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INTERNATIONAL FOREST FIRE NEWS

**No. 31
July – December 2004**



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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 or 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.

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

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Due of the time lag between editing and print/distribution of IFFN, readers interested in meeting announcements are kindly requested to visit the meetings page of the GFMC for short-term announcement of meetings (continuously updated) on: <http://www.fire.uni-freiburg.de/course/meeting.htm>

EDITORIAL

The Global Wildland Fire Network and the FAO Ministerial Meeting on Forest: Towards an International Accord on Cooperation in Wildland Fire Management

By end of 2003 the Inter-Agency Task Force for Disaster Reduction of the UN International Strategy for Disaster Reduction (UN-ISDR) concluded that there is a need for coordinated international and UN-interagency action to reduce the negative consequences of forest fires and other vegetation fires (wildland fires) on the environment and humanity. Based on the outcomes of work of the Working Group on Wildland Fire, which was operational under the Task Force between 2001 and 2003, as well as the recommendations of the International Wildland Fire Summit (Sydney, Australia, 8 October 2003)¹, it was decided to create the Global Wildland Fire Network. This decision was made under the impression of an escalating occurrence and impacts of wildfires and fire application in land-use change in most vegetation zones. The increase of vulnerability of humans to the effects of wildfires, the secondary disasters triggered by extreme weather events on sites depleted of vegetation cover due to high-severity wildfires (e.g., landslides and floods), and the transboundary effects of wildland fire emissions on the atmosphere, human health and human security require a coordinated international response.

The ISDR Global Wildland Fire Network is operating through Regional Wildland Fire Networks in which cooperative efforts of countries at bilateral and multilateral levels are promoted. Cooperation in wildland fire management includes a variety of activities ranging from establishing and operating joint, standardized or coordinated systems for early warning and monitoring of wildland fire, capacity building, definition of common terminologies and standards, or sharing of fire suppression resources – to name a few examples of potential fields of cooperation.

The international dialogue between the Regional Wildland Fire Networks, the United Nations, other international organizations and civil society is facilitated by the Global Fire Monitoring Center (GFMC). The GFMC is also serving as coordinator and secretariat of the UN-ISDR Wildland Fire Advisory Group. That group is a follow-up arrangement of the former Working Group on Wildland Fire and is serving as an advisory body to the UN. The Regional Wildland Fire Networks are represented in the Advisory Group.

After the International Wildland Fire Summit a series of consultations were held in the regions where networks were active or in the phase of being established. Background and strategic recommendations coming out of these consultations are covered in detail in this special issue of IFFN. Altogether the wildland fire experts throughout the world confirmed the need of enhanced international cooperation in wildland fire management.

After the last consultation in Central Asia a meeting of the UN-ISDR Wildland Fire Advisory Group was held at the GFMC (3-4 December 2004). By evaluating the statements and declarations of the Regional Wildland Fire Networks the Advisory Group came up with a set of recommendations directed to the FAO Ministerial Meeting on Forest (March 2005), the Ministerial Segment of the United Nations Forum on Forest (UNFF) (May 2005) and the World Conference on Disaster Reduction (January 2005). For the implementation of a catalogue of priority actions the Wildland Fire Advisory Group and the Global Wildland Fire Network recommend the development of an international agreement on wildland fire management.

This special issue of ECE/FAO International Forest Fire News has been prepared specifically for the delegates participating at the ministerial meetings convened by FAO and UNFF. It is hoped that the inputs of a large number of national and international experts representing government agencies, civil society, academia and UN agencies and programmes will be considered by the ministers. What is needed is a pragmatic and efficient international programme that will make a difference, regardless of a more or less formal or binding character. The political support by a resolution of the UN General Assembly would be a first encouraging step to confirm and consolidate the ongoing process and spirit of cooperation.

Freiburg – Geneva, January 2005

Johann G. Goldammer

¹ IFFN No. 29 – a special issue covering the International Wildland Fire Summit

IFFN Special Issue

The Global Wildland Fire Network and the FAO Ministerial Meeting on Forest: Towards an International Accord on Cooperation in Wildland Fire Management

In accordance with the Framework for the Implementation of the International Strategy for Disaster Reduction (ISDR), the World Conservation Union (IUCN) and the Global Fire Monitoring Center (GFMC) suggested, in 2000, to create an interagency "Working Group on Wildland Fire" under the auspices of the ISDR Inter-Agency Task Force for Disaster Reduction (IATF). This proposal was in line with several declarations made in international conferences during the last five years and intended to bring together both the technical members of the fire community and the authorities concerned with policy and national practices in wildland fire management to realise their common interests of wildland fire disaster reduction at global scale. The IATF at its second meeting on 11 October 2000 agreed to establish the Working Group on Wildland Fire. Through the Working Group it was envisaged to create an interagency and inter-sectoral forum under the auspices of the UN. One of the priority fields of activity to be addressed by the Working Group on Wildland Fire was:

Establishment of a global network of regional- to national-level focal points for early warning of wildland fire, fire monitoring and impact assessment, aimed at enhancing existing global fire monitoring capabilities and facilitating the functioning of a global fire management working programme or network.

At the 2nd meeting of the Working Group on Wildland Fire (3-4 December 2001) it was decided to establish a "Global Wildland Fire Network". This network would consist of a set of Regional Wildland Fire Networks that would include existing formal or informal network structures and initiatives, be formed where such arrangements are not yet in place. The envisaged timeframe for setting up the network was January 2002 - July 2003. The 3rd Global Wildland Fire Conference and the International Wildland Fire Summit (Sydney, 3-6 and 8 October 2003) was used as a platform to convene representatives from several regional networks. The strategy agreed by the International Wildland Fire Summit that followed the 3rd Global Wildland Fire Conference included the following agreement:

"The Regional Wildland Fire Networks will be consolidated, developed and promoted through active networking in information sharing, capacity building, preparation of bilateral and multilateral agreements, etc. This process will be facilitated through regional Wildland Fire Conferences and Summits in cooperation with the International Liaison Committee and the UN-ISDR Working Group on Wildland Fire".²

In 2004 a series of consultations were held in the following regions:

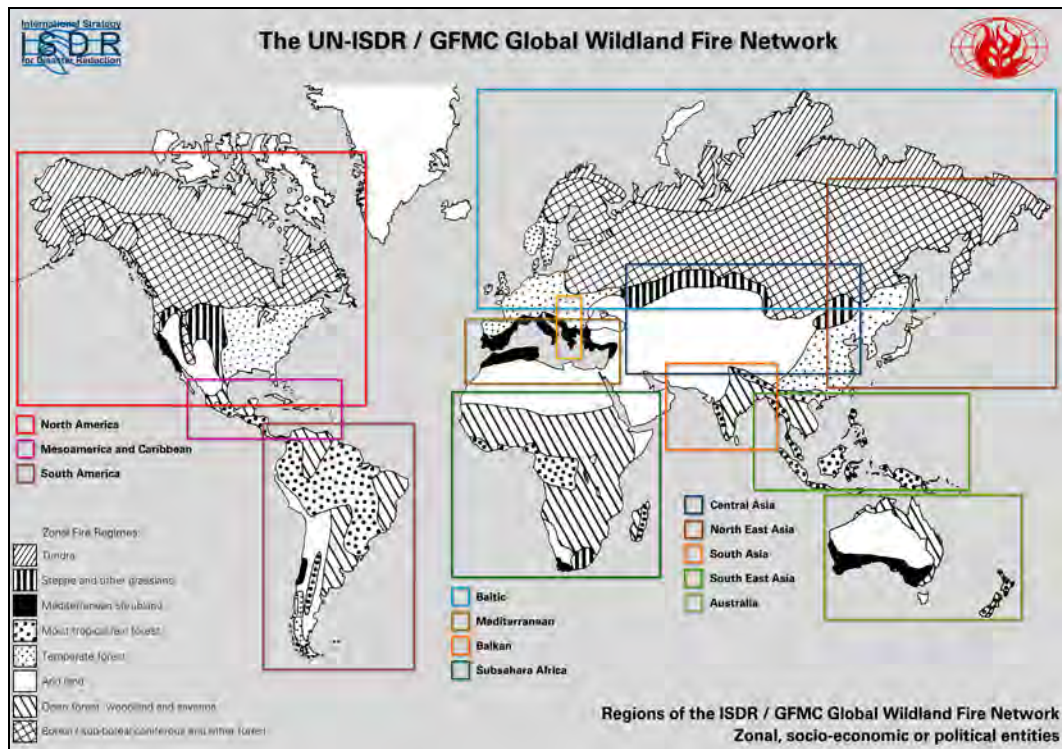
- Northeast Asia (Korea, March 2004)
- Eastern Mediterranean, Near East, Balkans, Central Asia (Turkey, April 2004)
- Baltic Region (Finland, May 2004)
- Sub-Sahara Africa (South Africa, June 2004)
- South America (Brazil, June 2004)
- Australasia (Australia, October 2004)
- North America (U.S.A, January 2004)
- Pan-American Region (Costa Rica, October 2004)
- South East Asia (Viet Nam, November 2004)
- Central Asia (Kyrgyzstan, November 2004)

These consultations had quite diverse organizational settings and objectives:

- Regional Wildland Fire Networks were formally initiated in some regions, e.g. in Northeast Asia or South America.

² For details of the preparation and outcomes of the International Wildland Fire Summit see:
<http://www.fire.uni-freiburg.de/summit-2003/introduction.htm>

- In other regions various initiatives were brought together aimed at creating or consolidating the efficiency of transnational cooperation in wildland fire management, e.g. at the Pan-American Wildland Fire Conference.
- Some networks are already operational in the field and conducting outreach programmes, e.g. the Regional Subsahara Africa Wildland Fire Network, which is offering training courses in advanced wildland fire management, introduction of the Incident Command System (ICS) and on Community-Based Fire Management (CBFiM).
- Other regional networks established prior to the creation of the Global Wildland Fire Network, e.g. the Fire Management Working Group of the FAO North American Forestry Commission and the Australian Fire Authorities Council (AFAC), formally joined the global network.



In December 2004 the first meeting of the WFAG was convened at the GFMC (Freiburg, Germany). The objectives included, among other:

- Evaluation of the regional consultations held in 2004 and the GFMC/ISDR/FAO "Framework for the Development of the International Wildland Fire Accord" (May 2004)
- Formulation of a recommendation of the WFAG / Global Wildland Fire Network for the Development of the International Wildland Fire Accord, directed to the FAO and UNFF Ministerial Meetings (March 2005 / May 2005), and the UN World Conference on Disaster Reduction (WCDR), Japan, January 2005
- Discussion on the participation of the Global Wildland Fire Network at the 4th International Wildland Fire Conference (Madrid, 2007)

This special issue of IFFN is prepared for the ministerial meetings at FAO and UNFF and provides background information and reports from the Regional Wildland Fire Networks and the Wildland Fire Advisory Group.³

The financial support by the German Foreign Office, Office for the Coordination of Humanitarian Assistance, and the International Liaison Committee (ILC) of the International Wildland Fire Conferences, financed by the U.S. Department of Agriculture, Forest Service, has significantly contributed to consolidate the dialogue within and the efficiency of the Global Wildland Fire Network.

³ Readers of IFFN are encouraged to visit the website of the Global Wildland Fire Network which is regularly updated with the latest news and developments in the regions and at international level:
<http://www.fire.uni-freiburg.de/GlobalNetworks/globalNet.html>



Regional Baltic Wildland Fire Network Meeting

Ministry of the Interior and Finnish Forest Research Institute, Helsinki, Finland, 10 May 2004

Rationale

In compliance with the objectives of the United Nations International Strategy for Disaster Reduction (UN-ISDR), the policy of the Food and Agriculture Organization (FAO), and the recommendations of the International Wildland Fire Summit (Sydney, Australia, 8 October 2003), aimed at reducing the negative impacts of wildland fires on humanity and the global environment and promotion of the application of methods of integrated and sustainable wildland fire management, a Regional Baltic Wildland Fire Meeting will be convened in Helsinki. The meeting will be held on 10 May 2004, in Helsinki, Finland.

The Meeting is organised by the Ministry of the Interior of Finland and the Finnish Forest Research Institute in collaboration with the United Nations (UN) through the ISDR Regional Baltic Wildland Fire Network, the FAO Forestry Department, the ECE/FAO/ILO Team of Specialists on Forest Fire and the Global Fire Monitoring Center (GFMC).



Overall Goal of the Meeting

The meeting aims to adopt the strategic recommendations of the Summit and encourage the countries bordering the Baltic Sea to develop agreements for cooperation in forest fire management. One of the driving reasons for organizing this meeting is the increased wildfire risk due to climate change resulting in weather extremes. At the same time urbanisation of the rural population has led to decreased skills among the public to manage fires. Consequently forest fire research, technology development and mutual cooperation in fire management must receive increasing attention.

Main Objectives

- To activate regional cooperation and mutual assistance in Forest Fire Management in the Baltic region

- To define and discuss the main problems and achievements in forest fire management in the Baltic countries
- To identify and discuss ongoing forest fire research activities and the interests to develop a regional research network in the Baltic region
- To support and enhance the networks, information sharing and research activity in forest fire management in the Baltic region

Opening Address by Mr. Pentti Partanen, Director General, Department for Rescue Services, Ministry of the Interior, Finland

Forest fires cause problems that many countries face every year. These fires have an impact on the destruction of vegetation, on atmospheric pollution and directly on human lives. I believe that all the countries have the common goal to reduce the number of uncontrolled fires and to mitigate the damage in case of a fire. However, we have to keep in mind that forest fires are also necessary for certain species and vegetation. This is especially the case in countries like Finland. This is also the reason why prescribed burnings are used more and more today. From the point of view of rescue services prescribed burnings are acceptable as long as they can be managed and controlled.

The forest fire system in Finland consists of three elements: prevention, early warning and extinguishing. In all these three elements educational, legislative and technical means are applied.

Over 60 % of the forest fires are caused by human action. In Finland arson is very rare but the people living in the cities do not realise the actual risk of a forest fire as well as in the past. Therefore it is clear that we have to focus on prevention of fires. Prevention is based on the forest fire warning system. The forest fire warning is issued when the fire index has reached a given threshold value. The index resembles the dryness of the terrain. A duty meteorologist at the Finnish Meteorological Institute makes the decision on forest fire warnings. This means that during a forest fire warning, certain regulations come into force such as prohibition to set an open fire in the forest or near the forest as enacted in the Rescue Act. Forest fire warnings are issued to the public on television and radio several times a day in weather forecasts. In Finland people in general respect the forest fire warning and act accordingly. So in forest fire prevention technical element is a forest fire index calculation and it is reinforced by legislation i.e. prohibition to set an open fire and by means of education we try to get people to understand what are the risks during a forest fire warning.

To get an early warning people are supposed to react when they see that something is wrong. In practice this means that they don't ignore the situation and that they also make the alarm to the number 112. In legislation this is also considered as an every man's obligation to inform the emergency response centre about accidents. This works very good in Finland and more than 90 percent of the alarms come from individual people. In fact the mobile phones have made this faster because people can make a call right away. This is reinforced by technical applications such as airborne surveys and satellite observation and alarm system in order to get as early warning as possible if people haven't detected fires before that. It should be mentioned that this satellite monitoring and alarm system is unique in the world and it detects fires in Finland, Sweden, Norway, Estonia, Latvia, Lithuania and western parts of Russia i.e. Karelia.

The third part of the system is a fast response. Risk assessment is based on law and the regional rescue services have to assess the risks, also the forest fire risk, and according the risk assessment they should have suitable manpower and equipment to handle forest fires. In Finland fast response is arranged by the 22 regional rescue services. This new system has been started in the beginning of this year and of course the fire stations and the responding units are scattered to the whole area according the risks. In Finland the forest fire suppression base on the use of ground units because in Finland forest fires are usually quite small and the units can get near the fires because of extensive timber road network and reasonable flat topography. Also the lakes function as natural restriction lines and help keeping the fires small. In addition to ground forces also aerial means such as helicopters and airplanes are used in large fires.

Forest fire system in Finland seems to be quite effective. When in the 1950's about 6 000 hectares was burned in a year in the 1990's only about 600 hectares was burned yearly. Our goal is to keep uncontrolled fires at the same level or smaller than in the 1990's also in the future.

However, the ministry of the interior has invested to forest fire research under the last few years and we have close cooperation with the Finnish Forest Research Institute and the universities. As I already mentioned in the beginning the reason is that prescribed burnings will be used more in the future and that the climate is slowly becoming warmer. Of course there is always a risk that prescribed burnings cannot be controlled and that is why we also need to educate people how to make prescribed burnings in a safe way. Special courses on prescribed burning methods have been arranged in the emergency services college under the last few years.

Finland has been quite active in the international level as far as forests and forest fire management is considered. When we are talking about UN a lot of Finnish know-how has been used especially in the developing countries in order to build forest fire management system e.g. Indonesia, Thailand, Nepal, Philippines, Tanzania, Zimbabwe, Namibia, Mozambique and Burkina Faso. Finland has also been active in the EU.

We are in a changing situation right now also in the Baltic region. Almost all the countries represented here are now members of EU. As we all know EU is strengthening its mechanism. In this respect it is crucial that EU and UN cooperate as good as possible so that we won't have overlapping arrangements. It is clear that in any case we need regional approach especially when we talk about mutual assistance. By that I mean that assistance is the more effective the closer and faster it comes.

On the behalf of the Ministry of the Interior I welcome you all to Helsinki. I hope that this seminar will be fruitful and I am looking forward the recommendations.

