local people” (GoN/GoF 1996). The immediate goal was to diminish the negative impacts of the indiscriminate use of fire on forest regeneration, agricultural and pastoral lands. Furthermore, with this program Namibia fulfils some of its obligations related to the signing the International Conventions on Climate Change.

A mid-term review took place at the end of 1998. A major recommendation for the Integrated Fire Management Component was to undertake a combined technical and socio-economic review (GoN/GoF 1999). The review was undertaken in July-August 1999 (Trollope and Trollope 1999, Kamminga 1999). In the 1999 socio-economic appraisal the strengths and weaknesses of the IFFM’s implementation strategy (the “model”) were assessed in terms of their effectiveness, socio-economic impact and long-term sustainability. Also more insight was obtained in the existing local knowledge, and fire management and practices.

The first phase of NFFP is coming to an end in April of 2001. In the upcoming second phase, fire management will no longer be a separate program component, but rather an integrated part of the new Community Forestry component. In this context, the IFFM advisor requested a second socio-economic assessment to be done, with an emphasis on *quantification* of economic benefits. Such information was expected to be particularly useful for generating Regional and National level decision-makers support for fire management activities in the future. The Government’s financial contribution to the IFFM activities during the first phase included financing of labor required for the construction and maintenance of firebreaks.

Unfortunately, the lack of base line information and the complexity of the issues at stake makes a conventional cost-benefit analysis impossible without arriving at broad generalizations and projections that make little sense to anybody who is really familiar with the local context. An illustration is the following. The risk of forest fires in East Caprivi is highest in areas where grazing pressure is low. The costs of protecting such an area with cutlines should be compared with the benefits derived from increased availability of pasture. If lack of water supply is the real constraint for bringing cattle into that area, it might be more cost effective and economically sustainable to construct a couple of boreholes so livestock will keep the grass sward down and reduce the fuel load for free. Allowing communal grazing within the State Forest would be another example of utilizing grazing as an instrument to reduce the fire risk (cf. Trollope and Trollope 1999, Kamminga 1999).

In order to assess the contribution of IFFM to poverty alleviation (“improved living standards” according to the project document) a more qualitative analysis was undertaken, drawing on recent experiences with so called “livelihoods approaches”. Since 1993, various international agencies (CARE International, DFID, Oxfam, UNDP) have developed approaches and methodologies that put people’s livelihood concerns at the center of analysis. Some recent publications that are particularly relevant for the situation in Caprivi are: Ashley and LaFranchi (1997), Ashley (2000), Ashley and Hussein (2000), and Shackleton et al. (2000).

The objective of this brief study was to identify and explore some of the key issues, to assess the contribution of Integrated Forest Fire Management component of the Namibia Finland Forestry Program to the enhancement of local livelihoods and to identify opportunities for improvement. The intended users of the information are (1)

Regional and National level decision-makers and (2) the new Community Forestry team that will be responsible for the implementation of forestry activities in Caprivi Region during the upcoming second phase of the program. The study was undertaken by Evelien Kamminga, sociologist with the Namibia-Finland Forestry Program.

1.2. Approach and methodology

A recent publication by Shackleton et al. (2000) "Re-valuing the communal lands of Southern Africa: new understandings of rural livelihoods" provides a useful overview of the livelihoods approach:

The concept of "livelihoods" has moved analysis away from narrow parameters of production, employment and income to a much more holistic view that embraces social and economic dimensions, reduced vulnerability and environmental sustainability, all within the context of building on local strengths and priorities. Households pursue a range of livelihood strategies based on the assets (natural, financial, social, human and physical capital) they have to draw on and the livelihood outcomes they wish to achieve.

The livelihoods of the poor are complex and dynamic, typified by a diverse portfolio of activities that not only enhance household income, but also food security, health, social networks and savings. Most households maintain rural-urban linkages including activities and income sources such as casual and permanent wage employment, remittances, welfare grants, crop production, animal husbandry, wild resource use, social network transfers and other means of income generation through small enterprises. The contribution of different strategies varies and is constantly shifting as household members adapt to changes in the internal and external environment. Gender is integral and inseparable part of rural livelihoods. Men and women have different assets, access to resources and opportunities. New opportunities can increase income for men but increase subsistence responsibilities for women. Diversification can have positive and negative impacts. (Shackleton et al. 2000).

The livelihood impact assessment of the IFFM component focused on how the program activities directly and indirectly affected people's livelihoods, and the significance of these impacts for poor people. How the impacts are distributed across different categories of people. How people's livelihood strategies affect their participation in and benefits from IFFM activities. How IFFM contributed to improving poor people's livelihood security. How people's assets and capabilities, their activities and strategies have been affected (cf. DFID 2000).

For this assessment, a wide range of key informants and resource people were interviewed. The villages Ibbu, Ikumwe, Isuswa, Lubuta, Muyako, Ngoma were visited. During these visits, interviews took place with traditional authorities, cutline contractors, cut line workers and regular male and female community members, either individually or in small groups. Information on other areas was collected through interviews with people originating from those areas, e.g. the Zambezi Floodplains and Sangwali (Samudono). Also existing secondary sources were consulted and relevant information has been incorporated in this report.

2. Description of the Integrated Forest Fire Management component

2.1 IFFM objectives, strategies and activities

The project was initially called "Pilot Project for Forest Fire Control". The name was in 1998 modified to "Integrated Forest Fire Management" (IFFM) in order to emphasize that fire is a legitimate land management tool, if carefully timed and used (Goldammer 1999).

One objective of the IFFM component is assisting in National fire policy development and the elaboration of a regional fire management plan for East Caprivi. The main objective according to the project document, however, is "the implementation of an applicable model for integrated forest fire management, implemented by Namibians". As major results (outputs) were defined:

- * Directorate of Forestry (DoF) and other agencies and stakeholders implementing applicable IFFM activities in the field with improved efficiency and effectiveness. National guidelines and Forest Fire Policy developed, and
- * Changed attitudes and behaviour of general public towards the use of fire and burning, and its detrimental effects to the environment in Caprivi. The assumption is that local people are careless with fire and that the costs occurred from wild fire on their resource-base are high.

The defined physical targets (called 'indicators' in the Log Frame) for the four-year program period from 5/1997 to 5/2001) are:

- * 50% reduction of annual burning compared with the 1990's, and
- * 30% of the communities in East Caprivi and 5% of communities in Kavango Region implementing IFFM.

Sources of verification are satellite images, aerial photographs, field inspections, DoF reports, survey reports and Namibia's Climate Change Report (NFFP 1999). Finnish funding to IFFM mounted to 4.3 million FIM over a three-year period. The contribution of the Government of Namibia is N\$ 500,000 annually, with about N\$ 200,000 reserved for the financing of community-based labor for fire break production (GoN/GoF 1999).

The implementing team consisted of one expatriate forest fire expert; three laborers, who were basically trained on the job, but do not have any formal education in forestry or related field; and two forest technicians. One of the two forest technicians is responsible for supervision (Fire Chief) and also deputy District Forest Officer. The project also utilized the expertise from the local Caprivan Arts and Cultural Association (CACA): actors for the drama performances and artists for the design of visual aids and materials.

Contrary to the mechanized approach in fire brake construction of the previous South African administration, a labor-based approach was adopted. This labor-intensive approach was thought not only to enhance long-term sustainability, but also to provide employment benefits to the local population. The developed IFFM model is summarized in the following two paragraphs.

2.1.1 Public awareness campaign

IFFM public campaign work has been focussed on the prevention of fire in general and fire accidents in particular. Activities include the placing of billboards along main roads; distribution of posters in various languages; radio programs and regular announcements of ongoing activities and results; designing and distribution of a national fire logo; production of car stickers, badges, key rings etc.; production of comic books and school materials; exhibits on art shows, trade fairs etc.; education program at schools; drama performances by a self-help theatre group. The 1999 review team concluded that the decrease in area annually burned could probably to a large extent be ascribed to the reduction of fire accidents (e.g. dropping of cigarettes; camp fires). IFFM's awareness raising activities have played an important role in this respect and the implementation strategy has been effective (Kamminga 1999).

2.1.2 Community-level activities

At community-level, financial and technical assistance has been provided for cut line construction and maintenance. The communities involved in the program have benefited as follows:

- * Cash income;
- * Better protection against wild fires entering the territory and spreading of fires within the community's territory, and
- * Experience the advantages of improved fire control.

In addition educational and mobilization activities were undertaken to promote community members voluntarily involvement in the suppression of fires and their prevention, and also to enhance social organization. Simple techniques for fuel load assessment and prescribed burning techniques were recently added to the list of activities.

The main aim of all activities has been reducing the area burned per annum. Activities generally emphasized the negative aspects of fire and tried to eliminate fire. The 1997 Forest Act was thereby utilized as an enforcement tool. The South African administration made the use of fire illegal and this is still the situation today. The new Draft Forest Bill, however, delegates fire management responsibilities to the Traditional Authorities. This will hopefully lead to local communities becoming empowered and assuming ownership over fire control and management. This is considered crucial for future sustainability of IFFM activities.

2.2 The 1999 Technical and Socio-economic review

The 1999 review team recommended a fundamental change in approach in order for the program to be more effective, socially acceptable and sustainable. Rather than forming a blueprint fire control program, the focus should

be on enhancing local capacities in the use of fire as a management tool, while building upon existing knowledge and practices. Earlier the Mid-term review had emphasized the need for promoting a more natural resource management perspective and integrated approach (GoN/GoF 1999).

The major conclusion of the 1999 technical assessment was, that East Caprivi Region is subject to too frequent indiscriminate wild fires that have been ignited for apparently no valid ecological reasons (Trollope and Trollope 1999). It was also observed that the stakeholders involved have rather different interpretation of what a 'wildfire' is depending on their orientation and concerns (forestry; biodiversity; wildlife; hunting; crop cultivation; livestock production; thatch grass selling etc.).

In terms of the effects of the current fire regime on the vegetation of East Caprivi and the potential for IFFM, the following ecological zones were distinguished (see Trollope and Trollope 1999):

Kalahari woodlands

The woody vegetation and pastures in the Kalahari woodland areas are most at risk to fire damage. This is particularly the case where the grass sward is dominated by pioneer grass species and the woody vegetation comprises of two distinct layers of firstly short coppicing shrubs and secondly an overstorey of scattered large trees. Exclusion of all fire, however, is generally not recommended. The potential impact of IFFM activities in terms of increased productivity of natural resources is estimated to be high in this zone.

A variety of institutional and political factors however needs to be addressed in order to deal with the underlying causes of the current problematic fire regimes. A significant proportion of the Kalahari woodland areas does not have a common property tenure regime: a) Caprivi National Forest (Directorate of Forestry); b) Sachinga quarantine station (parastatal), and c) community-based wildlife conservancies (community-based natural resource management or CBNRM).

Mopane woodlands

These woodlands generally burn less frequently and resources are less affected by fire damage. The main reason is the sparse nature of the grass sward (fuel load). There is therefore less need for burning of moribund and less risk of spreading in case that fire occurs. Thus the frequency of burning in these areas are probably primarily a function of the grazing pressure. Satellite images over the 1996-1999 and the information on grazing pressure globally confirms such relationship. (Mendelsohn and Roberts 1997; Trigg and Le Roux 2000). The potential impact of IFFM activities on the productivity of the natural resource base is probably not very high.

Zambesi Floodplains

They are subject to frequent (annual or biennial) fires, which are started by local people. This is generally acceptable from a livestock management perspective. Abundant moisture is provided by the annual flooding of the flat terrain, resulting in excessively high fuel loads of grass that have limited value for grazing and constitute a serious fire hazard. The potential of IFFM in these grassland areas is therefore relatively low.

Chobe, Linyanti and Kwando Floodplains

Indiscriminate wild fires negatively affect the fodder productivity of these plains. In these areas rainfall is generally lower and flooding has not occurred for a decade or more. As main causes of the wild fires have been identified: fires originating from Botswana and natural spreading of ground fires in the peat. Important benefits can be expected from IFFM.

Thatchgrass producing areas

Areas adjacent to the floodplains are of particular economic importance, since they produce an important new cash crop: thatching material. Wildfires are very destructive. Periodically controlled burns, however, are necessary to achieve optimal productivity. Different user groups (male livestock owners and female thatch grass cutters) might have different fire needs. A wild fire for one category might be a planned fire for the other. The potential benefits from IFFM in these areas are expected to be quite high (Trollope and Trollope 1999).

2.3 Developments since the 1999 review

Almost immediately after the 1999 review, the East Caprivi secessionist movement organized an uprising. This resulted in further political and economic isolation of the Region. This situation has affected functioning and performance of the IFFM component in many ways. The IFFM program has been one of the few foreign assisted programs that did not close shop and the team deserves much appreciation for their commitment. During a certain

period, specific areas were not safe to work in; NDF soldiers were accused of starting forest fires intentionally; and so on.

The regional economy has been badly affected. Those to suffer were the commercial markets that currently exist for thatch grass, livestock and baskets. These are all indirectly related to IFFM's work as will become clear in Chapter 3. In addition, tourism and trophy-hunting almost came to a halt and seriously hampered the take-off of the various community-based conservancies in East-Caprivi.

A major change since the mid-1999 review is that certain posters and billboards carry new messages. Rather than "stop the fire" or "fire is evil", messages are now "manage your fire" and "use fire wisely". Some of the IFFM workers did not seem to have fully understood the implications of this changed terminology. The legal context has also not yet changed. The use of fire is currently still illegal, whatever the billboards say. These are among the reasons why little progress has been made in enhancing people's capacities to use of fire to increase the productivity of their resources. Limited progress has been made in the implementation of the planned activity of "prescribed burning demonstrations".

As was noted in 1999, the selection of project sites is rather opportunistic and objectively verifiable and transparent criteria have not been developed (Kammainga 1999). This has not changed. As unemployment rates are still very high and social pressures are being put on decision making IFFM/DoF staff members, who are all from local origin. As a result, cutlines are not always constructed where fire risks are highest or even high.

Human resource capacity still forms a major constraint and an important reason why making the transformation into a more natural resource management oriented program has been so difficult. The fire workers are skilled in the technical aspects of cutline construction and fire suppression, and also are able to make contracts for cutline construction and supervise their implementation. They can also hold simple educational sessions and they know how to use the disc meter for assessing the grass sward (fuel load) and how to do "controlled burns". The communication techniques they utilize, however, are poorly developed. They are all one-way and focussed on transfer of technology and telling people what to do. They lack social and analytical skills, and proper attitude to be able to generate a community-based discussion on what people's concerns are and how the issue of fire possibly fits in. Facilitating a process in which various user groups discuss and negotiate their fire needs is beyond comprehension. Essentially they are hands-on fire technicians with very little formal education. The IFFM component as a whole lacks experience and vision in community development and participatory approaches.

3. IFFM and local livelihoods

3.1 Introduction

Satellite imaging has shown a significant reduction in the incidence of fire since the initiation of IFFM in 1996 (Trigg 1998, GoN/GoF 1999). The project's target is "50% reduction in annual burning compared with the 1990s". IFFM has no system in place for monitoring of vegetation changes on the ground (Trollope and Trollope 1999).

The positive contribution of IFFM in reducing the area burned is particularly ascribed to:

- * A diminishing number of fire accidents due to successful campaigning, and
- * Spreading of fire is reduced by the construction of cutlines

What these figures mean for the livelihoods for local people will be discussed in the following paragraphs.

3.2 Vulnerability context

Life in East Caprivi is full of uncertainties. Community members interviewed considered damage from wild fires as one of the many risk factors that affect their lives. Other factors beyond their control are unreliable rainfall; drought; attacks from wildlife on crops and livestock; too much or too little flooding; crop pests; animal diseases; fluctuation of meat prices; loss of household members (labour) to HIV/AIDS; political unrest and possibly landmines etc. At the moment of this study, most of East Caprivi suffered from late rains and people expected it to become a drought year. This would imply crop failure, poor pastures, limited water supply and so on. Also many communities visited suffered from problem animals: elephants attacking maize plants, and lions and hyenas their livestock.

In 2.2 an overview was given of how the potential negative and positive effects of fire differ per ecological zone. The risk of wild fires within each zone is strongly related to the prevailing land use system and tenure regime.

Traditional extensive systems have built-in strategies to cope with risks such as wild fire and patchy rainfall. Mobility (moving livestock) is one of them (cf. Scoones 1996). Establishing crop fields in different zones is another one. Both strategies are applied in East Caprivi (see 3.3.2.1 and 3.3.2.1). Generally, when land-use systems become more 'intensive' (in terms of productivity per ha and/or economic value of individual resources) investing in reducing risk levels becomes economically more justified. Fortunately, when grazing pressure increases the risk of wildfires are automatically reduced as well (decreased fuel load).

Another contextual vulnerability factor is the HIV/AIDS epidemic that has severely hit the Region. Caprivi has one of the highest HIV/AIDS infection rates in the country (UNDP 1998, Webb and Simon 1995). Although still not openly discussed, people indicated that the effects are felt in the availability of (healthy) labor for crop cultivation. It is in this context that potential costs and benefits of fire control should be placed.

3.3 Direct and indirect effects of IFFM activities

The IFFM strategy attempts to improve people's livelihoods through:

- * The provision of employment in cutline construction and maintenance,
- * The protection of the resource base against "wild fires" through subsidizing cut lines¹, and
- * Promotion of enhanced integrated fire management by communities.

The third set of activities includes the provision of knowledge, skills and motivation in order for community members to better control and use fire (e.g. prescribed burning) and enhanced social organization and local regulation to ensure fire control.

Rural households in East Caprivi rely on a combination of economic activities and sources of subsistence and income:

- * Crop production
- * Livestock production
- * Harvesting, processing and/or selling of non-wood products
- * Harvesting, processing and/or selling of wood products
- * Regular wages and pensions
- * Wildlife and tourism

East Caprivi has a settlement pattern, whereby houses are concentrated together and crop fields are located away from the village on the flood plane and/or higher grounds. Livestock is kept in different areas during the year. A survey among Salambala Conservancy member-communities showed that most villages were utilizing at least 10 different grazing areas during a single year (Mosimane 1996). Wildlife and tourism are expected to be a future source of income for Conservancy members. So far, however, earnings have been disappointing, mainly due to the political instability of the previous two years.

3.3.1 Employment in cutline construction and maintenance

A major observation of the 1999 review team was that community members consider cutline work as the most important benefit from IFFM and this was again confirmed during this second study. This is understandable because cut line work produces cash income in a context where paid work is extremely hard to find.

The work is done during a period of about six months (May to October) and involves usually about 10 people per community. The amount earned depends on the number of kilometers finished by the group. There is a large variation in earnings per person, per community and per year. IFFM has so far worked in 68 communities. Some communities participated every year, others stopped for one or more years and continued again; others stopped after one or more years. The decision to discontinue comes sometimes from the side of the community (contractor, the village chief [*induna*] or workers), sometimes from the side of IFFM. Most common reasons are arguments between

¹ "wildfires" are defined in this report as fires that are inadequately controlled either in space or in time depending on the management objectives of the person (groups) that uses the term. Natural resource user groups might have different and sometimes conflicting "fire needs".

workers and the local contractor; dissatisfaction about pay and toughness of the work; arguments among the workers; poor relationship with IFFM staff.

The average pay is about N\$ 200 per month, which is equivalent to the amount paid in ongoing food-for-work schemes in the region. The assumption of these food-for-work programmes and also the IFFM model is that part of the work is done on a voluntary basis (= the communities's contribution). Additional incentives are provided to the cutline workers in the form of boots and protective clothing (uniforms) . The pay is good compared to what a Zambian herdsboy earns (about N\$100), but the cutline workers do not like this comparison. Many of them are young school leavers, who in the past would have the task of cattle herding but now refuse to do this work. Complaints about the level of pay were widespread. In Lubate community for example, the workers referred to the much better pay of the Conservancy game guards (N\$ 750). This community is a member of the Mashe Conservancy. The village chief (*induna*) argued that goal of the cutline work is to conserve the environment ("to protect the lizards and even the trees") and therefore the responsibility of the government (or institution on its behalf).

There is a fundamental contradiction in perspectives between the IFFM component and the local people. In the IFFM model, the work is considered as partially voluntary (= the community's contribution) and the pay is therefore relatively low. From the perspective of the cutline workers, the work is just a job and they want to get proper wages. This observation has important implications for the future social and economic sustainability of the firebreaks.

In the livelihoods approach, emphasis is not so much put on the amount earned (quantified benefit), but rather on the strategic importance of the activity:

- * Advantageous is that cut line work takes place within the village environment and outside the rainy season (March-October). People can remain in the village and the work does not compete with agricultural tasks. It could compete with herding because during the same period livestock is moved over long distances, e.g. from the Zambesi plain to the *Chivulamunda*² woodlands (between February and July), but increasingly herding is done by Zambian boys anyway. February and March are the months that men cut poles to repair their houses. In July - August thatch grass is harvested. This is traditionally women's work, but since commercialization has increased, also men have become involved. The conclusion is that cutline work provides an opportunity for households to diversify their sources of income.
- * Depending on the options and motivations of the individual cutline worker, earnings are utilized for household needs or personal expenses. People interviewed said that women and married men would generally use the money to buy food, pay for school fees etc. while youngsters would use the money more often for non-basic needs. This can explain why contractors said that married men and women are generally more hardworking and committed to the work than youngsters. Recruited youngsters would also not necessarily come from the poorest households, while women and married men usually do.
- * In terms of gender, fewer women are working on cutlines than men. Village headmen usually make the selection. Several of the headmen expressed their concern about the jobless youngsters who are just hanging around. They wish to put them to work and hope that they learn some discipline. In addition, poor women said that they were not in a position to "waste their time" and wait for the pay (see next point). They might be better off making baskets. Another problem is that much of the work is done far out in the bush, which is not considered safe for women. Staying overnight is also common. In Muyako village, the contractor explained that married men were not willing to participate because they did not want to leave their wife alone during the night. The best solution seems that women would be allowed to work on cutlines closest to the village, while men do the work further away from home. No examples of such scenario were encountered.

² Chivulamunda is a Subiya word that means the area that never floods

- * Disadvantageous is that payments have been irregular in terms of amount and unreliable in terms of timing. Often one payment is done at the end of the season or several months later. Apparently, the cause of this problem is not with IFFM but with the Directorate of Forestry in Windhoek. This financial situation has frustrated both community members and IFFM staff, and has been negative for developing a relationship of trust. The livelihood implication is that cash does not become available in smaller amounts and not on a regular basis. This reduces the potential that the earnings contribute to food security and poverty alleviation in general. The conclusion is that the financial resources allocated by the Government cut line work are not optimally utilized and that the poorest sections of the rural population do not benefit as much as they could when payment was better organized (cf. Kamminga 1999).

3.3.2 Protection against wild fires

In the IFFM model, cutlines are an instrument to prevent wild fires and thus protect the natural resource base of local people. In the following paragraphs, the direct and indirect effects on people's livelihood activities and strategies will be discussed.

3.3.2.1 Crop fields and crop production

Crop cultivation is the cornerstone of the household economy of the Mafwe and Subiya people. Staple crops are maize, millet and sorghum. Some households earn cash with selling a surplus, but probably more common is that people sell because they need the money or exchange produce for other essentials. They then have to buy food later on in the year. According to Ashley and LeFranchi, the variability in harvest between households and between years is striking, but probably most households in most years cannot produce the cereals they need for the whole year. In livelihood terms, crop production provides:

- * subsistence food products
- * limited cash income
- * means to barter or for reciprocal exchange
- * 'rights to avail' (maintain access rights to communal grazing)
- * savings (storage of staple grains for future consumption or sale (Ashley and LeFranchi 1997)).

The main inputs are labour (particularly women's labour) and draught power for plowing. Farmers' strategy is "low-input low-output". The availability of labour is the most critical factor within the farming system. Labour is becoming increasingly scarce due to the HIV/AIDS epidemic. People in several communities said that they noticed that households produced less due to losses in the family.

Many people interviewed initially said that their crops suffer from wild fires in order to underline the importance of further project support for cutline work. From more probing and from interviews with various resource people it must be concluded that the risk of wild fires is usually not very high. In certain areas people could not remember that crops ever burned, while in other areas it happened so rarely, that the problem was really minor compared to all the other risks.

How complex the issue is can be illustrated by the following example. In Labuta, a village south of Kongola in the Kalahari Woodlands zone, fires sometimes come through and cause damage to standing crops. People reported that this had indeed happened in 2000. This village is a large maize producer and maize is an important source of income. The loss of crops results in a loss of means of subsistence plus income. It also implies a waste of women's labour in a period in which labour is getting scarcer. Some families might have also invested money in hiring workers. Fortunately however, people in this area usually have several fields distributed over a larger area. The result is that they spread the risk of patchy rainfall, pests and also fire. When wild fires strike they usually do not lose all their harvest at once. Also in other communities visited, people used to have several fields, normally in different ecological zones, but also possibly related to inheritance of land. It can be assumed that when crop fields catch fire, the most vulnerable households will suffer most because they have only a small area cultivated to satisfy (part of) their subsistence needs. They do not have the option to participate in the risk spreading strategy.

The Regional Rural Development Planner is responsible for food relief in the Region. He said that there are no cases of food relief being provided to people who lost their crops to fire, only to people who lost their homes and that is usually in (peri) urban areas. When asked if people could apply for assistance for crop loss his answer was vague.

Since cropfields are usually individually owned (ancestral rights) and land use is relatively intensive (productivity per ha) one can assume that the incentives to protect ones own crop field against fire are stronger than for any other use. Cutline subsidy should therefore only be provided in communities where repeated crop loss occurs due to indiscriminate fires from the outsiders (e.g. cross boundary; peat fires) Indirect measures to cope with the effects of wild fires should also be looked at: addressing security of tenure; techniques that reduce labor inputs (e.g. access to draught animals; techniques that increase crop productivity; and system for food relief for particularly vulnerable households that loose their crops and have no other means to bridge the loss.

3.3.2.2 Pasture and livestock production

For the Subiya and Mafwe people, livestock keeping is extremely important, not necessarily for food and cash, but for their value for ploughing, transport, building up reserves (to cope with drought; disease etc.). Livestock also has numerous social and cultural functions. Households without livestock have lower crop production, greater dependence on off-farm cash income and generally greater economic insecurity. Negative impacts resulting from fire are one of the risk factors for livestock owners (Ashley and LaFranchi 1997).

