Global Fire - A Message from the Global Fire Monitoring Center

Fires in forests and other vegetation - a terminology

Every year fires occur on several hundred million hectares of forests (***forest fires***) and other vegetation types worldwide. Fires in forests and open vegetation (woodlands, brushland, grasslands, savannahs, steppes) are commonly designated as ***wildland fires*** or ***vegetation fires***. Causes of uncontrolled fires (***wildfires***) and reasons for using fire as a management tool in agriculture, pastoralism, and forestry (***land-use fires, prescribed burning***) depend on the local environmental conditions (climate, vegetation type) and the culture with its specific social and economic conditions. Lightning is the most important natural cause of wildfires, especially in the less populated regions of the forests in high northern latitudes and tropical savannahs. Human-caused wildfires, however, play the most significant role in most regions of the world. The major reason is negligence, including escaped land-use fires, and sometimes arson.

Effects of wildfires and land-use fires

Wildfires can have both positive and negative effects on nature. In some ecosystems fires play an ecologically significant role in maintaining biogeochemical cycles. For instance, many savannahs in the tropics and subtropics burn annually or in intervals of several years (short fire cycles of 1 to 3 years). These fires are important to regenerate and stimulate the growth of grass and maintain the habitat structures of important wildlife species and domestic animals. Such "fire savannahs" are highly productive and are home to important plant and animal biodiversity. Similar adaptations are found in the natural northern coniferous forests which have a fire cycle ranging from several years or decades to several hundred years. Useful fires that improve the conditions for sustainable growing of crops are also set by experienced agriculturalists, herdsmen and hunters all over the world.

In other ecosystems fires are extremely destructive. The tropical rain forests are most vulnerable during extreme droughts such as those which repeatedly occur during El Niño years. During such extended dry spells the rain forest trees must protect themselves against the loss of water and shed their leaves. Consequently, the forest canopy becomes more open, sunlight penetrates down to the forest floor where the shed leaves become highly flammable. Fires escaping from agricultural sites or from pasture-burning are now able to spread into the forest and result in reduction of biodiversity and/or to long-term site degradation. During the strong El Niño of 1997-1998 large areas of rain forest were destroyed by fire in Asia and the Americas. A major reason for these detrimental fires was the inappropriate use of fire in converting forest or secondary vegetation to plantations.

In the temperate and boreal forests major damages occur in places where people are living at the interface between metropolitan or other residential areas and the vegetated lands such as brushland or forests. Thus, in almost all regions of the world wildfires burning under extreme weather conditions affect economies, human health and safety, with consequences which are of a significance and severity comparable to other major natural hazards. The vast majority of destructive fires are caused by the carelessness of humans. Thus, unlike the majority of the geological and hydro-meteorological hazards, vegetation fires represent a hazard which can be predicted, controlled and, in many cases, prevented.

Smoke emissions: impact on atmosphere and human health

Vegetation fires produce gas and particle emissions that have impacts on the composition and functioning of the global atmosphere. These emissions interact with those from fossil-fuel combustion and other technological sources that are the major cause of anthropogenic climate forcing. The extended fire and smoke episodes in South-East Asia and South America between 1982 and 1998 have demonstrated that smoke emissions from vegetation fires also affect human health and lead to loss

of human lives. In South East Asia alone more than 40 million people have been exposed to dangerous levels of smoke pollution from forest conversion burnings that lasted for weeks and in some places even for months.

Global climate change and fire

A look into the future shows that more problems are to be expected in a globally changed climate. Scenarios of climate change (based on global circulation models) indicate that changing fire regimes (increase of fire pressure) and other disturbances by humans will lead to more impoverishment of biodiversity and the carrying capacity of vegetation systems due to fire. Degradation and savannization of tropical rainforests, the loss of peat-swamp ecosystems and certain permafrost-dependent forests are the most prominent examples.

We can prevent wildfires!