Helsinki Declaration on Cooperation in Wildland Fire Management in the Baltic Region

10 May 2004

The participants of the Regional Baltic Wildland Fire Meeting:

- Recalling the International Strategy for Disaster Reduction (ISDR) and its Wildland Fire Advisory Group in supporting to harmonize and strengthen efforts by the United Nations agencies and programmes, as well as other international organizations including non-government organizations, to reduce the negative impacts of wildland fires on the environment, and to support the application of prescribed fire for the benefit of ecosystem stability and sustainability;
- Endorsing the ISDR-FAO-GFMC Framework for the Development of the International Wildland Fire Accord of 5 May 2004, outlining the concerted international efforts towards international cooperation in wildland fire management;
- Endorsing the goal of the Food and Agriculture Organization (FAO) of the United Nations to promote and strengthen bilateral and multilateral agreements for cooperation in fire management,
- Recognizing and supporting the goals and joint endeavours of the UN Convention on Biological Diversity (CBD), the Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), the UN Forum of Forests (UNFF) and the Ramsar Convention on Wetlands, to protect the global vegetation resources and the global atmosphere from negative influences by vegetation fires, as well as the promotion of knowledge and techniques to utilize the beneficial role of fire in ecosystem management,
- Recognizing and supporting the recommendations of the ECE/FAO Team of Specialists on Forest Fires and the recommendations of BALTEX FIRE 2000 (Baltic Exercise for Fire Information and Resources Exchange), concerning international cooperation in wildland fire management between the countries bordering the Baltic Sea;

- Endorsing the recommendations of the International Wildland Fire Summit (Sydney – 2003) concerning common international standards for fire management and the strategy for strengthening international cooperation in wildland fire management,
- Supporting the objectives of the ISDR Global Wildland Fire Network and its Secretariat, the Global Fire Monitoring Center (GFMC), to systematically enhance the intra- and inter-regional cooperation in wildland fire management throughout the world,
- Referring to the objectives of the Forests Sector of the Agenda 21 for the Baltic Sea Region
- Referring to the Helsinki Convention Article 15 concerning nature conservation and biodiversity of the coastal ecosystems
- Encouraging the EU to develop protocols and agreement for mutual assistance in wildland fire disaster management
- Encouraging the EU, UN-OCHA, NATO / EADRRC and GFMC to agree on procedures for coordination in international response to (wildland fire) disasters
- Welcoming the availability of the Ministry of the Interior of Finland -- the host institution of this meeting -- and the delegates of participating nations of the Baltic Region to actively cooperate to share experience and resources in wildland fire management
- Concluding from the national case studies and analyses on the wildland fire situation in the participating countries, as well as from the discussions held at the conference, that the majority of countries in the region are available to establish and strengthen a regional dialogue on cooperation in wildland fire research and management
- Expressing the intent to jointly overcome the currently existing gaps, deficits and problems related to
 - The high number of emerging new private small forest owners in Baltic States that have problems to conduct the necessary measures in forest fire management
 - Depopulation and abandonment of country sites, with consequences on changes in vegetation composition, succession, fuel loads, resulting in an increased wildfire hazard
 - Large-scale establishment of exotic tree plantations such as *Pinus contorta* that represent a high wildfire risk for the future
 - Uncontrolled use of agricultural fires that are a major cause of wildfires in forests and other wildlands
 - Lack of local awareness and knowledge of principles in fire ecology and fire management
 - Prescribed burning policies have difficult acceptance by the public and authorities in some countries
 - Lack of finances for fire management systems in some countries
 - Lack of a fire reporting system that allows to distinguish the economic and ecological consequences of fire, i.e. between the various degrees of damages or benefits caused by fire
 - Training for wildland / forest fire management / suppression inadequate in most countries of the region, especially concerning the ability to respond to large and long-lasting fire situations
 - Lack of adequate fire suppression equipment and protecting clothing in most countries
 - Need of further development of fire danger rating systems
 - Aerial assets not necessarily available due to competing demands

Recommend the following Helsinki Plan of Action for Cooperation in Wildland Fire Management in the Baltic Region

(1) The countries participating at the conference encourage governments to develop or strengthen, and international organizations to support

- Bilateral and multilateral agreements on cooperation in wildland fire management, based on international standards as proposed by the FAO and the International Wildland Fire Summit
- Investigate the introduction of the Incident Command System (ICS) as the international standard for all wildland incident management participating in international or interagency agreements and exchanges.
- Cooperative regional wildland fire research projects and programmes
- Decision-support systems for large fire situations
- Training / capacity building in wildland fire management
- Community involvement in fire management

(2) To regularly conduct follow-up activities aimed at further promoting collaborative efforts and procedures

- Bilateral and multilateral wildland fire emergency exercises, like those to be conducted between Estonia and Latvia in June 2004, or the NATO PfP exercise RM-04 in Latvia, Lithuania and Estonia in 2004
- Exchange visits and programmes to share lessons learned and solving problems
- Updating online (Internet) access to information related to regional wildland fire management issues
- Regional Baltic Wildland Fire meetings should be organized every 2 to 3 years. The next Baltic meeting shall be organized in 2006.

(3) To investigate the necessity to develop arrangements to support collection and dissemination of wildland fire information, facilitation of regular regional dialogue and joint projects between the countries, and to technically support countries in need of aerial assets for wildland fire suppression by the creation of

- Special regional mobile airborne fire response units, based on Public-Private Partnership arrangements

(4) To inform national governments about the need to prepare statements in favour of enhancing international cooperation in wildland fire management at the following forums:

- The World Conference on Disaster Reduction (WCDR) (Kobe-Hyogo, Japan, January 2005)
- The FAO high-level meeting at COFO 2005, devoted to wildland fire management and international cooperation (Rome, Italy, March 2005)

Delegates of the following countries and international organizations participated at the meeting:

- Estonia
- Finland
- Germany
- Latvia
- Lithuania
- Sweden
- United Kingdom
- Russian Federation

- Food and Agriculture Organization (FAO)
- ECE/FAO Team of Specialists on Forest Fire
- UN International Strategy for Disaster Reduction (UN- ISDR), Wildland Fire Advisory Group and Global Wildland Fire Network
- Global Fire Monitoring Center (GFMC)
- International Technical Committee on the Prevention and Extinction of Fire (CTIF), Forest Fire Commission

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Follow-Up of the Baltic Conference



Her Majesty's Fire Service Inspectorate for Scotland

Report from the Wildfire Conference held in Aberdeen, 5 October 2004

At the request of Her Majesty's Fire Service Inspectorate for Scotland, and in response to the events of the summer fire season of 2003, a conference was conducted on 5 October 2004 in Aberdeen. The conference was financially supported by the Scottish Executive, and attracted delegates from across the fire sector in the UK and also from the land management community. The conference aimed to:

- Discuss the immediate challenges facing land management and fire agencies, and
- The provide a basis for the establishment of a strategic level group to give focus to wildfire⁴ at a national level

The speakers for the event were drawn from both the fire and land management communities, and the presence of internationally recognised experts added considerable value to the discussions.

In opening the conference, the convener of Grampian Fire Board, Councillor Karen Freel, welcomed the delegates, exhibitors and speakers to Aberdeen, and spoke of the seasonal and high activity levels that Grampian Fire and Rescue Service had dealt with in 2003 due to wildfires. Councillor Freel then indicated the pressures placed upon a semi-rural fire authority in attending these incidents and, at the same time, trying to maintain readiness for "normal" fire service activities.

Her Majesty's Chief Inspector of Fire Services for Scotland, Jeff Ord, gave the opening address, and spoke with passion about the potential for an increase in these types of incidents. He highlighted the possible effects of climactic changes, referring to the predictions of shorter, hotter summers and wetter winters leading to ideal conditions being created for this type of incident. In establishing the potential scale of the future problem, this opening address identified the scale of the problem, and stressed the need to establish partnerships in order to develop cohesive strategies for the future.

Leading into the input from the second speaker of the day, Mr. Ord indicated that membership of international groups such as the CTIF forest fires commission and the UNECE/FAO⁵ and the global wildland fire network⁶ had already allowed Scotland to become influential in the international arena in this policy area.

The next speaker was Mark Jones, of Grampian Fire and Rescue Service, who had recently represented the Scottish Executive at both of the international committees referred to by Mr. Ord. Mr. Jones spoke of his recently completed international research project on the subject of public sector policy development, which had used the issue of wildfire as the focus. He made a number of important points whilst "setting the scene" for the conference, arguing that forestry/grass fires might have to be given a higher priority in future risk planning, indicating that they too constituted "property" in the broadest sense. He gave some practical examples of the effects that small wildfires can have on a comparatively small country, with a fragile transportation infrastructure, using the example of a 50-metre grass fire closing a main train link for over two hours. He referred to a research report published by the Scottish Executive in 2003⁷, which, although conducted for the purposes of considering flooding scenarios, also provided models that indicated drier and hotter springs and summers.

⁴ For the purposes of this article, the term wildfire intends to refer to any uncontrolled fire that occurs in the natural environment and includes fires in trees, grass, bushes, and fires on moorland and in crops.

⁵ The United Nations Economic Commission for Europe/ Food and Agriculture Organisation

⁶ The Global Wildland Fire Network is convened under the banner of the International Strategy for Disaster Reduction

⁷ Price, D., McKenna, J. (2003) Climate change: review of levels of protection offered by flood prevention schemes ukcip02 update. Final Report, Bابتie Group

<http://www.scotland.gov.uk/library5/environment/ccrlp-00.asp>

This presentation highlighted the current position within the UK focussing particularly on the topic of public expectation, and highlighted the international situation in terms of the potential effects on public health and the global environment.

The main strategic influences identified by the research included:

- The influences that affected public sector policy development, particularly the influence of “stable door” reactions.
- The attitudes of society towards the use of fire as a land management tool (and the apparent reluctance of society to accept this),
- The influence of demographic effects upon wildfire attitudes,
- The likely effects of climate change in terms of frequency and severity of fires, and
- Those economic factors that impinge upon policy development in this field.

Within his proposals, he outlined the need for further research and data capture to enable informed discussions and intelligence based decision-making. Debate at strategic level, enabling a national focus on the issue to be established along with partnering at a local level in order that all stakeholders to understand the requirements of others.

Michael Bruce from Glen Tanar Estate, Aberdeenshire followed with a thought provoking presentation that used examples from a lengthy involvement in wildfire issues in the UK. He highlighted that spring, when fuels are normally dead, can often be the period of greatest risk. Mr. Bruce showed how some of the current land-use policies and economic forces were leading to reduced levels of grazing and consequent accumulation of fuels, especially in the uplands.

He indicated that high fuel loads lead to higher rates of spread and higher fire intensities, which in the wildfire context creates fires that are more difficult, dangerous and expensive to extinguish. There were said to be a great variety of causes of wildfires, an example of the four major wildfires that happened on Easter weekend was given, where none of the fires were started by muirburn.

He showed how dynamic risk assessment related the fire behaviour to the types of fire suppression tools; tactics and strategies could be applied. He also highlighted the benefits of collaborative working between the fire services and land managers. The role of rural fire partnerships, that brought together fire services, other agencies and the land management sector, for the purposes of sharing resources, skills and experience, was described. These groups create a framework that allow specialist equipment and skills, available in the land management sector, to be shared with neighbours, or utilised through some form of mutual aid scheme with landowners supporting the fire service.

The first international speaker of the day was Dr Johann G. Goldammer, of the Global Fire Monitoring Center (GFMC) in Freiburg, Germany. He outlined the global organisations and groups that exist for wildland fires, and gave a view that, as the intensity of land management diminishes in forthcoming years, the result will be more frequent and intense wildfires in the future. In describing the different organisations that were working to combat and prepare for wildfire, and in showing the truly global nature of the effects of large and frequent wildfires, he reminded the audience of the fact that single nations in isolation were unlikely to be capable of effectively tackling the range of problems that were apparent.

Dr Goldammer gave an account of the work undertaken by the GFMC and gave some examples, demonstrating very graphically the extent of, and effects of, a number of fires in various parts of the world, including the UK in 2003. He offered the benefits of graphical imaging and statistical analysis, and the images that can be provided by the GFMC were also shown as being useful in determining the extent of fire spread when trying to determine the damage caused.

It became clear to the audience that the speaker's involvement across the globe highlighted the global nature of the problems and reminded all present that any national strategy would be best integrated with international partnerships and agencies already influential in this field.

The second international speaker of the day was Chief Fire Officer Trond Rane, of the Sarpsborg Fire Service, Norway. He gave a detailed account of the work and activities of the CTIF⁸, and then gave an account of the Forest Fires Commission, of which he is currently chairperson. The Forest Fires Commission was first established in 1986 and recently re-launched with fresh impetus. Its aim is firstly to establish the organisation, structure, training and equipment of the operational firefighting forces in each country, and then to consider proposals to seek to identify the possibilities of sharing of experience, knowledge and firefighting forces.

He described several initiatives that had started and then stalled, giving weight to the arguments made by a previous speaker on policy development and the need to “capture the moment”. The importance of Wildfire as an international problem was reinforced by this presentation, and whereas Dr Goldammer had explained the global community of interest, CFO Rane showed that the CTIF is very much a fire service-focussed organisation. The CTIF was said to be of the view that the best method of achieving its aims is international collaboration.

In discussing the problems and practical difficulties encountered in fighting wildfires, Jim Fraser, a commander from Lothian and Borders Fire Brigade in Scotland gave a thought provoking practitioners view of wildland fires, specifically highlighting the fact that access by the public to rural areas has greatly increased and will probably increase in future as more and more people undertake leisure pursuits in the countryside. Mr. Fraser’s talk gave audience members, who were not from the “fire” sector, an overview of the Command and Control and operational considerations that encompass Fire Service operations at Wildfire incidents. He included: Dynamic Risk assessment, Personal protection, environmental issues, the use of air support and Joint partnership working. He spoke of the operational risks, difficulties and challenges when dealing with wildfires. In order to fully address the range of challenges arising from woodland fires, he suggested that there was a need to establish a national strategy based upon greater interagency cooperation and training. He also highlighted the need for integration of pre-planning information, investment in appropriate equipment and PPE and the use of Integrated Risk Management Planning to set a strategic direction that balanced prevention with intervention.

During the lunch break, delegates were able to view and participate in an exhibition of equipment and protective clothing from a range of manufacturers and suppliers.

After lunch, the conference heard from Trevor Johnson of Highland and Islands Fire Brigade, who gave a very comprehensive account of the advantages and challenges faced in establishing and maintaining effective fire partnerships between the fire service and the land management community. Trevor alluded to the potential financial effects of wildfire incidents in Scotland, giving an estimate of loss of around £10m per annum within his own fire authority area, and asked the question – If this loss was sustained to property in the traditional sense, would there be a more visible response?

Trevor explained that their partnerships had been established using the “Grampian” model, and that they facilitated a great deal of pre-planning by ensuring that information is available on land owners, contact details are held within the Command and Control centre, and financial authority for the use of helicopters is generally approved prior to an incident occurring. It was felt that these working arrangements could be demonstrated as best practice and, as such, provide the basis for other brigades to develop a partnership approach.

The next speaker was David Dalziel, Deputy Firemaster of Grampian Fire and Rescue. He spoke of the influence of the Local Government (Scotland) Act 2003, indicating that the desire for community planning could be met in some circumstances by engagement with muirburning landowners, with the possibility that some form of partnership could be created between fire authorities and landowners.

The importance of wildfire in relation to Integrated Risk Management Planning (IRMP) was highlighted and the collaborative and partnership issues were shown to align well with an IRMP approach. Placing particular emphasis on implications for wildfire response levels, prioritisation of call types, and risks to fire crews, he argued that the use of data, historical information and mapping would ensure an evidential, risk-based approach would be taken, allowing full analysis of all risks. These were said to include risk to the environment, but also other risks such the risk to life, which has

⁸ CTIF - International Technical Committee for the Prevention and Extinction of Fire

not generally been associated with wildfire in the UK. The increasing amenity use of woodland, and increased access by the public was also highlighted as significant in risk planning. In highlighting the need for reliable data, the requirement for accurate fire statistics was clear.

Alistair Laing, of PDG Helicopters spoke next and, whilst strongly promoting the use of helicopters for wildfire incidents, he gave a good account of those operators' perspectives that were said to be not usually foremost in the minds of fire agencies.

In discussing the issue of hired helicopters, he made an argument for linkage between prediction of peak fire conditions and possible helicopter standby arrangements. It seemed that no one present doubted the effectiveness of helicopter airborne firefighting, but the (often contentious) issue of helicopter availability was also fully explained to the audience, and the explanation given that contractual and commercial work had to take priority. The alignment with the commercial plans of those clients usually required a high degree of logistical co-ordination, providing considerable challenge to the unforeseen demand by fire agencies.

Ian Moses, the Personal Protection Manager of Grampian Fire and Rescue gave an informative account of the challenges faced in giving a suitable clothing protection to crews engaged in rural firefighting. He identified the reluctance to invest in alternative protective clothing for what may be a seasonal and intermittent event. Ian suggested that it is no longer acceptable to place firefighters into situations without appropriate protection and stated that, given their high thermal barrier status, full structural firefighting garments could not be considered appropriate for wildfire circumstances. He spoke of the approach adopted by his own organisation, in which crews identified as likely to be involved in wildfire fighting had been provided with specifically designed suits for the purpose.

The conference then heard again from Jeff Ord, who summed up many of the points made by the speakers and brought the focus to 3 main points:

- The proposal to form the national working group.
- The need for a national wildfire strategy
- The need to maintain the UK's engagement with international activities and committees.

Issues such as the membership, scope, structure and working life of the group were fully aired and views sought in the form of written feedback from delegates and speakers.

The conference was well presented by Peter Murray of Grampian Fire and Rescue Service, and in response to the kind offer made by Grampian Fire Board to host the strategic group's inaugural meeting, the first was held in Aberdeen on 8 December 2004.

Most speakers presentations are available from Grampian Fire and Rescue Service's website. Details of the work of the group will be published on HMFSI Scotland website.

Websites for further information:

GFMC	http://www.fire.uni-freiburg.de/
CTIF	http://www.ctif.org/
GFRS	www.grampianfirebrigade.co.uk/
HMFSI	http://www.scotland.gov.uk/Topics/Justice/Fire/15130/1018

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JOINT FAO/ECE/ILO COMMITTEE ON FOREST TECHNOLOGY, MANAGEMENT AND TRAINING

Conference on Forest Fire Management and International Cooperation in Fire Emergencies in the Eastern Mediterranean, Balkans and adjoining Regions of the Near East and Central Asia
Antalya, Turkey, 30 March - 3 April 2004

Introduction

The Eastern Mediterranean Region, including the Balkan countries, the ECE member states of the Near East and Central Asia, and other neighbouring countries of Central Asia, e.g. Mongolia and China, have recently suffered major forest and other wildland fire problems. The causes of an increasing occurrence of wildfires in forests and other wildlands, including the underlying reasons for increasing human-caused fires, vary within the region and are due to:

- transition from centrally planned to market economies
- national to regional conflicts, creation of new nations
- increasing population growth and land-use pressure
- regional climate change towards increase of extreme droughts

It has been recognized that no regional activity is underway to establish cooperation in wildland fire management, including wildland fire science.

Several reasons support the idea for holding a regional conference. First, the Balkan countries, some of them being in a post-war situation and under reconstruction, as well as the South Eastern European countries which are still in economic and political transition, have not participated in recent activities of the ECE/FAO Fire Team and other international wildland fire research and development projects. Second, the neighbouring countries of Turkey, such as the Caucasus states, Iran, Turkmenistan, Uzbekistan, and Kazakhstan, have been quite isolated from recent scientific and technological developments in fire management. Third, the fire problems in Mongolia and northern China, and to a limited extent in Afghanistan, are calling for cooperation with the ECE region.

From the point of view of the ECE/FAO/ILO Team Specialists on Forest Fire and the Global Fire Monitoring Center (GFMC), which coordinates the work of the team in the ECE region and liaises with the Global Wildland Fire Network, the countries listed above deserve full attention and support to bring them into the family of the international community of forest fire scientists, managers and policy makers.

With reference to the objectives of the Global Wildland Fire Network (facilitated by the GFMC) and the recommendations of the International Wildland Fire Summit (Sydney, Australia, 8 October 2003) the Antalya conference also served as a follow-up of the Summit and provided an opportunity for a joint regional meeting for the Regional Wildland Fire Networks of the Mediterranean, Balkans and Central Asia.

Turkey's experience on fire management and its strategically important geographical situation, presenting similar problems to other Mediterranean countries, was very suitable for bringing together the fire science and management community of the region. This is why the ECE/FAO/ILO Team Specialists on Forest Fire welcomed the generous hospitality of Turkey to host the conference.