Distribution of livestock is increasingly unequal. Probably, most communities have households that do not own any cattle and households with over 200 heads of cattle (cf. Mosimane 1996). There are traditional social mechanisms to distribute the benefits to some extent. The *mafisa* system for example gives the herdsboy the right to keep some of the calves. This system is eroding for various reasons.

Caprivi's traditional grazing systems are not well documented. They are complex and dynamic with varying patterns of shifting, usually between the flood plains (winter grazing) and the Mopane and Kalahari woodland areas (summer grazing). It seems that people shift their animals between particular sub-khutas (*silalo*), one in the flood zone and one on the higher grounds. A *silalo* consists of a small number of villages. Each *silalo* has a number of different grazing areas or 'forests'. These areas have specific names and are usually called after the waterpan in the middle. The critical factor according to resource people and villagers interviewed is the availability of drinking water for the animals. Although stocking rates are believed to be increasing, the current system is still more water than fodder restricted.

- * When discussing the effects of fire on pasture villagers usually responded that some fires are good and some are bad. They all had experienced damage of wildfires on pastures. People were generally convinced that cutlines are an effective instrument for protecting pastures against external fires and help to better control (prevent spreading of) fire when burns are applied. Considering the location of most cutlines in relation to the village, protection against fire means secured availability of fodder within close distance to the village. Water sources are generally available here.
- * The risk of indiscriminate wild fire varies highly from one community to another. According to Trollope and Trollope (1999), wild fires are particularly negative for the fodder productivity of the the Chobe, Linyanti and Kwando Floodplains. In these areas rainfall is relatively low and flooding has not occurred for a decade or more. These fires often originate from Botswana or result from ground fires in the peat and spread naturally. Cut lines in these areas are relatively effective.
- * Some of the IFFM cutlines have been constructed in places with apparently little or no danger of fire. This observation was made by both community members and key informants. It is not uncommon that cutlines are primarily built to generate income and are utilized as an instrument to demarcate the village territory and function as roads. Targeting of project activities and selection of sites does still not take place according to objectively verifiable and transparent criteria (cf. Kamminga 1999). Since paid work is hard to find, social pressures on IFFM/DoF staff who are responsible for making the decisions on the allocation of funds are significant. As a result, firebreaks are not always sited where most effective from a foresters' point of view. They might, however, serve other local developmental goals.

- * The real impact of IFFM cutlines on livestock production depends primarily on the alternative grazing opportunities. This is a function of the combined water supply and fodder situation in nearby grazing areas. Natural water sources are freely accessible for everybody, but boreholes sometimes are privatized. In general, poor water supply is a major development problem in Caprivi and the largest concern in almost all communities visited (cf. UNDP 1998). Specific areas mentioned in this context were Kabe, Malindi, Lusu and Sangwali. In terms of access rights (tenure), people can shift their animals freely within their own subkhuta (*silalo*), but need to ask permission to enter another *silalo*. The headman (*induna silalo*) will generally provide permission without asking payment. Cultural norms and values support the sharing of resources in crisis situations (Kamminga 2000).
- * Access to alternative grazing, is in some parts of Caprivi, restricted due to large areas being converted into Conservancies and Parks. Certain areas lost access to alternative grazing because of the establishment of protected areas. Of special note is that “emergency” grazing and livestock watering are not allowed in any of these areas. Such a measure could increase local goodwill towards nature protection. People further explained that certain grazing areas have become less popular due to danger of wild life. Compensation for wildlife damage does not exist either. People in DRM, IRDNC and Salambala Management were opposed to these ideas of reducing the negative effects of wildlife on people’s livelihoods.
- * In most communities people said that alternative grazing opportunities are usually sufficient to cope with the effects of wild fires. The combination of “drought” (= combination of lack of water and lack of fodder) and fires is the most disastrous. In those situations animal losses occasionally occur. Some *induna silalo* announce a ban on the use of fire under such circumstances (Harrison 1995).
- * People were aware that the risk of wild fires is related to grazing pressure. The shifting of animals from the Zambesi plain helps to reduce the fire risk in the upper woodlands. This year animals might not be allowed to travel due to an animal disease that was discovered on the Zambesi floodplains. Reduced grazing pressure could increase the risk of wildfire in those upper woodlands and have consequences for the risk of fire in other areas.
- * People also noticed a trend of mobility (moving of cattle) becoming a less important factor in the livestock management system. More information is needed on this issue. Permanent settlement in the woodland areas away from the plains is increasing (e.g. along the Ngoma road). Increasingly, livestock is kept in these areas on a permanent basis. Some people also mentioned the issue of local boys not being interested in herding anymore and the hiring of Zambian herdsboys. Trusting these boys to the extent that they can take the animals over long distances is a problem. In fact, these boys are generally considered as “careless” and being a main cause of fire accidents. As was mentioned before, in the traditional *mafisa* system the herdsboy (e.g. son, nephew or other local boy) has a vested interest.
- * Fire is widely utilized as a tool for managing pastures, especially in the floodplain areas. It is traditionally the responsibility of the traditional leaders to announce the timing and the area that needs to be burned. People can then prepare themselves and take their animals to another area. It seems however, that there are strong differences in management style and level of authority among the individual leaders. Although people have in principle access to all grazing within their own *silalo*, it is likely that decisions on burning are taken by the nearest by village *induna*. Probably, pastures nearby a village are coming more directly under the jurisdiction of that particular *induna* (see also Kamminga 2000).
- * Households are affected differently by the protection of nearby grazing areas against wild fire. The poorest households and generally women do not own livestock. The large livestock owners (say over 200 head) will benefit. These men are also likely to have the means to cope with the consequences of wild fires. They can effort to finance shifting of their animals and cover associated costs. The households with a small number of animals probably benefit most, as they do not have to encounter additional costs of shifting and face less risk losing their savings and draught animals.

In summary, the real damage of wildfires on livestock production and therefore the effects of cutlines (or any other form of protection) depend on many situational factors. These factors can be the distance to alternative grazing; water supply; access rights to water and grazing; level of mobility in the existing livestock management system; the role of the traditional leadership; the ability of individual households to cope with the additional costs of shifting animals etc. Clearly from the livelihood perspective, fire should not be addressed in an isolated manner, but as an integrated part of the whole land-use system. When mobility in the livestock system is decreasing the incentives for more intensive fire management are likely to increase.

3.3.2.3 Harvesting of non-wood products

While livestock is considered a male domain, wild resources are generally more a female domain. The products are particularly important for the poorest categories of women and form an security buffer (cf. Ashley and LaFranci 1997, Mosmane 1996). Several categories of non-wood products can be distinguished.

Veld products

Women and children collect most veldfruits. Most commonly collected are the fruits from the *Ximenia americana* (blue sourplum); mushrooms; bark of the *Berchemia discolor* (birdplum) used to dye palm leaves for basketry), various green leafed vegetables, waterlilies and herbs. These products are essential for subsistence (food; nutrition; health), and provide also a limited – but often very important - source of cash income and means for local barter. Strategic advantages are that the products are relatively drought resistant and become available at different times during the year. The variety of products utilized by the Subiya and Mafwe people in East Caprivi is rather limited. The uses of *veld* products are not very varied, processing methods and marketing not well developed compared to for example the Ovambo Regions. This might be related to their background as fishermen. The Khoi people in West Caprivi on the other hand are using a larger variety of bush products (cf. Ashley and LaFranci 1997, Mosmane 1996).

A major constraint for obtaining more benefits, is the lack of a market outlet. The creation of nature conservation areas and the associated danger of wild animals have reduced bush products in certain areas. The effects of bush fires are difficult to assess, because they have to do with the time that women spent on harvesting, the opportunity costs of that time, the use value of the products, opportunities to sell and so on.

When discussing particular products, people said that blue sour plum and bird plum are not sensitive to wild fires. Mushrooms and green leafed vegetables generally grow during the wet season when there is no fire danger. Some herbs need seasonal fires, but they can also suffer from wild fires. The potential damage depends on the availability of alternative resources and marketing opportunities. The further away the more the demands on women's time and the lower the return on their labour.

Thatch grass and reeds

Reeds and thatch grasses are traditional building materials in East Caprivi. They are usually harvested by women for their own use, for barter/exchange or for local sale. Recently, the commercial market for thatch grass has improved and also men are now taking part. The market was very good until the security situation deteriorated in 1999. During 2000 the outside market virtually collapsed.

Thatch grass grows in areas adjacent to the floodplains. Wildfires are very destructive, but periodic burns are necessary to achieve optimal productivity (Trollope and Trollope 1999). The two communities that requested assistance with prescribed burning, Ibbu and Isuswe, both wanted to burn thatch grass areas that had not been burned in several years.

Thatch grass resources are considered still plentiful when utilized for subsistence use, but increasing commercial exploitation in certain areas has began to put putting pressure on the resources. There are signs of emerging conflicts between user groups (between neighbouring communities or between women who cut thatch grass and men grazing their livestock in the same area) due to competition. As was explained, people can traditionally go freely to areas within and outside their own *silalo* to cut thatch grass for their own use, but they have to follow the rules: the nearest by *induna* announces the moment when cutting can start (somewhere in June or July). The main rule is that the grass must have seeded before cutting can start. This is an illustration of the existing local knowledge and management practices.

With increasing demand and the market value of thatch grass growing, the need to better define access-rights and use conditions is growing as well. When the benefits are assured people will be more likely to invest in the costs of fire management. The benefits from such an investment however, must accrue to those people who carry the costs. Tenure is probably the key issue to be addressed in order to create incentives for fire management.

Palm leaves

The *Hyphaene petersana* or fan palm is utilized for the production of basketry. This is one of the few income generation options for women. The work can be well combined with other chores. Recently, marketing opportunities have in certain areas improved due to NGO assistance. In some localities in East Caprivi raw material supply problems were already observed in 1994 (Terry et al. 1994). In certain areas elephants cause much damage.

Apparently fires are not common in the palm producing areas (Harrison 1995). IFFM has not been working in these areas.

3.3.2.4 *Harvesting of wood-products*

At the regional level, the short term and long term availability of wood resources for local people is affected by factors such as land clearing for agriculture, excision of forest use areas (National Forest; Conservancy core areas) and also fires. Due to less flooding in recent years *Combretum imberbe* is expanding - or encroaching depending on your perspective - into the *mulapo*, seasonally flooded areas. These areas are usually burnt annually to enhance grazing. These burns destroy regeneration or make it grow back into multi-stemmed shrubs (*idem*) (cf. Harris 1995). IFFM has not been monitoring the effects of fire on vegetation and the effects of the project activities (Trollope and Trollope 1999).

At the local level, trees play an essential role in livelihoods, especially of those people living in or nearby wooded areas. The direct benefits from the collection of firewood and timber, and also from non-wood forest products are:

- * subsistence needs (energy; construction material, food, medicines, raw materials);
- * cash earnings (to buy food, clothes; pay for school fees; medicines; cuca shop etc.); and
- * reciprocal exchange and barter (firewood and poles for food).

Some of the indirect effects and strategic aspects are:

- * risk reduction/ drought coping/ food security (source of income and food in times of hardship)
- * off-season work (not competition with agricultural work)
- * activities have low entry costs (no capital needed to start) (cf. Ashley and LeFranchi 1997).

More details are given in the Salambala report (see Kamminga 2000).

Generally, these activities have a low level of commercialization due to lack of market opportunities. Most sales (or barter) take place within the own community or with communities in the flood plain areas. These relationships have usually also an important social dimension.

Furthermore, the majority of people interviewed did not perceive any problems in the availability of firewood or construction wood, or competition from outsiders (see Kamminga 1999, 2000). To illustrate the low pressure on the resources, the largest town, Katima Mulilo obtains its wood products from within a zone of 5 kilometres (firewood) and 20 kilometres (Mubiza) from town.

It is logical under these circumstances that people showed little concern about fire damage on trees. No difference was found between people spoken to in the Mopane Woodland zone and the Kalahari Woodland zone where wild fires would be more harmful from an ecological point of view (cf. Trollope and Trollope 1999). A survey by the Caprivian Arts and Crafts Centre in 1995 also arrived at the conclusion that most people were not concerned about the availability of wood resources and the effect of wild fires (Harrison 1995). Exceptions were the woodcarvers. They were worried about the effects of repeated fires on the regeneration and growth of their most favourite species, *Combretum imberbe* and *Pterocarpus angolensis*. These species are found in the Kalahari Woodland zones and are protected by law. The woodcarvers felt that future supply of raw materials is not assured under the current circumstances of uncontrolled utilization and fires.

Below two illustrations are given, one from the Kalahari Woodland Zone and one from the Mopane woodland zone:

- * Lebutu village is located south of Kongola in the Kalahari woodland zone. Cutline work started in 2000. The ten cut line workers are married and unmarried men of different age and educational levels. The workers explained that they only constructed 8.5 kilometres of cutline between May and July of 2000 out of dissatisfaction with the level of pay, the delay of the payment and the functioning of the contractor. They each received a single payment of N\$ 100 in December of that year. From a discussion with the cutline workers and the local authorities it became clear that forest fires are not considered a serious problem, not for the cropland, not for the pastures and not for the trees. In their opinion fire control is primarily in the interest of the Government and conservation agencies. They used this as an argument why they deserve proper pay and working conditions. The feeling of “ownership in this case was very low. The dynamics in this situation are influenced by the following factors: 1) the village is member of the Mashi Conservancy and the supporting NGO (WWF/LIFE) is referred to as the “the company” (WWF/LIFE) and 2) the village is the home area of one of the IFFM team members. This seems to make contract negotiation and supervision even more difficult.
- * Ibbu village has been with the program since the beginning in 1996. The headman is very concerned about the problem of unemployed youngsters. He is also concerned about the behaviour of the Zambian herdsboys, who show disrespectful behaviour and also are careless with fire. Since 1996, several cutlines were built and maintained on the floodplain area. In 2000, on request of the headman new cutlines were constructed on the northern side of the community in the Mopane woodland zone. The question about the purpose of the cutlines was answered in different ways. According to the headman they protect the village from fires coming in from the Salambala core area. According to another community member who is the vice-chairman of Salambala Conservancy, these cutlines protect the Salambala core area from fires coming from the village. Foresters said that the danger of fire within the Mopane woodland zone is very small, which conforms to Trollope’s observation.

These examples illustrate that rural communities and the IFFM component have different agendas when it comes to fire, cutlines and the protection of trees. From the livelihood point of view, this means that the program does not respond well to the priorities of the local people.

3.3.3 Enhanced fire management by rural communities

In the IFFM model, improving controlled and prescribed burning is the final stage. The cutlines are expected to demonstrate to local people that fire control has advantages and can be done. People might choose to maintain the existing cutlines, make new ones or they might choose another technology or even indirect strategy (e.g. manipulating the fuel load through grazing pressure). In other words, the aim is to provide local people with the knowledge, skills and motivation needed to fully control and apply fire, both at the individual level and the community level. This means promotion of self-help and empowerment.

As yet, strategies, technologies and activities to reach this intervention stage have not yet been well elaborated. So far few communities have expressed interest in receiving a demonstration in the safe application of prescribed burning.

Two communities, Isuswe and Ibbu, have asked permission and assistance to burn their thatch grass areas. In the first community it was a women-group, in the second the *induna* who contacted IFFM. In both cases, traditional burns had been postponed in order to comply with the IFFM requirements. After the request, IFFM financed the construction of cut lines around the two thatch grass areas and then set the grass inside on fire. In the literature reference is made how external prohibitions on the setting of bush fire can undermine local people’s early-burning strategies, risking greater fire damage by late fires (Leach and Mearns 1996).

In terms of training and preparation, the IFFM team took a specialized course in South Africa on how to assess the grass-sward and how to apply controlled burning. The social aspects of fire management, however, have not received any attention at all. Do different user groups within an area (e.g. small livestock owners; large livestock owners; thatch grass cutters; herb collectors; cultivators etc.) have different fire needs? What are the conflicts in interest and differences in perspectives and how can they be addressed? How are decisions on burning arrived at? What is the role of the traditional leaders in fire management? Clearly, the use of fire cannot be isolated from broader resource use and management issues

3.4 Sustainability aspects

In the previous paragraphs the direct and indirect effects of IFFM on people's livelihoods were discussed. How sustainable are these effects?

Economic sustainability

IFFM activities have a positive effect on the productivity of the natural resource base, on people's livelihood security and on opportunities for market participation (cf. Shackleton et al. 2000). The strategy, however, heavily relies on one instrument, subsidization of cutline construction.

The cut line technology is relatively labour intensive. The benefits of making and maintaining cut lines in grazing areas that are characterized by extensive land use, a common property use regime and low level commercialization are low compared to the costs. It is unlikely that communities will construct cutlines on their own initiative, even if there would be strong social cohesion. A choice of alternative, lower-cost technologies has not been offered by IFFM. The chance that cutlines will be maintained without external financial support is slim.

The recent increase in market value of thatch grass (commercialization) has resulted in competition and conflict between user groups from different communities, since access rights are not well defined. Several IFFM communities have placed their firebreaks in a manner that they protect their thatch grass resources and also demarcate them from the neighbouring communities. Cutlines can be utilized as an instrument to strengthen control over resources.

Social sustainability

There is generally a low level of "ownership". Fire was officially taken out of the hands of the Traditional Authorities during the South African administration. Nature conservation is considered the responsibility of the Government. Caprivians have been living with the risk of fire all their lives. Putting emphasis on fire reduction rather than fire management has also perpetuated the idea that the Government is in charge. The provision of uniforms and boots provides short-term incentives, but creates the impression that cut line work is special work that requires a special outfit. IFFM has also been keeping full control over the tools by taking them back from each community after every season.

Cutline construction is perceived as paid work not as self-help. The activities at community level usually start with the selection of a construction contractor, the drawing up of a contract to build a certain number of kilometres and the recruitment of workers. The program is perceived as an (improved) 'food for work' program. In addition, as one of the traditional leaders said: "If you start paying you can't stop and expect the people to do the work for free".

The IFFM approach has shown limited appreciation for existing fire management systems and practices. They have never been documented. The role of the traditional leaders is generally undervalued. The IFFM workers act like educators and fire control officers, and they are not afraid of using the law as a stick. Being in charge of the cutline contracts and payments also puts them in a powerful position. The relationship between the IFFM team and community members lacks in many cases mutual trust and understanding. There is no feeling of partnership towards the fire management objectives.

To which extent the program has had a long lasting development impact will have to be assessed at a later stage. Another socio-economic review is foreseen during the second phase of the Namibia Finland Forestry Program, where these issues could be assessed.

3.5 Conclusions

As was mentioned in 1.1, the overall objective of the IFFM component is to reduce the fires in East Caprivi in order to improve the living standards and the environment of the local people. The two main implementation strategies were provision of temporary employment through subsidized cut line work, and protecting people's subsistence base and income earning opportunities by reducing the incidence of "wild" fires. Later a third strategy was added, increasing the productivity of the natural resource base by introducing enhanced techniques for the application of fire as a management tool.

The first two strategies aim at respectively "livelihood provisioning" and "livelihood protection". They are applied from a kind of emergency and relief perspective. The third strategy aims more at "livelihood promotion" and has a longer-term development perspective, including elements of empowerment and participation. (Carney et al. 1999).

IFFM has put much emphasis on the first two strategies, which is consistent with the view that fires in East Caprivi are not only a local, but also a Regional, National and even global *disaster*. Furthermore, the socio-economic

situation in East Caprivi is considered to be a crisis as well, particularly the high levels of unemployment among the youth and the effects of the HIV/AIDS epidemic. Implementing the third strategy requires a different perspective and also different skills on the part of the implementers. The contribution to the enhancement of local livelihoods would have been larger when fire would have been addressed in a more integrated manner and cutlines would have been offered as one of the options from a whole package of techniques and strategies.

The issue of different costs and benefits of fire management according to tenure zones and (intensity of) land use has not been addressed at all. It is likely that areas or resources under a relatively extensive land-use system and a common property (e.g. *silalo*) tenure regime will benefit more from a holistic strategy aiming at reducing the possible impact of wildfire (e.g. by influencing grazing pressure; water supply). Areas or resources under more intensive use (e.g. thatch grass; pastures nearby village centre) on the other hand might benefit more from strategies towards the protection and more optimal use of fire (e.g. controlled prescribed burning).

From a livelihoods perspective, there is a need to move away from a blueprint approach focussed on forest fire prevention towards a more people-centred and broader resource management perspective. Only then will both the people and the forest benefit in an optimal and socially and economically sustainable manner. Hopefully the integration of the IFFM component within the new Community Forestry component will offer new opportunities in this respect.

4. Recommendations

4.1 Employment creation

- * Providing paid work in an area with high levels of unemployment, an economy that suffers from isolation due to political instability and geography, and one of the highest levels of HIV/AIDS infection in the country is a very effective way to contribute to poverty alleviation. This should be considered an objective in itself.
- * There must be a clear understanding and agreement between all actors concerning the character of the work. Is it (partially) community-based and thus voluntary or is it pure employment. If such clarity does not exist, disputes about wages will never end.
- * All communities need employment and social pressure on local IFFM staff is high. Nevertheless, cutlines should only be constructed in communities where a high risk of wild fires exists. Allocation of resources should therefore take place according to a priority plan and objectively verifiable and transparent criteria. Strong supervision is necessary (cf. Kamminga 1999).
- * To optimize the employment impacts recruitment procedures should favor the poorest categories of people, in particular female heads of households. Women should be allowed to work on cutlines closest to the village, while men can do the work further away in the bush.
- * Recruitment of female heads of households and married men should be encouraged, not only because they are usually more reliable and better workers, but also because there is better chance that earned money is utilized for the essential needs of the poorest household.
- * Recruitment of young male school leavers for subsidized cutline work has the advantage of providing work to otherwise idle boys and also giving them some work experience, discipline, technical skills etc. Emphasis must be put on recruiting youngsters from the resource-poorest households.
- * Cutline work is and should be timed outside the agricultural season in order to avoid competition with other household labour demands.
- * More frequent and timely payment of cutline work is crucial for optimizing benefits for the poorest categories of people. Especially poor women can not afford wasting their time on work that does not produce an immediate or at least regular income.

4.2 Community forest management and fire

IFFM has contributed to the enhancement of the productivity of the natural resource base and overall household security through a reduction of the risk of wild fires. These effects are primarily achieved through the subsidized construction (and maintenance) of cutlines. It is too early to assess the long-term development effects in terms of community members' ability and willingness to better control and apply fire as a management tool. The expectations, however, should not be too high. Increasingly sustainable impact on livelihoods can be derived from a strategy in which the issue of fire is incorporated in a broader land-use management or community forestry program.

When fire management is integrated within Community Forestry, there will hopefully be more opportunities for an approach whereby people's concerns, priorities and existing knowledge and practices are taken as a point of departure. The sub-khuta (*silalo*) seems an appropriate institutional entry point for community forest management, whereby fire management issues can be addressed as well. In the Salambala report more detail is provided on the potential of the *silalo* as a planning and management unit (Kamminga 2000).

A strategy that aims at mitigating the negative effects of wild fires on people's livelihoods should probably include measures to secure access to alternative grazing (e.g. removing water supply constraints) (alternative options) and to multiple crop fields in different fire risk zones (strategy: spreading of risk).

Since crop fields are usually individually owned (ancestral rights) one can assume that the incentives to protect ones own crop field against fire are stronger than for the other land uses (grazing; harvesting of wood and non-wood products). Subsidy for protection of crop fields should only be provided in communities where repeated crop loss occurs due to indiscriminate fires that originate in Botswana or sub-surface fires. In other areas, indirect measures to cope with the effects of wild fires should be identified. Examples are addressing security of tenure; techniques that reduce labor inputs (e.g. access to drought animals; techniques that increase crop productivity; and system for food relief for particularly vulnerable households that loose their crops and have no other means to bridge the loss.

The actual costs of wildfires for livestock production and therefore the potential benefits of cutlines (or any other form of protection) depend on many situational factors. These can be the distance to alternative grazing; water supply; access rights to water and grazing; level of mobility in the existing livestock management system; the role of the traditional leadership; and the ability of individual households to cope with the additional costs. From the livelihood perspective, fire should not be addressed in an isolated manner but as an integrated part of the whole land-use system.

With increasing demand and the market value of thatch grass growing, the need to better define access-rights and use conditions is growing as well. When the benefits are assured people will be more likely to invest in the costs of fire management. The benefits of such an investment, however, must accrue to those people who carry the costs. Tenure is probably the key issue to be recognized in order to create incentives for fire management.

The IFFM model has been largely based on the assumptions that local people are careless with fire and that people's livelihoods are very negatively affected by wild fire. In order to successfully and sustainably address the fire problem in East Caprivi, the costs and benefits of fire management in different tenure zones and for different land uses, need to be better addressed in their specific context. The approach should be community-driven and problem oriented. It can be expected that areas or resources under a relatively "extensive" land-use system and a common property (*silalo*) tenure regime benefit more from a holistic strategy aiming at reducing the possible impact of wild fire (e.g. by influencing grazing pressure; water supply). Areas or resources under more intensive use (e.g. thatch grass; pastures nearby village center; crop fields) will probably benefit more from strategies towards the protection and more optimal use of fire (e.g. prescribed burning).

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Editorial Remarks:

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The Internet version of this IFFN paper provides examples of design of visual aids and materials produced by the local Caprivi Arts and Cultural Association (CACA).

Namibia Round Table on Fire Windhoek, 10-11 November 1999

1. Rationale and Introduction

In his opening speech Mr. Tangeni Erkana, Permanent Secretary, Ministry of Environment and Tourism, laid the foundations of the Namibia Round Table on Fire for the preparation of a national fire policy for the country.

On behalf of the Ministry of Environment and Tourism, I warmly welcome the participants to this two-day workshop.

As befits this occasion, I wish to reiterate the mission of the Ministry of Environment and Tourism, which is rooted in the philosophy of sustainable management of our natural resources, in a manner that is environmentally sound. In regard to this, all the policies and pieces of legislation in this ministry support this philosophy.