The prevention of destructive fires is an integral element of land-use policies and fire management strategies. Fire prevention must address a broad range of elements and sectors of society, natural resources and environmental management, land-use planning, and technology development. Fire policies and strategies vary from country to country because of the different ecosystem characteristics and the cultural, social, and economic factors involved. Successful fire prevention must address the underlying causes of wrongful application of fire and other factors responsible for an increase in detrimental fires. For instance, in some regions of the tropics slash-and-burn agriculture is not sustainable because fire leads to impoverishment of soil fertility. Alternatively the combined use of agricultural and tree crop production (***agroforestry***), sometimes combined with grazing (***agrosilvopastoral systems***) and compost production of non-utilized plant biomass instead of wasteful burning will greatly improve the productivity and stability of soils. In the case of the need to convert forest and other wooded vegetation to agricultural and pastureland the woody biomass could be better used as an energy source (production of fuelwood or charcoal) instead of wasteful burning with uncontrolled air pollution.

Integrated fire management systems have been developed that are based on the involvement of communities and address fire at its roots. In some countries community-based fire management systems are in place which observe traditional rules of communities or are based on principles of advanced knowledge in sociology and anthropology. The reports from the Integrated Forest Fire Management (IFFN) projects in Indonesia and Namibia are good examples of experience in this regards (see separate reports in this kit).

Early warning for improving prevention and preparedness

Despite the importance of community-based fire management, early warning systems are essential components of fire and smoke prevention and management. They rely on evaluation of vegetation dryness and weather; detection and monitoring of active fires; integrating and processing of these data in fire information systems with other relevant information, e.g. vegetation cover and values at risk; modelling capabilities of fire occurrence and behaviour; and dissemination of information. Early warning of fire and atmospheric pollution hazards may involve locally generated indicators, such as local fire-weather forecasts and assessment of vegetation dryness. Advanced technologies, however, which rely on remotely sensed data, evaluation of synoptic weather information and international communication systems are now also available for remote locations. The Internet system and satellite telephone links are important channels for information flow. In addition, the international community has access to the international information system of the ***Global Fire Monitoring Center*** (GFMC), where scientists and operators prepare daily global to national early warnings on fire danger and monitor the state of fires throughout the world. Numerous other documents and links to sources in fire information can give the interested reader fast and reliable access to the world of fire. The prevention of destructive fires is the ultimate goal of GFMC which acts as a partner of the ***International Strategy for Disaster Reduction*** and its international partners in building a global culture of prevention.

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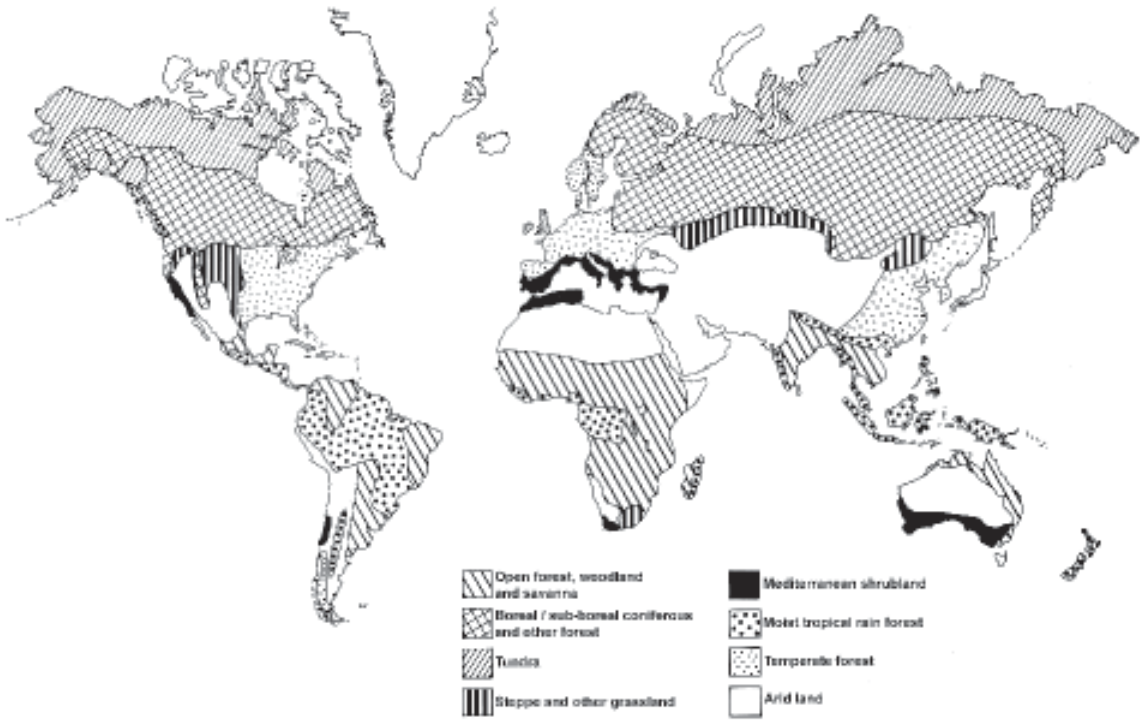