Objectives of the Conference

The objectives of the conference included:

- Provide a forum in the Eastern Mediterranean, Balkan and adjoining Regions of the Near East and Central Asia;

- Prepare mechanisms for information and resources exchange in forest and other wildland fire management within the region, including the establishment of partnerships for joint activities in fire research, training and policy development, and
- Prepare proposals to governments and international organizations of the region to establish mechanisms for sharing resources in large fire emergencies in accordance with existing international procedures.

The countries discussed the application of the recommendations of the FAO and the International Wildland Fire Summit to use the recommended "Template for International Wildland Fire Management Cooperation Agreements" for developing bilateral agreements for mutual assistance in wildland fire emergency situations. In this context the "Incident Command System" (ICS) was presented as a possible standard for a common global incident management system that will enable any assistance to quickly function in an effective manner.

The conference objectives were in line with the scope of work and recommendations of various international organizations including:

- the ECE/FAO/ILO Team of Specialists on Forest Fire;
- the Interagency Task Force for Disaster Reduction of the United Nations Strategy for Disaster Reduction (ISDR) and its Wildland Fire Advisory Group;
- the FAO, in accordance with the recommendations of the fire expert consultations on "Public Policies affecting Forest Fires" (1998) and "International Cooperation in Fire Management" (2001);
- the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA) and its joint UNEP Environment Unit, Environmental Emergencies Services;
- the European Commission;
- the European Council in the frame of the European Open Partial Agreement (EUR-OPA);
- the World Health Organization (WHO) and the World Meteorological Organization (WMO).

The Conference was held from 30 March - 3 April 2004 in Antalya, Turkey⁹ and organized under the auspices of the Joint FAO/ECE/ILO Team of Specialists on Forest Fire and in co-operation with the Turkish Government. Mr. Husein Hacıoglu, Assistant Director General of Forestry of Turkey, General Directorate of Forestry (Beştepe, Ankara), served as chair the Conference Organizing Committee. The Organizing Committee was assisted by a Scientific Advisory Board.



⁹ This conference had been scheduled originally for 15 to 19 April 2003. Due to the war in Iraq it had been decided to postpone the conference to early 2004.

Extracts from the Opening Address on behalf of the ECE / FAO / ILO Team of Specialists on Forest Fire and the Wildland Fire Advisory Group, United Nations International Strategy for Disaster Reduction (UN-ISDR) by Johann G. Goldammer, Global Fire Monitoring Center

Why do we need wildland fire management networks at regional and global levels?

Resources of government services and the private sector to cope with the increasing fire problems in the region are limited. This calls for better cooperation and sharing of resources between neighbouring countries. The development and operational use of wildland fire early warning and monitoring systems can often be shared between nations. This also refers to research and training.

Cooperation is also needed between agencies involved in the protection and sustainable management of vegetation resources and international organizations to provide the data that are required for assessing regional to global impacts of wildland fires and to develop informed policy at international level. The United Nations have shown an increased interest in the wildland fire arena. The United Nations International Strategy for Disaster Reduction is offering an international, inter-sectoral and inter-agency platform to harmonize and strengthen cooperative efforts to reduce the negative influences of wildland fires to humanity and the global environment. One of the key activities that have been promoted by the Inter-Agency Task Force for Disaster Reduction was to initiate the establishment of the Global Wildland Fire Network in 2002-2003. This global network consists of Regional Wildland Fire Networks in which nations belonging to a region with common fire problems would work together to share expertise and resources. At international level an inter-regional dialogue is facilitated within the Global Wildland Fire Network through its secretariat at the Global Fire Monitoring Center. This concept has received full support and endorsement by the International Wildland Fire Summit held in 2003.

During this conference experts from the region and other parts of the world as well as representatives of the United Nations will discuss basic issues on wildland fire research, fire management, new technologies and cooperation. This conference is offering the opportunity to discuss the objectives and agenda of regional networks within the Global Wildland Fire Network.

On behalf of the United Nations International Strategy for Disaster Reduction and the Global Fire Monitoring Center I would like to congratulate and thank the government of Turkey and the General Directorate of Forestry for taking the lead to bring the regional actors together. I would also like to thank all the delegates attending this conference to contribute to this important meeting.

Ladies and gentlemen, with these words, I wish you every success in your deliberations. Thank you.

**Antalya Declaration on
Cooperation in Wildland Fire Management in the Balkans, Eastern Mediterranean,
Near East and Central Asia**
Antalya, Turkey, 1 April 2004

The Conference:

- Recalling the rationale and recommendations of the World Summit for Sustainable Development (Johannesburg – 2002) concerning the international endeavours to secure sustainable development of the global vegetation resources,
- Expressing concerns about the increasing occurrence and destructiveness of forest fires in the regions between the Balkans, Eastern Mediterranean, Near East and Central Asia,
- Recognizing that the reasons for this development are due to increasing population pressure in many countries, increasing socio-economic problems of rural populations, increasing vulnerability of humans and the occurrence of extreme fire seasons that can possibly be explained by climate change,
- Recognizing the endeavours of the United Nations Economic Commission for Europe (UN-ECE) to address the fire problems in the Northern Hemisphere, notably through the work of the UN-ECE/FAO Team of Specialists on Forest Fire since 1993,
- Endorsing the endeavours of the International Strategy for Disaster Reduction (ISDR) and its Wildland Fire Advisory Group in supporting to harmonize and strengthen efforts by the United Nations agencies and programmes, as well as other international organizations including non-government organizations, to reduce the negative impacts of wildland fires on the environment,
- Endorsing the goal of the Food and Agriculture Organization (FAO) of the United Nations to promote and strengthen bilateral and multilateral agreements for cooperation in fire management,
- Recognizing and supporting the goals and joint endeavours of the UN Convention on Biological Diversity (CBD), the Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), the UN Forum of Forests (UNFF) and the Ramsar Convention on Wetlands, to protect the global vegetation resources and the global atmosphere from negative influences by vegetation fires, as well as the promotion of knowledge and techniques to utilize the beneficial role of fire in ecosystem management,
- Endorsing the recommendations of the International Wildland Fire Summit (Sydney – 2003) concerning common international standards for fire management and the strategy for strengthening international cooperation in wildland fire management,
- Supporting the objectives of the ISDR Global Wildland Fire Network and its Secretariat, the Global Fire Monitoring Center (GFMC), to systematically enhance the intra- and inter-regional cooperation in wildland fire management throughout the world,
- Welcoming the availability of the government of Turkey -- the host country of this conference -- and the delegates of participating nations to actively cooperate to share experience and resources in wildland fire management
- Concluding from the national case studies and analyses on the wildland fire situation in the participating countries, as well as from the discussions held at the conference, that the majority of countries in the region are available to establish and strengthen a regional dialogue on cooperation in wildland fire research and management
- Expressing the intent to jointly overcome the currently existing gaps and deficits in
 - Early warning systems of wildland fire
 - Spaceborne fire monitoring systems
 - Decision-support systems for fire management
 - Wildland fire research
 - Training / capacity building in wildland fire management
 - Transnational agreements and operations for bilateral and multilateral assistance in wildland fire emergency situations

Recommends the following Antalya Plan of Action for the region between the Balkans, Eastern Mediterranean, Near East, Western and Central Asia:

(1) The countries participating at the conference encourage governments to develop or strengthen, and international organizations to support

- Bilateral and multilateral agreements on cooperation in wildland fire management, based on international standards as proposed by the FAO and the International Wildland fire Summit
- Introduce the Incident Command System (ICS) as the international standard for all wildland incident management participating in international or interagency agreements and exchanges.
- Regional systems for early warning and satellite monitoring of wildland fires
- Cooperative regional wildland fire research projects and programmes
- Decision-support systems
- Training / capacity building in wildland fire management

(2) To regularly conduct follow-up activities aimed at further promoting collaborative efforts and procedures

- Multilateral wildland fire emergency exercises, starting with the multinational exercise EASTEX FIRE 2004 in Bulgaria and the tri-national exercise in Croatia in 2004
- Regional workshops aimed at further defining priority issues to be jointly addressed, especially considering the needs of collaboration with countries of the region that were not represented at the conference

(3) To develop arrangements to support collection and dissemination of wildland fire information, facilitation of regular regional dialogue and joint projects between the countries, and to technically support countries in need of aerial assets for wildland fire suppression by the creation of

- A Regional Fire Monitoring Center, hosted by the Government of Bulgaria
- A Regional Advisory Board of Senior Fire Officers, hosted and facilitated by the Government of Turkey in Antalya
- Special regional mobile airborne fire response units, based on Public-Private Partnership arrangements, e.g., those companies participating at the conference (Russian Irkut Corporation [fixed-wing aircraft – BE-200] and UT Air [helicopter assets])

(4) To inform national governments about the need to prepare statements in favour of enhancing international cooperation in wildland fire management at the following forums:

- The forthcoming Meeting of the three Rio Conventions (UN CBD, UN CCD, UN FCCC) (Viterbo, Italy, April 2004)
- The forthcoming 16th Session of the FAO Near East Forestry Commission, with regard to establishing networking structures in Western Asia (May 2004)
- The World Conference on Disaster Reduction (WCDR) (Kobe-Hyogo, Japan, January 2005)
- The FAO Ministerial-Level Meeting, devoted to wildland fire management and international cooperation (Rome, Italy, March 2005)

Participating Countries: Bulgaria, Croatia, Cyprus, Germany, Greece, Hungary, Israel, Italy, Kazakhstan, Macedonia, Poland, Russian Federation, Turkey, Ukraine.

International Organizations: ECE, FAO, ISDR Global Wildland Fire Network

On the following page a short report on the wildland fire emergency in Syria, October 2004, is given. The news report and the photographs taken give evidence of Turkey's assistance to Syria – a consequence of the Antalya Declaration and the spirit devoted to improve transboundary cooperation in wildland fire management in the Eastern Mediterranean Region.

The report is followed by the recommendations Workshop on Multilateral Assistance Against Forest Fires in The Mediterranean Basin (Zaragoza, Spain, 10-11 June 2003). This workshop provided the ground for cooperation in fighting the extreme wildfires in Portugal in August 2003 using resources of neighbour countries.

The Forest Fire Emergency in Syria in October 2004

An example for Transnational Cooperation addressing Wildland Fire Emergencies

Press Report: One dead, 22 injured in Syrian forest fires near Turkish border

DAMASCUS, 27 October 2004 (AFP) - At least one person was killed and 22 injured as fierce forest fires swept through a region of northwest Syria near the Turkish border, the state news agency SANA reported Wednesday. It said the fires which broke out late Tuesday north of the Mediterranean port city of Latakia raged on throughout the night but had later been brought under control in certain areas. An elderly man was killed when his home was burnt down in Ras al-Basit, a coastal resort some 400 kilometres (250 miles) northwest of the Syrian capital, said SANA. Twenty-two other people, among them four firefighters, were hospitalised in nearby towns. "Fifteen fires ravaged more than 2,000 hectares (4,900 acres) of forest and orchards," and several homes were destroyed, it said. Residents contacted by telephone said firefighters were still battling the flames Wednesday afternoon in the pine forests of Latakia province. Ras al-Basit and the Kassab mountains were the worst hit. "Drought and unseasonal high temperatures contributed" to the fire, said Syria's local administration and environment minister, Hilal Atrash, quoted by SANA. State radio, meanwhile, said the actual trigger was not yet known but the fires would be brought under control within hours. According to SANA, firefighters from five northern provinces were mobilised to combat the blazes, which were driven by a fierce northerly wind. Turkey said it gave a helping hand to combat the fires, in a new sign of rapprochement between the two former foes. Acting on a request from Syrian authorities, the Turkish army dispatched three C-130 planes and the forestry ministry sent two helicopters to help douse the blaze, the premier's office in Ankara said. Officials in the Turkish border city of Hatay, meanwhile, sent three fire engines, it said. Turkey and Syria have significantly improved ties since 1998 when they nearly went to war over Ankara's accusations that Damascus was backing Kurdish separatist rebels fighting the Ankara government.

Source: <http://www.turkishpress.com/news.asp?id=31984>



The GFMC supplied the Joint UNEP/OCHA Environment Unit, FAO, Syrian, Turkish and Israeli authorities with near-real time information on the wildfire emergency. The UNEP/OCHA National Focal Point in Syria, Mr. Erfan Ali (Director of Systems & Plans, Ministry of Local Administration & Environment) transmitted photos like these to the GFMC, which put them on the daily updated web page covering the situation, e.g.: http://www.fire.uni-freiburg.de/GFMCnew/2004/1028/20041028_syria.htm



MINISTERIO DE MEDIO AMBIENTE, SUBDIRECCIÓN GENERAL DE MONTES
 Área de Defensa contra Incendios Forestales
 In coordination with the CIHEAM and the Committee FAO / *Silva Mediterranea*

Workshop on Multilateral Assistance Against Forest Fires in the Mediterranean Basin

Zaragoza, Spain, 10-11 June 2003

Workshop recommendations for future activities

The participants of the Workshop agreed on the need to improve the technical tools and procedures available presently in the countries of the Mediterranean Basin (MB) to facilitate operations of Bilateral and Multilateral Assistance against forest fires.

This objective is attainable by promoting the following activities:

1. To complete the FAO inventory of existing bilateral agreements including others identified in this Workshop, and by the Committee FAO/Silva Mediterranea.
2. To prepare a request to the Joint Research Center (JRC) of the European Commission the diffusion of the MB forest fire risk maps, prepared daily, to the non-EU countries in the Region.
3. To study the possibilities for the implementation of a Forest Fire Data-Base (FFDB) in the MB, including information on resources available for Multilateral Assistance.
 The Workshop recommended to connect this FFDB to the FAO web on Forestry, to the European Forest Fire Information System (EFFIS) and to the Global Fire Monitoring Center (GFMC).
4. To connect the Web pages of the GFMC/UNEP-OCHA on Fire Emergencies and the FAO Fire Alert Web page with the Web Page of the Response Centre of the European Union to facilitate operations inside the Global Wildland Fire Network in case of serious emergencies.
5. To study in the EU Forest Fires Experts Group a draft for future agreements on:
 - bilateral assistance in border areas, facilitating dispatch and cooperation between local resources
 - multilateral assistance at long distances
6. To organize a Course/Seminar on Coordination of Plans for Joint Operations, like a previous activity for the development of a General Agreement on Multilateral Assistance.
 The non-EU countries in the MB would be invited to participate.
 This Seminar was recommended to take place in the Mediterranean Agronomical Institute of Zaragoza, during the latter part of 2004.¹⁰
7. To promote the organization of annual or biannual Conferences of Operating Bodies (Administrations and Companies) of air resources against forest fires (amphibian aircrafts and others) to exchange experiences and establish links facilitating joint operations of multilateral assistance.
8. To promote the organization of a Mediterranean Conference on Multilateral Assistance against Forest Fires, at political level.
9. To communicate these recommendations to the Summit to be held after the 3rd International Conference on Wildland Fire, Sydney, October 2003, as a contribution of the Mediterranean Basin to the Summit objectives.
10. To communicate also these recommendations at the FAO/ECE/ILO Conference on Forest Fire Management and International Cooperation in Fire Emergencies in the Eastern Mediterranean, Balkans and Adjoining Regions of the Near East and Central Asia, to be held in Antalya, Turkey, Spring 2004.

¹⁰ Editorial Remark: The follow-up workshop was held in Zaragoza, Spain, 27 September – 1 October 2004



Advanced Wildland Fire Management Course A Joint UN Inter-Agency Training Course for the SADC Region

Sponsored by the German Foreign Office, Office for the Coordination of Humanitarian Assistance
Nelspruit, South Africa, 30 May – 5 June 2004

Executive Summary

The significance of wildland fire in Sub-Sahara Africa, particularly in the SADC region, in shaping fire-adapted and highly productive ecosystems vs. its destructive role of excessive fire threatening the sustainability of natural and land-use systems, requires human resources and capacities enabled to deal with the complexity of the issue. Considering the recent progresses made by cooperation in wildland fire science and management, including wildland fire disaster mitigation and response, it is necessary to provide senior-level officials from SADC countries with an updated and comprehensive advanced fire management training / capacity-building package. The Advanced Wildland Fire Management Course covered (a) an introduction to African fire ecology, (b) fuel and fire management, (c) fire prevention, (d) fire-use, (e) fire fighting, (f) fire behaviour prediction, (g) fire monitoring using remote sensing tools, (h) fire early warning systems and application, and (i) international cooperation in wildland fire management. The role of the UN agencies and programmes involved in the course was to inform SADC member states about the international arrangements and procedures in place or to be developed to enhance multilateral cooperation in wildland fire management including disaster management support. Together with the United Nations University Institute of Environment and Human Security the course was conducted by the Global Fire Monitoring Center (GFMC) in the frame of the outreach programme of the Global Wildland Fire Network of the UN International Strategy for Disaster Reduction (UN-ISDR). Main funding for the course was provided by the German Foreign Office.

Background and Rationale

Fire is a widespread seasonal phenomena in Africa. South of the equator, approximately 168 million hectares burn annually, nearly 17% of a total land base of 1014 million hectares, accounting for 37% of the dry matter burned globally. Savanna burning accounts for 50% of this total, with the remainder caused by the burning of fuelwood, agricultural residues, and slash from land clearing. Fires are started both by lightning and humans, but the relative share of fires caused by human intervention is rapidly increasing. Pastoralists use fire to stimulate grass growth for livestock, while subsistence agriculturalists use fire to remove unwanted biomass while clearing agricultural lands, and to eliminate unused agricultural residues after harvest. In addition, fires fuel by wood, charcoal or agricultural residues are the main source of domestic energy for cooking and heating.

In most African ecosystems fire is a natural and beneficial disturbance of vegetation structure and composition, and in nutrient recycling and distribution. Nevertheless, substantial unwarranted and uncontrolled burning does occur across Africa, and effective actions to limit this are necessary to protect life, property, and fire-sensitive natural resources, and to reduce the current burden of emissions on the atmosphere with subsequent adverse effects on the global climate system and human health. Major problems arise at the interface between fire savannas, residential areas, agricultural systems, and those forests which are not adapted to fire. Although estimates of the total economic damage of African fires are not available, ecologically and economically important resources are being increasingly destroyed by fires crossing borders from a fire-adapted to a fire-sensitive environment. Fire is also contributing to widespread deforestation in many southern African countries.

Most southern African countries have regulations governing the use and control of fire, although these are seldom enforced because of difficulties in punishing those responsible. Some forestry and wildlife management agencies within the region have the basic infrastructure to detect, prevent and suppress fires, but this capability is rapidly breaking down and becoming obsolete. Traditional controls on burning in customary lands are now largely ineffective. Fire control is also greatly

complicated by the fact that fires in Africa occur as hundreds of thousands of widely dispersed small events. With continuing population growth and a lack of economic development and alternative employment opportunities to subsistence agriculture, human pressure on the land is increasing, and widespread land transformation is occurring. Outside densely settled farming areas, the clearance of woodlands for timber, fuelwood and charcoal production is resulting in increased grass production, which in turn encourages intense dry season fires that suppress tree regeneration and increase tree mortality. In short, the trend is toward more fires.