With forest fires as a point of reference, I have noted that the current draft Forest Bill provides for Fire Management Committees in wooded areas and gives the minister powers to declare Fire Seasons and prohibit specific activities in forested lands when current Fire Danger Ratings necessitate it.

In the attempts by the Government of Namibia to adopt the organised and systematic management of fire in land management, we should be motivated by the following facts:

- * It is estimated that 3-5 million hectares (ha) of forests, bush and grasslands are burned every year in Namibia. Despite this alarming magnitude, no systematic and nationwide fire extension work has been carried out, except in pilot areas such as the Caprivi and more recently the Kavango Regions.
- * Traditionally, burning is considered a necessary activity before each rainy season to renew grass for grazing purposes and also for the preparation of land for cultivation. Furthermore, no nationally recognized policy on fire management is available.
- * Uncontrolled burning is also resulting in considerable economic losses through damage to valuable and non timber resources, loss of grazing and consequent increased life stock and wildlife mortality, all of which are to the detriment of the local and national economies .
- * Internationally, the concern is that extensive burning of forests and grasslands is contributing directly to the anthropogenic greenhouse effect and thereby influencing global climate change. It is argued that widespread fires in the wooded areas are reducing the overall phytomass or vegetation, thereby causing a release of radiatively active trace gases and aerosols into the regional and global atmosphere.
- * From the recent case of extensive forest fires in Indonesia, it is now appreciated that gases from such fires cause untold respiratory and other illnesses.
- * It is also true that, just as the effects of fires on ecosystems are many, the causes are also from a variety of sources, hence the need for wide consultations in formulating a policy are essential and crucial.

Because of the above local and global concerns, the Government of Namibia entered into an agreement with the Government of Finland to implement a project, which was at the beginning, known as the *Fire Control Project in Caprivi* which started in 1996. This Project was more recently renamed the *Integrated Fire Management Project* with the realisation that fire is a legitimate land management tool, if carefully timed and used. It is therefore important for Namibia as a nation to distinguish between the legitimate and organised use of fire as opposed to the intentional abuse of fires which often have destructive consequences.

After three years of the implementation of the integrated fire management project in the Caprivi, the evaluation of recent satellite imageries suggest that there has been a steady decrease in the frequency and extent of burning in the region. Despite this pleasing trend, uncontrolled fires are still to be found in the Caprivi, both within the Communal farming areas and in the protected national parks.

It is also a telling point this year, that the commercial harvesting of thatching grass by rural communities, is becoming a major industry in the North Eastern part of Namibia. To sustain the economic benefits of such commercial harvesting, the careful management of fire is required. However, this is but one of the benefits of managing fire.

A major dilemma is that as fires rage through our woodlands and grasslands every dry season, no one clearly takes responsibility, especially if it happens on public and communal lands. To complicate matters further, most of these fires stem from agricultural activities related to cultivation and traditional range practices. In addition, others are started by hunters who often do not stop to consider the wider consequences of the fires when they spread, as they often do. Arsonists who bum for the sheer pleasure of it are a special and unfortunate source.

The various causes and sources of fire therefore demand that its management be an issue of public concern and must involve all sectors of government which are concerned with land management and also education. For this reason, the Ministry of Environment and Tourism has chosen merely to act as a catalyst to provoke debate at a national level on the planned and safe use and if need be, the prevention of fire from specified areas of our region. We invite non-governmental organisations (NGOs) to actively support our efforts in this regard.

The ministry is delighted to note that several Government Ministries and NGOs are in attendance at this workshop. It is also encouraging that experts and policy makers from neighbouring SADC countries are also going to participate in this workshop. I extend a special welcome to them.

Furthermore it is quite encouraging that some consultants who have done some work for us on fire management are going to make presentations. We value your international experience and encourage you to exchange ideas with us and above all, to stimulate our thinking in formulating a well worked-out and researched document on fire management that can be implemented by Namibians.

We recognise that fires also know no international boundaries and often cross our borders with neighbouring countries. It is hence extremely important that a national fire policy considers cross border management issues.

In conclusion, this ministry will be keen to have the workshop consider a number of issues and challenges. These include:

- * the formulation of policies that enable wide community participation in the responsible custodianship of natural resources through the wise use of fire.
- * the need for a common philosophy across government ministries regarding fire use and the sharing of responsibility for its management the development of joint strategies that are accepted and fused
- * with national and international initiatives such as the United Nations Framework Convention on Climate Change (UNFCCC) and the Criteria and Indicators for Sustainable Forest Management
- * the promotion of decentralized systems of fire control to give more responsibility to regional governments, who must be seen to assist the central government in activities such as rangeland management
- * the harmonization of sectoral pieces of legislation to reflect a common philosophy
- * the possible development of regional or bilateral protocols to deal with cross-border fire issues just as much we are now encouraging the concept of trans-boundary conservation areas in the SADC region.

After saying the above, it is appropriate to the occasion to extend my ministry's sincere gratitude to the Government of Finland for providing the technical support and the funds to run the Namibia-Finland Forestry Programme, of which the Fire Component is a part.

I wish you the very best in your deliberations and look forward to a milestone policy paper in the not too distant future. I now declare this workshop open and I thank you.

2. Preparation of the Round Table

In early 1998 the Namibia-Finland Forestry Programme was supported by the Fire Ecology Research Group which in the same year established the Global Fire Monitoring Center (GFMC). One of the main aims of the GFMC is to facilitate countries, the UN system and other international organizations, including NGOs, in developing fire science programmes, technology transfer to fire management and policy development (see: <http://www.uni-freiburg.de/fireglobe>). In consultation with the Research Group / GFMC it was proposed to develop a "National Fire Policy and Guidelines on Fire Management in Namibia (Goldammer 1998). The following paragraphs are extracted from the 1998 report and updated where necessary.

2.1 Fire in Namibia: History, Use and Problems

In the evolutionary history natural fires caused by lightning have significantly contributed to shape Namibia's savanna and forest ecosystems. In addition, fire influence through traditional burning practices over millennia has strongly favoured and selected plant communities that are considered to be sustainable and long-term stable fire ecosystems if not affected by additional disturbances.

However, in the recent past fire regimes are undergoing dramatic changes. This is the consequence of decline in nomadic life and the overall increasing human population pressure on these areas where fire is being used extensively as a land utilization tool, e.g., for conversion of forested/wooded lands into agricultural lands; for maintaining grazing lands; and for facilitating the utilization of non-wood forest products, e.g. honey collection and hunting. Formerly sustainable time-space-fire relationships are being altered in the wake of changing land-use practices. Forest ecosystem and site degradation becomes most visible where excessive disturbances by logging have changed the equilibrium between vegetation composition (tree species, occupation of sites by invading grasses), fuel characteristics (available flammable material), and fire behaviour. One of the main reasons of degradation is the increase of wind and water erosion of the Kalahari sand soils. As a consequence, ecological damages and loss of biodiversity become more and more visible. High economic losses are caused by fire damaging valuable timber and non-timber resources, natural regeneration, and planted forests. Indiscriminate burning in Namibia's forests and grazing lands has also led to increasing losses in pastoral resources and losses of domestic livestock. Fires in the interface of wildlands and residential areas often cause the loss of human lives, property, and other values at risk, e.g., food stores, power and communication lines, other infrastructures, and livelihoods.

In addition, large-scale burning of vegetation exerts impacts on the regional and global atmosphere. Emissions from wildland fires in Namibia are important sources of radiatively active trace gases and aerosols. Those fires which are associated with the degradation of vegetative cover consequently lead to the reduction of the carbon sequestration potential. Thus, they contribute directly to the anthropogenic greenhouse effect.

Altogether, the current levels of wildfire occurrence and severity are seen as incompatible with the nation's social goals and resource management objectives.

This proposal to develop Guidelines on Fire Management in Namibia is aimed to provide the basis for an in-depth preparation of a set of guidelines for the various administrative settings and ecosystems concerned. Major emphasis in this proposal is on fire prevention, particularly on a community-based approach.

2.2 Crosscutting / Intersectoral and International Issues

This report seeks cross-references to various national regulations and strategic plans. The proposal is also considering regional plans for the Southern African region and international binding and non-binding conventions.

2.2.1 The Namibia Forestry Strategic Plan

The Namibia Forestry Strategic Plan (Directorate of Forestry 1996) provides the framework for fire policy and management planning. The Strategic Plan is based on ecological, environmental, cultural, and socio-economic considerations. The Plan considers "Production, Protection and Participation" as the three imperatives of forest policy.

In this context, the plan underscores the need of reducing the negative effects of fires by stating in Section 3.2.1 that

"The occurrence and severity of uncontrolled and accidental forest fires has to be reduced, and the policy of burning off patches of woodlands to improve hunting grounds, should be changed to one using fire only as a controlled tool under specific circumstances".

Furthermore it is stated in Section 3.2.4 that

"Participation of local communities and the private sector is essential for the sustainable use of the forest resources. The active involvement of local communities in management and conservation of forest resources is desirable for the purposes of environmental protection and for significant increases in rural incomes and employment levels."

Besides the statement, that "Policy formulation must precede the formulation of forest legislation" (Section 3.3.1) it is also underscored that "there is no reason why different regions in Namibia should not adopt different policies" - an important statement which will open the options for the development of fire policies which are in accordance with the distinctly different impacts of fire (or fire regimes) in the various vegetation types of the country.

Under the expected contribution of the programmes towards the achievement of sectoral and national objectives (Section 5) the environmental forestry programme underscores that

"Strategic forest protection of biodiversity and sequestering of carbon (to restrict potential climate change) will make possible for Namibia to meet the requirements of the International Conventions on Biodiversity and Climate Change."

The Namibia Climate Change Report must be seen in this context (see para 2.4).

2.2.2 Forest Act, Forest Ordinance, and Regulations under the Forest Act

The Forest Act No.72 of 1968 provides some brief procedural regulations on clearing of fire belts and rules of fire control. The Preservation of Trees and Forest Ordinance, assented to 8 July 1952³, regulates the use of fire in construction of fire belts and assistance in fire suppression. The new Forest Act of Namibia (which is in preparation) will provide rules on fire management. The Final Draft of the Regulations under the new Forest Act of Namibia shall provide several regulations concerning fire, namely on access and connecting roads in forest reserves and on the composition, functions and procedures of fire management committees.

2.2.3 Other Regulations of the Ministry for Agriculture, Water and Rural Development, Ministry for Environment and Tourism, and the Department of Women's Affairs

At the time of writing the 1998 report no statements could be found regarding fire policies, rules or regulations under the responsibility of the Ministry for Agriculture, Water and Rural Development. The Ministry of Local Governments and Housing in a policy statement (not formally decided by the Cabinet) has taken over the responsibility for rural fire control.

The Directorate of Environmental Affairs, Ministry for Environment and Tourism, has clearly indicated that it will support future intersectoral policies in fire management.

The Office of the President, Department of Women's Affairs has finalized the National Gender Policy in 1998. In Section "Gender and the Management of the Environment" emphasis has been given on the role of women in protecting the environment. Although fire management has not yet been mentioned explicitly in that section it is expected that more detailed activity programmes will include a fire component.

2.2.4 UN Convention on Climate Change

Namibia in 1995 has ratified the United Nations Framework Convention on Climate Change (UNFCCC). Consequently, Namibia submitted a report detailing its contributions and its vulnerability to climate change to the Secretariat of the Framework Convention on Climate Change. The inventory of contributions to climate change includes emissions from the agricultural sector, notably those from land-use changes and vegetation fires. Thus, from the point of view of this binding international convention, Namibia is required to provide quantitative assessments of free-burning vegetation fires.

The mitigation strategies are an important part of the Climate Change Report. A national fire management policy and a derived fire management strategy, as proposed by this report, consequently will have an important focus on the reduction of those fires which are detrimental not only from the point of view of protection of ecosystems, biodiversity, and productivity, but also in regard to contributing to regional and global changes of atmosphere and climate.

³ Official Gazette, extraordinary of South West Africa, of 30 June 1952, Chapter III on "Protection of Land from Fire"

2.2.5 The UN International Decade on Natural Disaster Reduction (IDNDR)

The development of a national fire policy and guidelines on fire management are in accordance with the UN Resolution 44/236 in which the 1990's were designated as the International Decade on Natural Disaster Reduction (IDNDR). The basic idea behind this proclamation of the Decade was and still remains to be the unacceptable and rising levels of losses which disasters continue to incur on the one hand, and the existence, on the other hand, of a wealth of scientific and engineering know-how which could be effectively used to reduce losses resulting from disasters. The general objective of the Decade (which ends in 1999) was:

to reduce through concerted international actions, especially in developing countries, loss of life, property damage and economic disruption caused by natural disasters such as earthquakes, windstorms, tsunamis, floods, landslides, volcanic eruptions, **wildfires** and other calamities of natural origin such as grasshopper and locust infestations.

The following four goals represent the **desired** destinations which Decade efforts should lead to:

1. improve the capacity of each country to mitigate the effects of natural disasters expeditiously and effectively, paying special attention to assisting developing countries in the assessment of disaster damage potential and in the establishment of early warning systems and disaster-resistant structures when and where needed;
2. devise appropriate guidelines and strategies for applying existing scientific and technical knowledge, taking into account the cultural and economic diversity among nations;
3. foster scientific and engineering endeavours aimed at closing critical gaps in knowledge in order to reduce loss of life and property;
4. develop measures for the assessment, prediction, prevention and mitigation of natural disasters through programmes of technical assistance and technology transfer, demonstration projects, and education and training, tailored to specific disasters and locations, and to evaluate the effectiveness of those programmes.

Based on the above broadly defined goals, it was found necessary to focus on a number of specific areas of activities which would mark progress to be achieved at the end of the Decade period.

By the year 2000, all countries, as part of their plan to achieve sustainable development, should have in place:

1. comprehensive national assessments of risks from natural hazards, with these assessments taken into account in development plans;
2. mitigation plans at national and/or local levels, involving long-term prevention and preparedness and community awareness, and
3. ready access to global, regional, national and local warning systems and broad dissemination of warnings.

Namibia as a signatory country of the IDNDR has placed its National Committee of Namibia under the auspices of the Office of the Prime Minister (Emergency Unit). In the information provided by Namibia's national report to the IDNDR it was clearly stated that the country considered wildfires to be a prevailing hazard.⁴

The development of a national fire policy, fire management guidelines and management capabilities in Namibia will assist the government of Namibia to meet the targets set by the IDNDR. As the Decade will be terminated by end of December 1999, successor arrangements have to be defined at national levels

2.2.6 The Rome Declaration on Forestry and the FAO Forest Resources Assessment 2000

The FAO convened the Ministerial Meeting on Forestry on "Sustainability Issues in Forestry, the National and International Challenges", Rome, 8-9 March 1999. On 9 March 1999 the Forest Ministers released the "Rome Declaration on Forestry". The statements regarding forest fires are based on the resumé "Global Action to Address Forest Fires" which was a summary of the recommendations of the Expert Meeting on Public Policies Affecting Forest Fires (FAO, Rome, October 1998). The Ministerial Meeting, among other, welcomed the recommendations

⁴ Source: Yokohama World Conference on Natural Disaster Reduction, Information Paper No.2 (April 1994).

the Fourteenth Session of the Committee on Forestry (COFO) (Rome, 2 March 1999) and encouraged their endorsement by the FAO Council with a view to facilitating their early implementation.

In the Rome Declaration on Forestry of 9 March 1999 the ministers responsible for forests or their representatives, among other:

- * noted that the causes of forest fires are many and complex and recognizing the need to harness efforts to prevent forest fires as well as to address the multiple causes and consequences of fires around the globe,
- * welcomed the meeting on Public Policies Affecting Forest Fires hosted by FAO in October 1998 and encourage FAO to take action to implement the recommendations directed to it,
- * called on FAO and other international organizations, donor agencies and interested countries to work together to address the underlying causes of forest fires, to improve the coordination of their efforts to prevent and combat forest fires and to rehabilitate affected areas with a view to providing assistance requested by governments,

Beginning with the Round Table on Fire Namibia intends to implement the recommendations of the Rome Declaration.

It must also be mentioned that Namibia must provide the fire statistical information to the FAO as required by the Forest Resources Assessment 2000 (FRA 2000). In the frame of the FRA 2000 the FAO collects data on the numbers of fires and area burned for the period 1990-99 for all wildfires or any fire occurring on forest and other wooded land. Like many countries Namibia must urgently build up technical and human resource capabilities to conduct fire inventories on a regular base.

2.2.7 Regional Cooperation within the Southern African Development Community (SADC)

All member countries of the Southern African Development Community (SADC) have one unifying problem, among other, the problems of changing fire regimes associated with population growth, land-use changes, and land degradation. It is consequent that SADC came up with proposals on a regional Southern African wildfire management project. In 1992, during discussions between representatives of the Forestry Sector Technical Co-ordination Unit (FSTCU) of SADC and USDA Forest Service, the possibility of a SADC-wide regional forest fire management system was raised. This led to terms of reference in 1994 for an investigation or review of the situation in each country, a report on the findings and recommendations that were discussed at a meeting in Lusaka in November 1995, attended by representatives of 11 of the then 12 SADC countries and by the project team, consisting of experts from the United States and Canada. The review was sponsored by the United States Department of Agriculture Forest Service and the Canadian International Development Agency (CIDA). A follow-up report was produced in February 1996. This report contains recommendations leading to project proposals which are presented in some detail. A list of recommendations contained in the follow-up report was provided by Kromhout (1999) and is given below.

SADC-Wide Recommendations

Chapter 3 of the SADC Regional Forest Fire Management System Review report details the following recommendations:

1. All resource management agencies involved with a fire responsibility need to adopt a proactive attitude to fire management. As a first step, a position should be dedicated to fire management at the national level and preferably at the regional and project levels as well. The establishment of these positions will provide accountability for the fire management program.
 - ⇒ Status: accepted in principle by member states attending a workshop in Lusaka, Zambia, 21-23 November 1995.
2. SADC members should commit to building cooperative fire management arrangements with each other in order to accomplish their fire management objectives, as opposed to "going it alone". These arrangements should include sharing of resources, operational understandings on common border zones, joint participation in training initiatives, research and technology, and information exchange.
 - ⇒ Status: accepted in principle by member states attending the workshop in Lusaka, Zambia, November 1995, and further developed in Project Proposal No.1.

3. FSTCU should arrange for a team to visit Angola to gather information regarding their fire management situation which could be included in an updated version of this report.
 ⇒ Status: completed with FSTCU visit to Angola in August of 1995 and subsequent publication of "Addendum to the SADC Regional Forest Fire Management Systems Review Project" in November 1995.
4. FSTCU should convene a meeting of SADC country forestry, national park and wildlife representatives to review this report and to chart a course for implementation of the Project Proposals.
 ⇒ Status: completed through workshop held in Lusaka, Zambia, 21-23 November 1995, attended by 11 of the 12 SADC member states.
5. Following the meeting mentioned in above (No.4), SADC should consider the need to develop a strategic action plan for implementing a fire management program in Southern Africa.
 ⇒ Status: to be addressed; accepted in principle at Lusaka workshop.
6. In the absence of comprehensive data on fire occurrence and extent at the national level in most countries, a regional program should be developed to monitor and report vegetation loss to fire.
 ⇒ Status: accepted in principle at Lusaka workshop and further developed in Project Proposal No.1.

SADC Regional Wildfire Management Project Proposals

Incorporating the direction and prioritization provided by the delegates to the Lusaka workshop, four Project Proposals, each with several Modules, have been developed:

Regional Wildfire Management Coordination

Modules:

- * Wildfire Management Coordinating Group
- * Wildfire Management Specialist
- * Wildfire Monitoring and Assessment Information System
- * Equipment Development and Acquisition
- * International Wildfire Agreements
- * Wildfire Weather Data Network

Wildfire Personnel Training

Modules:

- * Basic Wildfire Suppression Training
- * Forestry College Improvements
- * Mid-Career Internships

Wildfire Prevention and Public Education

Modules:

- * Wildfire Prevention Information Materials
- * Extension Training - Wildfire Management

Operational Wildfire Research and Technology Transfer

Modules:

- * Prescribed Burning - Miombo Woodlands
- * Operational Fire Management Research - Zambezi Teak Woodlands
- * Wildfire Management Demonstration Centres

After the proposal to USAID to fund the implementation of the wildfire management proposals was declined. FSTCU is still seeking assistance in implementing the projects that have been identified. Although donors dislike funding that cannot be taken over by the budgets of recipients, to avoid dependency, some of the projects are not of a kind to cause dependency when funded by donors.

2.2.8 Recommendations by the International Tropical Timber Organization (ITTO) through the "Guidelines on Fire Management in Tropical Forests"

Between 1993 and 1997 the International Tropical Timber Organization (ITTO) developed "Guidelines on Fire Management in Tropical Forests" (ITTO 1997). These fire management guidelines are designed to provide a base for policy makers and managers at various levels to develop programs and projects in which the specific national, socio-economic, and natural problems related to fire in tropical natural and planted forests will be addressed. The scope of the guidelines is to assist the ITTO member countries (producer and consumer countries) to develop programs for reducing damage caused by fire; and to help tropical forest managers and rural residents to safely use and take advantage of the beneficial effects of fire in land-use systems. The guidelines recognize that many forest fires originate in the agricultural and pastoral systems; and in degraded vegetation which is outside of forests. Therefore, fire management on former and degraded forest lands may help to re-establish productive forests and to safeguard the success of reforestation programs.

At present, Indonesia is the first country in which the general ITTO guidelines are "fine-tuned" to the national level. However, the ITTO guidelines are not exclusively developed for the ITTO Member Countries or the tropical countries *sensu strictu*.⁵ The guidelines address principles which are also valid outside the ITTO region, especially in the less developed world of the subtropical and temperate zones. Namibia could certainly take advantage of ITTO's precursor work when formulating a national fire policy and fire management strategy.

2.3 Conclusions and Recommendations

It is clear that the various fire regimes and fire effects in forestry, wildlife conservancy and land-use of Namibia will require a set of measures in fire management. The following conclusions and recommendations require a coordinated national approach leading to a clear fire policy and its implementation through a series of measures within the timeframe of 1998-2001.

Creation of an Inter-Agency Round Table on Fire Management and Development of a National Fire Policy and Fire Management Guidelines

The various agencies and land owners to be involved in the implementation of a national fire management program need to agree on clearly defined responsibilities, joint strategies and sharing of resources. An inter-agency round table should be created as soon as possible. This could be initiated in a workshop, tentatively entitled "Development of a National Fire Policy and Guidelines on Fire Management in Namibia". Besides the agencies concerned, this workshop should involve NGOs, women's groups, the donor community, international programmes and representatives of fire science and related fields.

The proposed objectives of the Workshop are:

1. to provide all parties represented in the workshop with comprehensive information on the present status and problems in the field of vegetation fires and fire management in Namibia;
2. to introduce a framework which can assist to guide and coordinate national responsibilities and international assistance;
3. to provide an opportunity for potential international partners to express their interests and ideas with respect to a cooperation in the development of a functioning Long-Term Integrated Forest Fire Management System in Namibia and a basic fire science program;
4. to define follow-up procedures of this international workshop.

⁵ Namibia does not belong to the group of 26 tropical Producer Countries or the Consumer Countries which are members of ITTO. Some member countries from Africa, however, may soon follow the process of fine-tuning the general international guidelines to national policies. African ITTO Member Countries include: Cameroon, Congo, Cote d'Ivoire, Gabon, Ghana, Liberia, and Zaire.

Desirable results and recommendations of the workshop:

1. The development of a *Long-Term Integrated Forest Fire Management (IFFM)* System for Namibia is recognized as a field of high priority in order to protect natural, socio-economic and human resources from the detrimental effects of fires.
2. A basic and most critical task will be to provide the necessary legal and organizational base within the existing structures (Government administration, private sector) in order to strengthen or to create (where not yet available) the fire management capabilities.
3. International contributions are essential (a) to secure the introduction of fire management methods adapted to the requirements of local political, social, and ecological conditions in Namibia; (b) to provide the funding necessary to build up expertise and infrastructures that will secure the most time-efficient build-up of fire management capabilities in the most critical areas, and (c) to ensure the continuity of research inputs covering the
4. Both the national (Namibian) and international activities require a high degree of coordination because of the multi-sectoral approach and the multitude of international partners being involved.
5. In order to ensure the efficient realization of the required activities a National Fire Management Coordinating Committee needs to be established as a follow-up step.

Proposed terms of reference of a National Fire Management Coordinating Committee:

1. to establish a national platform for the development of a Long-Term Integrated Fire Management System;
2. to ensure an intersectoral approach in which all Government authorities, other organizations and the private sector will participate;
3. to coordinate international support to the establishment of the fire management system in order to avoid duplications of activities and investments and to optimize the efficiency of contributions; international partners shall be consulted for coordinating activities; and
4. if required, to develop the legal and organizational structure of a permanent body, e.g. a National Fire Management Council, which will ensure the efficiency and future continuity of this national program.

3. Meeting Report

The Namibia Round Table on Fire was convened in Windhoek, 10-11 November 1999. A broad range of government agencies and non-government organizations of Namibia, governments of neighbouring SADC countries and the international forestry and fire science community was represented by ca. 50 participants. In the first part of the Round Table the presentations of representatives from Namibian, SADC and the international community highlighted the background of fire history, the utilization of fire in land-use systems, the current magnitude of fire occurrence as depicted by spaceborne observations, the sustainable role of fire in certain savanna wildlands and grazing ecosystems, the detrimental role of wildfires in fire-susceptible forests of Namibia and its neighbours countries, and the impact of vegetation fire emissions on the local, regional, and global atmosphere.

After plenary discussion of basic aspects of a national fire policy two breakout working groups were formed in the second part of the Round Table. The groups

addressed the most urgent areas of action and co-ordination by government agencies and stakeholders. The results are summarized in the following.

3.1 Breakout Group 1: Government Co-ordination

The breakout group agreed to proceed as follows:

1. Identify areas, institutions (current/potential) & stakeholder groups as “service providers”
2. Brainstorm activities by priorities
3. Tie activities to lead agencies

4. Identify legal, institutional, policy implications & constraints
5. Prepare a time table, distribution of financing among local institutions/ foreign donors

Table 1 provides a list of issues and/or resources to be addressed by a national fire policy and the responsibilities of government institutions and NGOs to take responsibility or lead in implementing, monitoring or enforcing a national policy.