A Global Fire Map

Reliable statistical data on occurrence of wildland fires, areas burnt and losses are available for only a limited number of nations and regions. Instead of an incomplete statistical table the global wildland fire map shows the distribution of distinct fire regions.

1. Open forests, woodlands and savannahs

Tropical and subtropical open forests, woodlands and savannahs which have a distinct dry season cover an area of about 2.3-2.6 billion hectares (= 23 to 26 million square kilometres) worldwide. The combustible materials in these ecosystems are grasses and leaves which are shed during the dry season and are burnt periodically at intervals ranging from one to four years. Many plant and animal species are adapted to regular fire. The fire frequency has increased in some regions as a result of increasing population and more intensive use of rangelands. The global area of savannahs potentially subjected to fire each year is up to several hundred millions of hectares.

2. Boreal/sub-boreal coniferous and broadleaved forest

The world's total boreal forests and other wooded land within the boreal zone cover 1.2 billion ha of which 920 million ha are closed forest. The latter number corresponds to ca. 29 per cent of the world's total forest area and to 73 per cent of its coniferous forest area. The largest piece of boreal forest is on the territory of the Russian Federation. The distinct climatic seasonality with a short vegetation period and low average temperatures leads to the accumulation of organic layers and widespread permafrost soils. Regular natural fires play an important role in promoting the growth of some economically important coniferous species. Recently increasing ignitions caused by human activities are responsible for destructive wildfires, especially in the Russian Federation.

3. Tundra

The tundra ecosystems represent the northernmost (subarctic) vegetation and consist of shrubs growing on thick organic terrain; in the southern parts of the tundra belt scattered trees indicate the beginning of the ***taiga*** forest belt. During dry northern summers wildfires are mainly caused by lightning and spread over large distances. Such fires which are monitored from satellites are usually not suppressed.

4. Steppe and other grasslands

A large variety of grassland ecosystems in different vegetation zones are subjected to regular fire influence. In some grasslands prescribed fire is used as a management tool to stimulate growth and improve the nutrient quality of grasses for livestock grazing or to prevent growth of undesired bushes and trees. In some steppe ecosystems wildfires may destroy valuable grass resources. The Central Asian steppes have suffered increasingly destructive wildfires since the 1990s. Between 1996 and 1998 more than 27 million ha of steppe and steppe-forest ecosystems were burnt in Mongolia.

5. Mediterranean shrublands

A type of climate characterized by hot, dry, sunny summers and relatively cool, rainy winters. In the extreme South-West of Africa the winter rainfall region is dominated by evergreen, sclerophyllous shrublands (***fynbos***), similar to the ***macchia*** and ***garrigue*** shrublands in the Mediterranean Basin, or the shrublands of Southern Australia and the ***chaparral*** in Western North America. The vegetation is quite fire adapted. Fire problems are mainly at the interface between shrublands and the residential areas where wildfires cause high economic losses by burning houses and infrastructures of urban areas. In the Mediterranean Basin an average of ca. 0.6 million hectares of forest and other land is burnt annually.