Problems in African Societies in Transition

Budgetary constraints on governments have basically eliminated their capacity to regulate from the centre, so there is a trend towards decentralization. However, the shortage of resources forcing decentralization means there is little capacity for governments to support local resource management initiatives. The result is little or no effective management and this problem is compounded by excessive sectoralism in many governments, leading to uncoordinated policy development, conflicting policies, and a duplication of effort and resources. As a result of these failures, community-based natural resource management is now being increasingly widely implemented in Africa, with the recognition that local management is the appropriate scale at which to address the widespread fire problems in Africa. The major challenge is to create an enabling rather than a regulatory framework for effective fire management in Africa, but this is not currently in place. Community-based natural resource management programs, with provisions for fire management through proper infrastructure development, must be encouraged. More effective planning could also be achieved through the use of currently available remotely sensed satellite products.

These needs must also be considered within the context of a myriad of problems facing governments and communities in Africa, including exploding populations and health (e.g. the AIDS epidemic). While unwarranted and uncontrolled burning may greatly affect at the local scale, it may not yet be sufficiently important to warrant the concern of policy makers, and that perception must be challenged as a first step towards more deliberate, controlled and responsible use of fire in Africa.

The prevailing lack of financial, infrastructure and equipment resources for fire management in Sub Sahara Africa goes along with a lack of human resources adequately trained in fire management. The gap between the decreasing fire management resources and the increasing fire problems in Sub Sahara Africa requires immediate response through capacity building.

The Contribution of the Global Wildland Fire Network

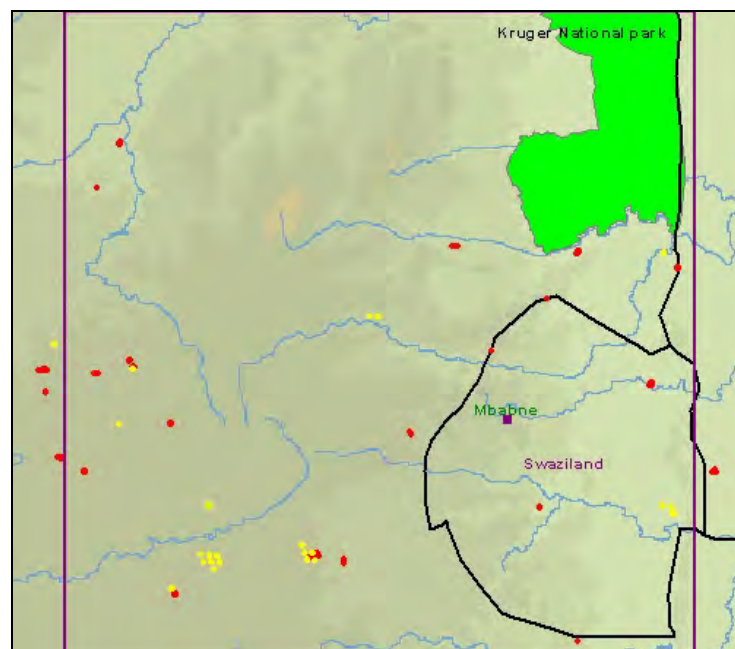
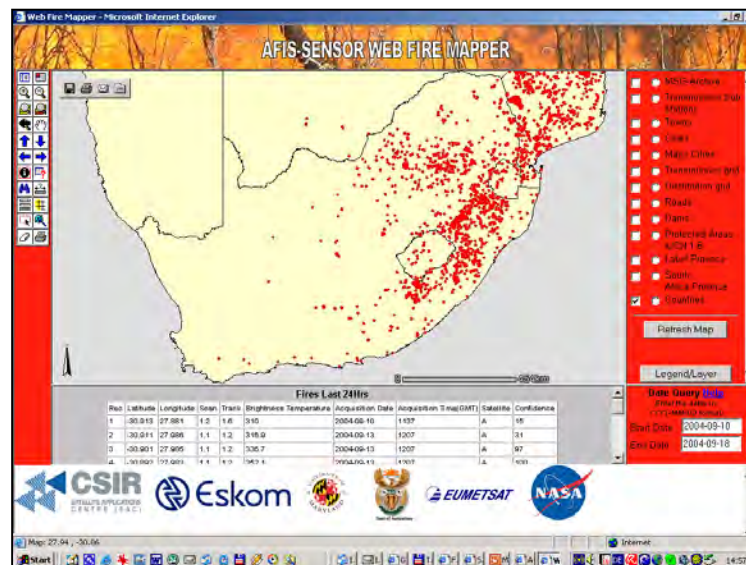
As a first step the Regional Sub Sahara Fire Management Network (AFRIFIRENET) has been founded in July 2002 under the auspices of the Global Fire Monitoring Center (GFMC) and the Working Group on Wildland Fire of the UN International Strategy for Disaster Reduction (ISDR). The objectives of the network include:

- Establishment and maintenance of the network through multilaterally agreed mechanisms of communication and information sharing
- Establishment of topical sub-nets, e.g. fire monitoring, early warning of fire, wildland fire science, fire management cooperation and training, etc.
- Regular communication with network members; contribution to and circulation of International Forest Fire News (IFFN)
- Support of the establishment and facilitate access - and the use of - remote sensing and related technologies for fire and fuel monitoring, fire management planning, and wildfire impact assessment
- Creation of an early wildland fire warning system
- Contribution to a global fuel status, fire monitoring and impact assessment programme which will secure the contribution for and by the continent.
- Improvement of integrated fire management at regional and national scale.
- Improve research and technology with regard to fire science, and to streamline technology transfer
- Assist in wildfire disaster management (emergency support)
- Provide/facilitate training at all levels of fire management.

- Promote communication between wildland fire disciplines of Africa and from other continents, under the umbrella of the GFMC.
- Contribute to the New Partnership for Africa's Development (NEPAD) and the African Union

In preparation of the fire management training activities the GFMC and the coordinator of AFRIFIRENET have produced the "Fire Management Handbook for Sub Sahara Africa" which was launched at the course. The book provides the state-of-the-art knowledge in fire management for Sub Sahara Africa. For more information: See book order form at the end of the IFFN issue.

The Advanced Fire Information System (AFIS): Publicly introduced in Nelspruit



Figures 1 and 2. The Advanced Fire Information System (AFIS) was publicly introduced in Nelspruit as a service module of the Wide Area Monitoring Information System (WAMIS), which will deliver fire information products to the Fire Protection Agencies and Disaster managers all over Southern Africa in support of effective decision-making in the monitoring of natural and manmade fires over the Southern African Development Community region. Upper screen shot: AFIS website. Lower map: Example of map distributed by AFIS - Web Fire Mapper e-mail (generated 19 August 2004 02:15:41).



Nelspruit Declaration on Cooperation in Wildland Fire Management in the SADC Region and adjoining Countries of Sub-Sahara Africa

Released by the Participants of the

Advanced Wildland Fire Management Course
A Joint UN Inter-Agency Training Course for Sub-Sahara Africa

The participants of the Joint UN Inter-Agency Regional Wildland Fire Management Training Course:

- Expressing concern about the impacts of uncontrolled fires and excessive application of fire in land-use systems Sub-Sahara Africa on ecosystem stability, including problems related to biodiversity conservation, sustainability of vegetation, soil and water resources, and other environmental resources
- Noting that the effects of human-caused climate change already result in an increase fire severity and destructivity of wildland fires in some ecosystems, particularly threatening drying wetlands and peatlands
- Noting the increasing vulnerability of human populations in Sub-Sahara Africa to secondary disasters, notably flood disasters, landslides and erosion
- Expressing the intent to jointly overcome the currently existing gaps, deficits and problems, notably concerning the lack or weakness of
 - National fire management strategies, plans and legislation
 - Capacities of human resources trained for advanced wildland fire management
 - Participatory fire management arrangements (Community-Based Fire Management in the frame of Community-Based Natural Resources Management)
 - Resources for public awareness and education campaigns
 - Resources for adequate fire management infrastructures and equipment in most Sub-Saharan countries
 - Research capabilities and academic training
- Concluding from the national case studies and analyses on the wildland fire situation in the participating countries, as well as from the discussions held at the training course, that countries in the SADC region / Sub-Sahara Africa are available to establish and strengthen a regional dialogue on cooperation in wildland fire research and management
- Recalling the International Strategy for Disaster Reduction (ISDR) and its Wildland Fire Advisory Group in supporting to harmonize and strengthen efforts by the United Nations agencies and programmes, as well as other international organizations including non-government organizations, to reduce the negative impacts of wildland fires on the environment, and to support the application of prescribed fire for the benefit of ecosystem stability and sustainability;
- Endorsing the ISDR-FAO-GFMC-GOFC/GOLD Framework for the Development of the International Wildland Fire Accord of 5 May 2004, outlining the concerted international efforts towards international cooperation in wildland fire management;
- Endorsing the goal of the Food and Agriculture Organization (FAO) of the United Nations to promote and strengthen bilateral and multilateral agreements for cooperation in fire management,

- Recognizing and supporting the UN Convention on Biological Diversity (CBD), the Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), the UN Forum of Forests (UNFF) and the Ramsar Convention on Wetlands, the goals and joint endeavours of the Partnership on Environmental Emergencies (led by the UNEP-OCHA Joint Environment Unit), to protect the global vegetation resources and the global atmosphere from negative influences by vegetation fires, as well as the promotion of knowledge and techniques to utilize the beneficial role of fire in ecosystem management,
- Recognizing and supporting the objectives of the Regional Sub-Sahara Wildland Fire Network and the Southern Africa Fire Network (SAFNet), concerning international cooperation in wildland fire management between the countries members of and adjoining the SADC Region;
- Endorsing the recommendations of the International Wildland Fire Summit (Sydney – 2003) concerning common international standards for fire management and the strategy for strengthening international cooperation in wildland fire management,
- Supporting the objectives of the ISDR Global Wildland Fire Network and its Secretariat, the Global Fire Monitoring Center (GFMC), to systematically enhance the intra- and inter-regional cooperation in wildland fire management throughout the world,
- Encouraging countries to develop protocols and agreement for mutual assistance in wildland fire disaster management, for example within the SADC region with special reference to Article 3 of the SADC Protocol on Forestry (dated 3 October 2002), and in close cooperation with the UN-ISDR, FAO, UNEP and OCHA.

Recommend the following Nelspruit Plan of Action for Cooperation in Wildland Fire Management in the SADC Region:

(1) The countries participating at the conference encourage governments to develop or strengthen, and international organizations to support

- Bilateral and multilateral agreements on cooperation in wildland fire management, based on international standards as proposed by the FAO and the International Wildland Fire Summit
- Cooperative regional wildland fire research projects and programmes
- Decision-support systems for large fire situations
- Training / capacity building in wildland fire management
- Community involvement in fire management
- Specific transboundary agreements between communities along borders of neighbouring countries
- Investigate the introduction of the Incident Command System (ICS) as the international standard for all wildland incident management participating in international or interagency agreements and exchanges

(2) To regularly conduct follow-up activities aimed at further promoting collaborative efforts and procedures

(3) To ensure the funding for continuation and further development of the Advanced Fire Information System (AFIS) developed by the CSIR SAC in collaboration with the University of Maryland and ESKOM (AFIS utilizes satellites such as Terra and Aqua MODIS and MSG to operationally monitor fire events over the whole Southern African region. The pilot system will be available to all SADC countries free of charge for the current fire season June – November 2004. The continuation of availability of AFIS will be dependant on funding from the SA government as well as regional organisations).

(4) To investigate under the auspices of the GFMC the necessity to develop arrangements and organizational structures to support collection and dissemination of wildland fire information, facilitation of regular regional dialogue and joint projects between the countries, and to technically

support countries in need of aerial and other technical assets for wildland fire suppression by the creation of

- Special regional mobile fire response units, based on Public-Private Partnership arrangements

(5) To inform national governments about the need to prepare statements in favour of enhancing international cooperation in wildland fire management at the following forums:

- The World Conference on Disaster Reduction (WCDR) (Kobe-Hyogo, Japan, January 2005)
- The FAO high-level meeting at COFO 2005, with focus on international cooperation in wildland fire management (Rome, Italy, March 2005)

(6) To support the following countries with resources needed to improve fire management capabilities; take advantage of specific expertise to be utilized in neighbouring countries; or to follow the specific suggestions made by country representatives:

Angola

- Strengthen international lobbying for cooperation in fire management
- Improve information sharing in SADC

Botswana

- Establish an advanced fire monitoring system
- Introduction of fire education in primary and secondary schools
- Design of a fire management policy and strategy in synchrony with land-use systems and policies
- Develop a national fire management plan
- Develop communication and information systems, including database
- Strengthen wildland fire research

Congo, Democratic Republic

- Identify critical fire zones with regard to biodiversity conservation, socio-economic and health disasters
- Implement SADC Protocol on Forestry by developing a national policy, a national fire management programme
- Strengthen university-based research capabilities and collaborative research with local NGOs and the local and international community respectively
- Establish information databases (fire history, monitoring, early warning; fuel monitoring, including standardization of methods; monitoring of volcanic activities and impacts)
- Focus on relationships between poverty alleviation and opportunities in Community-Based Fire Management
- Strengthen fire awareness campaigns
- Contribute to satellite validation projects
- Establish a Regional Central Africa Wildland Fire Network Office in Kinshasa

Lesotho

- Prioritise research concerning the impact of drought and fire on wetlands
- Strengthen training and capacity building
- Introduce public awareness campaigns

Malawi

- Information on forest fire is done by a number of government institutions, there is need for one body to coordinate forest fire issues, or alternatively, there is need to establish a coordinating body on forest fire management
- In relation to the above, there is need to streamline policies, legislations and plans to implement forest fire management
- Need for adequate training in forest fire management both formally and informally

- Need to establish and develop forest fire research, this should be housed within existing research institutions
- Adequate fire fighting equipment and protective clothing should be made available for fire fighting.
- Regional and bilateral cooperation in forest fire management within the country should be enhanced.

Mozambique

- Support establishment of Community-Based Fire Management in rural communities and support the development of strategies (through GOs, NGOs, international community)
- Provide technical assistance to support personnel, equipment and new technologies
- Develop a programme addressing and mitigating the impacts of climate change and fire on environment and society

Namibia

- Fire fighting equipment and transportation urgently needed
- Upgrade major internal firebreaks
- Upgrade international boundaries, particularly between Namibia, Botswana, Zambia
- Fire management positions to be included in ministries and other relevant organizational structures

South Africa

- Take advantage of the experience and lessons learned of the Ukuvuka campaign (which has created a safe space to test out different approaches, raised funds from diverse sources, garnered political and media support to raise fire awareness in the Cape region) and use it as model to organize and coordinate fire management at community level
- Examine and possibly use the legislation (Veld and Forest Fire Act) as a model for other countries
- Coordinate and standardize wildland fire management training
- Develop further and offer opportunities for higher academic and practical qualification in advanced wildland fire management through Nelson Mandela Metropole University, Saasveld Campus
- Promote involvement of local communities in fire management
- Expand existing fire fighting capabilities in the country

Swaziland

- Development of a national fire management strategy and amendment of appropriate legislation
- Strengthen capacity building (training, infrastructure)
- Strengthen networking (SADC, GFMC, SAFNet, CSIR...)

Zambia

- Develop a national fire management policy
- Establishment of a fire monitoring and management center
- Promote wildland fire research
- Establishment of Community-Based Fire Management Projects
- Promote awareness on the importance of fire and other natural resources management and livelihood

Zimbabwe

- Assistance needed in building capacities in Community-Based Fire Management
- Recognition of indigenous fire management expertise

Annex

Delegates of the following countries and international organizations participated at the meeting:

- Angola
- Botswana
- Congo, DR
- Kenya
- Lesotho
- Malawi
- Mozambique
- Namibia
- South Africa
- Swaziland
- Zambia
- Zimbabwe

- Global Fire Monitoring Center (GFMC)
- UN International Strategy for Disaster Reduction (UN- ISDR), Wildland Fire Advisory Group and Global Wildland Fire Network
- GOFC/GOLD Southern Africa Fire Network (SAFNet)
- UN Environment Programme / Office for the Coordination of Humanitarian Affairs (OCHA)
- Food and Agriculture Organization (FAO)

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GOFC/GOLD Southern Africa Fire Network (SAFNet):
<http://safnet.umd.edu/>



Training Course for Instructors in Community Based Forest Fire Management (CBFiM)

Nelspruit, South Africa, 30 October - 12 November 2004

Background

Nearly half of the global area affected by wildland fires burn in sub-Saharan Africa each year and affect approximately 170 million hectares. While some of this burning is ecologically sound and ecologically useful, a large share of this burning is harmful and damaging to the environment. It is estimated that 95% of all these fires are human in origin whereas the remaining 5% are natural caused e.g. by lightning. For the sustainability of the forestry environment in Africa there is a need to reduce area of unnecessary or harmful burning.

Due to the fact that 95% of all fires are caused by human activities it is necessary to address the reasons for these fires; rather than only trying to increase the suppression capacity or by tightening fire legislation. Proactive fire management approaches are needed to establish data on the underlying causes these fires; only then is it possible to develop national strategies in the appropriate use of fire as a management tool.

Fortunately, however, long-term fire management programmes in Africa have been able to achieve substantial decrease in the numbers and extent of unnecessary burning. This has been achieved by raising the awareness of local people and providing training to multiple level stakeholders in the proper use of fire as a management tool in rural activities at landscape level. By managing fires at local level, resources, including forestry can be managed sustainably.

The aim of the training course was to collate all information about community based forest fire management (CBFiM) in the region and analyse the experiences gained since the first landscape level projects were started in 1996.

Earlier fire management approaches in Africa (since the 1940s) have been purely conventional (copies of European approaches) in nature and had never involved local population or communities in a participatory manner.

The recent African experiences gained in the involvement of government, local communities (under conventional and traditional leadership), NGOs and other stakeholders in integrated forest fire management approaches need to be highlighted; including the obstacles encountered in the process.

There is also a need to highlight the present legislative and policy constraints in involving and transferring fire management responsibilities from government to local communities, including the need to present positive solutions to these legislative constraints; by highlighting experiences from Mozambique, Namibia and South Africa. There is also a need to reform and focus on policies, mechanisms and institutions that can support sustainable forest management by converting present wildfires into controlled fires.

Equal gender participation is one of the prerequisites for obtaining sustainable results in participatory fire management; means and ways of how this can be achieved need to be elaborated further i.e. by including components of fire management in national Gender Action Plans.

The responsibility of national awareness rising in forest fire management need to be distributed beyond forestry and agriculture to the national network of local schools, health clinics, local communities and NGOs etc. For achieving efficient information dissemination outside forestry, agriculture, education and health, there is a need to expand this capacity by making the awareness

rising a task and duty of the national network of local artist; including all the people involved in producing handicrafts of a multitude of forest products, grass, reeds etc. All these co players have a vested interest in the sustainable use of forest resources, including the need to use fire as a management tool for various purposes.