List of Activities

1. Collate, analyze existing information on sound fire management practices including references to traditional land management systems.
2. Initiate, analyze and publicize targeted research to fill gaps (e.g. biodiversity, climate)
3. Identify perceptions and needs of different service providers and stakeholders
4. Establish a National Fire Forum
5. Promulgate a policy including legislative framework for fire management
6. Design and implement an output oriented national fire monitoring system which serves national as well as international (global) obligations (e.g. CBC, CCD, UNFCC, ISDR Interagency Task Force [IDNDR successor arrangement]).
7. Develop participatory guidelines for appropriate fire management
8. Develop and implement public awareness campaign to serve land users, service providers & general public.
9. Identify training needs + opportunities for land users and service providers, and train priority candidates
10. Establish a locally applicable fire danger rating system

Tab.1. Resources and issues to be addressed by a national Namibian Fire Policy

Resource / Issue	Service Provider (main players in bold)
A. Fodder, Grazing	MAWRD, MET, NLRR, MRLGH, NAU, NNFU
B. Firewood, Timber (Permit and Control)	MET, D.o.F., DRM, D.o.T., NBP,MAWRD, MME, MTI, DWA, MRLGH
C. Biological Diversity / Resources	MET (NBP, DRM, DoF, DoT), MAWRD, MBEC, (NMN) MFMR, MTI, MOHSS, MHA (NamPol), UNAM/PoN, MHEVTST
D. Public Health, Pollution, Natural Disasters	MOHSS, MoLabour, DWA, MET
E. Environmental Degradation, Resource Depletion * loss of biodiversity * soil erosion * desertification/bush encroachment * loss of forest cover, no regeneration of forests, * other disturbance issues	MET, MAWRD MLRR, MBEC, NPC
F. Emissions / Climate Change	MET (DEA, DoF.), MFA, MOHSS, NPC
G. Disasters / Wildfires	OPM, MOD, MET, MRLGH, MOHSS
H. Food + Agriculture / Management (e.g., use of fire , clearing)	MAWRD, MET, NPC
I. Training, Research, and Monitoring	MBEC, MHEVTST, (UNAM-PON), MRLGH
J. Public Awareness, Public Education, Dissemination of Information	MAWRD, MET, MIB, (DRFN, NNFU, NAU) Rossing, NNF, DAPP, IRDNC, NNFC, Churches, NPC, NBC

List of Acronyms Used in Table 1

A. Fodder / Grazing

MAWRD: Ministry of Agriculture, Water & Rural Development
 MET: Ministry of Environment & Tourism
 MLRR: Ministry of Lands, Resettlement & Rehabilitation
 MRLGH: Ministry of Regional & Local Government & Housing
 NAU: Namibian Agricultural Union
 NNFU: Namibian National Farmers' Union

B. Firewood or Timber

DoF: Directorate of Forestry
 DRM: Directorate of Resource Management
 DoT: Directorate of Tourism
 NBP: National Biodiversity Programme
 MME: Ministry of Mines & Energy
 MTI: Ministry of Trade & Industry
 DWA: Department of Water Affairs

C. Biological Diversity / Resources

MBEC (NMN): Ministry of Basic Education & Culture, National Museum of Namibia
 MFMR: Ministry of Fisheries & Marine Resources
 MOHSS: Ministry of Health & Social Services
 MHA (NamPol): Ministry of Home Affairs (Namibian Police)
 UNAM: University of Namibia PoN: Polytechnic of Namibia
 MHEVTST: Ministry of Higher Education, Vocational Training, Science & Technology

D. Public Health, Pollution, Natural Disasters

MoL: Ministry of Labour

E. Environmental Degradation / Resource Depletion

MBEC: Ministry of Basic Education & Culture
 NPC: National Planning Commission

F. Emissions / Climate Change

DEA: Directorate of Environmental Affairs
 MFA: Ministry of Foreign Affairs

G. Disasters / Wildfires

OPM: Office of the Prime Minister, Emergency Unit
 MoD: Ministry of Defence

H. Food and Agriculture

MAWRD: Ministry of Agriculture, Water & Rural Development
 MET: Ministry of Environment & Tourism
 NPC: National Planning Commission

I. Training, Research and Monitoring

MBEC: Ministry of Basic Education & Culture
 UNAM-PoN: University of Namibia - Polytechnic of Namibia
 MHEVTST: Ministry of Higher Education, Vocational Training, Science & Technology
 MRLGH: Ministry of Regional & Local Government & Housing

J. Public Awareness

MAWRD: Ministry of Agriculture, Water & Rural Development

MIB: Ministry of Information & Broadcasting

DRFN: Desert Research Foundation of Namibia Rossing: Rossing Foundation

NNF: Namibia Nature Foundation

DAPP: Danish Action People to People

IRDNC: Integrated Rural Development & Nature Conservation

NNFC: Northern Namibia Forestry Council

NBC: Namibian Broadcasting Corporation

Tab.2. Priority steps for implementation activities listed above

Activity	Lead Agency / Program	Timeframe	Instrument and possible source of finance
4.	DoF	Now ongoing, inception by 1/2000 Establishment by 11/2000	NFFP ⇒ GRN 04/2003
5.	DoF	1997; Policy in place 11/2000 Legislation by 04/2001	NFFP ⇒ GRN FAO
1.	DoF	1996 11/2000 key participants informed and analyses completed	NFFP ⇒ GRN 04/2003
2.	DoF	Analysis of gaps 12/2000 Research, analysis, literature; ongoing	NFFP/GRN + donor sources 04/2001 NFF to seek financing through donors, GRN and levies
6.	DoF	1999 ongoing	NFFP + GRN 04/2001
10.	DoF	Fire Danger Rating System by 12/2001	NFFP + GRN 04/2001
3.	DoF + MAWRD	1999 ongoing	NFFP + GRN 04/2001
7.	DoF + MAWRD	Now ⇒ 12/2000	NFFP
8.	DoF ⇒ NFFP	Current and ongoing Handing over to NFF by 11/2000	NFFP NFFP ⇒ NFF by 11/2000
9.	DoF ⇒ NFFP	Training needs assessed for fire ecology and fire management by 06/2000	NFFP ⇒ NFF by 11/2000

3.2 Breakout Group 2: Stakeholder Co-ordination

The Development of an intersectoral fire management programme for Namibia requires a high degree of co-ordination efforts between the different sectors of the society represented by government agencies (see Breakout Group 1), non-government institutions and interest groups, and stakeholders to be involved.

The group discussed the state of fire knowledge, technology transfer, institutional capacities in fire management in Namibia.

3.2.1. Current Status Of Fire Management In Namibia

3.2.1.1 Information

- * Etosha burning guidelines and regulations for nature conservation are based on long-term ecological research and fulfil the requirements of advanced ecosystem and fire management
- * No guidelines are available for commercial farming areas
- * Guidelines are available for communal areas in the Forest Act but are currently not applied because the Act does not conform with present socio-cultural conditions
- * Guidelines in the **new** Forest Act include all sectors
- * Lack of burning policy. Such a policy is needed for the prescription of fire or fire regimes in accordance with the need for burning in various land-use systems and wildlands, e.g. burning moribund grasses, control of bush encroachment, stimulation of forest regeneration, etc.

Elements to be considered in burning:

- * reasons for burning
- * appropriate fire regimes
 - type of fire
 - intensity of fire
 - season of burning
 - frequency of burning
 - manpower & equipment
- * management after burning
- * assessment of traditional burning practices
- * impacts on biodiversity
- * fire information systems

Stakeholders to be involved in policy development:

- a Ministry of Agriculture, Water & Rural Development
 - * Research division
 - * Extension division
 - * Veterinary services
 - b Ministry of Environment and Tourism
 - * DoF, DEA, DRM
 - c Ministry of Regional, Local Government and Housing
 - * Regional governor's offices
- * Established procedures exist for fire safety but prescriptions lacking
 - * Availability of free satellite information access (NOAA/AVHRR) from Harare, Zimbabwe
 - * Problems; lack of techniques to assess and monitor fire effects
 - * Legislation governing the use of fire
 - * Lack of quantitative data on fire effects
 - * Accessibility of unpublished data on fire management and effects

3.2.1.2. Communication

- * Lack of communication channels of relevant information to all stakeholders (electronic system).
- * High level endorsement at ministerial level is required to build up a communication network

3.2.1.3. National responsibilities

National responsibilities need to be defined to guide, co-ordinate and implement a broad range of tasks within a nationally harmonized fire management strategy. The

- * Coordination
 - who is responsible for overall national co-ordination
- * Who is responsible
 - for policy
 - for training
 - for liaison
 - for sensitization
 - for extension
 - for fire management burning policy
 - for extinguishing fire

The key stakeholder to be involved in sharing responsibilities are:

- * Commercial farmers (commercial farming areas)
- * Community leaders/tribal-traditional authorities(communal lands)
- * Private landowners (municipalities)
- * Service providers (national parks)
- * Fire brigades (urban areas)
- * Tourism sector
- * Relevant research institutions
- * Educational institutions
- * Relevant NGOs

3.2.1.4. Research and Training

Research and training must address the most urgent and immediate needs of the country. It has been recognized that the wealth of fundamental knowledge in fire science as well as existing technologies and procedures in fire management must be transferred to the user level. The focus should be on:

- * Problem-oriented research
- * Research on developing techniques for assessing and monitoring fire effects by field based remote sensing
- * Intergrative sectoral research
- * Training i.a.w. the needs to be defined
- * Capacity building of existing staff
- * Practical training courses in fire management
- * Exchange of extensionists in SADC
- * Co-ordination of syllabi on fire management at national training institutions

- * Public awareness campaign
- * Exploring funding possibilities within GRN & donors

3.2.1.5. International co-operation

The transboundary fire issues affecting Namibia and its neighbours require a strong co-operation with the neighbouring countries, the SADC community and international partners. Main emphasis should be given on:

- * Transboundary meeting to involve all stakeholders
- * Reactivation of the SADC protocol on fire management, 1996
- * SADC and bilateral agreements
- * Magnitude of crossboundary fires
- * Magnitude of crossboundary air pollution
- * Procedures for containing cross-border fires
- * SAFARI 2000 research
- * Connect Namibia with international fire information network via the Global Fire Monitoring Center (GFMC)
- * Organization of workshops with international inputs
- * Identification of best fire management practices within the region

3.2.1.6. Finance

- * For financing institution and capacity building and implementation of a national fire management policy commitments are required by the government of Namibia and the international community. Priority must be given to
- * work towards economic independence at all levels to create sustainable funding

International funding sources need to be explored through:

- * Donors, e.g. IUCN, WWF, GEF, GFMC, FAO, EU
- * NGOs
- * Business enterprises (PPP - Public-Private Partnerships)
- * Exploit opportunities such as E.I.F.
- * Seek partners for carbon trade

3.2.1.7. Evaluation and Feedback

An efficient monitoring and evaluating capacity must be built in Namibi. It is recommended that the **National Fire Forum** should:

- * Monitor and review/evaluate fire management Programmes
- * Establish systems/channels for monitoring and evaluation of fire management activities including bush encroachment, climate change, employment generation through the control of e.g. transboundary fires.

4. Conclusions and Recommendations

The national Namibian Round Table on Fire was an important kick-off event to initiate a national fire management strategy and programme in which all sectors of the society concerned will actively participate.

From the very beginning the Round Table was not designed to elaborate the details of a national fire programme. The report, which includes the recommendations arising from the breakout groups and the Round Table plenary,

represent the opinions and visions of the most important government and non-government institutions and stakeholders.

It is now most urgent to follow up the recommendations by priority. Highest ranking priority is the establishment of a national fire forum which will provide the continuation of the spirit of a Round Table in which all stakeholders will jointly share responsibility.

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This report has been prepared in the frame of the Namibia-Finland Forestry Programme, Directorate of Forestry, Ministry of Environment and Tourism, Windhoek, Namibia (December 1999) by

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The ostrich in Namibia's fire prevention logo represents a species that is endangered by excessive wildfires

National Guidelines on Forest Fire Management in Namibia

Final Draft 31 March/2001

Preface

The extent of occurrence of forest fires in Namibia in recent years, especially during year 2000, shows that fire management efforts have to be strengthened throughout the country. Only East Caprivi has been able to show promising reduction in burned areas since the pilot efforts on Forest Fire Management started there in 1996.

In areas outside Eastern Caprivi, results have been slow in coming. One of the main reasons for the slow response is the lack of institutional capacity in the Directorate of Forestry (D.o.F.) itself. The same applies to the Agricultural Extension staff as well as the staff of the Directorate of Resource Management working outside Etosha. Some of the National Parks like Etosha have well established guidelines on Fire Management whereas others; like Mamili, Mudumu, Kaudom etc. are totally burned year after year. The Malengalenga-Liyambezi peat lands are also burned annually, through agricultural practices. This shows that the properties of peat are unknown among agricultural extensionists.

The outdated forest legislation has also been lacking in specific areas e.g. on guidelines for Forest Fire Management both in communal as well as in commercial farm areas. The uncertainty regarding fire management directives also applies to the Ministry of Regional, Local Government and Housing which Ministry, by and large, is responsible for all fire management activities in Namibia.

With the inception in 1996 of the Namibia's Forestry Strategic Plan, the path was opened for community participation in local management of Forest Fires. These participation efforts were soon named Integrated Forest Fire Management activities or IFFM activities.

On the behalf of the Namibia-Finland Forestry Programme (NFFP) and its component on Integrated Forest Fire Management (IFFM) we would like to acknowledge the valuable contribution to the process of preparing the National Guidelines on Forest Fire Management for Namibia by the following persons:

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The Ministry of Environment and Tourism through its Directorate of Forestry wishes to thank all the people listed above and additionally many others who's names do not appear above for their valuable contribution to these National Guidelines on Forest Fire Management in Namibia.

These new National Guidelines on Forest Fire Management are expected to become a yardstick for all Forest Fire Management activities in the country in the future.

We hope that these new Guidelines will be useful in developing suitable practices for sustainable forest management in Namibia.

Windhoek, April 2001
 Chairman of Project Steering Committee

Dr. H.O. Kojwang
 Director of Forestry

ABBREVIATIONS

CACA	Caprivi Arts and Cultural Association
CBO	Community based organization
CBRM	Community based resource management
CEC	Constituency Emergency Committee
DFO	District Forest Officer
DRM	Directorate of Resource Management
D.o.F.	Directorate of Forestry
EOU	Emergency Operational Unit
ECE	United Nations Economic Commission for Europe
FAO	Food and Agricultural Organization of United Nations
FBSO	Fire Brigades Service Ordinance
FDO	Forestry District Office
FPA	Fire Protection Association
GFMC	Global Fire Monitoring Center
GPTF	Game Product Trust Fund
IFFM	Integrated Forest Fire Management
IFFN	International Forest Fire News (FAO/ECE)
ILO	International Labour Organization of United Nations

Induna	Village elder or village chief
Induna Silalo	District Village Chief
ITTO	International Tropical Timber Organization
Khuta	Council of Village or District Chiefs
LIKWAMA	Local farmers union in Caprivi
MBESC	Ministry of Basic Education, Sports and Culture
MET	Ministry of Environment and Tourism
MRLGH	Ministry of Regional, Local Government and Housing
NamPol	Namibian Police
NBC	Namibian Broadcasting Corporation
NDF	Namibian Defense Forces
NEMC	National Emergency Management Council
NEMU	National Emergency Management Unit
Neudamm	Agricultural College of the University of Namibia
NFFP	Namibia-Finland Forestry Programme
NFF	National Fire Forum
NGO	Non-governmental organization
Ogongo	Agricultural College of the University of Namibia
PO	People's organization
REC	Regional Emergency Committee
SADC	Southern African Development Community
TAA	Traditional Authorities Act
UNEP	United Nations Environmental Programme
WHO	World Health Organization
WMO	World Meteorological Organization

TABLE OF CONTENTS

I.	NATIONAL FOREST FIRE POLICY AND LEGISLATION
II.	FOREST FIRE MANAGEMENT STRATEGIES
III.	INSTITUTIONAL FRAMEWORK AND CAPACITY BUILDING
IV.	SOCIO-ECONOMIC CONSIDERATIONS
V.	PUBLIC TRAINING AND EDUCATION
VI.	RESEARCH AND DEVELOPMENT
VII.	MONITORING AND EVALUATION
VIII.	REFERENCES

I. NATIONAL FOREST FIRE POLICY AND LEGISLATION

1.1 National Policy

Principles of Forest Utilization

Namibian forests are considered a natural gift from God. They are there for the benefit and use of the Namibian nation and its recreational values are to be enjoyed by the rest of the world.

Namibian forests form a part of the basic capital in the nation building process. They need to be used wisely and sustainably for the prosperity of all nationals, commercial farmers, municipalities and local communities both now and in the future, and in accordance with established national forestry criteria specified by the indicators for sustainable forest management in Namibia.

Activities

- a Strengthen the coordination between all government sectors and other stakeholders using forests and land resources so that the utilization actions are based upon sustainable use of the environment.
- b Motivate and encourage all citizens in both government, private sectors and local communities to consciously and voluntarily protect the forest resources from disturbances that can decrease the sustainable functions and benefits of a well-managed and protected forest.

- c Encourage private sector, local communities and government agencies involved in forest utilization to carry out their activities in a way that secures prosperity to the region.

Principles of Forest Protection

Issue guidelines that sees to it that forestry development continues to be upgraded in a way that ensures the availability of forest products. This will aid the development of industries, work sectors, business opportunities, national income and regional development. The national forests are to maintain their functions in the ecosystem; benefiting hydrology, gene pool, soil fertility and climate. Forest protection is meant to secure the sustainability of forests at the same time maintaining the continuity of forest development.

Forest protection includes all efforts, initiatives and measures to prevent and limit the damage to forests and forest products. Humans, livestock, fire, wild life, natural disaster pest and disease can cause forest destruction. This is also reflected in the *National Disaster Plan of Namibia*.

Forest protection also includes the preservation of ancestral and communal rights to a forest area or rights to utilize the products in the forest. These principles are also included in the *Traditional Authorities Act* of 1995 wherein Point 10 outlines the following: Functions, duties and powers of Traditional Authorities (Sub-section 10.2: In addition to the functions specified in subsection (1), the members of a traditional authority shall have the following duties, namely:

Activities

In accordance with the *Traditional Authorities Act* of 1995 the members of a traditional authority shall have the following duties, namely:

- * to assist the police and other law enforcement agencies in the prevention of crime and apprehension of offenders within their jurisdiction.
- * to assist and cooperate with the organs of the central, regional and local government in the execution of their policies by keeping the members of traditional community informed of developmental projects in their area
- * to ensure that the members of their traditional community use the natural resources at their disposal on a sustainable basis and in a manner that conserves the environment and maintains the ecosystem, for the benefit of all persons in Namibia.

General:

- a Encourage regional forestry institutions, government agencies, concession holders and local communities to take all possible measures in limiting the damages to the forest and the forest products.
- b Ensure that stakeholders at all levels understand the functions and benefits of the forest. This will encourage cross-sectoral support in the protection and prevention of damaging wild fires.
- c Create a functional regional/district level fire control system that is supported by; facilities, human resources and adequate funding.
- d Encourage the formation of Fire Protection Associations among commercial farms. This provision also covers new settlement farms in commercial farming areas.
- e Develop regulations and guidelines on land clearing by the use of fire or by other means.

Principles on Protection Priorities

The priorities in forest protection should include specific areas of International, national or local priorities. This would include flora and fauna, religiously or culturally important forests, conservancies or community forests. Therefore the protection of these forests from fire should be given highest priority. This does not exclude forest areas of *Production Forest* from the priority list.

Activities

- a Develop a master plan on the protection of forests from fire for each conservation area.
- b Motivate local communities to develop a fire management plan for their area.

- c Establish regulations on the use of fire within each specific area including bush encroached areas where fire is used as a tool to eradicate the bush. These well intended activities may however lead to desertification and loss of biodiversity.

Principles for Community Participation in Forest Protection

Besides the national government, traditional authorities, commercial farmers and local communities are also responsible for the implementation of forest protection policies to maintain and manage the environment, to prevent and overcome damages, reduce air pollution, wind and water erosion as well as to sustain natural resources.

When it comes to *Declared National Parks* the principles of *Community Involvement in Park Management (CBRM)* should be applied to any fire situation in or around the Park. The local communities involved in forest fire management should be paid out of the *Game Product Trust Fund*.

Activities

- a To inform and educate the rural population, commercial farm communities and the general public in the role of forests and its contribution to the national economy. Numerous are still the people who see the forest as merely a source of income for timber and non-wood forest products. This short term exploitation goal has led to drastic damage and denudation of forests to the point that the existence and quality of forest resources have declined greatly.
- b To inform and educate the public about adverse environmental and economic effects of bush encroachment on commercial farming communities.
- c Encourage the formation of Fire Protection Associations in commercial farming areas and Fire Committees in communal areas.
- d Encourage NGOs, CBOs and private initiatives regarding forest extension and law abiding activities.
- e Encourage civic organizations, religious organizations, women groups, listener-reader-viewer groups, conservation groups, handicraft producers, local artists and environmental organizations to upgrade their understanding and appreciation of forests through their participation in regular activities and exchange of information.
- f Enhance the role of civic organizations in motivating community participation in forest protection activities including fire prevention and suppression.

Principles on the Success of Policy Implementation

The protection of forests from fire can succeed if the local communities, commercial farming communities and all levels of government agencies understand the problem. They have to appreciate the complexity of the issue to be able to implement all policies of forest protection from fire based on fire management legislation and technical provisions.

The *Directorate of Forestry, Ministry of Agriculture* and NGOs should be involved in establishing Fire Protection Associations in commercial farming communities and in addition to provide appropriate training to commercial farming communities. In communal areas the government and traditional authorities have been implementing forest fire management in selected communities since May. 1996.

In order to achieve a more successful implementation, following steps have already been taken:

1. The Caprivi Forest Fire Control Project was initiated in March 1996
2. Namibia Forestry Strategic Plan was developed in May 1996.
3. Fire Drama Play developed together with Caprivi Drama Group, July 1996.
4. Regional Meeting on the Draft Forest Bill, August 1996.
5. Evaluation carried out on the Community Based Fire Control Approach, August 1997.
6. First Draft of Forest Fire Policy and Guidelines developed, March 1998
7. Fire Control was incorporated in the new Namibia-Finland Forestry Programme July 1998.

8. Material collected for National Guidelines/Caprivi Fire Management Plan, August 1998.
9. 50 schools and 25.000 people covered by fire education November 1998.
10. Second meeting in Caprivi Governor's Office, August 1998.
11. Project renamed: Integrated Forest Fire Management (IFFM) September, 1998
12. Mid-Term Review of IFFM carried out, report produced, December, 1998.
13. Investigation of Attitudes to Forest Fires carried out (MSc. Thesis), December, 1998.
14. Gender assessment on IFFM carried out, Report Produced, April, 1999.
15. Socio-Cultural assessment of IFFM carried out, Report produced, August 1999.
16. Technical/environmental assessment of IFFM carried out, Report produced, August 1999.
17. Third meeting in Caprivi Governor's Office, August 1999.
18. National/International Round Table Meeting organized; October 1999.
19. Second Draft of National Forest Fire Policy and Guidelines produced, December 1999.
20. Handing over of 10,000 copies of Fire Story and Cartoon handed over to Ministry of Basic Education, Sports and Culture (MBESC) , National Television and radio broadcast, January 2000.
21. 100 schools and 40,000 people covered by fire education, February 2000.
22. Workshop on National Criteria and Indicators for forestry, February 2000.
23. Youth Fire Drama Festival; National television and radio broadcast, March 2000.
24. Survey on grass biomass (and its implications on burning) in eastern Caprivi, July, 2000.
25. Five training courses carried out for 15 farmers associations in commercial farms, September, 2000.
26. First Meeting on the establishment of a proposed National Fire Forum, October 2000.
27. Third Draft of National Guidelines on FFM handed over to the Regional Governor, December, 2000.
28. Fourth Draft of Caprivi Forest Fire Management Plan prepared, December 2000.
29. Fifth Draft of National Guidelines handed over to the Regional Governor, February, 2001.
30. Second meeting for Namibia National (Forest) Fire Forum convened, February 2000.
31. Caprivi Forest Fire Management Plan Drafted. March, 2001
32. Final Draft of National Guidelines on FFM distributed, March 2001.

Activities

- a Synchronize understanding of forest protection policy on fire with other governmental land use policies through intensive communication via; formal correspondence, meetings, seminars and workshops.
- b Formulate an integral forest and land management policy including forest and land fire aspects. The fire elements must be balanced with other elements and must be acceptable to all involved parties. The formulated policy should be easily understood, it should be accepted by all parties and all stakeholders should be able to implement it.

1.2 Legislation

Principles Governing Fire Law Enforcement

The Namibian Constitution and other Laws are the tools for the government to govern the country. Thus all actions of the state apparatus are based on laws, including those actions carried out to protect forests from wild fire.

Advance coordination between forestry and other institutions is required prior to implementing forest fire rules and regulations.

In order to establish a comprehensive forest protection system that includes items of varying importance, numerous legislative acts have to be enacted. Given that forest and land fire problems are very complex and that they continue to change over time, there is a need to stabilize, simplify and re-dress this legislation into technical instructions that are more practical to apply in the field.

These acts must be widely publicized so that all stakeholder levels, government agencies, commercial farmers and local communities can understand, accept and implement them correctly.

Fire Brigade Services Ordinance, 1978 states further: *Emergency* means any situation requiring immediate action to prevent death or injury to persons or damage to property, but not declared state of emergency in terms of any law.

Any local authority maintaining a fire brigade service or a community fire unit; shall appoint a *Chief Fire Officer* or *Fire Chief*.

There is a need to strengthen the IFFM resources within the D.oF. by establishing a special fire task force at headquarter level. This taskforce will establish links with: NDF, NamPol, Agriculture, NamPower, Works/Roads and NamRail on fire prevention activities.

This task force will also co-ordinate the activities evolving around the formation of a *National Fire Forum*.

Additionally one member should be specialized in the education (forest extension) of schools and local communities and commercial farms.