6. Tropical rainforests

The undisturbed equatorial rainforests are usually too moist to allow the propagation of wildfires. However, extreme drought in association with forest exploitation and encroachment of other land-use systems periodically create conditions of flammability, fuel availability and fire spread in the equatorial rainforests. Such extreme drought events regularly occur in the forests of tropical South East Asia as a consequence of the El Niño-Southern Oscillation (ENSO) phenomenon. The causes of wildfires are escaped management fires from forest conversion and shifting cultivation activities. During the last major ENSO event in 1997-1998 Indonesia experienced land-use fires and wildfires over more than 10 million ha.

7. Temperate forests

Temperate forests are mainly located in the densely populated industrial regions of the world. The European temperate forests are managed by strict fire protection (exclusion of any fire). In North America a large number of different forest ecosystems show a broad range of adaptations to natural and human-made fires. Thus, fire management strategies vary from region to region.

8. Arid lands

Arid lands include non-vegetated regions, e.g. deserts, or sparsely vegetated ecosystems in which the low density and discontinuity of combustible materials do not allow the spread of fire. Some arid lands sometimes become flammable after a (cyclic) wet year during which the growth of vegetation has been extraordinarily stimulated.

The Global Fire Monitoring Center (GFMC)

In order to serve the demands of a large variety of global users of fire information the German Foreign Office in 1998 supported the establishment of the Global Fire Monitoring Center (GFMC) as a contribution to the United Nations International Decade for Natural Disaster Reduction (IDNDR) and its successor arrangement, the International Strategy for Disaster Reduction (ISDR). GFMC is a facility for global early warning and monitoring of forest and other vegetation fires and provides decision support for the United Nations system, international programmes and nations on request. It operates through the Internet and can be visited freely at:

http://www.uni-freiburg.de/fireglobe

Recent Major Fire Disasters

Comprehensive reports with final data on losses caused by forest and other vegetation fires (wildland fires), including impacts on biodiversity, are only occasionally available. The main reason for the lack of reliable data is that the majority of both the benefits and losses from wildland fires involve intangible non-use values or non-market outputs which do not have a common base for comparison, i.e. biodiversity, ecosystem functioning, erosion, etc. Market values such as loss of timber or tourism activity have been calculated in some cases. The following documented large fire events reveal the magnitude of losses by wildfires:

- Wildfires in Indonesia 1982-1983
  - Loss of timber and non-timber values and rehabilitation costs: ca. US$ 9 billion
  - Biodiversity losses not quantifiable
  - Impact of smoke on human health: not assessed

- Extended forest and savannah fires in Côte d'Ivoire 1982-1983:
  - Human fatalities: > 100
  - Burnt land area: 12 million ha
  - Burnt coffee plantations: 40,000 ha
  - Burnt cocoa plantations: 60,000 ha

- Australia's Ash Wednesday Fires of 1983:
  - Human fatalities: 75
  - Burnt homes: 2,539
  - Burnt domestic livestock: about 300,000

- Forest fires in the North-East of the People's Republic of China in 1987:
  - Human fatalities: 213
  - Burnt forest: 1.3 million ha
  - Homeless population: 50,000
  - Annual average of human fatalities in China between 1950 and 1998: 92 people killed and 551 injured

- Fire episode in the Soviet Union during the 1987 drought:
  - Burnt forest: 14.5 million ha

- Mongolia steppe and forest fires 1996-1997:
  - Burnt area 1996: 10.7 million ha
  - Human fatalities: 25
  - Burnt domestic animals: 7000
  - Burnt stables/houses: 576/210
  - Damage assessment: US$ 2 billion
  - Burnt area 1997: 12.4 million ha

- Wildfires and forest conversion burning in Indonesia 1997-1998
  - Burnt area in Sumatra and Kalimantan: ca. 10 million ha
  - Short-term direct damages: ca. $US 10 billion
  - People in South-East Asia affected by severe smoke pollution: ca. 40 million

A Brief Forest Fire Terminology

Some selected important wildland fire management terms given in here are taken from the ***Wildland Fire Management Terminology*** of the Food and Agriculture Organization of the United Nations which is currently updated by the Global Fire Monitoring Center.