Rationale

Several reasons supported the idea to conduct this regional Workshop. Half of the global wildfires are burning annually in Africa; therefore the forestry professionals in this region, need to be looking for solutions to this problem beyond conventional fire management approaches, which only work in private plantations. To achieve sustainable management of fires in areas outside plantation forests, other solutions need to be sought; solutions that transfer the fire management responsibility to local communities and NGOs, women groups etc. There is a need to apply an ecosystem approach wherein all fires; regardless of its purpose (agriculture, land clearing, beekeeping, hunting, cooking, heating) are managed by the local people. With the national forestry departments as lead agency, all use of fire should be coordinated by a community level fire management unit.

The FAO and the Global Fire Monitoring Center (GFMC) through the Regional Sub-Sahara Africa Wildland Fire Network (AFRIFIRENET), which facilitates cooperation of fire management work in Africa, involved the international community of forest fire scientists, managers, policy makers and NGOs in this workshop. The aim is to develop viable fire management options for the present socio-cultural conditions in rural Africa.



Objectives of the Training Course

The overall objectives of the Workshop included:

1. Provide (a) a forum on CBFiM in Africa, (b) prepare mechanisms for information and resources exchange in forest and other wildland fire management within the region, including the establishment of partnerships for joint activities in fire research, training and policy development, and (c) prepare proposals to governments and international organizations of the region to establish mechanisms for sharing resources in fire management and in large fire emergencies in accordance with existing international procedures.
2. Compile a CBFiM database on regional fire management capabilities in order to support the overall objectives of the Course to facilitate international cooperation and exchange in developing appropriate technologies and knowledge base on CBFiM; transfer of technologies and capacity building by creating an enabling environment.

The Workshop was being organized by FAO and the Global Fire Monitoring Center (GFMC) through the ISDR Regional Sub-Sahara Wildland Fire Network (AFRIFIRENET) and the GFMC Wildland Fire Training Center Africa (WFTCA), which facilitates cooperation in fire management in Africa. The workshop was primarily financed by the FAO, supported by the Global Fire Monitoring Center (GFMC), funded by the German Foreign Office, Office for the Coordination of Humanitarian Assistance.



Participants of the CBFiM Training Course

The South African Working on Fire Programme and the Regional Sub Sahara Wildland Fire Network (Afrifirenet)

The following contribution provides background information about the Working on Fire Programme (WoF) of South Africa, its vision and the cooperation with the ISDR Regional Sub Sahara Wildland Fire Network (Afrifirenet).



WoF and Afrifirenet cooperated closely for the last years, as both organisations realized the need of promoting integrated fire management in Southern Africa through integrating all role players from government and industry down to the local communities through sharing of resources, information and involving the communities, often the poorest of the poor.

On 10 November 2004 a Memorandum of Understanding between the two organisations was signed to promote integrated fire management for the whole Southern Africa Development Community (SADC) region.

- Afrifirenet will be the conduit and platform for exchange of information within the SADC region
- Afrifirenet will facilitate the flow of information between different countries and be the point of contact for organizing cross border co-operation with respect to training and capacity building.

Foci of such information sharing shall be:

- The promotion of Integrated Fire Management practice, with emphasis on community participation
- Research
- Development and implementation of Best Practice standards
- Strategy and policy development conducive to building co-operation across the SADC region
- Building a community of practice network across the region
- Standardization of training, services and integrated fire management practice across the region
- Appropriate knowledge and technology transfer through ongoing development of knowledge management systems
- Ensuring compatibility when faced with exchanging resources, training and information, especially in the case of cross border assistance
- Cost efficiencies through avoidance of duplication
- Ensuring that the capacities built through this partnership assist the regional (SADC) needs, through the New Programme for Africa's Development (NEPAD), under the leadership of the National Disaster Management Centre in the Department of Provincial and Local Government

Together we continuously strive to improve operating systems and build knowledge that can be applied in bringing fire prevention benefits to communities affected by fire. Cross-border and international collaboration with wild land fire research and development organisations results in regular reciprocal cross border training visits and workshops.

WoF Introduction

Most regions in South Africa are situated in naturally fire-prone ecosystems. The inherent fire hazard is exacerbated by the following:

- An increasing extent of the urban development interface with naturally fire-prone systems

- The escalating occurrence of extensive infestations of invading alien plants
- Fire risks associated with forestry and agriculture
- The build-up of excessive fuel loads (natural, commercial and invasive)

Budget and capacity constraints have also severely curtailed the effective management of these areas. While the natural ecological role of fire must be recognised, the exposure of communities, agriculture and business to large, devastating fires in the recent past has emphasised the need for an integrated approach to fire management in the affected regions.

The impact of wild fires in natural vegetation on the poorest of the poor, particularly the rural poor, cannot be overstated. It is those living at the margins who are always the most vulnerable. In the case of rural informal settlements (and also in the case of some of the urban settlements), these are located physically at the margin, in the transition zone between densely settled land and land carrying high fuel loads. Whether these fuel loads are the result of alien invasive plants or the lack of integrated *veld* management (including fuel reduction strategies) in the natural *veld*, the consequence is the same. It is high fire risk, and it is the inhabitants of the adjacent informal settlements that bear the brunt of such unmanaged risk. The direct losses are in terms of:

- loss of life, and disability, due to vegetation fires
- loss of housing and possessions when thatched or wooden dwellings ignite, and
- loss of grazing, crops, livestock and subsistence natural resources

Of equal – if not greater – importance is the “knock-on” effect of wild fires on rural economies. A survey of flower and thatch harvesting of natural plant resources in the *fynbos* in 1993 showed that the value of this produce amounted to R65-70 million per year and sustained 20-30,000 rural people in subsistence livelihoods. While no accurate current value is available, it is reliably estimated that the value of this industry is now at least R120 million per year, sustaining an equal number of jobs.

The extensive fire in early 1998 in the Plettenberg Bay area provides a poignant illustration of the impacts of such fires on the poor. Five *Working for Water* (WfW) employees and a sixth person lost their lives, and a further nine were seriously injured. In the Craggs area alone, as a result of the loss of forestry and natural veld resources, 150 jobs were lost in the plantation/saw milling and flower harvesting sectors. While these jobs may not all be lost permanently, there will be a hiatus of four to five years before the veld is old enough for flower harvesting can recommence. The extent to which jobs in the timber industry will be recovered is questionable. In a small rural community where the alternatives for economic activity are limited, a fire such as this one has devastating social consequences.

These large fires also impact seriously in terms of the costs to the WfW programme. In the Plettenberg Bay case, approximately 15 000 hectares of natural *veld* with alien infestations in the 25-50% density category were burnt. Fire stimulates the germination of the seed of many invasive species, including *Hakea* species (in this case). It can be reliably predicted that on at least half the area burnt, the level of infestation post-fire will exceed 75% and the cost per hectare of treat these denser infestations will rise by 60% from R 1100/ha to R 1850/ha. Note: WfW is not “giving away its money” – it is “investing” in a programme, best suited to be run by the Department of Local and Provincial Government (DPLG), to curb the massive costs for WfW through uncontrolled *veld* fires. This is real co-operative governance!

The investment in alien clearing on this land preceding the fire has been compromised and the volume of work generated by post-fire germination is too large to be manageable. This means that for a period of time the programme will be in retreat in this particular catchment, with the costs of recovery escalating continuously. While WfW recognises the importance of fire as a natural phenomenon and does not intend the above example to portray that WfW intends to suppress all natural fires, it should be emphasised that better control of large fires (when and where they occur) could have significant financial implications and allow for better planning in terms of where to focus WfW's efforts. This translates into a cost to the WfW programme of at least R 5.5 million in additional initial clearing costs that it must fund from the Plettenberg Bay fire alone, and these costs will escalate to more than double the costs as the trees grow and spread further, if (as is the case) WfW does not have the financial and managerial capacity to deal with this new invasion.

The impact that uncontrolled wild fires have had on the mountain catchment areas of the Western Cape in recent years should not be ignored. The extensive fires in the Boland Catchments, which serve agriculture and the Cape Metropolitan Area, have significantly influenced the quality and level of stream flow feeding the major catchment dams. Dam water levels for the period 1996-2000 were the lowest ever recorded.

In addition to the above considerations, the *National Veld and Forest Fires Act* of 1998 requires that landowners take particular measures for fire protection, and that communities should establish *Fire Protection Associations* (FPAs) to address the need for co-ordinated fire management. The FPAs referred to below are those created in terms of the *National Veld and Forest Fires Act*. This must include rapid response capability if the probability of disastrous fire events in the rural landscape is to be reduced. However, resources in terms of capacity, skills and funding are limited in most of the affected areas. For this reason, the *Umbrella Fire Protection Associations* (UFPAs) are envisaged to provide the overarching, co-ordinated support, including aerial fire-fighting support, in provinces. The UFPAs will provide for over-arching services such as aerial fire-fighting support, rapid attack teams, fire weather services, and co-ordination of fire records and training.

Eight UFPAs have been set up:

- Western Cape UFPA - Working on Fire Stellenbosch Fire Control Centre
- Southern Cape UFPA – Working on Fire Witfontein Fire Control Centre (George)
- Eastern Cape UFPA – Working on Fire Ugi Fire Control Centre
- KwaZulu Natal UFPA – Working on Fire Shafton Fire Control Centre (Howick)
- Freestate UFPA – Working on Fire Bethlehem Fire Control Centre
- Mpumalanga UFPA – Working on Fire Nelspruit Fire Control Centre
- Limpopo UFPA – Working on Fire Tzaneen Fire Control Centre
- Gauteng / Northwest UFPA – Working on Fire Tshwane Fire Control Centre

The commercial sectors of Forestry and Agriculture suffer extensive financial loss every year as uncontrolled fires destroy crops, plantations, buildings and equipment. Both sectors invest substantially in fire protection measures, through the development of firebreaks, deployment of fire-fighting teams and purchase of fire-fighting equipment. A national support structure will provide the commercial sector with access to additional resources and improved infrastructure to control large fires. Government, in terms of Section 16 (i) (d) of the Disaster Management Bill 2002 (led by DPLG through the National Disaster Management Centre [NDMC]) will negotiate with the private, forestry and commercial sectors to ensure a fair and reciprocal arrangement. As this project aims to provide direct benefits to private sector bodies, it is expected that this sector will in return, support the venture in a variety of ways.

Fires of all sorts produce a mixture of gases and particles (collectively called 'smoke') that have detrimental effects on the global climate, air quality and human health. Vegetation *veld* fires in South Africa generate approximately 64,000 tons of methane, 76,000 tons of non-methane hydrocarbons, 39,000 tons of nitric oxide, 6000 tons of nitrous oxide and about 40,000 tons of smoke particles per year. They also produce about 12 million tons of carbon dioxide, but as a first approximation, it is assumed that the vegetation, which re-grows after the fire, re-absorbs this gas, and therefore stable fire regimes are 'carbon neutral'. This is not true for the other trace gases, which remain net emissions. Thus a reduction in fire frequency and/or extent leads to a reduction in greenhouse gas emissions, which can be accurately quantified.

It is neither practical, nor desirable, to completely eliminate fires from natural vegetation, but a reduction in area burned per year of in the order of 25% would be achievable and compatible with other land management objectives, including the preservation of biodiversity, the control of alien vegetation, and the maximum yield of clean water.

Greenhouse gas emission reduction inherent in forestry areas where fires can occur can be funded by trades in carbon credits, with initial financing provided by the World Bank's Prototype Carbon Fund. South Africa is one of five countries identified by the Global Environment Facility (GEF) for funding specifically earmarked to address national environmental disaster management. A concept proposal has been submitted through the Department of Environment Affairs and Tourism to GEF for funding to supplement this initiative. What will be developed now is a "second phase" to this business

plan, through which the resourcing of the programme can be significantly enhanced, and the scope and extent of the programme substantially increased. It is expected that such funding would only become available in one to two years' time.

The situation has focused attention on the need to establish an integrated plan for fire management. Speed of response and adequate ground support are absolutely critical factors in fighting fires. This plan proposes the development of an integrated fire management strategy through appropriate *veld* management, fuel load reduction and practical protection measures, linked to the development of the required capacity, skills and structures. These actions will be undertaken in accordance with the National Veld and Forest Fires Act. Furthermore, the achievement of the optimum cost-benefit ratios will be promoted by the reciprocal use of resources between regions.



Figure 1, WoF Handcrew assisted by a MI-8 MTV helicopter

An amount of R35 million per year will be suspended from the Vote of DWAF and transferred to the Vote of DPLG, sub-programme Disaster Management for an initial period of one year, to ensure effective implementation of the plan in eight provinces. This will include facilitating the establishment of FPAs with fire-fighting capacity (including ground crews to support aerial fire-fighting capacity and fire control teams to do prescribed burning) in areas within the eight provinces – namely Western

Cape, Eastern Cape, Southern Cape, Mpumalanga, KwaZulu-Natal, Limpopo, Free State and Gauteng / Northwest – as a pilot exercise. Skills and capacity development and the creation of labour-intensive job opportunities, in keeping with the Poverty Relief Fund requirements, will be undertaken. The jobs created by this programme are estimated at 1100 for the year ending March 2005. It is expected that these pilot FPAs will provide role models that, as they are replicated elsewhere in the country, will leverage private sector investment in FPAs and their activities. In this way, the improved management of fire risks will be promoted. It could also provide successful “exit opportunities” for those workers who have gained temporary employment in the WfW programme and similar Poverty Relief Fund initiatives. The seed funding for this initiative is from the Poverty Relief Fund, through the WfW Programme to DPLG (NDMC).

What was reached by end of 2004?

Over 1000 trained men and women, 64% of them under thirty - five years old, are now employed in twenty two person *veld* firefighting hand crews and “on the ground” management, available to assist partners in preventing and suppressing unwanted fires. Most were previously unemployed and for many, this is the first regular income earned. During the period April 2004 to December 2004 a total of 164,526 person days employment and training have been created, contributing R 7,000,000 in salaries earned.

In addition to person power on the ground, six helicopters, twenty five fixed wing bombers and fifteen spotter aircraft flown by highly experienced pilots are presently co-ordinated from six dispatch centres, in conjunction with national partners. Ground and aerial support from around South Africa can be rapidly mobilized to assist with suppression of disaster or potential disaster fires, and have been deployed during the last fire season to do just this. Quantifying the damage averted as a result of rapid, well co-ordinated attack is without doubt the most difficult measurement to assess accurately, however partners have been vocal in their praise of Working on Fire aerial and ground support and contribution during all major fire incidents attended.



Figure 2. Still smiling after a 12 hours shift (Photos: Working on Fire)

Pooling of firefighting resources, fuel reduction and establishment of Fire Protection Associations are proven efficiency measures in combating unwanted fires and the Management Team can report positive progress in all pilot geographical regions, contributing towards the vision of a nationally co-ordinated approach to integrated fire management.



Figure 7, Fire Camp, exercising rapid deployment within South Africa and in case of assistance for neighbouring countries

Internationally a number of exchange training courses were organised in cooperation between the two organisations. All workshops and courses were conducted according to highest international standards.

Through these activities we have been able to establish excellent relations with our neighbours in the SADC region and are confident to prove in the future that we are working on a SADC wide wildland fire strategy, which is developed and accepted by all contributing countries, organisations and individuals.

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References

Working on Fire Website: www.workingonfire.org

Afrifirenet Website at GFMC: www.fire.uni-freiburg.de/GlobalNetworks/Africa/Afrifirenet.html



Regional South America Wildland Fire Network

Foundation Meeting, Curitiba, Brazil, 17 June 2004

1. Summary: Rationale and Overall Objective of the Network Foundation Meeting

During the last decade socio-economic developments, land-use change and climate variability in the South American continent have resulted in widespread change of fire regimes and an increasing occurrence of destructive wildfires affecting highly vulnerable human populations and ecosystems. Limited resources for efficient wildland fire management in most South American countries have prompted governments, non-government organizations and international organizations to seek common procedures and agreements for bilateral and multilateral cooperation in sharing expertise, capacity building and resources in fire management. The strategic goals of the Global Wildland Fire Network (GWFN) and the recommendations of the International Wildland Fire Summit (Sydney, Australia, 8 October 2003) are in line with the visions of the South American countries and the community of wildland fire scientists. The 3rd South American Symposium on Wildland Fire Control and the 7th Joint Technical Meeting FUPEF/SIF/IPEF on Wildland Fire Control, 14 to 17 June 2004, Curitiba, Brazil, provided an opportunity and a springboard for the foundation of the “Regional South America Wildland Fire Network”.

The Network Foundation Meeting was prepared jointly by the UN-ISDR Wildland Fire Advisory Group and the Global Fire Monitoring Center (GFMC). Host of the Network Foundation Meeting was the Federal University of Paraná, Curitiba, which organized the 3rd South American Symposium on Wildland Fire Control and the 7th Joint Technical Meeting FUPEF/SIF/IPEF on Wildland Fire Control. This series of conferences was initiated in 1993 and since then has become one of the most important forums on debates about the problem of wildland fires in Brazil and the other countries of South America. Participants from Argentina, Brazil, Chile, Colombia, Paraguay, Peru, Uruguay and Venezuela attended the conference and the foundation meeting.

During the two days preceding the foundation meeting a number of papers from throughout South America were given. Together with extensive discussions these papers provided the background for discussion at the network foundation meeting. Reports given by the representatives from North America, Central America and the Caribbean revealed the pan-American wildland fire problems, their particularities, similarities and differences, and the overall intent to encourage cooperation throughout Latin America, North America and the Caribbean.

The network foundation meeting was sponsored by a number of national and international organizations (those contributing with finances to allow participation of delegates from the region are underlined):

- Food and Agriculture Organization of the United Nations (FAO) (due to the delay in launching a regional TCP, FAO's financial contribution will be committed to the follow-up process)
- Global Wildland Fire Network / Global Fire Monitoring Center (GFMC)
- Global Observations of Forest and Land Cover Dynamics (GOFC/GOLD)
- International Tropical Timber Organization (ITTO)
- The Nature Conservancy (TNC)
- United States Department of Agriculture, Forest Service (USFS)

2. Preparation of the Network Foundation Meeting

The preparation of the network foundation meeting was initiated in late 2003. A first outline and agenda of the foundation meeting was drafted by the GFMC and circulated on 18 December 2003 to the host and the cosponsors. In May 2004 a questionnaire was drafted and consolidated by the

GFMC in consultation with the FAO. The questionnaire was circulated to the participants of the conference and the foundation meeting. It aimed at collecting information on available resources in wildland fire management, training and research, as well as defining deficits and gaps to be addressed by international cooperation. The meeting participants were also asked on their expectations towards a regional wildland fire network, as well as to develop visions and propose concrete actions.

The questionnaires were distributed in three languages (English, Portuguese, Spanish) and were (and still are) available on the GFMC website at:

http://www.fire.uni-freiburg.de/course/meeting/meet2003_14.htm

In the days before the network foundation meeting the returned questionnaires were compiled in a single database document in which the suggestions of the contributing countries were summarized by topics. This summary was compiled in Spanish (Annex II). Countries not yet having filled out the questionnaire are encouraged to do so for further strengthening the regional network and cooperation efforts in the South American Region.