Activities

- a Study the existing laws and formulate a new Forest Bill and Traditional Authorities Act to accommodate the increasing fire protection problems caused by socio-cultural changes, particularly technical and organizational aspects. These new guidelines and approaches will then form the framework for annual work plans for integrated forest fire management.
- b Encourage all government levels, private sectors and traditional authorities network to develop standard fire management procedures that are suited to the local socio-cultural set-up as well as to the technical skills of the people in the target community. Keep Chief Forester and Head Office levels informed about intended recommendations and activities in the field.
- c Publicize the regulations and legislation on the protection of forests from fire to enhance awareness. Use formal and informal education processes to disseminate information through various governmental and mass media channels, communication forum, correspondence, seminars, workshops etc.
- d Enhance law enforcement efforts through cooperation and coordination between enforcement personnel and related institutions e.g. NDF, Police, Veterinary, Water supply and Customs and Immigration in the case of transboundary activities.
- e Analyze how and to what extent the ITTO Guidelines on Fire Management in Tropical Forests are applicable to Namibia. Apply these special provisions to Namibian conditions.
- f Adopt and apply relevant components of the Global Action Plan on Peatlands through the Ramsar Convention, the Kyoto Protocol of the Framework Convention on Climate Change and other relevant mechanisms.

II. FOREST FIRE MANAGEMENT STRATEGIES

Principles concerning Forest Fire Management Plans

Forest Fire Management, as a management activity should be carried out based on a proper planning. A forest fire management plan is an integral part of a forest management plan, but not only that, it should also form a part of any land use plan for a certain area. This plan is developed at national, provincial district and field level e.g. for an area with thatch harvesting. Fire management planning is a continuing process and the plan needs to be renewed and updated periodically.

Activities

1. The plan should provide sufficient resources (manpower, facilities, infrastructure and funding) for the development of a comprehensive fire management plan at each of the various governmental levels (national, provincial/regional and district levels).
2. The plan should identify all factors affecting forest fire management including:
 - Forest fire history
 - National, regional and district plans
 - Type of ecosystem (related to fuel type) including peat lands, low flood plains, hills and mountain forest, Mopane forest, savanna forest.
 - Seasonal variations in climate and weather conditions
 - Socio-economic and cultural variations in local communities
 - Government and other stakeholder groups e.g. CACA, grass cutting groups
 - Transboundary fire management agreements and their level of accomplishment
3. The plan should integrate the forest and land fire management plans into development plans which should be included in the long and medium term planning of the forestry sector.
4. The plan should include provisions to prepare annual forest fire management plans that include:
 - Fire management objectives
 - Detailed management programs, scheduling source of funding and the amounts required

2.1 Fire Management Options

The Principle of Approach and Application of Forest Fire Management Options

There are several approaches in forest fire management that can be applied in any one region or local area. These approaches are based on the specific situations and conditions found in these respective areas. One management approach is an *Integrated Forest Fire Management* (IFFM) System whereby all aspects of prevention and suppression are considered together. This approach is the correct option for both the commercial as well as for the communal areas of Namibia considering the socio-cultural, biological and economic realities in these areas.

The problem is related to available local resources, technical aptitudes of people in local communities, availability of manpower (for suppression) and the most common agricultural practices which they apply in their lands. In addition, the environmental awareness among traditional leaders directly reflect the commitment of the local people in participating in forest fire management activities.

Like wise, the environmental awareness among the Farmers Associations play the same role in commercial areas of the country.

There is also a need to compile a legislation on *veld* fires which will cover IFFM activities in commercial farm areas including resettlement areas. This obligations, which are not specifically covered in the new Forest Bill, will i.e. compel all land owners to report all fires.

Activities

- a To develop an integrated forest fire management system to protect forest from fire by considering not only the technical fire management aspects but also the decentralization which brings in the prevailing socio-economic and cultural aspects of local communities.
- b To develop a forest fire management system appropriate for commercial farms.
- c To train trainers for IFFM activities in commercial farming communities.
- d Appropriate national or sub-national education agencies should incorporate peatland curricula in educational programs particularly in areas where peatlands form a significant component of the landscape under both forested and non-forested ecosystems. Such curricula should feature the ecological and cultural functions and values of peatlands as well as their importance to people including traditional knowledge based on input from local communities, women and local healers.

- e Review the present framework of national policies, laws and regulations to ensure that effective peatland wise use and management are practiced; and enhance such measures where there is national consensus that peatlands are at significant risk due to anthropogenic activities.
- f Where there is a national consensus that an incomplete network of protected peatland sites is present, expand peatland reserves, parks or conservancies.
- g Promote the wise use and management of peatland functions and values through the implementation of national land use planning through the implementation of international conventions and treaties.

2.2 Fire Prevention

Principles surrounding a Fire Prevention Plan

Fire prevention is the key to overcome forest fire problems which are caused by anthropogenic or human induced fires. Fires induced by lightning are rare in northern and north-eastern Namibia where 99% of all fires are human in origin. It is estimated that fires in the central and western parts of Namibia 60% of fires are caused by nature and 40% by human activities. Thus, the prevention should play a key role when reducing human induced fires. Local people and the general public should be made aware of the impact of wildfires (uncontrolled fires) have on the environment and particularly on the trees in the forests. The work to educate local people (including all school children) takes 3-5 years to achieve.

Long term experience from fire education in Asia shows, that although the new knowledge is firmly implanted in peoples minds, the changes in traditional behaviour still takes a few more years to materialize.

In the Namibian context, the so called *cutline* or fuel break system also belongs to the category of fire prevention activities.

Suggested outline for a fire prevention plan:

Development of a basic plan:

- Fire occurrence map with numbers and location of fires
- Fire statistics showing dates and times of fires, size of fire etc.
- Fire risk map showing locations where new or untrained or drunkard villages are situated
- Fire risk map showing locations where fires cross national boundaries
- Thematic maps (hydrology, roads, Khutas, police stations, Defence Force outposts)

Determine prevention objectives:

- Lead agency: The Directorate of Forestry (D.o.F.)
- Forest Fire Campaign directed towards the entire population.
- Special target groups; all schools, 50 % of all communities, 100 % of all border crossings to Zambia, Botswana, all Government offices, 30 NGOs.

Develop prevention activities plan, needed infrastructure, scheduling and a fire prevention fund:

- Encourage and motivate all forestry officials, traditional authorities, and other forest users to participate in prevention activities
- Review the dissemination and information channels and material periodically
- Fire extension work among the local communities and other rural extensionists
- Education and training
- Prevention engineering (cutlines, prescribed burning, silvicultural treatment e.g. pruning)
- Develop the legal status of communities to prevent fires in their areas

Develop a monitoring and evaluation plan:

- Survey among stakeholders, media coverage, satellite imageries

Develop a funding plan and its sources:

- Government agencies
- Regional authorities

- NGOs,
- Transboundary (SADC)
- International funding (e.g. research)
- Special national fund (e.g. by tourism levy)

Implementation of Forest Fire Prevention:

According to the *Government Policy on Combating of Bushfires*, the *Ministry of Environment and Tourism (MET)* is by a Cabinet decision given the responsibility of fire prevention. In reality the veld- and forest fire prevention work will primarily be the responsibility of the Directorate of Forestry. The same Ordinance also outlines the Powers of Regional Councils and Powers and duties of Local Authorities.

The principles of successful fire prevention is determined by:

- Appropriate selection of activities and programs for each target group
- Appropriate selection and implementation of preventive techniques and their scheduling
- Adequate facilities, infrastructure and funding
- Adequate number and quality of human resources as executors of the prevention program
- Support from political and traditional leaders

A national fire danger rating system needs to be developed and in place to be able to reach an effective fire prevention. Likewise the land tenure system needs to be clear so as to determine who is fire-responsible for each geographic area.

The Government (Agriculture, Veterinary, NamRail) should investigate into the use herbicides for clearing fuel breaks along fences, rail roads, national roads and national borders. Consideration should be given to the subsidizing of herbicides to these stakeholders.

The losses on fencing caused by fires are e.g. 2500\$/km for an ordinary 5-strand fence. Game fences are 3-4 times more expensive to replace.

Activities

To develop an operational guideline for forest fire prevention which takes into consideration the;

5W + 1H = Why, What, Who, Where, When and How

To implement the education, training, information/dissemination and other extension activities by:

- Personal contacts
- Interview/discussions with target groups; Government agencies, traditional leaders, farmers, fishermen, cattle raisers, women's groups, conservation cadres, environmentalists, tourists, hunters, honey hunters, arsonists, school children, teachers, handicraft makers etc.
- By developing and establishing a National Fire Logo
- Use of printed and electronic media
- By using Theatre Drama Play and national radio to relay fire message to illiterate rural people
- By targeting primary and secondary schools and other training institutions
- By involving local artists in the production of educational materials, text writing, song writing, video production
- By participating in literary programs for adult learners the majority (68%) of whom are women
- By participating in national/local exhibitions, cultural festivals, parades, school competitions
- By participating in National Arbor Day or Environmental Day, Food Day
- By organizing national Fire Campaign Radio/TV with National Fire Logo (ostrich) displayed
- By producing ostrich; badges, key rings etc.
- By producing Fire Stories or Fire Cartoons for mass distribution in English and local languages
- By producing fire billboards in strategic areas in English as well as in local languages

Technical actions and regulatory measures:

- Patrol and control/guard fire risk areas (e.g. like the border areas with Botswana and Zambia)

- Fuel treatment (fuel modification, e.g. slashing for reduced flame height), fuel isolation, fuel reduction by grazing or by prescribed burning
- Construction and maintenance fire breaks, fuel breaks, grazing corridors and or silvicultural treatment areas
- General weather expectancy for fire seasons (e.g., El-Niño-Southern Oscillation)
- Socialize and enforce laws, by-laws and customary law

Implement formal and informal education and training:

Involve local communities, grass cutting groups, game lodges, rural schools in fire prevention activities including cutline (fuel break) construction, prescribed burning whether done jointly with the Directorate of Forestry (D.o.F.) or by themselves.

2.3 Role of both Local and Commercial Farming Communities

Principles of Community Involvement

An effective and efficient forest fire prevention and suppression strategy is based upon an understanding socio-economic, cultural and economic realities in the use of fire and burning among the local population. Any forest fire prevention or suppression programs rely on good relationship between the Government as law enforcer and both local communities and commercial farming communities as forest users. This joint partnership for the sustainable use of the forests is called community based forest fire management in local communities. In commercial areas the partnership is based on the establishment of a network of *Forest Protection Units* or *Forest Protection Associations*.

Forest managers (also in community forests) are required to implement forest fire prevention activities in their respective areas as well as to actively participate in extinguishing any wild fires burning in their areas.

Activities

- a Encourage the establishment of new voluntary community fire management units and strengthen those groups already trained as fire control units
- b Enhance community participation in planning, implementation, monitoring and evaluation of all integrated forest fire control activities through the development of incentive systems
- c Establish a systematic and continuous community based fire control program in northern Namibia
- d Encourage the creation of volunteer forest fire prevention groups through public education and national fire campaigning

2.4 Fire Suppression

Principles of Pre-Suppression

Effective and efficient forest fire suppression (fire fighting) can be carried out only when appropriate preparations are made prior to the required suppression activity. Pre-suppression includes preparation, staffing, organizing, equipping, funding and training of all people planned to do the suppression work. Cooperative agreements between stakeholders need to be mutually developed. Standard suppression procedures need to be established, as do detection and early warning systems. Procurement and maintenance of equipment, advance training of qualified mechanics, must also be arranged.

Activities

A. Preparation

- Prepare data and information needed in suppression operations including topographic maps, risk area maps, accessibility (road) map, support location map, hydrologic map, annual statistical data on forest and land fire, list of available suppression resources including trained villagers.
- Make an inventory of available equipment, infrastructure and manpower to be needed in an area to ensure the readiness for mobilization.
- Study and evaluate past suppression needs.
- Identify the fire hazard and fire risk level based on field observations (local activities, humidity, temperature, wind speed, fuel moisture).

B. Develop and initiate cooperative support from other stakeholders

- Consolidate policies and action among all organizations established at national, provincial/regional, district, community level through meeting called by the local Fire Chief or DFO.
- Ensure readiness of elements in various organizations through exchange of data and information: Seasonal weather forecast, general weather pattern, risk and hazard areas (e.g. Chobe crossings) inventory of facilities, infrastructure and manpower, funding and software.
- Ensure readiness of aid resources between and among related institutions. These include Home Affairs, NDF, Public Works Department, Social Works, Health Department, Public works Department, Agriculture and water Affairs, Prime Ministers Office/National Disaster Coordination Unit, Civil Aviation, Telecom etc. This includes a complete list of contact persons at each level in Forestry Districts.

C. Strengthen Standard Procedures

- Identify criteria to determine the caution (awareness) level and preparedness.
- Strengthen procedures for all elements within the suppression operation; including procedures for size-up, mobilization of manpower and equipment, communication and command system, procedures for mobilization of stakeholder resources, research and investigation, personal safety, accident reporting etc.
- Develop a structured fire command system for each size of fire disaster (small, medium, large).
- Ensure the lead-agency role of D.o.F. in standard mobilization situations, need to build possible store rooms in field locations for keeping fire equipment. This would include the earmarking of transport equipment, marking of water points, electrical power sources, communications systems, food and water supplies.

D. Equipment Preparation

- Check and maintain that all detection and early warning equipment, local fire look-outs, satellite image receiving stations and Telecom, Weather Bureau facilities are functioning and staff available.
- Check, maintain and test run the equipment at the suppression centres and sub-stations to ensure they function as required.
- Check also that they may be easily loaded and dispatched to fire suppression areas.
- Identify and ensure readiness of any needed stakeholder equipment intended for suppression and its present condition that it conforms with national safety regulations.
- Build store rooms for fire suppression equipment and tools at sub-stations or Khutas, priority should be given to suppression tools.

E. Early Detection and Warning

- Develop, equip and check and ensure facilities for early detection and warning systems at national and district level are fully functioning. Included are such items as look-out points, weather station (rain gauge), thermometer, anemometer, (wind) hygrometer, (moisture/humidity), remote sensing facility (software, human resources), procedures for gathering information from surveillance, air reconnaissance, police patrols.
- Define forest risk and fire hazard areas (e.g., with grass cover of more than 4000 kg/ha).
- Increase law enforcement patrolling and inspect high risk fire areas (national borders, drunkard villages).
- Define alert areas and disseminate information on these.
- Post and maintain daily Fire Danger Index signs.

F. Manpower Preparation (recruitment and training)

- Identify human resources development needs for various suppression activities (home or overseas).
- Recruit new staff for fire suppression units.
- Organize forest fire suppression for manual and motorized methods for basic and advanced skills levels fire control units. Likewise training in prescribed burning. Conduct training in May-June prior to peak fire season.
- Encourage the formation of skilled voluntary fire crews in local communities and equip them with tools and other gear.

G. Funding Preparations

- Prepare a fire suppression budget
- Prepare requisition orders for budget allocations
- Evaluate the allocations spent

Principles of Forest Fire Suppression

By the *Civil Defense Ordinance* and a cabinet decision the *Ministry of Regional, Local Government and Housing* is responsible of fire suppression. Each Region needs to establish a *Regional Emergency Committee (REC)*. This committee is chaired by the Governor. Each Constituency needs to establish a *Constituency Emergency Committee (CEC)*. Under this umbrella Emergency Operational Units need to be established (E.O.U) These units are composed of people who have been trained by the *Emergency Management Units (EMU)*. In the case of training in forest fire management it should be the responsibility of the Directorate of Forestry (MET/D.o.F.).

In order to be effective and efficient, the forest fire suppression activities must be initiated at an early stage (initial attack), implemented progressively, organized properly, with human safety as first priority, and the control of fire completed with mopping-up. Adequate early detection facilities, infrastructure and manpower must support fire suppression. Fire detection is an important factor and a key to successful early suppression activities.

When initial attack forces cannot control the fire, then further steps are taken to mobilize more resources (extended attack).

The Government (Ministry of Information and Broadcasting, Directorate of Communication) should declare a national radio frequency for emergency use only with all private radio stations. The old 68kHz can no longer be used.

The Ministry of Regional, local Government and Housing, being responsible for the entire national fire management as well as for local Fire Brigades, should be requested to budget and provide local Fire Brigades with radio communication so that they may contact established with Fire Protection Associations in case of emergency.

The duties of the NRSC of D.o.F. should be extended to accommodate a national fire detection centre in collaboration with the Global Fire Monitoring Center (GFMC) in Freiburg, Germany.

Activities

A. Fire Detection

In order to conduct initial attack, all fire detection potentials should be employed, including detection from fire look-outs, ground and air patrol, satellite imagery and use of information/reports from the general public and local communities.

- Assess needs to be taken to increase awareness of the part of the general public and local communities as far as their requirement for early detection and rapid reporting to responsible protection organization.

B. Implementation of Fire Suppression

Increase knowledge and skills levels of all parties involved in fire suppression, particularly the fire fighting team as to methods and tactics to apply in effective fire suppression. These methods and tactics include:

- Analyze the fire situation (size up) and define initial attack method
- Supervise all fire fighting crews (community units) based on above analysis
- Carry out early control actions, rapid initial attack to contain and prevent fire from spreading
- Suppression operations using appropriate methods and tactics: Direct, parallel or indirect attack depending on topography, fuel and weather conditions

If fire escapes initial escapes initial action and is expected to greatly increase in size or to develop into a national emergency, there is a need to promptly report it to a higher level following the chain of command. Thereby it is possible to mobilize additional suppression resources. This also requires on to make an Emergency Fire Suppression Plan which includes Government agencies, major stakeholders, traditional authorities and local communities. This plan should be based on clearly defined responsibilities among stakeholders to prevent duplication of efforts so as to optimize resource utilization. Considerations should also be taken to request

appropriate international aid. Funding arrangements should be agreed upon prior to a declared emergency situation.

C. Logistics Preparations

Prepare sufficient logistics (plan for a network of supply and resource movements) in case of continued suppression operations. The logistics include back-up teams, equipment, water for any needs, food and first aid. There is also need to prepare facilities and infrastructure to mobilize these logistics on time and at a specified location.

D. Escape and Rescue Routes

Determine the action plan and route for self-escape when the situation becomes dangerous (e.g. change in wind direction). Every member involved in suppression operations needs to understand the conditions when and how to apply these emergency orders. This also includes a rescue route from the fire location.

E. Mop-up and Patrolling

All team members involved in suppression operations must understand that they are required to stay at the fire location until the fire is completely extinguished

Examine and patrol burned areas and extinguish all existing burning materials

Principles of Post-Fire Evaluation

When the forest fire suppression activity is over, or when the annual fire season is over (and rainy season starts) an extended review of past suppression activities has to be carried out. These evaluation outputs are used for revision or improving the fire management plan for the next year.

Activities

- a Develop forest fire statistics which include the number of fires, burned areas, fire locations, fire sources, vegetation and the fire damage.
- b Evaluate the success and failures of fire suppression and analyze the results of this evaluation
- c Estimate the economical, social and ecological damages and losses caused by the fire, both inside and outside forest areas
- d Estimate the cost of fire control and compare it with the budget allocation
- e Evaluate the overall fire management plan and its implementation
- f Conduct fire investigation to determine the need for further law enforcement procedures or changes in forest, land tenure or other legislation.

2.5 Rehabilitation of Burned-Over Areas

Rehabilitation of burnt forest is not often discussed as a part of forest fire management simply because the planning and implementation of the rehabilitation is seldom carried out by the fire management organization. However, rehabilitation is a common and effective means to reduce fire hazard and to re-establish the functions of the burnt forest.

Activities

- a Evaluate the feasibility of rehabilitating the burnt over forest area and identify appropriate rehabilitation efforts.
- b Develop a rehabilitation plan for the burnt over area based on the existing condition of vegetation and the original function of the forest. Rehabilitation can be carried out by means of protecting the burnt area from repeated fires so as to ensure natural regeneration or by applying enrichment planting.

2.6 Tools, Equipment and Facilities for Fire Prevention and Suppression

Principles of the Preparation of a Requirement Plan

The success of forest fire prevention and suppression depends not only on the manpower and applied methods, but also on the provision of adequate equipment and facilities and qualified staff. The type and number of the provided equipment and facilities must be suitable for the local climatic and terrain conditions. Additionally it has to be tailor made to the socio-economic and cultural conditions in local communities. The use of advanced equipment also requires well trained people as well as an appropriate spare part supply and workshop facilities.

Under Namibian conditions, Windhoek excluded, qualified workshop technicians or necessary electronics are not available to make repairs to sophisticated equipment, not even to simple fuel injection used in most modern vehicles.

Activities

- a Make a list of an ideal requirement of tools and equipment based on prevailing local conditions so as to ensure the best prevention and suppression effort. A suggested grouping of tools and equipment by various team activities:
 - Mobile fire detection team
 - Stationary fire detection/look out team
 - Hand tool team
 - Prescribed burning team
 - Fire campaign team
 - Water pump team
 - Mechanical/heavy equipment team
 - Air attack team
 - Logistics, evacuation and medical team
 - Fire danger rating team
- b Conduct an inventory of tools, equipment and other support material (location) that already exist.
- c Develop a requisition plan (+ budget) for tools, supplies and equipment

Principles of Allocation and Utilization of Tools and Equipment

Fire tools and equipment allocated for prescribed burning and fire suppression should be used exclusively for that purpose. Use of tools and equipment for other purposes (like e.g. irrigation) is not allowed, particularly (vehicles) under fire alert situations. Exceptions may be permitted for use of facilities which due to their character can be used for other purposes without disturbances to forest fire control activities.

Use, maintenance and storage of all equipment will be according to standard procedures.

Activities

- a Strengthen and develop standard procedures for use, maintenance and storage of forest fire equipment.
- b Develop standard procedures for permitting use of fire equipment and facilities for other purposes.
- c Develop information network on available fire equipment at inter-agency, inter-district and provincial/national levels.

III. INSTITUTIONAL FRAMEWORK AND CAPACITY BUILDING

Principles of Institutional Development and Strengthening

Forest resources play an important role and have a long-term strategic value for national development. The forest is important and valuable because of its inherent character as a renewable natural resource. In order for the forest resources to be sustainable and protected from disruptive elements, including forest fires, the management of the forestry sector is the responsibility of the Government. To insure proper and appropriate sustainable use of the forests of Namibia, a strong national organization, the Directorate of Forestry, was established.

In order for the policies concerning the protection of forests from fire to be implemented optimally, all the people must support the protection effort. This includes governmental and non-governmental institutions at all levels and specifically local communities whose lifestyles are closely related to the sustainable management of forests.

To cover adequately the issues regarding forest fires in commercial farms of the country, legislation need to be in place regarding the establishment, registration, duties and functioning of Fire Protection Associations. These associations must deal with all aspects of veld fire prevention, detection and suppression. This chapter also has to deal with the appointment and duties of each association's Fire Chief.

The development and strengthening of institutions involved in the protection of forests from fire, need to be given high priority. This is particularly true at regional and district levels. This development and strengthening is directed towards the creation of good coordination between units within the Directorate of Forestry (D.o.F.) and the various stakeholder groups. This requires the availability of adequate quality and quantity of human resources, the provision of appropriate forest fire management equipment and availability of financial resources. It is extremely important that these financial resources be used in the most effective and efficient manner i.e. by involving local communities in fire management.

Activities

- a Strengthen the organization of the Ministry of Environment and Tourism and its Directorate of Forestry and line directorates so that they are capable of executing their duties and responsibilities, particularly in formulation and implementing existing forest fire management policies and directives. Even though the protection of forests from fire may be assigned to one D.o.F.'s forest fire sections, all persons in other units within the forestry organization as well as other Government agencies must at times assist in this protection effort. Information, additional support and staff may need to be provided to the fire staff in the event of a particularly severe fire season.
- b To establish and register Fire Protection Associations throughout the commercial farm areas of the country including new settlement farms.
- c To define the duties and functions of these associations.
- d To assign Fire Chiefs for each association including the definition of their duties.
- e Strengthen the existing land and forest fire control institutions at national, regional and district level. Improve the structure, duties, functions, responsibilities and authority of the organization.
- f Establish an Inter-Sectoral National Coordination Task Force (National Fire Forum) on Forest Fires with direct link to the national disaster coordination unit under the Prime Minister's Office. In order to be effective and efficient, especially on funding, the minister who is responsible for the protection of Forest will allocate the funding.
- g Forest Fire Management unit of D.o.F. coordinates this National Fire Forum. This National Fire Forum should have well defined duties, functions, responsibilities and authorities.
- h Strengthening of urban fire brigades under the Ministry of Regional, Local Government and Housing. Larger urban centres require a full time or part time properly trained Fire Chief.
- i Upgrade present fire and other equipment of Fire Brigades so that they may meet the demands of modern rescue activities.
- j Encourage the establishment of regional and Traditional Authorities and district level (Khuta) institutions under the supervision of the National Fire Forum. The D.o.F districts which have established forest fire control sections need to strengthen their organization. The responsible person (fire chief) of the organization is also the "fire head" of the Region. Additionally Forest Fire Committees need to be established locally in communal areas.
- k Formulate regulations containing clearly defined tasks and responsibilities of inter-regional Fire Forum and other stakeholders in fire protection.

Principles governing an Institutional Framework

Forest fire management involves all parties concerned with general land use; national forests, game reserves, community forests, forests on communal lands and private farms, conservancies and forest plantations. It is therefore

necessary to establish an institutional framework to ensure the implementation of national policy on inter-sectoral forest fire management and to coordinate the activities at both national and regional/district level.