Agrosilvopastoral Systems

Land-use system in which woody perennials are used on the same land as agricultural crops and animals, in some form of spatial arrangement or temporal sequence. In fire management agrosilvopastoral systems are planned on fuelbreaks (particularly shaded fuelbreaks) to reduce fire risk by modifying understorey vegetation and soil cover.

Crown Fire

A fire that advances from top to top of trees or shrubs more or less independently of the surface fire.

Early Burning

Prescribed burning early in the dry season before grass, tree leaves and undergrowth are completely dry or before the leaves are shed, as an insurance against more severe fire damage later on.

Firebreak

Any natural or constructed discontinuity in a fuelbed utilized to segregate, stop, and control the spread of fire or to provide a control line from which to suppress a fire; characterized by complete lack of combustibles down to mineral soil (as distinguished from fuelbreak).

Fire Danger Rating

A component of a fire management system that integrates the effects of selected fire danger factors into one or more qualitative or numerical indices of current protection needs.

Fire Hazard

A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree both of ease of ignition and of fire suppression difficulty.

Fire Management

All activities required for the protection of burnable forest and other vegetation values from fire and the use of fire to meet land management goals and objectives. It involves the strategic integration of such factors as a knowledge of fire regimes, probable fire effects, values-at-risk, level of forest protection required, cost of fire-related activities, and prescribed fire technology into multiple-use planning, decision-making, and day-to-day activities to accomplish stated resource management objectives. Successful fire management depends on effective fire prevention, detection, and pre-suppression, having an adequate fire suppression capability, and consideration of fire ecology relationships.

Fire Prevention

All measures in fire management, forest management and forest utilization concerning the land users and the general public that may result in the prevention of outbreak of fires or the reduction of fire severity and spread.

Fuel

All combustible organic material in forests and other vegetation types, including agricultural systems, such as grass, branches and wood, which create heat during the combustion process.

Fuelbreak

Generally wide (20-300 metres) strips of land on which either less flammable native vegetation is maintained and integrated into fire management planning, or vegetation has been permanently modified so that fires burning into them can be more readily controlled (as distinguished from firebreak). Some fuelbreaks contain narrow firebreaks which may be roads or narrower hand-constructed lines. During fires, these firebreaks can quickly be widened either with hand tools or by firing out. Fuelbreaks have the advantages of preventing erosion, offering a safe place for firefighters to work, low maintenance, and a pleasing appearance.

Ground Fire

A fire burning in organic terrain, e.g. dried swamps and peat layers.

Prescribed Burning

Controlled application of fire to vegetation in either their natural or modified state, under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to attain planned resource management objectives.

Pre-Suppression Planning

Activities undertaken in advance of fire occurrence to help ensure more effective fire suppression; includes overall planning, recruitment and training of fire personnel, procurement and maintenance of fire fighting equipment and supplies, fuel treatment, and creating, maintaining, and improving a system of fuelbreaks, roads, water sources, and control lines.

Smoke Management

The application of knowledge of fire behaviour and meteorological processes to minimize air quality degradation during prescribed fires.

Surface Fire

Fire that burns only surface litter, other loose debris of the forest floor, and small vegetation.

Wildfire

(1) Any unplanned and uncontrolled wildland fire which regardless of ignition source may require suppression response, or other action according to agency policy. (2) Any free burning wildland fire unaffected by fire suppression measures which meets management objectives (see definition of wildland)

Wildland

Vegetated and non-vegetated land in which development is essentially non-existent, except for roads, railroads, power lines, and similar transportation facilities; structures, if any, are widely scattered. In fire management terminology this general term includes all burnable vegetation resources including managed forests and forest plantations.

Wildland Fire

Any fire occurring on wildland regardless of ignition sources, damages or benefits (see definition of wildland)

Wildland/Residential Interface

The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.