In the afternoon of 16 June 2004 an informal consultation was held with representatives from the South American countries participating on the following day.

This meeting was instrumental in discussing the possible modalities for the formal and informal set up and functioning of the Regional South American Network. The GFMC explained the different regional network arrangements participating or joining the Global Wildland Fire Network. Some networks have a rather formal structure, some are coordinated and supported by government agencies. Other networking arrangements are less formal and / or are facilitated by civil society. Some networks are operating directly under the auspices or within the frame of programmes of the United Nations. The GFMC is providing regular updates on the status of the Global Wildland Fire Network on this website:

<http://www.fire.uni-freiburg.de/GlobalNetworks/RationaleandIntroduction.html>

The participants of this preparatory meeting discussed the advantages and disadvantages of involvement of government and non-government organizations. The GFMC underscored the need to distinguish between the facilitation of networking activities at non-government and often rather informal level (e.g., facilitation through an independent university institution, building of databases, regional exchange of information on wildland fire early warning, monitoring, maintaining a regional dialogue through exchange of information, newsletters, conferences, etc.) and intergovernmental (legally binding) agreements on cooperation in wildland fire management. Such formal agreements are likely to be developed in an enabling atmosphere of regional cooperation initiated by the preceding and more informal dialogue.

Following this preparatory consultation the representatives of the countries prepared inputs for the meeting on the following day.

Another side meeting was held on 15 June 2004 with representatives of institutions from Central America and the Caribbean. The aim of this meeting was to agree on a strategy and calendar of events to liaise the networking / cooperation processes in these regions with the South American initiative.

It is envisaged that a future Regional South America Wildland Fire Network will closely interact with the Regional Central America Wildland Fire Network, a Regional Caribbean Wildland Fire Network (to be formed), the North American Forestry Commission, Fire Management Working Group, and the Global Wildland Fire Network. A starting point will be the Western Hemispheric Wildland Fire Conference, scheduled for 23 October 2004 in Costa Rica.

3. Presentations at the Network Foundation Meeting

On 17 June 2004 the Regional South America Wildland Fire Network Foundation took place (Annex I). The following presentations provided an overview of existing and desired cooperation in wildland fire research and management:

- The UN International Strategy for Disaster Reduction (ISDR) through the Global Fire Monitoring Center (GFMC) is facilitating communication and information flow between regional wildland fire networks under the umbrella of the Global Wildland Fire Network (GWFN). Some regional networks are actively supported by the GFMC. The GWFN is an ISDR outreach programme. The ISDR Wildland Fire Advisory Group has been established in November 2003 as an advisory body to the ISDR Secretariat and the Inter-Agency Task Force for Disaster Reduction (IATF/DR)¹¹. Speaker: Johann G. Goldammer (GFMC).
- The Food and Agriculture Organization of the United Nations (FAO), through the Forest Fire Management Officer (FORM) and the FAO Forestry Commissions of North America and Latin America / Caribbean, is actively working in Latin America and preparing a regional Technical Cooperation Programme (TCP). The TCP will involve three subregional studies (Central America & México, Caribbean, South America) and one regional synthesis study on the wildland fire situation in the three subregions. These studies will be presented at the Western Hemispheric Wildland Fire Conference of the FAO Forestry Commissions of North America and Latin America / Caribbean (23 October 2004, Costa Rica). The overall goal of the TCP is to enhance Sub-regional and regional networking and cooperation in wildland fire management. The expected result of the Western Hemispheric Wildland Fire Conference is to have a Regional Strategy to be presented at the high level meeting on 14 March 2005 in Rome. Speaker: Carlos M. Carneiro (FAO).
- The mission of The Nature Conservancy (TNC) was presented. TNC sponsors a Global Fire Initiative, an organization-wide effort aimed at working with diverse partners to take practical action in ecosystems where altered fire regimes (too much, too little or the wrong kind of fire) pose major threats to people and ecosystems. TNC is a member of the Global Fire Partnership (with WWF-International and IUCN). The Conservancy sponsors the Latin American-Caribbean Fire Management Learning Network that is linking scientists and decision-makers with on-the-ground managers and communities in pursuit of solutions to common fire-related challenges. Speaker: Ron Myers (TNC).
- The networking activities of the Mesoamerica agreement (agreement of the *Primera Reunión Mesoamericana de Cooperación en Materia de Protección contra Incendios Forestales*", Guatemala, 8-9 July 2002) and the Honduras Strategy (*Taller para el Desarrollo de un Plan Estratégico Regional para el Manejo del Gorgojo del Pino y los Incendios Forestales en Centroamérica*, Honduras, 26-30 August 2002), as well as the work of the *Comisión Centroamericana de Ambiente y Desarrollo* (CCAD) were presented in a joint paper. These cooperative activities are currently in the preparation stage of implementation, supported by US-AID sponsorship. Speaker: Miguel Antonio López Quiñónez (Coordinador Nacional Protección Forestal del Instituto Nacional de Bosques [INAB], Guatemala), contributors: Josué Iván Morales Dardón (Coordinador del Consejo Técnico del Sistema Nacional de Prevención y Control de Incendios Forestales [SIPECIF], Guatemala) and Alberto Vásquez Rodríguez (Coordinador Nacional para el Manejo del Fuego del Sistema Nacional de Áreas de Conservación [SINAC] / Ministerio del Ambiente y Energía [MINAE], Costa Rica).
- The wildland fire situation in the Caribbean region was summarized and a proposal was made to create a Regional Caribbean Wildland Fire Network. The representative from Cuba offered a platform for a foundation network meeting in September 2004. Speaker: Marcos P. Ramos (Universidad de Pinar del Río, Cuba).

¹¹ The mandated functions of the UN Inter-Agency Task Force for Disaster Reduction (IATF/DR) are (a) to serve as the main forum within the United Nations system for devising strategies and policies for the reduction of natural hazards; (b) to identify gaps in disaster reduction policies and programmes and recommend remedial action; and (c) to provide policy guidance to the ISDR secretariat; and to convene ad hoc meetings of experts on issues related to disaster reduction.

- The United States Department of Agriculture, Forest Service (USFS), reported on the cooperation mechanisms in North America, notably on the work of the Wildland Fire Working Group which has been established under the FAO North American Forestry Commission and in which Canada, Mexico and the United States are represented since 1962. This group is operating rather independently and efficiently since then. Speaker: Denny Truesdale (USDA-FS).
- The host of the network meeting, Federal University of Paraná underscored the need for better cooperation in wildland fire management in South America. For the initiation of a network he proposed to set up a working group and a website. He suggested that the 4th South American Symposium on Wildland Fire Control (Viçosa, Minas Gerais, 2006), should be held under the auspices of the Regional South American Wildland Fire Network. Speaker: Antonio C. Batista (Federal University of Paraná, UFPR).
- The representative of the Brazilian Institute for Environment and Renewable Natural Resources (Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis [IBAMA]), reported about the involvement of IBAMA at international level and the agreements between Paraguay and Peru concerning the support by satellite fire monitoring. He strongly supported the networking concept. Speaker: Heloiso B. Figueiredo (Director of Prevefogo, IBAMA).

4. Presentation of the Results of the Enquiry

Before a break the GFMC presented and distributed the evaluation of the questionnaire. The returned comments and inputs had been compiled in a single database document in which the suggestions of the contributing countries were summarized by topics (Annex II).

Recommendations on future activities and priority elements for a network had been extracted from the returned questionnaires and included in a draft "Curitiba Declaration on Cooperation in Wildland Fire Management in South America" (Declaración de Curitiba sobre la Cooperación en el Manejo de Incendios en América del Sur). A Spanish version of the draft declaration was also distributed before the break.

5. Discussion of the Draft Curitiba Declaration and Modalities of a Future Regional South America Wildland Fire Network

The second part of the network foundation meeting was governed by the discussion about the final version of the declaration (Annex III) and the modalities.

The major items discussed included:

- Proposal to establish an initial working group, preferably small in size
- Advantages and disadvantages of government vs. non-government institutions hosting a future network secretariat
- The need to include the private sector and other sectors of society
- Other South American countries not represented at the foundation meeting should be consulted
- That participants should inform their ministers about the Regional Network Initiative
- The preparation of a Proposal for a Regional South American Work Plan, to be carried out by the initial working group
- Opportunities to organize the network under the auspices of the UN (FAO, ISDR), regardless of the modalities of network coordination (network secretariat)

At the end of the meeting a consensus was reached that a follow-up electronic discussion and possibly a follow-up meeting should be organized as soon as possible.

FAO and GFMC offered support in establishing the network within the work of the Technical Cooperation Project “*Apoyo al desarrollo de una estrategia regional de cooperación para la prevención, control y combate de incendios forestales*” and the Global Wildland Fire Network.

Rapporteurs: Johann G. Goldammer and Claudia Scholz, Global Fire Monitoring Center (GFMC)

6. Initial Working Group of the Regional South America Wildland Fire Network

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7. Follow-Up: The Roadmap towards the Hemispheric Wildland Fire Conference and the Ministerial Meeting on Wildland Fire (FAO, March 2005)

The follow-up process of the network foundation meeting and the side meetings with representatives from Central America and the Caribbean will be harmonized with the timetable of the “Framework for the Development of the International Wildland Fire Accord” (as agreed by the Global Fire Monitoring Center GFMC, FAO, ISDR and GOFC/GOLD, May 2004) (Annex IV).

The Western Hemispheric Wildland Fire Conference will provide an opportunity and a forum at which the network initiatives will meet. The conference, scheduled for 23 October 2004 in Costa Rica, will be co-sponsored by the FAO Forestry Commission for Latin America and the Caribbean, and the North American Forest Commission. The Global Wildland Fire Network through the Global Fire Monitoring Center (GFMC) will be a cosponsor of the conference. The conference aims at (a) reviewing options and means to improve fire management in the Western hemisphere, (b) reviewing the efficiency of institutional arrangements involved in fire management, and (c) defining actions needed to improve international cooperation in wildland fire management.

Before and immediately after the conference separate regional meetings and a meeting with representation of all regional networks of the Americas will take place to consolidate the networking process.

The following timetable has been proposed to follow up the Network Foundation Meeting in Curitiba as well as the side meetings with representatives from Central America and the Caribbean, and to prepare inputs for the Western Hemispheric Wildland Fire Conference as well as the ministerial-level meeting at the Committee for Forestry (FAO, Rome, March 2005).

Timetable for activities of the newly emerging Regional Wildland Fire Networks in Latin America and the Caribbean

Date / Timeframe	Regional Wildland Fire Networks		
	South America	Central America	Caribbean
July 2004	Establishment of the Initial Working Group Electronic discussion	Meeting and consolidation of Central America Network (CCAD/CCAB, Mesoamerica process, Honduras Strategy)	Preparation of network foundation meeting
August 2004			
September 2004			Network foundation meeting (Cuba)
21 Oct 2004 San José, Costa Rica	Regional network meeting	Regional network meeting	Regional network meeting
22 Oct 2004 San José, Costa Rica	Joint meeting of Regional Wildland Fire Networks (South America, Central America, Caribbean): Mutual information on regional network activities and development of a proposal for the Western Hemispheric Wildland Fire Conference. Separate or joint meeting of the North American network (NAFC Fire Management Working Group - FMWG). Meeting of the International Liaison Committee (ILC) for the preparation of the 4 th International Wildland Fire Conference (Madrid 2007)		
23 Oct 2004 San José, Costa Rica	Western Hemispheric Wildland Fire Conference: Definition of an hemispheric action plan on cooperation in wildland fire management (with the participation of all four regional networks in the Americas)		
24 Oct 2004 San José, Costa Rica	Wrap-up meeting of all networks of the Western Hemisphere		
Nov 2004 – Feb 2005	Continuation of ILC meeting (if required)		
	Follow-up of Hemispheric Conference: Fundraising, implementation of regional strategies, preparation of FAO ministerial meeting	Follow-up of Hemispheric Conference: Fundraising, implementation of regional strategies, preparation of FAO ministerial meeting	Follow-up of Hemispheric Conference: Fundraising, implementation of regional strategies, preparation of FAO ministerial meeting
March 2005	FAO high-level meeting on International Cooperation in Wildland Fire Management (COFO)		



Red Regional Sudamericana de Incendios Forestales

Reunión de Fundación, Curitiba, Brasil, 17 Junio 2004

Declaración de Curitiba sobre la Cooperación en el Manejo de Incendios Forestales en América del Sur Curitiba, 17 Junio 2004 ¹²

Los participantes de la Conferencia:

- Expresando preocupaciones sobre una mayor ocurrencia y fuerza destructiva de los incendios forestales, incendios de la interfaz y los incendios en otros ecosistemas, incluyendo el uso excesivo del fuego en la conversión de bosques y en el cambio de uso del suelo en América del Sur, afectando la vida humana, la biodiversidad, recursos de agua, de suelo y otros recursos del medio ambiente,
- Reconociendo que las razones para este desarrollo son debido al incremento de la presión de la población en muchos países de América del Sur y al incremento de los problemas socio-económicos de poblaciones rurales,
- Notando el incremento de la vulnerabilidad humana en América del Sur frente los desastres secundarios, principalmente inundaciones, derrumbes y erosión de suelos,
- Notando que los efectos del cambio climático inducido por las actividades humanas ya estan produciendo épocas de incendio más extremas y resultando en un incremento de la severidad de los incendios forestales en algunos ecosistemas, en particular amenazando el desecamiento de humedales,
- Notando que hay ecosistemas como savannas, pastizales y matorales (como el Cerrado) que se mantienen por regimenes de fuego apropiados.
- Expresando la intención de superar en conjunto los actuales vacíos y déficit en:
 - Sistemas de alerta temprana
 - Capacidades de detección y monitoreo terrestre, aéreo y satelital
 - Programas de prevención de incendios forestales incorporando a comunidades locales
 - Capacitación y entrenamiento para el manejo de incendios forestales
 - Recursos para infraestructuras adecuadas y equipos para el combate de incendios forestales
 - Programas de organización de personal para el combate de incendios forestales
 - Certificación de competencias de personal de combate
 - Planes y programas de seguridad en el combate, incluyendo equipamiento de protección personal
 - Protección de la salud de la población civil y de los combatientes de incendios forestales
 - Conocimiento de las capacidades individuales para apoyo en combate en emergencias en los países de la Región

¹² Finalizado el día 14 de Julio 2004 seguido a una discusión de seguimiento por correo electrónico entre los participantes de la conferencia e instituciones nacionales de América del Sur.

- Programas de manejo de emergencias mayores
 - Capacidades de investigación
 - Usos del fuego
 - Papeles ecológicos del fuego
 - Desarrollo de modelos actualizados de combustibles forestales
 - Modelaje del comportamiento del fuego
 - Valoración de daños y pérdidas debido a incendios forestales
 - Bases de datos sobre incendios forestales
 - Recursos para crear conciencia pública y campañas de educación
 - Estrategias y planes nacionales de manejo de incendios forestales
 - Actualización de legislaciones nacionales y locales de prevención, control y la gestión de los incendios forestales.
 - Conocimiento de las instituciones y puntos focales de los países de la Región responsables de los incendios forestales.
 - Legislación internacional en incendios forestales
 - Establecimiento y normalización de protocolos, acuerdos, convenios para la cooperación bilateral / multilateral
 - Diseminación de experiencias, conocimientos, publicaciones, etc.
 - Compartir materiales de difusión y extensión.
 - Tener una estrategia regional para el manejo de incendios forestales
 - Tener una nomenclatura, glosario, o terminología común de incendios forestales
- Concluyendo de los análisis y estudios de casos nacionales sobre la situación de los incendios forestales en los países participantes presentados durante el 3º Simposio Sur-Americano sobre Control de Incendios Forestales y la 7ª Reunión Técnica Conjunta FUIPEF/SIF/IPEF sobre Control de Incendios Forestales en Curitiba, del 14 al 17 de Junio 2004, así como de las discusiones realizadas durante el simposio, que la mayoría de los países de la Región están disponibles para establecer y fortalecer un diálogo regional sobre la cooperación en investigación y el manejo de incendios forestales,
 - Endosando los esfuerzos de la Estrategia Internacional para la Reducción de Desastres (EIRD) de la Organización de las Naciones Unidas (ONU) y su Grupo Consultivo sobre Incendios Forestales en apoyar en a armonizar y fortalecer los esfuerzos de las agencias y programas de la ONU, así como de otras organizaciones internacionales incluyendo organizaciones no-gubernamentales, para reducir los impactos negativos de los incendios forestales sobre el medio ambiente,
 - Endosando el Documento Marco EIRD-FAO-GFMC-GOFC/GOLD para el Desarrollo del Acuerdo Internacional sobre Incendios Forestales del 5 de Mayo 2004, resumiendo los esfuerzos internacionales concertados hacia una cooperación internacional en el manejo de incendios forestales,
 - Endosando los objetivos de la Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO) de promover y fortalecer acuerdos bilaterales y multilaterales para la cooperación en el manejo de incendios forestales,
 - Reconociendo y apoyando las metas y los esfuerzos conjuntos del Convenio sobre la Diversidad Biológica de las Naciones Unidas (CDB), de la Convención de Lucha contra la Desertificación de las Naciones Unidas (CLD), de la Convención Marco sobre el Cambio Climático de las Naciones Unidas (CMCC), del Foro de las Naciones Unidas sobre los Bosques (UNFF) y de la Convención Ramsar sobre Humedales, para proteger los recursos mundiales de vegetación y la atmósfera mundial de las influencias negativas de los incendios forestales, así como la promoción de conocimientos y técnicas para utilizar el fuego beneficiosamente en el manejo de ecosistemas,
 - Recordando los objetivos y las recomendaciones de la Cumbre Mundial sobre el Desarrollo Sostenible (Johannesburgo - 2002) acerca de los esfuerzos internacionales de asegurar un desarrollo sostenible de los recursos mundiales de vegetación,

- Endosando las recomendaciones de la Cumbre Internacional de Incendios Forestales (Sydney - 2003) con respecto a estándares internacionales comunes para el manejo de incendios forestales y la estrategia para fortalecer la cooperación internacional en el manejo de incendios forestales,
- Apoyando los objetivos de la Red Mundial de Incendios Forestales (RMIF) de la EIRD y su Secretaría, el Centro Mundial de Monitoreo de Incendios (GFMC), de aumentar sistemáticamente la cooperación intra- e inter-regional en el manejo de incendios forestales en todo el mundo,
- Agradeciendo la disponibilidad de la Universidade Federal do Paraná, Curitiba - la institución anfitriona de este simposio - y de los participantes de las naciones americanas de cooperar activamente para compartir experiencias y recursos en el manejo de incendios forestales,

Recomiendan el siguiente **Plan de Acción de Curitiba** para América del Sur:

- Formación de un grupo de trabajo inicial por parte de los países participantes en la reunión del 17 de junio 2004: Argentina, Brazil, Chile, Colombia, Paraguay y Perú,
- La Universidade Federal do Parana organizará una discusión electrónica y una reunión de este grupo de trabajo inicial.
- El grupo de trabajo inicial deberá elaborar una primera propuesta para ser presentada a la reunión de la Comisión Forestal para América Latina y el Caribe (COFLAC) (Octubre 2004, Costa Rica) para que la Red Regional Sudamericana de Incendios Forestales funcione bajo los auspicios de la Organización de las Naciones Unidas (ONU), trabajando en conjunto con la oficina regional de la Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO) en el marco del TCP "Apoyo al desarrollo de una estrategia regional de cooperación para la prevención, control y combate de incendios forestales" y el Centro Mundial de Monitoreo de Incendios (GFMC).
- Esta propuesta será presentada a la Reunión del Hemisferio Oeste el 23 de octubre 2004.