Activities

- a Formulate and implement the duties of all levels of the fire management organization which includes the following:
 - Prevention
 - Pre-suppression
 - Prescribed burning
 - Post-fire (fuel reduction, fuel breaks, evaluation and measurements with disc stamp meter)
 - Establish contacts with Traditional Authorities (Khutas) and Indunas
 - Forest fire extension and educational campaign
 - Implementation of fire management guidelines
- b Build and strengthen the governmental infrastructure to establish the capability to control fire at Regional and district level. Establish and strengthen inter-sectoral fire organization at regional and district levels.
- c Develop and strengthen an appropriate mechanism and structure for organizations at national, regional and district so that forest fire organizations, including voluntary fire brigades, at sub-station and local community level can be established.
- d Develop operational plans that establish the role of volunteer organizations, especially of NGOs and women groups. Prepare and execute training plans for upgrading their capabilities and readiness.
- e Preparation of cooperative fire agreements with rural communities, NGOs, other related stakeholders by forest fire management institutions at national, regional and district levels.
- f Dissemination of information regarding forest and land fire management to all national institutions and local communities through mass media like NBC etc. By carrying out this activity, citizens rural farmers and the general public will better understand their role in environmental protection and recognize their capabilities to work hand-in-hand with the Directorate of Forestry in fire prevention and suppression activities. Dissemination of fire information also to international community will be evidence that Namibia is seriously dealing with the forest fire problem.
- g Provide human resources and necessary hardware, including implementation plans for national, regional and district levels.
- h Develop cooperation with communities through social organizations, traditional authorities, youth organizations, cultural organizations, schools, spiritual organizations and NGOs. Involve these organizations in every stage of forest fire management activities. Education and training of the members of these organizations, in integrated forest fire management, should be given high priority.

3.1 Sub-Regional (SADC) and International Cooperation

Principles regarding Forest Fire Effects to Neighbouring Countries

Forest fires that are crossing international borders as well as smoke pollution, needs to be minimized. These incidents are not only damaging and polluting neighboring countries, but they are also giving an impression about negligence and incompetence in controlling fires.

It is pointed out in the *Health Guidelines for Vegetation fire Events* (WHO/UNEP/WMO) that: with respect to smoke plumes from biomass burning and corresponding health effects, particles receive the most attention of all air pollutants that have potentially detrimental health effects. Very small airborne particles (aerodynamic diameters below 2.5 µm) are considered the most significant pollutants. These particles have very high probability of deposition in deeper parts of the human respiratory tract, where they may lead to a range of health impacts by virtue of their physical, chemical toxicological or carcinogenic nature.

Exposure to smoke plumes from biomass burning has a bearing on contracting Tuberculosis which again, may form a part of the HIV/AIDS cycle. Regardless of the origin of the smoke, people living in communal lands in northern Namibia are the most susceptible to smoke pollution.

Activities

- a Develop the involvement of local communities or border patrols to contain fires within Namibia's land area.
- b Develop fire using technologies that produces minimal smoke problems.
- c Increase information and knowledge exchange concerning forest fire management among the SADC governments. A special task force on control of wild fires should be established.
- d Encourage cooperation between NGOs and other institutions among SADC especially in public education and fire research and the development of culturally and economically viable integrated fire techniques and management options.
- e Support cooperation in forest and land fire programs that allow possible utilization of aid resources (manpower/funding) from neighbouring countries if required for fire emergencies and cross-border activities.

Principles governing International Cooperation

To support most effective and efficient forest fire management capabilities, there is a need to master knowledge and technology in various fields, that are directly or indirectly related to forest fires and fire ecology. This can be achieved through international cooperation agreements.

Activities

- a Develop and increase bilateral and multilateral cooperation with developed where fire management has reached an internationally recognized standard. This will enhance the availability of professional skills and knowledge in all aspects of forest fire when required.
- b Increase technical and financial cooperation with other countries to assist in funding of e.g. research into the advancement of forest fire management programs in Namibia. This must be followed up by internal support from the Namibian government in providing adequate counter (part) budget funding which generally is the requirement in these forms of cooperation.
- c Increase exchange of information quickly and continuously on regional and global weather and climatic conditions by becoming a member of world organizations that have direct mandate to deal with forest fires. This includes organizations such as the Climate Change Convention, World Meteorological Organization (WMO), the Global Fire Monitoring Center (GFMC) the Joint FAO/ECE/ILO Committee on Forest Technology, Management and Training and its Team of Specialists on Forest Fire. This will allow early preparation to anticipate severe changes in weather or climate, that may increase the risk of forest fires.
- d During 1999 UN through (WHO/UNEP/WMO) prepared Health Guidelines for Vegetation Fire Events-added with a Teachers Guide.

These Guidelines applied to Namibian conditions outline e.g. : To provide the necessary evidence and guidance on vegetation fires and their health impacts, to strengthen the basis for inter-sector action in sustainable development policy and planning.

The message of these Guidelines should be disseminated by relevant ministries as well as by D.O.F:s fire management personnel. Assistance for dissemination of these Guidelines can be obtained from the UN.

- e Increased participation in scientific meetings, seminars workshops, conferences and other fora that have direct or indirect involvement in forest fire management.

3.2 Funding and Implementation**Principles for the Source of Funding**

Protecting the forest from fire can only be achieved when adequate funds are made available for efficient and effective activities. Forest and grass fires burn an area of 3-6 million hectares each year in Namibia. Besides enormous direct losses, valued at a billion dollars per year, the forest fires also cause losses in environmental quality, human and animal health and degradation of the ecosystems. Considering these factors, the required monetary input for an efficient management of forest fires would be far less than the financial losses from forest fires.

Funding of forest fire management activities may be obtained from both governmental and non-governmental sources. Funding for forest fire management must be available on time and on target.

For the financing the activities of a fire service or Fire Unit, a special *Fire Service Fund* may be established. The initial funding could come from the National Emergency Management Council (NEMU) through the Regional Emergency Committee (REC) down to constituency and community level. In commercial farming areas the funding should go to the Fire Protection Associations.

The private Forest Protection Associations also need external funding specifically for the development of appropriate suppression techniques and for the training in efficient tactics to be used in various climate conditions. Research into these activities (e.g. bush encroachment) also needs external funding.

Activities

- a Provide special budget for forest fire management activities at both national and provincial/district levels, so that they may perform optimally. This budget should not be a joint budget of several departments, that are involved in fire control.
- b Provide a special fund for fire prevention activities at every forest office at field level.
- c Provide an on-call budget for emergency fire activities.
- d Support cooperation among local communities, private sector, NGOs, CACA and mass media to voluntarily and actively participate in prevention and suppression of forest fires. This voluntary participation indirectly creates an immediate-use-funding source.
- e Support funding in form of non-binding grants through cooperation with other countries, regional and international institutions to increase capability in forest fire prevention and suppression.
- f Develop aid programs from donor countries for the protection of forests from fire. This aid is available in the form of expertise, technology transfer and assistance in education and training of national staff, research and development of forest fire management.
- g Organize cooperation with United Nations Commission on Sustainable Development (CSD) in implementing program Agenda 21 for forestry. Emphasize forest fire aspects for international promotion of protecting the world's forests from fire. Utilize and provide information to the *Global Fire Monitoring Center* (GFMC). Donor countries and institutions that may provide funding need to receive a proposal from Namibia describing the impact of forest fire in the forests of Namibia and how funds could alleviate this problem.

Principles on Implementation:

In order to be able to empower both traditional authorities and their bodies, as well as the new Fire Protection associations, up-to-date legislation is urgently required. Fire activities in communal areas is well covered by the forthcoming Forest Bill. However, fire activities in commercial farms will urgently require a separate *Forest & Veld Fire Act* since the forthcoming *Forest Bill* does e.g. not recognize the establishment of Fire Protection Associations or give guidance in the functions of Fire Chiefs.

Fire Brigade Services Ordinance, 1978 (FBSO) states further: "*Emergency*" means any situation requiring immediate action *to prevent death or injury to persons or damage to property*, but not declared state of emergency in terms of any law.

Any local authority maintaining a fire brigade service or a *community fire unit*; shall appoint a *Chief Fire Officer* or *Fire Chief*.

Section 7. (1) further: The Fire Chief may do anything, and take any measure which in his opinion is necessary under the circumstances do the following:

- close any street or road temporarily
- enter, or break into and enter, any premises, and take temporarily possession thereof
- damage, destroy, demolish or remove any property
- forcibly remove, or cause to be removed, any person;
 - * from any property or
 - * from the scene where the Fire Unit is operating, if such person interferes with the work of the Fire Unit at that place, or is in obstruction or hindrance

- size, or make use of any material from any available source, whether such material is owned or controlled by the local authorities.
- any member of the Namibian police shall assist any Chief Fire Officer or Fire Chief in execution of his duties.

Section 7. (2) b. A Fire Chief or member of the Fire Unit shall not be liable for any loss or damage as a result of bodily injury, loss of life or loss of or damage to property which is caused by performing duties as outlined in this Ordinance.

Duties of a fire brigade service or local Fire Unit:

- preventing and extinguishing fires, and the preservation of life and property
- to monitor and act upon the growth or accumulation on any land or premises of trees, bushes weeds, grass or other matter in such manner as is likely to promote the kindling or spread of bonfires or large veld fires.
- to monitor the burning of rubbish, trees, bushes weeds or grass and the making of bonfires.
- in communal areas the work of the local Fire Unit would also include the advising of local people in prescribed burning.
- the National Gender Policy and its Plan of Action: Chapter 8. Gender and Management of the Environment further: Take steps to protect women against harm from environmental hazards at home and at work. This includes the teaching of rural women in how to use fire safely for land clearing activities without getting harmed by the activities.

Activities

- a To process and finalize the new Forest Bill.
- b To start developing a Forest and Veld Fire act for Namibia.
- c Each Regional Emergency Committee should start the preparation of Regional Forest Fire Management plans.
- d Each Constituency Emergency Committee should start preparing a Forest Fire Management plan for their constituency.
- e Each Emergency Operational Unit (in local communities) should start preparing a Forest Fire Management Plan for their area. This includes the construction of e.g. water dams, cutlines and storing facilities for fire tools.
- f To establish mobile forest fire extension units for the education of rural people and farmers in suppression and management of fires.

IV SOCIO-ECONOMIC CONSIDERATIONS

4.1 Economic implications

Principles on the Damage and Loss of Various Environmental Components

Forests damaged by wild fires will not be able to provide a large number of forest products that are vital to the life of the nation. This is a significant loss in terms of production potentials of the forest. It is estimated that the value of this annual loss amounts to N\$ 133 million in East Caprivi. Forest fires also have a negative impact on other environmental components such as: Soil, water resources and air quality. It also affects the regularity of rain falls locally. In the rainy season 1999-2000 East Caprivi received an almost even 700 mm of rainfall over the entire area unlike during the preceding periods of 1996-98 when the variation was from 150 - 800 mm.

Activities

Develop guidelines to estimate the potential direct loss of the national economy due to forest fire. This estimate will assist in helping other parties to understand that programmed fire management cost is substantially less than the losses suffered when fires occur. The required steps for this estimation are:

- a Study and record the impacts of fire; both direct and indirect

- b Formulate methodology for estimating financial losses
- c Determine losses to local communities and the nation at large(micro-macro)

Principles on Cost-Effectiveness of Fire Prevention and Suppression

Anthropogenic fires (human induced) started around rural communities are the main causes of fire. Rural residents often do not understand the value and function of the forest bio-system and they use fire without prepared control measures or advance planning thereby allowing fires to escape.

Activities

- a Introduce and develop permanent agricultural systems, agro-forestry, agrosilvo-pastoral and fruit tree orchards as alternative solutions to shifting cultivation. Establish demonstration plots to show the above methodologies emphasizing proper fire management practices and measures.
- b Develop an incentive system to reward communities or other NGOs that apply appropriate land use practices that prevent escaped or accidental fires or reduce fire caused damages to the forest.
- c Introduce and establish a program for environmental community awareness. Any programs like e.g. the Ostrich (Namibia's national Forest Fire Logo), Fire Drama Play, The Fire Video, The Fire Story, The Fire Cartoon, Fire Posters, Fire Billboards and the Fire Plays on NBC Radio must be appropriate to the social, cultural and economic background of the local communities. They must emphasize the function of the forest as "lungs" in the circulation of water in the environment as well as the negative effects of burning the savanna forest too frequently.
- d Utilize research findings of grass survey in relation to prescribed burning in formulating basis for the Model for *Integrated Forest Fire Management* in northern Namibia. This model will also suggest methodologies for fire prevention activities in training and educating the people.
- e Develop and implement agricultural practices for nutrient cycling so that biomass is utilized optimally to enhance soil fertility and avoid wind erosion. By burning off the accumulated humus layer through annual non-prescribed fires, the wind will blow away the topsoil.
- f Establish demonstration plots showing prescribed burning techniques and results for both genders and for both cattle owners and the rural poor.

4.2 Using Experiences Found in Local Communities for Carrying Out Prescribed Burning According to Plan

Principles on conflicts in land utilization among communities inside and outside forest areas

Conflicts in land use rights among local communities can lead to arson and wildfires. All surrounding communities must get direct benefits from the forests in order to have any incentive to protect the forest. Local communities use fire for economic, agricultural, recreational or cultural interests; and these practices will continue in the future. Some of these experiences may be useful for a wider area, and may be incorporated in the Model for *Integrated Forest Fire Management*.

Activities

- a Arrange for consultations with local communities to resolve the conflicts on utilization of forest land in order to protect the area from wild fire.
- b Train local communities in fire prevention, suppression and prescribed burning techniques so that they are capable in suppressing fire which escape from their planned burnings.
- c The local Forestry District Office will supply appropriate forest fire tools to local communities that manage their fires.
- d Eventually their new skills and motivation and will lead to the establishment of a voluntary fire group in each community.
- e Involve local government and traditional leaders in determining methods of controlling fires in their area. The communities may also need financial assistance in controlling fires on land which belongs to the Government.

- f Develop exchange of information and experience concerning fire management within the Namibian Regions as well as among neighbouring SADC countries. This exchange may be assisted by international organizations such as the Global Fire Monitoring Centre (GFMC) or alike, NGOs or governments within the SADC.

Principles on the role of Communities around the forest, Traditional Authorities, NGOs and Women Groups in the Management of forest fires

Communities around or within forest areas, Traditional Authorities, NGOs and Women Groups play an important role in fire management. Women often play a big role in agriculture by raising livestock, collecting fuelwood and gathering of non-timber forest products. The women also carry out most of the burning for clearing agricultural lands for shifting cultivation or burning for cultivation of next crop.

Women are often more appreciative and caring for the natural environment, although it is often difficult to involve them in the educational or extension programs due to cultural constraints. Their active participation in forest fire management is crucial in trying to protect the forest resources from wild fires.

Besides this, all family members can actively be involved in the control of fires.

Activities

- a Develop active participation of communities in forest areas and adjacent grass covered tracts. Provide training in the safe and controlled use of fire in rural activities.
- b Develop an effective education program for women on fire utilization and suppression skills at both national (Women Affairs) and local levels.
- c Develop national Gender Policy and Guidelines from the perspective of fire and burning
- d Control wildlife and protect biodiversity by developing a network of permanent fuel breaks and by providing training in prescribed burning.

V. PUBLIC TRAINING AND EDUCATION

Definition:

Education includes formal, non-formal (training and extension) and informal education.

5.1 Training and Extension

Principles on the Training of Forestry and Government Officials, Workers and other staff

Every government and non-government official (e.g. in Conservancies and Community forests, National Parks) responsible for forest and land management activities at any level, need to acquire and develop knowledge in forest fire management.

Every forestry staff and worker, and in particular staff who are assigned to forest protection duties, should acquire skills in forest fire management.

Every official, manager, worker and staff member in forestry whose duties cover forest fire management activities, must acquire the skills required in successful forest fire prevention and suppression work.

There is a need to strengthen the IFFM resources within the D.o.F. by establishing a special fire task force at headquarter level. This taskforce will establish links with: NDF, NamPol, Agriculture, NamPower, Works/Roads and NamRail on fire prevention activities.

Additionally one member should be specialized in the education (forest extension) of schools and local communities and commercial farms.

Activities

- a Identify the number of persons within D.o.F. who are dealing with Integrated Forest fire Management (IFFM) and assess their training needs.

- b Identify information needs and training requirements for the forestry staff. Training may be provided by dissemination of library material, conducting seminars, workshops, short courses; it also includes study tours on site to look at the forest fire management principles and their application locally.
- c Prepare an IFFM training plan for officials, managers, workers and other staff. This plan should include the targeted number of people to be trained each year as well as the budget allocation required for the training.
- d Provide training and retraining of IFFM field staff on regular basis in fire prevention and suppression activities. Training needs to be conducted by the Forest Fire Section within the Directorate of Forestry.
- e Develop a national standard IFFM training curricula for efficient field training; especially in fire prevention and prescribed burning practices.
- f Keep the *Ogongo*, *Neudamm* and *UNAM* forest fire curricula constantly updated so as to include latest development results and findings in the field.
- g Disseminate Forest Fire related law (Act) and regulatory measures to all Government Units (regional/local) dealing with land management issues.

Principles on the Training of Traditional Leaders and both local and commercial Communities

All Governmental institutions dealing with land management issues are responsible for providing education in the control of fires in land clearing activities in forest areas and generally in the safe use of fire and burning.

Activities

- a Prepare and organize training in forest fire extension for forestry officers who will become the future trainers. This can be coordinated by *Ogongo Agricultural College* which can provide the necessary pedagogical input.
- b Identify and recruit (together with local community leaders) appropriate community members to be trained as Forest Fire Contractors. This training includes: basic time keeping, accounting, fire prevention and the construction of cut-lines (fuel breaks) by the use of fire. Train the local people in IFFM activities in communities which are contracted by D.o.F.
- c Provide contracted communities with appropriate tools for fire line construction
- d Establish close ties with local arts and craft associations (like the *Caprivi Arts and Cultural Association* (CACA) whose members depend on the availability of wood and non-wood forest products. Establish an extension network through their members.
- e Prepare basic training programs and appropriate extension materials for local communities to enhance their awareness as to the importance of forest resources. This includes: Billboards (English and local languages), posters, car stickers, newsletters and video.
- f Develop Fire Drama Plays with local units (Community Theatres) of the National Theatre of Namibia (NTN). Involve the Chief Cultural Officer in each region to support the Forest Fire Extension work.
- g Cooperate closely with the *Ministry of Basic Education and Culture* (MBEC) in carrying out fire education in local schools for students and their teachers. Develop appropriate materials for school children and also for Adult Learners in literacy programs in rural areas.
- h Cooperate closely with local Media and the *Namibia Broadcasting Corporation* (NBC) in developing Forest Fire Education material for radio listeners.
- i Increase knowledge of *Integrated Forest Fire Management* by participating in national environmental competitions e.g. by competitions in fire drama plays or drawing competitions among school children.
- j Establish demonstration plots where various levels of prescribed fires fire has been applied for the education of the public.

Principles on the Influence of Traditional Authorities and Spiritual Leaders

Residents in local communities often have traditionally in-learned attitudes and values regarding the surrounding trees and forest. These attitudes and the local environmental behaviour often influence the way they perceive forest

protection issues. Local communities are influenced by their traditional leaders, thus these leaders can (if properly motivated) assist the Directorate of Forestry in disseminating forest fire management issues.

Activities

- a Identify and recruit traditional community leaders and spiritual leaders as cadres in promoting the needs to protect the forest. Develop a program which includes both incentives and penalties.
- b Prepare, produce and present training material in forest fire management for traditional authorities, community leaders and local farmers. This material (like the Fire Cartoon, Newsletters and posters) may then further be used by them, as guides in providing additional information to the local communities.
- c Provide local communities with extension materials on Integrated Forest Fire Management to enhance their awareness regarding the environment and the effects of fire.
- d Provide Tourists and the General public with information on forest fires (e.g. stickers, posters, billboards) the benefits of avoiding wild fires in the forest. This includes every day activities like e.g. smoking, camping, hunting or other recreational activities.

Principles on the Education of NGOs, POs and Women Groups

NGOs, POs and women groups can provide effective and appropriate assistance in developing the awareness and need for a continuous forest fire management program.

Activities

- a Develop and organize courses for NGOs, POs and leaders of women groups so that they can participate in the management program for forest fires. Include information on the impacts of wild fires to the ecosystem and the benefits of reducing wild fires in their communities
- b Assist local Women Grass cutting Groups in the protection of their resource and provide training for the women in prescribed burning.
- c Develop and produce suitable forest fire management material for Adult Learning programs and especially for literacy classes where 68 % of the learners are women.
- d Develop a fire safety program for women working within their homesteads. This includes thatch roofs, inflammable materials, construction of fuel breaks around houses and fields with growing crops.

5.2 Public Education/National Campaign

Principles on Public Education on the Use and Impact of Fire

These educational activities will lead to Increased knowledge of changes in climate and habitat due to forest destruction by burning and also give guidance into what impact applied research may have on field activities in local communities:

Between 1996 and 1999 some local people in eastern Caprivi were wondering why some large cleared forest areas did receive abnormal rains during rainy season. This question was often raised by traditional leaders. Little did they know about of the sharp increase in soil temperatures of up to 10°C, when forests are burned, compared with unburned areas.

Although the issue about the rising temperature is very complex, one may relate this increase to solar radiation. The darker the soil, the more it will absorb heat. Lighter colours will reflect the incoming sun light more effectively.

Increase in soil temperatures:

- * The increase in soil temperature over burned areas causes irregularities in rainfall. Large tree-less clearings may become so called rain-shadow areas.
- * Areas covered by trees transmit up to 10,000 litres/ha/year more water compared to plain grass cover (research published by *Commonwealth Forestry Association*).
- * The local implication among communal farmers is to clear more land for cultivation to avoid these “rainless” pieces of land. This leads to more denudation of remaining forest cover.

New findings about the role of trees:

- * Recent long term research carried out in Hyytiala, Finland reveals that; growing trees have a protective mechanism against too intense solar radiation, they emit aerosols into the air.
- * The research shows that aerosols have a shorter lifespan than the surrounding CO₂ particles, likewise their effect is more localized.
- * In reality this means that when trees continuously discharge ozone and other particles above and around itself, this has a cooling effect on solar radiation into that area. This also implies that soil temperatures around trees are cooler than in surrounding soils even without the effect of the shadow of the tree itself.

In summing up:

Large treeless areas (caused by anthropogenic activities) in arid regions often become so called “rain-shadows”. This implies that due to the increased soil temperatures, the major rainfall tends to cover areas with lesser soil temperatures i.e. adjacent areas still covered by trees. Some frequently burned areas may gradually turn into desert, especially around the Kalahari basin.

Any local Community may suffer losses from forest fires in the form of property and income losses, material losses, loss of medicines and food, loss of “mielies” and other crops, personal safety, sustainability of forest ecosystem, uneven distribution of rainfall due to forest destruction. The Government together with NGOs and other interested parties are responsible to organize general education to communities in the safe use of fire. Education will be more effective when given at an early age to school children and youth.

Activities

- a Establish and enhance cooperation between all Ministries dealing with land management issues as well as with the *Ministry of Basic Education, Sports and Culture* (MBESC) so the school curricula at all levels will reflect the importance of forest fire management.
- b Support involvement of non-governmental institutions (NGOs) and other civic groups like the *Farmers Union in Caprivi* (LIKWAMA) the *Caprivi Arts and Cultural Association* (CACA), in public awareness campaign on the importance of forests and the protection of them.
- c Following the Arts and Cultural Policy Statement: Artists shall be required to advocate the need for protecting the environment. Further, they shall be required to mobilize the public to preserve and safeguard the environment.
- d Use media to provide information to communities on the underlying causes, impacts and management of forest fires. The success of the Forest Fire Campaign depends on the selection of appropriate National Fire Symbol (the *Fire Ostrich*), slogans to increase the public’s understanding. Seek cooperation with as many stakeholder groups as possible in the implementation of the Fire Campaign.
- e Provide fire and environmental education, about fire management issues; negative as well as positive, to local schools and their teachers.
- f Publish booklets on forest fire management and its effect upon basic ecology and the economics of controlling fires in a sustainable way.
- g Develop suitable material for public education e.g. erect billboards along most important routes (in local languages) organize fire education for the public on open markets etc.
- h Appropriate national or sub-national education agencies should incorporate peatland curricula in educational programs particularly in areas where peatlands form a significant component of the landscape under both forested and non-forested ecosystems. Such curricula should feature the ecological and cultural functions and values of peatlands as well as their importance to people including traditional knowledge based on input from local communities, women and local healers.

VI. RESEARCH AND DEVELOPMENT

BASIC AND APPLIED RESEARCH

Principles for Basic and Applied Research

Fire research will provide the basic information required for forest fire management. This information supports the development of various fire management practices, be it in communal or commercial areas.

Research is also required to determine fire techniques to apply for e.g. for range management or for silvicultural forest practices. Available resources as well as the terrain and biomass load will determine the tactics and techniques to be applied for each specific fire management case.

The issue regarding bush encroachment should be dealt with at the national Fire Forum since the problem deals with numerous stakeholders outside forestry.

Activities

Support co-operation between universities and local research institutions and if necessary with international partners, to undertake joint research on the following different aspects of forest fire:

- a Fire ecology;
 - a with priority to study fire behaviour at all types of ecosystems
 - b gather and analyze past, present fire knowledge (fire occurrence and ecological impact)
 - c fire impact or prescription on natural regeneration e.g. Terminalia serisea

- b Basic science of fire;
 - d fuel inventory and fuel modeling
 - e fire behaviour models
 - f fire danger index
 - g fire risk and hazard mapping
 - h fire weather forecasting
 - i environmental impact modeling (social, economic and cultural)
 - j impact of gaseous, smoke and particle emissions of fire on bio-chemical cycles, atmosphere and climate.

- c Socio-economic and cultural implications;
 - a socio-economics and fire use
 - b socio-cultural fire use and views of communities
 - c research on swidden (shifting) cultivation
 - d research of traditional gathering of non-wood forest products
 - e research of hunting practices (honey, wildlife)

- d Smoke management;
 - a application of burning techniques that may reduce and control smoke production
 - b study of atmospheric aspects that allow smoke to be dispersed into upper atmosphere and not collect at the land surface
 - c create demonstrations plots of successful prescribed burning results

- e Fuel management;
 - d study the appropriate techniques for prescribed burning for various purposes
 - e develop various grazing techniques for fuel reduction in critical areas
 - f develop a standard for the construction and clearing of cut-lines or fuel breaks for both forested and non-forested areas
 - g develop a fuel break system for commercial farms wherein fenced lines are cleared by the use of herbicides
- f Utilization of wood waste and other organic matters
- g Develop bush management techniques by the use of fire and browsing
- h Research on possible agricultural alternatives to shifting cultivation practices

Principles on the Co-ordination and Co-operation with International Institutions and Experts

Exchange of information on forest fire knowledge and fire management practices between forestry experts and researchers from all over the world is very important in enhancing co-ordination and collaboration in fire prevention and suppression activities. It also facilitates an efficient way of dealing with transboundary fire issues e.g. within Africa or SADC.