Expectativas a la Red Regional Sudamericana de Incendios Forestales

- Fungir como coordinadora de las actividades de incendios forestales de los países de la Región, ser un punto de encuentro de sus especialistas, donde compartir experiencias y conocimientos.
- Fungir como apoyo para los países de la Región para desarrollar el interés de los Gobiernos y Organizaciones todas en torno a la protección contra incendios forestales.
- Obtener apoyo institucional para investigación y generar aporte técnico para gestión pública.
- Permitir el intercambio de información, tecnología, recursos y financiamiento de proyectos.
- Que exista un equipo internacional de educación y que en los países miembros realicen un curso anual de nivel superior
- Identificar problemas regionales y formar equipos interdisciplinarios / grupos de trabajo en cada uno de los temas para solución de problemas y fortalecimiento de las instituciones.
- Formar centros nacionales de monitoreo de incendios forestales
- Formar acuerdos bilaterales de ayuda mutua sobre todo en el combate de incendios forestales.
- Desarrollar proyectos demostrativos y organizar giras de estudio.
- Desarrollar un Plan Regional para mitigar, educar y controlar el uso del fuego.
- Orientar las políticas nacionales a un interés regional para el cuidado de la Amazonía y otros ecosistemas vulnerables en la Región, así como el control del fuego, por la contaminación a varios países.

Actividades concretas sugeridos para la Red Regional Sudamericana de Incendios Forestales

- Realizar un Taller Regional de Discusión en torno a los Incendios Forestales asegurando la asistencia de la totalidad de los países de la Región. / Organizar una reunión en Colombia (~Marzo 2005), invitando a los países de la Amazonía, los países andinos y otros.
- Identificar problemas conjuntos y estrategias de solución.
- Establecer una agenda de trabajo compartida por todos.
- Formar equipos de trabajo en los diferentes temas (T1-T16, ver Resultados del Cuestionario Informal previo a la Fundación de la Red Regional Sudamericana de Incendios Forestales).
- Identificar las instituciones gubernamentales con responsabilidad en incendios forestales en la Región, definir los puntos focales en cada país, coordinar con gobiernos nacionales
- Realizar reuniones trimestrales en cada país miembro de la red
- Concretar formal y ordenadamente la cooperación.
- Que los Gobiernos se comprometan a reducir la burocracia para apoyo en emergencias y dar facilidades de entrada y salida aduanera de equipos para atención de emergencias.
- Intercambiar anualmente información entre los diferentes países.
- Cursos de entrenamiento focalizados en prevención de incendios forestales e información.
- Actividades en materia de prevención de incendios forestales.
- Obtención de recursos financieros de mediano y largo plazo.
- Inserción en esquemas de cooperación internacional .
- Lograr la incorporación formal de los países de la Región con un compromiso real de cada uno, acuerdos formales entre países.
- Lograr una cooperación efectiva multilateral, p.e. un curso de capacitación, etc.
- Generar las condiciones para desarrollar una guía estándar para promover la gestión y estudio de los incendios forestales.
- Introducir el “Sistema de Comando de Incidentes (SCI)” para el manejo de incendios forestales a nivel nacional y / o para estar preparado para una cooperación multilateral en caso de una eventual emergencia de incendio.
- Utilizar el “Formato Modelo para establecer Acuerdos de Cooperación en el Manejo de Incendios Forestales”, el cuál se acordó en la Cumbre Internacional de Incendios Forestales (Sydney, 2003).
- Establecer un acuerdo de naturaleza vinculante entre los países de América del Sur para la cooperación en el manejo de incendios forestales.

Otros temas a ser discutidos

- Incorporación e inserción en la Red Mundial de Incendios Forestales (RMIF).
- Asumo de responsabilidades en caso de contaminación de países vecinos
- Costos de servicios ambientales
- Legislación internacional



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Pan American Conference on Wildland Fire
San José, Costa Rica
23 October 2004

Sponsors	Latin America and Caribbean Forestry Commission (LACFC); North American Forest Commission (NAFC)
Co-sponsor	Global Fire Monitoring Center (GFMC)
Host	Government of Costa Rica
Objective	To strengthen international cooperation for the management, prevention, and control of wildland fire
Expected results	A declaration supporting a commitment to develop a regional strategy for improved management, prevention and suppression of wildland fire A call to strengthen international cooperation on wildland fire at bilateral, multilateral and global levels
Target audience	Heads of national forestry and wildland fire organizations in the Western Hemisphere; representatives of organizations that are interested in the improved management of wildland fire

AGENDA

0900 – 0930	Opening Ceremonies: Remarks by the Minister of Environment and Energy, Government of Costa Rica Remarks by M. Hosny El-Lakany, Assistant Director-General, FAO
0930 – 1000	Keynote Address: Johann G. Goldammer, Global Fire Monitoring Center
1000 – 1045	Wildland Fire: Issues in Latin America and the Caribbean: Jorge Menéndez, Director de Bosques, Argentina, and former Chairman, COFLAC Wildland Fire: Issues in North America: Dale Bosworth, Chief, US Forest Service and former Chairman, NAFC
1115 – 1135	Presentation on Wildland Fire in South America Patricio Sanhueza, CONAF, Chile
1135 – 1155	Presentation on Wildland Fire in the Caribbean Marcos Pedro Ramos, Universidad de Pinar del Río, Cuba
1155 – 1215	Presentation on Wildland Fire in Meso-America Fernando Arenas, Comisión Nacional Forestal, Mexico
1215 – 1235	Presentation on Wildland Fire in North America Kelvin Hirsch, Research Management Advisor, Northern Forestry Centre, Canadian Forest Service, Natural Resources Canada
1430 – 1500	Report on the preparatory meeting on Friday, 22 October and presentation of the draft Conference Declaration
1500 – 1600	Discussion on the draft Conference Declaration ** Approval of the Conference Declaration

Chairman	A senior representative of the Government of Costa Rica
Moderator	M. Hosny El-Lakany, FAO
Facilitator	Johann G. Goldammer, GFMC, assisted by Claudia Scholz
Secretaries	Douglas Kneeland (English), Carlos Marx Carneiro (Spanish)

Over the past decade, many countries have witnessed a growing trend of excessive fire application in land-use systems and an increasing occurrence of wildfires of extreme severities. Sometimes these wildland fires have transnational impacts, for example smoke pollution and its impacts on human health and safety; loss of biodiversity; or site degradation at landscape level leading to desertification, flooding, and reduced food security. The depletion of terrestrial carbon by fires burning under extreme conditions in some vegetation types is an important factor in causing disturbance in the global carbon cycle.

In other words, increasingly severe wildland fires are contributing to climate change; and climate change is contributing to increasingly severe wildland fires.



This trend is stirring the international community to address the problem collaboratively. The development of informal partnerships, joint projects and formal agreements among governments and between government and non-governmental institutions is essential to enable nations to develop sustainable fire management capabilities.

¹ Report prepared by the Global Fire Monitoring Center (GFMC) and the Food and Agriculture Organization of the United Nations (FAO)

In order to share human and technical resources in wildland fire management, a number of collaborative activities have been initiated throughout the Americas and the Caribbean during recent years. Representatives from throughout the region have initiated and – where already existing – expanded networking structures. Regional Wildland Fire Networks in South America, Mesoamerica and the Caribbean tied to the Global Wildland Fire Network are currently receiving support by FAO to develop a regional cooperation strategy in wildland fire management.

In order to further develop cooperation throughout the Western Hemisphere and globally, the Pan-American Conference on Wildland Fire is calling for strengthening international cooperation. The conference is sponsored by two statutory bodies of FAO, the Latin America and Caribbean Forestry Commission (LACFC) and the North American Forest Commission (NAFC), with co-sponsorship by the Global Fire Monitoring Center (GFMC). It is hosted by the Government of Costa Rica.

The Global Context

The primary responsibility for preventing unplanned wildland fire and for managing planned fire lies with governments. The efforts of countries can be supported by international organizations and non-governmental organizations. Several agencies and programmes of the United Nations system work on problems related to wildland fire management:

- FAO: sustainable forest management, fire management and community involvement, promotion of international cooperation in wildland fire management; jointly with GFMC conducting Global Forest Fire Assessments (FRA 2000 and 2005), publication of Fire Management Guidelines for Temperate and Boreal Forests, Wildland Fire Management Terminology,
- Office for the Coordination of Humanitarian Affairs (OCHA) with United Nations Environment Programme (UNEP): coordination of international response to wildland fire emergencies;
- World Health Organization (WHO): protection of human health against adverse effects of vegetation fire, smoke pollution;
- World Meteorological Organization (WMO): early warning of precursors leading to critical fire situations.

In addition, several international conventions are mandated to advise and assist countries to protect global vegetation cover and ecosystem functioning, i.e. the Convention on Biological Diversity (CBD), the Convention to Combat Desertification (UNCCD), the Framework Convention on Climate Change (UNFCCC), and the Ramsar Convention on Wetlands.

UN agencies and convention secretariats have limited resources and are generally unable to fulfil all of the requests from countries for assistance and technology transfer to promote sustainable fire management. Collaboration among governments and civil society, including bilateral and multilateral cooperative efforts, is crucial.

Given the diversity of responsibilities within and outside the UN system, an international platform was created to facilitate a global policy dialogue. A *Working Group on Wildland Fire* was established in 2001 within the Inter-Agency Task Force for Disaster Reduction under the United Nations International Strategy for Disaster Reduction (ISDR).

Following the World Summit for Sustainable Development (WSSD) (Johannesburg, South Africa, 2002) which provided the groundwork for the development of an action programme to reduce the negative effects of wildland fires on environment and humanity, an International Wildland Fire Summit was held in Sydney, Australia in October 2003. The theme of the summit was “Fire Management and Sustainable Development: Strengthening International Cooperation to Reduce the Negative Impacts of Fire on Humanity and the Global Environment”.

The Summit called for enhancing international cooperation in wildland fire management through agreements on common principles, procedures and a common global strategy. Several modalities exist for international cooperation, such as voluntary agreements, UN General Assembly resolutions, and international conventions.

Based on the recommendations of the Summit and the outputs of the UN-ISDR Working Group of Wildland Fire, the Global Wildland Fire Network became instrumental to facilitate the regional and global dialogue. The UN-ISDR Wildland Fire Advisory Group (the successor arrangement of the Working Group of Wildland Fire) and the Global Fire Monitoring Center (serving as convener and secretariat) are acting as facilitators for this process.

FAO, ISDR and GFMC agreed on a strategic "Framework for the Development of the International Wildland Fire Accord" (May 2004). To support this process a number of regional consultations and conferences were held in 2004 (Northeast Asia, Eastern Mediterranean / Balkans / Near East / Central Asia, Baltic, Sub-Sahara Africa, South America). The Pan-American Conference on Wildland Fire (23 October 2004), together with the meetings of the Regional Wildland Fire Networks of South America, Mesoamerica and the Caribbean (21-22 October 2004), is the last round of regional consultations before the FAO Ministerial Meeting on Forests at which wildland fire will be a major agenda item (Rome, 14 March 2005): Ministers responsible for forests will consider a proposal directed from the regions to the international community requesting support for a coordinated effort in international cooperation in wildland fire management. The outcome of the Pan-American Conference on Wildland Fire will be reported to the FAO Ministerial Meeting on Forests.

Expected Outputs of the Pan-American Conference on Wildland Fire

Based on regional wildland fire reports (South, Central and North America, and the Caribbean) and the outcomes of the discussions of the Regional Wildland Fire Networks during the days preceding the conference, heads of national forestry and wildland fire organizations in the Western Hemisphere and representatives of organizations that are interested in the improved management of wildland fire will discuss and may consider the endorsement of a draft declaration developed by national representatives on the day before the conference

- supporting a commitment to a regional strategy for improved management, prevention and suppression of wildland fire
- calling for strengthened international cooperation on wildland fire at bilateral, multilateral and global levels

Additional background materials available prior to the Conference

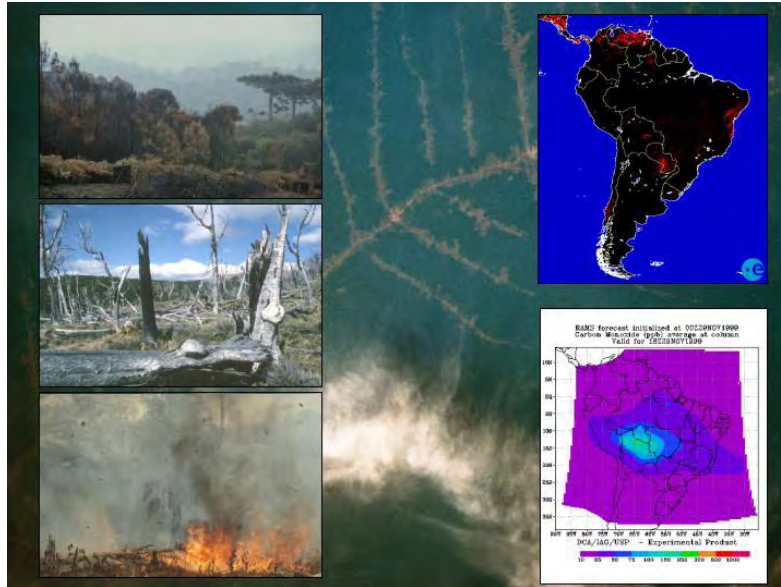
- Agenda for the Conference
- Schedule for Regional Wildland Fire Network Meetings 21 – 22 October
- Regional syntheses reports from South, Central and North America, and the Caribbean
- Status Paper of the Global Wildland Fire Network
- Framework for the Development of the International Wildland Fire Accord
- Communiqué of the International Wildland Fire Summit (including strategic agreements)

Reports to be prepared on site

- Short reports of the Regional Wildland Fire Network Meetings 21-22 October
- Report of the joint meeting of the Regional Wildland Fire Networks, 22 October afternoon
- Draft text of the San José Declaration on International Cooperation in Wildland Fire Management, based on the meetings of the Regional Wildland Fire Networks on 21-22 October 2004 and discussed at the Friday afternoon joint meeting
- Summary report on the Pan-American Conference on Wildland Fire, 23 October 2004

South America Regional Brief on International Cooperation in Wildland Fire Management¹

Wildland fires in the South America region occur in different forms from one country to the next, depending on different climatic conditions, vegetation, land uses, cultures, and social behavior. It follows that the occurrences of wildfire vary among countries. By analyzing each country separately, significant differences are observed in the magnitude and characteristics of the problem, as well as differences from one season to another. In recent years, the majority of area damaged by fire (88%) has been concentrated in Argentina, Bolivia and Brazil, which together with Chile comprise most of the annual or seasonal fire events. Fires occur at different times throughout the region in different countries in accordance with their climatic characteristics and geographic location.²



Different economic situations in each country result in different capabilities to implement fire management programs, to understand the problem, and to carry out effective planning and use of technology. This is also influenced by the priority given to fire management within national laws and policies, including the value accorded to the management and protection of forest resources. At the same time, traditional land uses generate situations in relatively poor countries that restrict the implementation of actions that might be considered normal in other countries.

Only a few countries in the region have systematic statistics based on complete and reliable information. In half of the countries in the region, reliable information about wildland fires is not available or is not published.

More than 95% of the fires in South America are caused by humans.³ Common sense and the experience of professionals in the field lead to the conclusion that, without doubt, the use of fire to clear land for agriculture, livestock, and human settlements, are the major causes of wildland fires and the destruction from fires in South America. In Brazil and Chile there has been a notable increase in intentionally set fires and arson around large urban areas arising from a mental illness (pyromania) or from intentions to harm the society or individuals.

In Chile, large plantations and wooden industrial complexes located in poor rural areas invite the use of fire to destroy forests and infrastructure as an expression of discontent because benefits are not

¹ Study prepared by Patricio I. Sanhueza, CONAF, Chile, psanhuez@conaf.cl

² Cooperación bilateral y multilateral sobre prevención, control y combate de incendios forestales: Suregión sudamérica. Sanhueza Patricio I., Agosto 2004

³ Latin America wildfire situation: An Outlook. International Wildland Fire Summit, Sydney. Martínez, R., Sanhueza, P., October 2003

generated for the neighbouring populations. For indigenous people this can be a way of claiming what they consider that they have the rights to land ownership in the area.

The trend during the last decade has been an increase in fires in the region. Wildland fire has become the major threat to forests. Fires occur in areas of urban expansion into forest areas. Fires result from conflicting claims over land ownership or occupancy, an expression of mental insanity, increasing deforestation and persistent agricultural burning without taking necessary precautions. Forests are more vulnerable to fire due to the phenomenon of climate variability – evidenced by an increase in the frequency of *el niño* in the decade of the 90s, causing, prolonged droughts and an increase in local temperatures. Already some fires are producing a large amount of damage. Finally, the increase in monoculture plantations without applying sound silvicultural practices (such as pruning and fuel reduction), as well as rural poverty, complete the context within which to consider the problem of wildland fire.

The priorities for improving the management of fires in the region must center on mechanisms for strengthening the institutional capability of organizations that are responsible for fire. This is especially true in those countries with weak capabilities or that are having management problems, so that they can comply with international commitments. Countries in the region need to develop and implement effective national forest programs that include provision for managing and preventing wildland fires.

Regulation of the use of fire is an important part of the control and management of agro-silvicultural practices. Increasing the capability of forestry personnel to enforce laws in local communities is another major administrative challenge.

However, when looking at present rise in fire occurrence, one may draw the conclusion that enforcement or tightening of law alone will not solve the fire problem in the long run. Complementary strategies are needed to tie up the local population in various fire management activities. Unfortunately very few projects, except the PROARCO/IBAMA/MMA project in Brazil, have been concentrating on how to involve local communities in fire management. Implementation of Community Based Fire Management (CBFiM) requires the development of an enabling fire legislation and fire policy; when 95 % of all fires stem from various human activities, then naturally as substantial part of fire management activities should be geared towards rising of awareness and training of local communities.

For poor people fire is the only option for land clearing, but unfortunately very few people possess the skills in applying prescribed burning; therefore prescribed burning should form a priority area in agricultural education and training. Foresters alone and fire fighters, cannot change local habits without the assistance from agriculture.

Another priority issue is for countries to take action following catastrophic events. Countries need to develop the capability to take effective action to formulate plans and programs with sufficient human and material resources to prevent and combat forest fires.