Activities

- * Select and organize training concerning information exchange methods. This would e.g. include the availability and accessibility of the daily fire scar monitoring at the Web sites of the *Global Fire Monitoring Center* (GFMC).
- * Organize periodic national and international seminars on forest fire management
- * Bridge fire knowledge with fire management and policy development by issuing periodic newsletters, journal, magazines, comic books, car stickers on forest fire research and development activities.

VII. MONITORING AND EVALUATION

Principles on Monitoring of Statistical Data on Forest Fires

Statistical data on forest fires is important for preparing fire management plans. Statistical data can also be used to motivate and arouse the attention of decision makers, local politicians, other related institutions and the general public. These statistics include, at a minimum, data on forest fire occurrence, emerging hot spots, manpower, facilities and infrastructure as well as estimated damages.

Activities

Encourage all forestry and Government institutions, farmers associations and traditional authorities in local communities to develop:

- a A database on forest fire occurrence with emphasis on the data collection at local/field level, at a minimum, data on forest fire occurrence, manpower, tools and equipment, facilities and infrastructure, possible damage (human, environment, cattle, infrastructure). At a minimum data will include location, day, month, year of occurrence, time spent on suppression, size of burned area, vegetation type, costs involved.
- b Database on manpower resources including; IFFM staff and personnel, classified by their duties, educational level, training courses attended (e.g. on prescribed burning, international seminars), duty location and status (Chief, Contractor, D.o.F. extension worker).
- c Database on facilities and infrastructure including number and location of: *Bakkies*, hand tools, swatters, back pack pumps, sleeping bags, tents, cooking devices, radios.

- d Adequate computer facilities and software for data processing
- e Standardized reporting tally sheets for computer processing
- f Obtain qualified staff and personnel to carry out above duties
- g A way or process to evaluate or assess the efficiency and effectiveness of:
 - The National Fire Forum
 - The local Fire Committee
 - The local Fire Protection Association

Principles for Monitoring of Fire Risk and Hazard Areas

It is important to determine the specific regions and districts susceptible to fire in order to set national priorities for allocation of resources and concentration of manpower. The forest fire potential of an area can be determined based upon climatological data and weather information, human activities within the area and condition and amount of biomass. The recorded national amounts of rainfall will already give an indication as to where severe fires are to be expected.

Activities

1. In the short-term, there is a need to determine the beginning of the dry season utilizing forecasts from the Meteorological Bureau, and to disseminate the information nationwide. This allows the local fire management organizations to anticipate the coming fire season and make necessary preparations.

Steps should be taken to strengthen the co-ordination between the fire organizations and the Meteorological Bureau. Information on weather conditions and forecasts must be readily shared between the W.B. and all fire institutions. Likewise there is a need to make the regional and local weather data collected readily available locally. This would include local data like: Wind speed, humidity of the air, moisture and amount of biomass (grass).
2. In the long-term, it is necessary to develop a *National Fire Danger Rating System* so that daily forest fire forecasts can be made.
3. Notify all communities, commercial farms and organizations within high fire risk areas to take necessary prevention actions. Provide guidelines to local communities and commercial farms on prevention measures to be taken during the various phases of the fire season.
4. Encourage all regional/district MET-offices to construct signboards or warning notice boards displaying current forest fire danger level.
5. Strengthen D.o.F/MET information network at all levels to be able to provide information quickly so that field officers and staff can make adjustments on the signs as reflected by the current fire danger level.

Principles governing an Early Fire Detection System

Early fire suppression may be achieved when an early detection system has been established and operates well at all levels. This achievement is closely related to the establishment of a fire organization with its root in HQ and branches covering the fire prone areas of Namibia.

Early detection is possible by using by alerting all traditional authorities, Government offices and Fire Protection Associations. Alerting people could take place by using NBC radio, wooden drums, hand held radios. In addition, optimal use of existing means such as ground patrolling, watching from fire towers or look-out posts, will ensure that fire may be detected at an early stage.

For forest areas in remote and inaccessible areas, it is necessary to establish co-operative agreements with other institutions and Government agencies and Farm Associations. The central level of the Directorate of Forestry (D.o.F.) should initiate the construction of a satellite receiving station to cover the forest areas of Namibia. The fire information can be delivered by: phone, fax or e-mail.

The satellite data may be verified through the *Global Fire Monitoring Center* in Freiburg, Germany.

Activities

- a Encourage all forest management units at field level to prepare detection facilities and infrastructure such as fire lookouts and to strengthen the detection system in their respective areas. D.o.F. offices should provide guidance to all stakeholders regarding the development and implementation of local detection systems.
- b To strengthen the detection capabilities and responsibilities of traditional authorities by explaining their responsibilities towards management of forest fires as outlined in The Traditional Authorities Act and the new Forest Bill.
- c Use traditional ways of relaying messages to neighbouring communities or NBC radio, in commercial areas by hand held radios or by commercial radio stations.
- d Formalize co-operative agreements with stakeholders and air transport operators and with the national airline (AirNamibia).

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SENEGAL

Fire Situation in Sénégal

Introduction

In Sénégal, fire occurrence contributes to increased pressure on agricultural and rangeland systems through the destruction of natural pasture and the degradation of agricultural land, particularly in the Sahel. Fire activity in the forests in southern Sénégal decreases forest productivity and is a threat to regeneration.

The Government of Sénégal has put in place the means to fight bush fires in the principal eco-geographic zones of the country. These include active firefighting, prevention activities such as awareness campaigns, and the establishment of a network of fire breaks. One of the most important strategies, introduced in 1965, is the use of prescribed fires early in the season in order to reduce fuel loads and prevent late fires, which are often much larger, more difficult to control and more destructive. These strategies are complemented by the appropriate use of fire

information by the public services as well as the general public. Traditionally, fire information consisted of field reports of observed or fought fires. However, the estimation of burned areas and fire frequency are fundamental to the management of natural resources with respect to fire activity.

Remote sensing of active fires and area burned

To complement traditional fire information, the *Centre de Suivi Écologique* (CSE) of Dakar has implemented a methodology to monitor fire activity using NOAA-AVHRR satellite data received locally through their own station installed in 1992. While not exhaustive, it is well accepted that fire information obtained from AVHRR provides a good indication of fire activity over a large territory. Initially, only the territory of Sénégal was covered, and information was used operationally by both the Forestry, Waters, Hunting and Conservation Department and the Livestock Direction. Now the CSE monitoring activities are also providing fire information to neighbouring countries. The CSE has also recently become one of the nodes of the World Fire Web of the Joint Research Centre (EU). In 1999, an agreement was signed with the Global Fire Monitoring Center (GFMC) which allows the GFMC to disseminate CSE fire products on the GFMC homepage.

Analysis of fire information from the period 1993 to 1998 led to a better understanding of fire activity in Sénégal and the identification of important issues that are briefly described below.

The fire season takes place from October to May. The most troublesome period is often January and February, when there is a high volume of senescent vegetation and the weather is very dry. During that period, large uncontrolled wildfires can be very destructive. The spatial and temporal distribution is generally heterogeneous and variable. Figure 1 illustrates this variability and clearly indicates peak fire activity in February 1994 and January 1996. These two periods can mostly be explained by high rainfall that lead to increased fuel loads as well as unsuccessful prescribed fire programs.

Spatially, as illustrated in Figure 2, most fire activity occurs in the centre, south and southwest. Most of this activity takes place in the regions of Kolda, Tamba and Ziguinchor because of their continuous vegetative cover combined with human activities such as honey and gum gathering, hunting and charcoal production. In the northern part of the country, the little vegetation available is usually quickly used by cattle and fire activity is consequently very low.

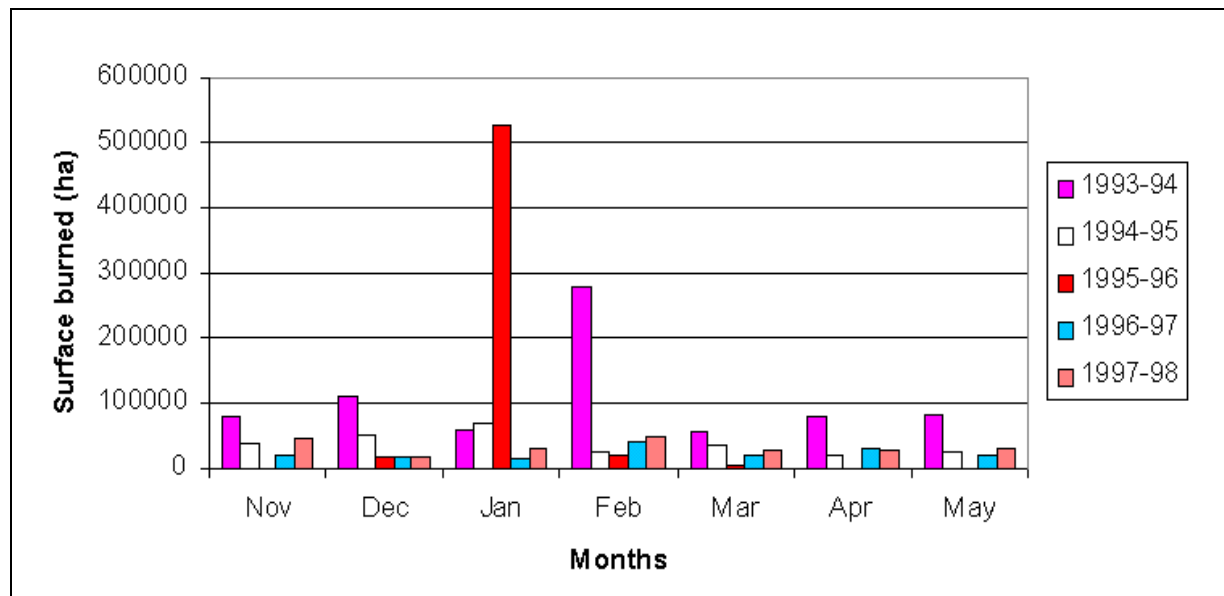


Figure 1. Monthly burned area in Sénégal between 1993 and 1998.

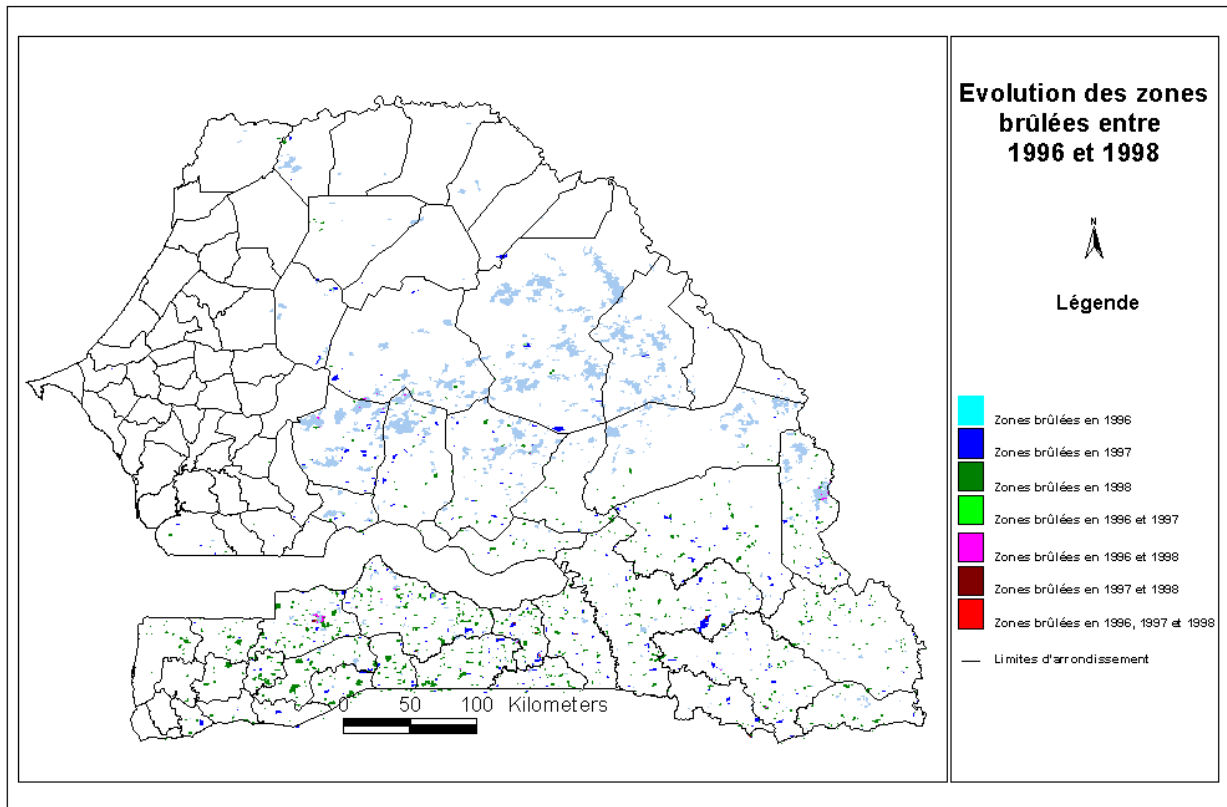


Figure 2. Fire occurrence in Sénégal between 1996 and 1998.

Fire management organization

The Directorate for Water, Forests, Hunting and Soil Conservation (Direction des Eaux, Forêts, Chasses et Conservation du Sols - DEFCCS) is the main organisation responsible for wildland fire management. DEFCCS promotes fire prevention but lacks adequate tools and funding. The CSE provides information that allows the government to determine the location and size of fires. For fire management purposes, the fire maps, together with maps of primary production and fire statistics, allow the recognition of vulnerable areas and the mobilization of firefighting forces. The Directorate of Livestock Breeding (Direction de l'Élevage) manages the pasturelands, which are indispensable for the nutrition of domestic livestock under the extensive management system common in Sénégal. The Directorate is faced with two major problems. First, wildfires destroy considerable areas of important grazing resources, resulting in overgrazing of the remaining vegetation. Second, the mobility of the migrant (nomadic) pastoralists increases the fire risk. The information generated by the CSE allows the authorities to better manage pasture resources in space and time.

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SOUTH AFRICA

Fire Situation in South Africa

Fire environment, fire regimes, ecological role of fire

Forest

Natural forests in South Africa cover less than 1 percent of the total area, and fire plays an important role on the edges of these forest communities. However, wildfires seldom penetrate the larger patches of mature forest, although charcoal within the soil profiles of some forests indicates that fires may occur in natural forests at intervals of several hundreds of years (Huntley 1984).

Industrial forests, such as even-aged *Acacia*, *Eucalyptus* and *Pinus* plantation stands, cover an area of approximately 1.5 percent of South Africa, and have mostly been established in the higher rainfall areas of the Grassland Biome of the Summer Rainfall Region. These forests are regularly exposed to wildfire damage, because of the fire history of the host vegetation, and the fire history of the countries of tree origin. Until 1990 fire was mostly excluded from these forests. More recently slash burning after clearfelling and prescribed burning under trees for fuel reduction purposes are now established management tools. These prescribed fires are being applied at a limited, but increasing, scale.

Other wooded land

The Fynbos Biome falls under this category, where trees are rare, but the vegetation is dominated by evergreen sclerophyllous heathlands and shrublands (Huntley 1984). This Biome covers approximately five percent of the land area of the country. Fynbos communities generally require four to six years to accumulate sufficient fuel to burn and fires occur at random within 6 to 40 year rotations (Kruger 1979). Prescribed burning is applied in most fynbos communities, but during the 1990's prescribed burning programmes have been reduced for various reasons, such as to allow more natural fire occurrence. Another reason for fewer prescribed fires is the reduction in the availability of experienced fire managers who can apply block-burning correctly (own observations).

Other land

The remaining vegetated land of South Africa includes these categories: Grassland (24 percent), Arid Savannah Biome (24 percent) and Moist Savannah Biome (9 percent). These estimations have been rounded off to make provision for plantation forests. As yearly biomass production differs significantly within these biomes, fire rotations vary likewise (from 1 to 15 years), and these rotations are also exposed to seasonal variation. Winter burns normally occur after moisture stress and frost sets in during autumn.

Fire is an infrequent, but significant phenomenon in the Arid Savannah Biome, normally occurring after above-average rainfall has been recorded, and subsequently a higher biomass production was experienced. In the Moist Savannah Biome fire occurs more frequently at approximately five-year intervals, but as common as annually in places during some seasons (Huntley 1984).

A recent paper by van Wilgen et al. (2000) analyses the fire history of the Kruger National Park (1.9 million ha) for different periods in the park's history, where fire protection was followed by prescribed burning and then a "natural" (lightning) fire policy. Fires covering 16.79 million ha occurred between 1941 and 1996 (16 percent of the area burning each year on average). Of this area, 5.15 million ha burnt between 1941 and 1957, when limited prescribed burning and protection from fire took place (16 percent burning each year on average). Between 1957 and 1991, 2213 prescribed burns covering 5.1 million ha (46.3 percent of the 10.98 million ha burnt during that period) were carried out.

Lightning fires burnt 2.5 million ha between 1957 and 1996, or 21.6 percent of the area. The mean fire return period was 4.5 years, with intervals between fires from 1 to 34 years. The distribution around the mean was not symmetrical and the median fire interval was 3.1 years. Some areas burnt more often than others, and mean fire return periods ranged from 2.7 to 7.1 years in the 11 major land systems of the park. Fires occurred in all months, but 59 percent of all fires took place from September to November. Prescribed burns were concentrated late in the dry season (September to November). Lightning fires were later, with 84.7 percent of the area burning between September and January (see also van Wilgen et al. 1998, Brockett et al. 2000).

Major wildfires experienced during 1990 - 2000, and their impacts

1990/91

Compared to the year 1989 - which was a year that saw some serious wildfires in Industrial Forests - 1990 and 1991 saw a steady increase in the number of fires experienced in Kwazulu-Natal, from 210 during 1989, to 350 during 1990 and to 510 during 1991. The Fire Danger Index (FDI) only reached one day of extreme fire danger (a red day) during 1990 and one day during 1991. Large forest fires were not recorded during these years.

1992/93

In 1992, a serious drought occurred in most of the Summer Rainfall Regions in the North and East of South Africa. Subsequently, the number of fires reported in the forest regions of these provinces increased to 792, but surprisingly losses from wildfires were less than during 1991, and only 9 333 ha of industrial forests were lost (Meikle et al. 1993). In 1993, no major fire events were recorded.

1994

A few serious wildfires occurred in industrial forests and in surrounding grassland in the Mpumalanga and Kwazulu-Natal Provinces. Towards October 1994, three major plantation wildfires raged in the Sabie District, destroying more than 1 000 ha in each case. During one fire in a SAFCOL plantation in the area, ten firefighters lost their lives when the fire spotted around the team inside *Pinus* and *Eucalyptus* stands. Two firefighting vehicles were also burned out in the process, and combined losses for the district in terms of timber losses exceeded US\$1 million.

1995

During the dry winter season, some serious grassland wildfires were experienced in the Eastern Free State, while in one fire 5 500 ha of timber plantations were destroyed in the Melmoth District of the Kwazulu-Natal Province. Surprisingly no lives were lost.

During December 1995 a bushfire spotted into a heap of 15 000 tons of sulphur belonging to an explosives and chemical company near Cape Town, and a local community was overwhelmed by the toxic fumes. Two thousand five hundred people had to be evacuated, and 500 patients had to be treated in the trauma unit of the nearby hospital. Two persons died. The fumes also affected nearby agricultural crops through direct scorching of leaves.

1996/97

Numerous grassland fires were reported in the Summer Rainfall Region of SA, but higher than average rainfall prevented serious moisture deficiencies from occurring, and subsequently area burned remained relatively small. During both years rainfall days extended well into the June/July period, and long seasonal drought was avoided.

1998:

A dry summer prevailed in the Cape Regions. An early start of hot *Bergwind* conditions during March/April caused extreme fire weather conditions in these areas in the Fynbos Biome, and in some adjoining Industrial Forests. Two serious fires occurred in the Tsitsikamma Region. In one of them 60 000 ha of fynbos were burned and 4 000 ha of industrial forests were destroyed. Six people lost their lives in this fire and 250 were left homeless. Damage to standing timber alone exceeded US\$1 million. The ecological impact of this fire on the fire-adapted fynbos was not that serious, although some of the older fynbos sub-communities experienced excessive fire temperatures that may have led to some localised erosion problems on steep slopes.

In the Summer Rainfall area the fire season started extremely early in April. By May 30 000 ha of grassland grazing areas were lost in wildfires in the Eastern Free State, and one fire blackened 20 000 ha of a nature reserve in the region. Another wildfire burned most of the grassland in a Nature Reserve in Mpumalanga. A tragic loss of life occurred indirectly as a result of a grassland fire in the Gauteng Province during June. Twenty people lost their lives in a traffic pile up caused by thick smoke on a highway from a nearby grassland fire.

Also in the Summer Rainfall area, four people lost their lives in one of the numerous grassland wildfires in Mpumalanga, while wildfires in industrial forests caused losses exceeding 1 000 ha of standing timber in the Northern Cape and Mpumalanga Provinces, and in Swaziland. In the NW Province, where wildfires are seldom experienced, a grassland fire burned down some farms and homesteads and killed two policemen.

1999

In the Southern Cape and Tsitsikamma regions, more wildfires burned through thousands of ha of fynbos vegetation, burning down homesteads in the Plettenberg Bay area, as well as a few thousand ha of timber plantations and farmland. These fires occurred during extremely dry *Bergwind* conditions. In the Summer Rainfall area, most wildfire damage - in the form of grazing area lost and timber plantations damaged - were experienced in Swaziland.

2000

During January 2000, the Cape Peninsula was devastated by a serious fynbos wildfire, which burned 8 000 ha of fynbos vegetation in that area. Elsewhere in the Western Cape Province an additional 10 000 ha of fynbos burned. In the Cape Metropolitan area 70 houses were damaged or destroyed by the fire and 200 shacks of an informal settlement were also razed in the process. Total fire suppression costs exceeded US\$3 million, while insurance claims are expected to exceed US\$0.5 billion. No lives were lost.

Fire database

Additional databases are not available. For fire data in the grassland and savannah biomes the reader is kindly referred to the overview summary on fire in sub-Saharan Africa.

Operational fire management organization

The Department of Water Affairs and Forestry (DWAF) is responsible for the provision, management and administration of the 1998 *National Veld and Forest Fire Act*, and the support of Fire Protection Associations (FPAs). DWAF will not play a direct firefighting role or duplicate the work of fire management agencies.

Fire prevention is normally regarded to be the responsibility of the landowners, guided by DWAF and the new National Veld and Forest Fire Act. However, there is still a lack of regional co-ordination in this field. Certain exceptions exist where integrated regional fire protection plans have been implemented: the Mpumalanga Highveld, in the Melmoth District of the Kwazulu-Natal Region, and in the NE Cape. Local (private and state) fire management bodies in Industrial Forests, Agricultural Regions and Nature Reserves are normally responsible for their own fire prevention measures.

Early warning, fire detection and monitoring systems are extensively used in Forestry regions, and these are mostly managed by private forestry concerns. Elsewhere in South Africa detection systems, such as fire towers and other early warning systems, are seldom used.

In most provinces the firefighting role is conducted and controlled by Regional Services Fire Brigades in rural areas, assisted by Municipal Firefighting Units in Metropolitan districts. In some areas these efforts are being assisted by certain Central Government bodies, such as the Defence Forces, particularly when wildfires expand to disastrous sizes. Local forestry organisations and agricultural bodies also assist in fighting fires in certain regions, depending on the dominant land-use of these regions.

The most important forestry firefighting organisations in South Africa are the Forest Fire Association (FFA) based in Nelspruit, the Zululand Fire Protection Association (ZFPA) and the Natal Fire Protection Association (NFPA).

Although spontaneous firefighting support from local communities has been recorded during some wildfires, no major voluntary firefighting organisations exist in South Africa.

Fire research

Some fire research in South African Natural Biomes is being maintained under the umbrella of universities, nature conservation bodies and forestry companies. However, during the 1990s there was a marked decrease in these activities, compared to fire research conducted during the 1980s. It was particularly in the formal Agricultural and Forestry Sectors that there has been a marked decline in fire research funding and this has had a particularly negative effect on some longer-term research venues, which were in many cases shelved or terminated.

During 1999, however, there is a more positive approach to fire management in general in South Africa, with some training institutions now in the process of restructuring their fire management/ecology curricula (such as at the Forestry Training Centre of the PE Technicon at Saasveld). Some fire research programmes are also re-considered.

Use of prescribed fire

Forestry (industrial forests)

Slash burning after clearfelling even-aged stands is a common practice, particularly where heavy slash from tree crowns make re-establishment of trees a costly operation. However, where slash is not forming serious obstacles, e.g. steep slopes occur or where nutritional problems occur (such as on poor sandy soils), slash burning is avoided.

Prescribed burning inside *Pinus* plantations is being used more as a fuel reduction measure, particularly within strategic buffer zone (fire belt) systems in some forest regions (de Ronde et al. 1990).

Natural biomes

Prescribed burning is used extensively in grassland management throughout the area, particularly in areas with a high biomass production where grassland curing causes a regular wildfire threat. Grassland is burned in fire protection systems outside and within plantation areas, and, also, in the form of fire belts elsewhere in the Summer Rainfall Region. Grassland is also burned regularly by farmers and by nature conservators to provide grazing, where this type of burning is classified as maintenance burning. In certain nature reserves, such as in the Kruger National Park, there was also a major shift in policy towards more natural (lighting) fire areas (so-called *Laissez Faire* approach) and less prescribed block-burning (*Structural Burning*). However, the debate regarding these issues is continuing, and some form of combination of both regimes is probably the answer.

In the Fynbos Biome, prescribed burning has been used extensively in the past until the 1980s, but there was a marked decrease in prescribed burning activities in the Cape Regions during the 1990s. More natural fynbos vegetation was regarded as *Natural Burning Areas*, becoming dependent on the rare lighting occasion. This was mainly caused by a drain of experienced fire managers - and subsequent increase in fire hazard - as a result of fuel accumulation. Therefore, there was a marked increase in fynbos wildfires during the 1998 - 2000 period, in the Western Cape, Southern Cape and Tsitsikamma Regions.

Sustainable land-use practices used in South Africa

Integrated fire protection, at a regional scale, has been implemented in areas such as the Mpumalanga Highveld, the Melmoth District of Kwazulu-Natal and in the NE Cape Region. However, these areas only form a small percentage of the total South Africa area (less than one percent). Further implementation of the system, using integrated fire hazard evaluation and fire break zoning, will be required in regions with a known high fire hazard. Implementation is at present being considered in the Western Cape (Boland District) and Kwazulu-Natal Midlands.

Fuel reduction programmes, such as the application of prescribed burning of natural and activity fuels on a selective scale, form the basis of this fire protection integration. This approach combines the use of fire for agricultural and silvicultural goals with fire application for ecological requirements and riparian zone maintenance.

Public policies concerning fire

Legislation and policies concerning fire

As a consequence of the severe fires in the Western Cape Province, the Minister of Water Affairs and Forestry, Pretoria, supported by the Premier of the Western Cape, established a *Task Team to Review the Western Cape Fires of January 2000*. The Task Team reviewed the course of events of several fires, analysed fire weather, interviewed role-players, and analysed the legislative framework. The report of the Task Team came up with a list of recommendations to improve fire management and fire disaster management in the country (Task Team 2000). The geographical scope of the study was the Cape Peninsula and the areas within the Berg and Breede River Water Management Areas.

The legislation pertaining to fires that occurred in the Western Cape fall under the categories:

- a Legislation Directing Regulating Fires and Fire Management (Within a mostly emergency management context):
 - Forest Act
 - Fire Brigade Services Act
 - National Environmental Management Act

- Mountain Catchment Areas Act
- b Towards Integrated Disaster Management Regulation:
 - Disaster Management Bill (in prep.)
 - Veld and Forest Fires Act
- c Resource Management Regulation:
 - National Parks Act
 - Cape Nature Conservation Ordinance
 - Conservation of Agricultural Resources Act
- d Land Use Planning Legislation:
 - Physical Planning
 - Development Facilitation Act
 - Local Government Transition Act 209 of 1993
 - Environment Conservation Act 73 of 1989
 - National Environmental Management Act
- e Air Quality Control Legislation:
 - Atmospheric Pollution Prevent Act
 - Local Authority Legislation
- f General Environmental Management:
 - National Environmental Management Act

The objective of the review was to use the lessons from these fires to identify the strengths of current fire management systems, and to propose necessary improvements. From an analysis of all relevant information, the study was to derive the lessons relevant to the Western Cape itself, as well as for the fire management systems in South Africa generally, including the relevant elements of the National Disaster Management System as a whole.

The key questions to be addressed in the review included:

- * What ecological conditions (e.g. weather, natural and alien vegetation) prompted the fires to occur and contributed to their intensity and spread?
- * What institutional arrangements were in place for fire management and firefighting, which of these proved effective, and what improvements may be needed?
- * What strategies for fire management and firefighting were adopted during the fires and how were resources (personnel and equipment) used; what proved effective, and what needs to be improved?
- * How effective were the extant provisions of the Forest Act of 1984, the provisions of the Veld and Forest Fires Act of 1998 that were in force at the time, and any other statutes that determine fire management?

The study was to generate a report that would include findings, the inferences from these findings, and recommendations for improvements in the legislative, institutional, and ecosystem management regime that determines the fire management system.

Specifically, recommendations were to include:

- * Proposals for improvement to and guidelines for the effective implementation of the National Veld and Forest Fires Act, as well as recommendations for improved linkages between this Act and other relevant statutes;

- * Recommendations for improvements in the organising and resourcing of and co-ordination and co-operative governance arrangements between spheres of government responsible for and otherwise influencing management for the prevention of veld fires, the control of fires that do break out, and the mitigation of the consequences of fires that do occur;
- * Improvements in the management for fire control of ecosystems as well as of the built and settled environments adjacent to natural or semi-natural ecosystems.

The final output would be feasible proposals for improvements in fire management in South Africa, including legislation, especially the National Veld and Forest Fires Act, institutions and their co-operative governance arrangements, supporting systems, and ecosystem management.

The draft report has been submitted to the Minister in the second half of 2000. It contains a list of more than 60 recommendations addressing the major gaps and fields of activities that have been identified by the Task Team.

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Santam / Cape Argus Ukuvuka Operation Firestop

The wake-up call

As shocked Capetonians watched their mountains burn in January 2000, the thought in every mind was that something urgent had to be done to prevent such devastation from ever occurring again. The terrifying sight of the flames was etched into the minds of all who witnessed the fires. For days the air over the Cape Peninsula was heavy with smoke. Traffic moved at a crawl, emergency services' sirens shrieked and helicopter engines throbbed from dawn to dusk. The situation was extremely serious, but if the wind had behaved just slightly differently, the outcome could have been totally catastrophic. Clearly, a plan was needed to protect lives and land during inevitable future fires.



Crisis can lead to dramatic action, encouraging people to co-operate in new and creative ways. The response to this disaster was speedy, dynamic and powerful. Busy people shared a vision of maximum fire protection and restored ecological integrity in the Peninsula. They gave willingly of their time to translate this vision into a professional business plan, a plan that would find resources and co-ordinate how various authorities would act.

Thus, the energy released by the fire gave birth to the aptly named *Ukuvuka: Operation Firestop Campaign* (*Ukuvuka* is a Xhosa word meaning 'to wake up'), bringing together representatives of government, private enterprise and the media in a partnership unprecedented in South Africa.

The partners

The public sector members of the *Ukuvuka: Operation Firestop Campaign* are the National Government (represented by the Working for Water programme), the Western Cape Government, SA National Parks, the South Peninsula Municipality, the City of Cape Town and the Cape Metropolitan Council, which has committed 30 million Rand (R) to the campaign. Other public sector organisations are contributing staff support and expertise. The campaign's alien clearing and ecological rehabilitation goals link closely with those of the Cape Peninsula National Park, with its generous funding from the Global Environmental Facility and the Working for Water programme.

Major private sector sponsorships have come from Santam (R20m, believed to be the largest single donation ever made to a South African environmental project), the Cape Argus (R5.5m), Nedbank (R5m) and Total (R4m). In addition, local companies and the World Wide Fund for Nature (WWF) South Africa have offered the campaign free services, ranging from the production of advertising material to legal assistance.

Ministers Ronnie Kasrils (Water Affairs and Forestry) and Valli Moosa (Environmental Affairs and Tourism), Deputy Minister Cheryl Gillwald (Justice), Western Cape Premier Gerald Morkel and Mayor Peter Marais are among the political heavyweights who are backing what is formally called the Santam/Cape Argus Ukuvuka: Operation Firestop Campaign. The campaign team involves all three spheres of government and unites representatives of all major political groupings. Indeed, a particular feature to date has been the maturity with which these representatives have ensured that the campaign remains above political and institutional differences. Those involved point out that without this maturity there would have been competing, wasteful and ad hoc responses to the fire. This bringing together of often conflicting interests is already hailed as one of the campaign's major successes.

The campaign's activities are governed by a Board, managed by a steering committee and overseen by independent trustees of the *Ukuvuka Trust Fund*. The campaign does not carry out ecological restoration work itself but co-ordinates and funds projects under the control of SA National Parks or the local authority, the City of Cape Town.

The objectives

Ukuvuka: Operation Firestop aims to significantly reduce the risk of damage and danger from wildfires in the Cape Peninsula.

The first key target area is the land and its plants, where the aim is to:

- * control invading alien plants; and
- * rehabilitate fire-damaged areas.

The second key area is communities and individuals, by helping to:

- * create employment, training and poverty relief for disadvantaged people;
- * protect the most vulnerable communities from fire; and
- * promote co-operation and social cohesion between communities.

Thirdly, institutions will be assisted to:

- * implement integrated fire management plans; and
- * manage the urban edge.

The Ukuvuka Campaign has a four-year mandate (ends March 2004) to achieve its goals. Key elements of the campaign include an effective communications and education programme, and an accountable administration.

The lessons learned about effective biodiversity conservation linked to social delivery will be passed on, so that the campaign becomes a role model for similar projects elsewhere in the country.

Working with the land and its plants

Since January 2000, much work has already been done to clear alien plants and rehabilitate public land. After the fires, the immediate need was for emergency measures to stabilise burned slopes, as these will only be fully secure once the natural vegetation has grown back. The spectre of post-fire flooding and mudslides was much in the minds of people who had experienced this in Glencairn and Fish Hoek the previous year. To prevent further damage and danger, the City of Cape Town worked quickly to identify 34 high-risk sites, and by the end of June 2000 they had put in place numerous anti-erosion structures, including silt curtains, sandbags and stone gabions.

Helped by a below average rainfall, this operation was a resounding success. Now, the Ukuvuka: Operation Firestop Campaign is developing community-based nurseries to build up stocks of indigenous plants to promote the regrowth of plants in these areas.

The longer term, and more substantial, problem is the presence of invading alien vegetation. To date, some 750 tree and 8000 other plant species have been imported to South Africa for use as crops, timber, firewood, barriers or for ornamental purposes. Most cause no trouble, but 198 of them have been declared weeds and invader species.

Uncontrolled, these aggressive alien plants tend to reproduce rapidly. They are thirstier than our well-adapted indigenous plants and consume billions of litres of precious water each year.

Historically, both the City of Cape Town had taken action against invasive aliens and made significant strides, while currently the Cape Peninsula National Park commits more than R10 million annually to invasive alien clearing. Freeing water is a good enough justification for a war against weeds, but another is to limit the volume of plant material available to burn in the event of a fire.

As the Peninsula found to its cost, the intensity of uncontrolled wildfires increases substantially when fire-prone aliens take root among the indigenous plants. The fuel load increases and densely invaded areas become impenetrable to firefighters, increasing the risk of disaster.

Urbanisation, agriculture and forestry have already swallowed up almost one third of the 90 000 km² Cape Floral Kingdom, and what remains (mostly in mountain areas) is threatened by invading alien plants. Indeed, these plants are the single greatest threat to the floral kingdom, regarded as the world's 'hottest hotspot' for biological diversity.

Since March 2000, more than 1000 ha of alien plants have already been cleared with Ukuvuka: Operation Firestop Campaign funding, and a firebreak is being created along the 200 km boundary of the Cape Peninsula National Park. One of the campaign's first priorities was a study to identify private properties at risk, and it is working with the local authority to advise these property owners about how best to fireproof their homes.

What this means for landowners:

- * Existing regulations require landowners to get rid of invasive alien plants, and the laws are becoming much tougher. But in fact it's in everyone's best interests to deal with these plants as quickly as possible: the longer they are ignored, the more invasive they become and the more costly to remove. The campaign's extension officers are available to identify invasive trees and plants that must go, help find suitable contractors and oversee the clearing operation.

Some stands of alien trees have special appeal because of their historical or cultural significance, or their recreational use. They will be spared, or phased out over a gradual period. Forestry, responsible for a sizeable percentage of alien infestation, will continue in the Peninsula, but plantations will be managed very responsibly. And some hard realities will not be ignored: because poor communities have such a pressing need for fuel, some carefully controlled woodlots of alien species may be grown to provide firewood.

It is important to remember that not all alien plants are under attack – only those deemed to be a problem. Some people react emotionally when established trees are felled, but the Ukuvuka: Operation Firestop Campaign is going out of its way to explain the threat to our rich indigenous vegetation and the increased fire risk if the spread of invasive alien plants remains unchecked.

Working with communities and individuals

Employment and training

One of the Ukuvuka: Operation Firestop Campaign's key objectives is to create job opportunities for as many disadvantaged people as possible. Fortunately, eradicating alien invasive vegetation is very labour intensive, and cutting down trees is only the first step. The job is not complete until all the unwanted plants have been removed or burnt, and careful follow-up clearing done to prevent regrowth – usually over several years. All this work is being done on a contract basis. Only one person from each household is employed at any one time, so as to spread the economic benefits as widely as possible. Once skilled, they can sell their services as individual entrepreneurs on the open market.

Protecting the most vulnerable from fire

Part of the Campaign's mission is to empower disadvantaged people to protect their families and communities. Residents of informal settlements may not be affected by a mountain blaze, but they are always at risk from fire. Their shacks are often built of highly combustible materials and are usually clustered close together. When fire strikes one of these densely populated communities, it's often impossible to contain the resulting inferno and hundreds can lose their homes.

The campaign's target area includes five disadvantaged, fire-prone communities: Imizamo Yethu, Hout Bay fishing village, Ocean View, Masiphumelele, and Red Hill. Two vulnerable satellite areas on the Cape Flats, Joe Slovo and Silver City, will also receive help. Last year, 30 per cent of reported fire incidents in informal settlements in the Cape Town municipal area occurred in Joe Slovo – and 60 per cent of all dwellings destroyed were there. Working in partnership with Disaster Management and community volunteers, the campaign has handed out 4800 buckets, whistles and informative posters in Joe Slovo. Demonstrations were given of how effectively a swift response to an alarm whistle could control a fire, using buckets of sand and water.

In each of these vulnerable areas, training in firefighting techniques, interventions to provide fire hydrants and hardened tracks that perform as access and firebreaks is underway or being investigated. Youth groups have been established to act as information officers. Fire and access breaks between homes is still needed in some areas – a step that calls for sensitive negotiation as, inevitably, some homes will have to be relocated to create the necessary space.

Promoting co-operation between communities

Affluent people usually have fire insurance and the means to either fight a blaze or flee by vehicle. So, in their areas, the campaign will encourage landowners to manage their properties responsibly, to join forces to reduce the risk of fire and flooding, and to contribute financially to projects in the public interest. Informal settlement dwellers, on the other hand, generally have few choices, no insurance and very little control over their environment. But with assistance from the campaign, they have the potential to become better organised, more protected from fire, and better able to respond to neighbouring communities that might be in trouble. As the previous Cape Town mayor

Nomaindia Mfeketo pointed out, the Peninsula's mountains belong to everyone and not just to those who live on the slopes.

Working with institutions

Fire management plans

An integrated fire management plan is vital if the firefighting activities of the various authorities are to be best coordinated and streamlined. The Veld and Forest Fires Act (1998) makes provision for Fire Protection Associations (FPAs), and the Ukuvuka: Operation Firestop Campaign is funding the appointment of a facilitator to establish an FPA in the Peninsula. It's primary tasks will be to help maintain firebreaks and to supervise volunteer firefighting groups and a rapid response system. While the FPA directs the practical operations, the campaign's input will be in the form of education, firefighting training, disaster planning and the provision of equipment.

Living on the edge

People who choose to live on the mountain slopes, enjoying the beauty and advantages of the adjoining natural environment, must accept a degree of vulnerability to fire. Now, they must also accept responsibility for protecting their immediate surroundings. There is a need for firebreaks, erosion control and fireproofing of properties along the urban fringe. There are established hack groups and nature clubs, and the campaign is supporting their efforts with planning, mapping, training, equipment and plants. As public awareness grows, it is hoped that landowners, as well as clearing alien plants and replacing them with indigenous substitutes (many of which have fire-repellent properties), will join these groups. For ordinary people to buy into Ukuvuka: Operation Firestop, they must care; in order to care, they must know what they stand to lose.

Communication

To help the Ukuvuka: Operation Firestop achieve its objectives, there must be awareness, environmental education, community enthusiasm and goodwill, pressure from insurance companies and banks, and (where necessary) legal enforcement by authorities. Campaign activities are already being widely publicised in the media. Schoolchildren will soon be exposed to an educational programme that will increase their knowledge about invasive alien plants and their link to fire and its consequences. Already, campaign workers and partners sport eye-catching T-shirts, and publicity initiatives include banners, bumper stickers and advertisements to inform the public of the Ukuvuka: Operation Firestop drive.

The campaign is a huge undertaking, but fortunately it already has the enthusiastic support of various authorities, generous funding from the private sector, and a high level of co-operation and commitment from landowners. But it's also a campaign that aims to facilitate a fundamental shift in the mindset of Capetonians; a shift that will ultimately be felt throughout South Africa as the successes of this ambitious project are duplicated elsewhere in the country.

Lessons have been learned, and although Ukuvuka: Operation Firestop Campaign was born out of devastation and despair, its legacy will be immensely rich: rehabilitated and protected natural assets, and safer, more empowered communities.

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SUDAN

Fire Situation in Sudan

The fire environment

Climate and fire regimes

The dry season starts two to three weeks after the rains end in northern Sudan, i.e. November to April/May. Tall and short grasses are increasingly desiccated during the dry season. Increased wildfire hazard is associated with low humidity, high fuel loads and the presence of moving graziers. Annual wildfires are common and spread rapidly due to northeast winds and flat terrain. This is the case in central, western and southern Sudan. Repeated fires occur if the hot dry weather continues, i.e. late rains.

Ecological role of forest fires

In the high-rainfall savannah ecosystems of southern Sudan fires kill certain fire-sensitive trees, e.g. *Isobertinia doka*, *Daniellia oliveri*, etc. and reduce the growth of other species. Fires may reduce gum yields from *Acacia senegal* by up to 50 percent. This is considered a big economic loss. In an average year fires affect about 70 percent of the open rangelands.

Fires may also encourage the spread of some species, e.g. *Acacia mellifera* in central Sudan on clay soil where the "Acacia-grassland cycle" takes place. The occurrence of *Acacia* alternates with tall grasses. *Acacia* takes over if the fires are of low severity. Grasses become dominant with increasing fuel loads and high-intensity fires.

Impacts of wildfires

Lightning fires or fires caused by nomads often damage or destroy whole villages with huts that are built from grass and wooden materials. This problem is very common in central Sudan. Villagers in many instances are caught by surprise.

Wildfire database

Fires statistics for the period 1980 to 1999 are lacking except for limited incidents in Jebel Marra where some 3 000 feddan (1 feddan = 0.42 ha) of *Cypressus lusitanica* were destroyed in the 1990s. Large tracts are often swept over by wildfires in central and western Sudan. Nothing is presently known of the situation in southern Sudan where fires are presumably set by the army to improve visibility and for control of the terrain. More than 60 million ha are affected annually.

Organizational set-up

A fire management organization is not in place. However, the traditional system of constructing or maintaining forest fire lines (firebreaks) is adhered to through an annual budgeted program, but funds are always short. Surface vegetation, especially grasses, may dry very quickly after the end of the rainy season and the firebreak programme is never completed in time.

By law, fire lines are supposed to form the boundaries and protect Government forest reserves. The law states that fire lines should be at least two meters wide but these are inadequate and normally five- to eight-meter-wide lines are cleared, but fires may still jump over. Cleaning fire lines is an expensive operation.

In colonial times and up to the end of the 1960s the Native Administration, under the supervision of the Range and Pasture Department and in close collaboration with the Forestry Department, maintained a firebreak network extending north-south over North Kordofan and North Darfur to protect grazing lands and gum gardens. Usually four-metre-wide lines are cleaned and spaced parallel to each other and separated by an 80 m wide area that is burnt just before the end of the rains. This pattern is repeated systematically over the semi-arid lands. Early warning, detection and monitoring systems are not available. No volunteer fire fighters are available but people and communities are obliged by the forest law to report and help fight wildfires. Fire research is absent.

Use of the prescribed fires

Prescribed burning is used in natural forests in western Sudan (Jebel Marra) and used to be practised as early burning in southern Sudan but stopped due to the war. The use of backfiring for controlling wildfires is forbidden except for certain conditions and under control of appropriately trained foresters.

Sustainable land use practices to reduce wildfires

Very wide fire lines (50 m) have been used to separate blocks of *Eucalyptus* plantations in the Khartoum green belt. Fuelbreaks (greenbelts) consisting of teak (*Tectona grandis*) were used in the south to protect fire-prone species. In traditional agricultural areas, people and farmers are guided by extension workers to protect their villages and lands. At present there is no method other than burning to clear forest lands for cultivation. The forest law, however, prevents wasteful burning and obliges cultivators to make use of cleared woody material (shrubs, trees) by converting it into useful products, e.g. charcoal.

Public policy concerning fires

The forest policy of 1986 emphasizes the protection of forests against fire. The forest law of 1989 prohibits trespassing of people and their animals into reserved forests and prohibits the carrying of ignited material into the forests, making fires for cooking or other purposes in or near forests and obliges people to help extinguish forest fires.

Reduction of fires will definitely conserve the natural resources of the country and will improve the growth of many tree species.

Fire management needs cannot be detailed here due to the complexity of the different environmental conditions and the need for different management techniques. The very large size of the country, the various local factors and weather conditions, the trend toward repeated severe droughts and desertification, the increase in population and domestic animals, the displacement of rural people to cities, the expansion of unplanned rain-fed cultivation, the poverty of the people and the lack of knowledge of decision makers regarding forest conservation are all major problems and impediments.

Sudan needs extension capability to teach people how to protect their lands. Research is needed to find safer methods to prepare land for agriculture or forest plantations. Above all, trained personnel and supporting equipment are needed for transport, detecting and fighting forest fires.

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RECENT PUBLICATIONS

Global and regional wildland fire monitoring from space: Planning a coordinated international effort

Increasing conflagrations of forests and other lands throughout the world during the 1980s and 1990s have made fires in forests and other vegetation emerge as an important global concern. Both the number and severity of wildfires and the application of fire for land-use change, seem to have increased dramatically compared to previous decades of the twentieth century. The adverse consequences of extensive wildfires cross national boundaries and have global impacts. Fire regimes are changing with climate variability and population dynamics. Satellite remote sensing technology has the potential to play an important role for monitoring fires and their consequences, as well as in operational fire management. In response to this need as well as to respond to other needs for more rapid progress in forest observation, in 1997 the Committee on Earth Observation Satellites (CEOS) initiated Global Observation of Forest Cover (GOFC) as an international pilot project to test the concepts of an Integrated Global Observing Strategy. The GOFC program is currently part of the Global Terrestrial Observing System (GTOS). GOFC was designed to bring together data providers and information users to make information products from satellite and in-situ observations of forests more readily available worldwide. Fire Monitoring and Mapping was formed as one of three basic components of GOFC.

A new book volume has been prepared that reviews and synthesizes the existing capabilities of spaceborne sensors to detect and monitor wildland fires, to use remote sensing for early warning of wildland fires and to provide decision support for fire managers and policy makers. This book contains eighteen contributions authored by scientists who represent the most active international research and development institutions, aiming at coordinating and improving international efforts for user-oriented systems and products. These papers were initially presented at a GOFC Fire Workshop held at the Joint Research Centre, Ispra. The volume is a contribution by the GOFC Forest Fire Monitoring and Mapping Implementation Team to the Interagency Task Force, Working Group on Wildland Fire of the UN International Strategy for Disaster Reduction (ISDR).

Ahern, F., J.G.Goldammer, and C. Justice (eds.). 2001. Global and regional vegetation fire monitoring from space: Planning a coordinated international effort. SPB Academic Publishing bv, The Hague, The Netherlands, 302 p. (ISBN 905103140-8) (Order information: \$US 70.00. Contact: kugler.spb@wxs.nl)

Year of the Fires The Story of the Great Fires of 1910

1910 was America's millennial year of fire. That summer, American nature and American society collided with tectonic force as western wildfires scorched millions of acres, darkened skies in New England, and deposited soot on the ice of Greenland. Farms, mining camps, and rail towns cracked and burned. A survivor said that the towering flames raged with the sound of a thousand trains rushing over a thousand steel trestles. As one ranger put it, the mountains roared.

Stephen Pyne, recognized by the Chicago Tribune as "the world's foremost authority on fire and its role in human culture," tells the whole story of that catastrophic year and its indelible legacy. Pyne explains how wildland fires happen and how they are fought, how forests are created then re-created in cycles of burning, and what happens to a landscape when roads, railways, mining camps, logging, and national parks appear. The action distills into a two-day crisis, the "Big Blowup" of 20-21 August 1910, when the fires tripled in size, and focuses in particular on the heroics of Ranger Ed Pulaski, who held his panicked crew at gunpoint in a mine tunnel while the firestorm raged outside.

Pyne brings that astonishing year to life through the experiences and words of the rangers, soldiers, politicians, bureaucrats, scientists, and civilians who faced the fires, fought the flames, and were forever scarred by them. It was the first and greatest test of the five-year-old Forest Service. Yet even as seventy-eight firefighters perished, a national debate raged about policy, and especially about the relative merits of firefighting versus fire lighting.

The Great Fires were unlike any American fire before them, and no wildland fire since has fundamentally differed from the pattern they inscribed. Everything we do in this country with respect to forest fire – from the actual tools firefighters still carry to strategies of land management – is rooted in the way we fought the fires of 1910. Geography, nature, and civilization did battle in 1910 in a crazed, lethal struggle that has become one of the great sagas of Americans and their lands. More than a memorable adventure tale, this is the chronicle of a profound event that continues to shape American life.

Pyne, S., 2001, Year of the Fires: the story of the great fires of 1910, Viking Penguin, 322 p. (ISBN 0-670-89990-9)

Mapping Wildfires Hazards and Risks

Based on the October 1996 workshop at Pingree Park Colorado, *Mapping Wildfires Hazards and Risks* is a compilation of the ideas of federal and state agencies, universities, and non-governmental organizations on how to rank and prioritize forested watershed areas that are in need of prescribed fire. This book explains the vital importance of fire for the health and sustainability of a watershed forest and how the past acceptance of fire suspension has consequently led to the increased fuel loadings in these landscapes that may lead to more severe future wildfires. Complete with geographic maps, charts, diagrams, and a list of locations where there is the greatest risk of future wildfires. *Mapping Wildfires Hazards and Risks* will assist you in deciding how to set priorities for land treatment that might reduce the risk of land damage.

Sampson, R. N., Atkinson, R. D. and Lewis, J. W. (eds.), 2000, Mapping Wildfires Hazards and Risks, Food Products Press, Binghamton NY USA, 343 p. (ISBN 1-56022-071-6 – ISBN 1-56022-073-2)

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