There is considerable informal cooperation among countries in the region without formal conventions or protocols. These approaches have resulted in capacity building through shared techniques for combating fires, use of equipment, education and training, remote sensing, information, management techniques, and transfer of technology. Examples of bilateral cooperative assistance and sharing of resources between countries in forest emergencies include Argentina – Brazil; Chile – Argentina; Brazil – Venezuela; y Chile – Bolivia.

In addition, a number of formal bilateral cooperative agreements have been established:

- Cross-border fire-fighting agreements (Chile – Argentina, Uruguay – Brazil, Argentina – Brazil, Perú – Brazil).
- Memoranda of understanding between the New South Wales Rural Fire Service in Australia, and Chile and Brazil; and between IBMA – Brazil and the USDA Forest Service in the United States.
- Collaboration between Spain and Chile, Venezuela and Colombia.
- Training agreement for firefighters between USAID Office of Federal Disaster Assistance and Ecuador, Paraguay and Venezuela.

- Cooperative agreements between institutions of the state (ministries, secretariats, provincial governments, armed forces) and civil society (firefighting corps, civil defence) for the prevention and combat of fires, in all of the countries in the region.
- Strategic alliances with private forest enterprises to prevent and combat fires (Chile, Brazil, Argentina, Venezuela).

In general, there are few reported initiatives and participation of the countries of the region in global forest fire projects. This is a concern, but it is also a challenge. At the moment, the project that stands out is the FAO regional TCP project to support a regional strategy for cooperation in the prevention, control and suppression of forest fires, TCP/RLA/3010. Argentina, Costa Rica, Cuba, Ecuador, the Dominican Republic, and Trinidad and Tobago and other countries in the region have requested FAO to implement this project.

At the same time, there is interest in the proposed project, "Prevention before cure" to be implemented by three countries under the International Tropical Timber Organization ITTO: Bolivia, Perú and Ecuador, under the initiative Global Fire Fight, executed by IUCN and WWF.

Several countries (Colombia, Chile, Venezuela) are participating in the international agreement derived from the UN Framework Convention for Climate Change (UNFCCC) and the UN Convention to Combat Desertification (CCD).

On 17 June 2004, the South America Regional Forest Fire Network was established by the Curitiba Declaration. Countries in the region initiated a regional dialogue and agreed to implement an Action Plan whose goals and activities are described in the Declaration. The regional network is supported by the United Nations, specifically the FAO regional office in Santiago, and the Global Fire Monitoring Center (GFMC).

To strengthen the Curitiba Declaration, civil society organizations will be invited to participate in the regional network (environmental and anti-disaster associations and foundations, consulting firms, and professional specialists), along with private companies and forest protection associations. An agenda of events and meetings will be established, including symposia, congresses, and special seminars in which the network can promote agreements among its members who will need to subscribe to the goals of the network.

The primary member of the network in each country is the entity that is responsible for the management of and protection against fires. Within each country, it is necessary to promote the development of improved policies, especially in those countries that have not defined the problem or that have insufficient or precarious laws that are disconnected from effective implementation.

It is necessary to record fire occurrences, damage and causes in order to develop the capacity to analyse and implement a corrective plan to prevent and combat fires, and to develop effective strategies that correspond to the problems in the country.

Protection, detection and organization of fire suppression methods must be integrated with the plans and programs that are used to manage the country's resources. Empirical evidence shows that, when these activities are assigned to different organizations, they have a tendency to develop distinct criteria and stages of preparation, and frequently are competing with each other instead of developing cooperation and synergies.

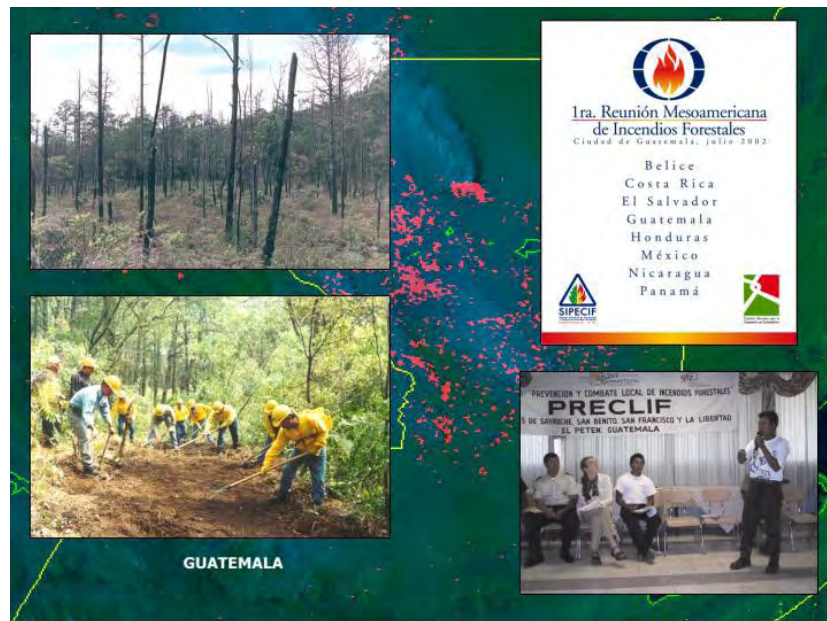
International commitments in defence of renewable natural resources, care for the environment and sustainable development facilitate the design and establishment of new agreements that, built on this base, will contribute to the protection against forest fires.

Central America and Mexico Regional Brief International Cooperation in Wildland Fire Management¹

Introduction

The Central America and Mexico regional forest fire and pests network was officially established during the meeting of the Central American Council of Forests and Protected Areas (CCAB/AP), whose members are the directors of the national forest service of each country in the region, held in El Salvador 18–19 August 2004.

In the case of forest fires, there have been various efforts since 1996 when the Central American Regional Technical Committee for Forest Fires (COTCAMAF) was established during the 19th meeting of CCAD on 11 March 1996. On 23–24 June 1998 the Workshop on Forest Fires in Honduras generated increased interest of governments. As a result, each country in the region developed action plans for the dry season of 1999 and reactivated the agreements from March 1996.



Following these efforts, the first Mesoamerican Cooperation Meeting on the Protection Against Forest Fires was held in Guatemala 8–9 July, 2002, followed by a workshop to develop a regional strategic plan for forest fires and pests, held in Honduras 26–30 August 2002.

In order to implement the strategic plan, two further workshops were held, in Guatemala 24–26 April 2004, and in El Salvador 8–9 July 2004, both to develop an action plan for Central America and Mexico to prevent and control forest fires and pests; with financial assistance from USAID.

On the other hand, several documents were generated that documented the achievements in the region: “Reduction in the Greenhouse Effect through the limitation and absorption of CO₂ in Central America – Proposal: Plan for preventing and combating forest fires in Central America (May, 1996)”, “Forest Fires and Agriculture in Central America – Balance in 1998 (June, 1998)”, “Central American strategy for fire management (1998–2003)”, “Forest fires and agriculture in Central America: Project profile – Central American action plan for fire management (February, 1999)”.

¹ Brief prepared by Miguel Antonio López, INAB, Guatemala, malq1971@yahoo.com

Objective

- Understand the actual situation in the region of Central America and Mexico with respect to forest fires
- Serve as the basis for the work of the Regional Network for Central America and Mexico (21–22 October 2004) and the Pan American Conference on Wildland Fire (23 October 2004).

Statistics

The year 1998 introduced a critical period for forest fires in Central America and Mexico; this was due to the effects of El Niño in which Mexico (849,000 ha), Guatemala (679,000 ha) and Honduras (97,000 ha) were the most affected (refer to the following table 1).

Table 1. Area in hectares burned by wildland fire in each country in the region

Country / year	1998	1999	2000	2001	2002	2003
Honduras	96,623	54,986	63,593	82,356	63,442	56,655
Panama			2,204	3,344	1,580	
El Salvador	2,041	359	1,700	1,613	1,261	3,661
Nicaragua						
Mexico	849,000	230,000	263,000	137,000	198,500	322,500
Costa Rica	64,893	11,192	36,896	57,511	50,337	32,372
Belize						
Guatemala	679,000	10,600	53,400	22,150	22,387	425,000

2003 was another critical year, when Guatemala, Mexico and El Salvador were seriously burned, in spite of the fact that the capacity to respond had been increased in comparison with 1998.

Trends in fire preparedness

Governments in the Central America and Mexico region have become increasingly interested in the prevention and control of forest fires; however when the issue is translated into political discussion, much of the effort and initiatives have not achieved concrete results.

At present, in the region there is a shortage of human resource capacity, timely detection systems, equipment and minimum tools for control, among others.

In general in Central America and Mexico, during the recent years there has been an emphasis on fire control, and there is now a need to strengthen local fire prevention strategies.

Trends in projects

The analysis of the causes of the incidence of forest fires corresponds to social inequality, under valuation of natural resources, a lack of forest culture, inadequate policies, a lack of forest resources available for the use of communities that works against sustainable management, among others; that more than 98% of all fires are started by man, the dynamic variable of forest fires and climate change, globalization; we can conclude that unless the management of forest resources is decentralized to rural communities, to social organizations, and to those who benefit from forests, then fires will continue to be a problem.

As part of the protection of the region, there should be a major emphasis on actions to prevent forest fires based on the specific social and cultural aspects of each area.

From the technical point of view, to increase and adapt training processes to the level of each country, to improve the planning processes, organization and detection systems would be timely to reduce response times, in order to implement formal systems for predicting forest fires at the regional level.

As part of the process, decentralization of fire prevention and control to the level of communities, municipalities and civil organizations are also key steps; but accompanied by strengthening technical capacities, resources and equipment.

Fire management priorities

Regional priorities included fire prevention; decentralization to the community and municipal level with training, equipment, tools, etc.; increasing the technical level for predicting, detecting and monitoring forest fires; increasing the assistance of aerial control, and defining a strategy for strengthening the technical capacity of the involved countries.

Cooperation agreements for forest fire management and their state of development

The Central America and Mexico region have a number of agreements and conventions for cooperation on forest fires:

- a) The Central American Commission for Environment and Development (CCAD) has established a Central American Council of Forests and Protected Areas (CCAB/AP) who nominate members of the Commission on Forest Pests and Fires in Central America and who have invited Mexico to participate; shaping the Central America and Mexico Regional Network on Forest Fires and Pests.
- b) Satellite detection for forest fires Mexico (CONABIO) and Guatemala, Salvador, Costa Rica and Honduras (bilateral agreements between Mexico and each country).
- c) Satellite detection for forest fires between Nicaragua and Honduras.
- d) Under the bilateral agreement between Mexico and Guatemala and the Commission on Forest Pests and Fires in Central America and Mexico, two international Mesoamerican courses for forest fire management have been developed (the first was held in November 2002 and the second in November – December 2003).
- e) At present there is in the process of being developed an action plan for fire management in Central and South America, framed within a regional strategy for initiating its execution, with the assistance of USAID.
- f) The “Trifinio” pilot area has been established in the border area of Guatemala, Salvador and Honduras to develop activities for forest fire prevention and control.
- g) In frontier areas there are activities to prevent and control forest fires in countries that belong to the Central America and Mexico Regional Network on Forest Fires and Pests.
- h) In Central America there are training processes: one supported by OFDA/USAID and the other supported by Mexico, “Mesoamerican course on forest fires.”
- i) In the border area between Guatemala and Mexico, there is an agreement to coordinate emergency response.
- j) There is an emergency response agreement between Costa Rica, Nicaragua and Panama.

Suggestions for strengthening regional and bilateral cooperation

- a) Strengthen satellite systems for detecting and monitoring fires in the region and improve processes for predicting forest fires.
- b) Revise the forest fire strategy for Central America and Mexico; and define a regional forest fire management policy, taking into account the Central American Regional Forest Strategy (EFCA), considering the strategy for the forest sector for the next 25 years.
- c) That the member countries of the Central America and Mexico Regional Network on Forest Fires and Pests give priority to resources for forest fire management.

d) Develop cooperation mechanisms for bilateral and regional projects that develop forest fire management, in order to present proposals for international assistance.

e) Now that the Central America and Mexico Regional Network on Forest Fires and Pests exists, it should develop objectives, procedures, mechanisms for cooperation and work, and protocols.

f) Create channels and procedures for communications among the networks in Central America and Mexico with those in the Caribbean; North America; and South America, and with the Global Fire Monitoring Center (GFMC).

g) Develop a work plan in a short time period at the level of regional networks, with roles and responsibilities, identifying dates for achieving results.

Caribbean Regional Study on International Cooperation in Wildland Fire Management¹

Recent trends in wildland fires in the Caribbean region

Forest fires occur in the countries of the Caribbean region, just like in the majority of countries in the world; however, it is difficult to obtain reliable information. It was only possible to obtain information about the number of fires in 5 out of 25 territories² in the region (20% of the total) for the period 2000 – 2003; and information about the surface area burned was only available for three countries. In the report on the global Forest Resources Assessment 2000³, FAO reported information about forest fires in 52 countries around the world, but only two of these countries were in the Caribbean: Cuba, and Trinidad & Tobago.

Table 1. Distribution of fire occurrences and area burned in Caribbean countries

Países	Number of fires	Area burned (ha)	Severity Index (ha/fire)
Barbados *	3 932		
Cuba **	1 119	38 891.95	34.75
Dominica *	607		
República Dominicana *	564	18 644.40	33.06
Trinidad y Tobago *	964 ***	11 232.00 ***	11.65 ***

* Presented at the 12th meeting Heads of Forestry in the Caribbean Forestry, Puerto Rico, June 2004

** Reported by the Cuerpo de Guardabosques.

*** Data only for Trinidad.

Based on the information in Table 1 above, the trend in fire occurrences is shown in figure 1 below. During the period 2000–2003, there is a tendency for an increase in the annual number of fire occurrences.

¹ Brief prepared by Marcos Pedro Ramos Rodríguez, Universidad de Pinar del Río, Cuba, cramos@af.upr.edu.cu

² Anguila, Antigua & Barbuda, Dutch Antilles, Aruba, Bahamas, Barbados, Bermuda, Cuba, Dominica, Dominican Republic, Granada, Guadalupe, Haiti, Cayman Islands, Turks & Caicos, Virgin Islands, Jamaica, Martinique, Montserrat, St. Kitts a& Nevis, St. Vicente & Grenadines, St. Lucia, Trinidad & Tobago)

³ FAO, Working Paper 55, Global Fire Assessment 1990 – 2000, CD-ROM, 2001

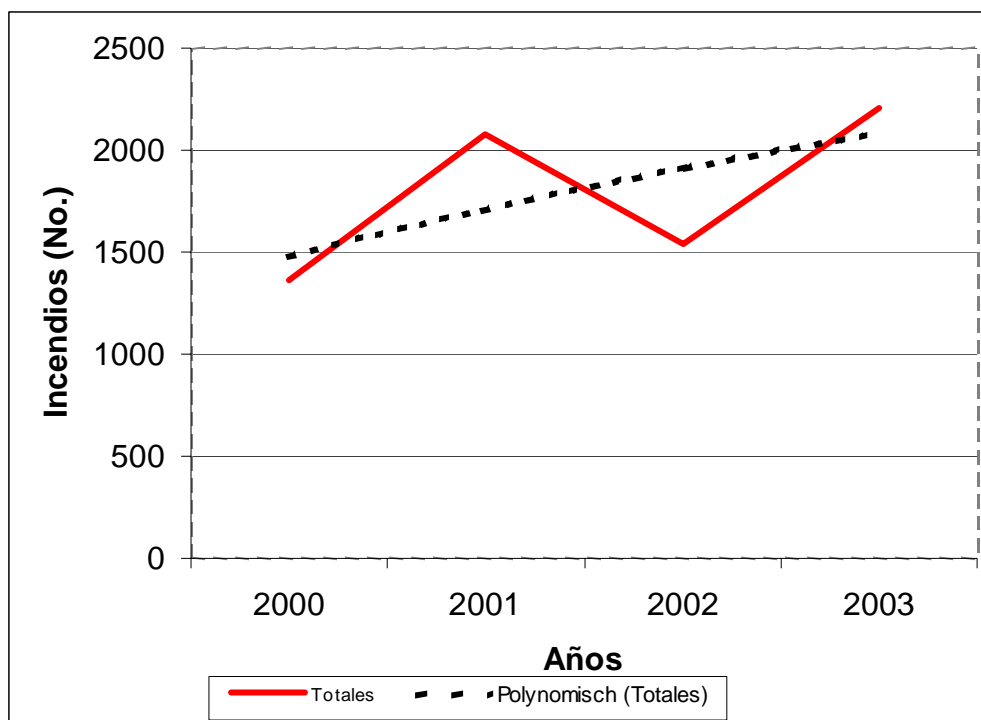


Figure 1. Distribution and trend of fires in five countries in the Caribbean 2000–2003

Projected trends in wildland fire occurrences in the Caribbean region

For years tropical forest fires were not considered an alarming problem. However, in the 1990s the number and size of fires in tropical countries in Latin America and the Caribbean began to increase, just as in the rest of the world. At the global level the uncontrolled use of fire to convert forest land to agriculture and to pasture land increased and continues to this day. This is a major cause of deforestation. In addition, in recent years forest fires have had a serious impact on natural resources, on human health, on transportation, navigation and on air quality in large areas. In the 1990s, humid tropical forests were also affected. In this context, the Caribbean is no exception. It can also be mentioned that the rural poor are the most vulnerable people affected by fires. Due to the situation just described, it is very probable that in less than a short time, the trend of forest fires will be to increase.

Priority issues for fire management

The most important priorities are: a) Strengthen prevention technicians, b) Support collaboration between national agencies and states on the matter of fire management, c) Develop a research program that takes into account the priorities of each country, d) implement a system of monitoring fires, e) Promote the development of a regional database, f) Develop training strategies.

Cooperative agreements for forest fire management

According to consultations that have been carried out, it was not possible to determine exactly what bilateral, multilateral or international agreements for forest fire management are in existence in the Caribbean.

Other international projects

At the present time, according to the sources that have been consulted, there are no international projects being developed regarding fire management in the Caribbean.

Status of the development of activities and agreements based on regional networks

It was proposed to establish a Caribbean regional fire network during the meeting of the South American regional fire network in Curitiba on 17 June 2004. This idea needs to be implemented during the meeting of region networks in Costa Rica 21 – 22 October 2004.

Suggestions for future cooperation

The situation described above indicates the need to establish mechanisms for exchanging information among Caribbean countries. It is likely that this is a propitious time for planning cooperation in forest fire management. From this framework it is possible to establish strategic alliances and mechanisms for training, statistics and organization and creating working groups at the regional level under the structure of COFLAC.

Other

In the Caribbean region, perhaps the CARICOM (Caribbean Economic Community) organization can be used to support regional mechanisms. However, there are members like Belize, Guyana and Suriname, and observers include Colombia, Mexico, and Venezuela. These countries participate on the continent. It must be decided if these countries would participate in the Caribbean regional network, or are they part of other regional networks.

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Summary of the Wildland Fire Situation in North America¹

1. Summary of recently observed trends of wildland fire occurrence in the region

Throughout the US and Canada, the trends in wildfire occurrence are similar. Fires are growing larger, causing more damage, threatening structures, property, and lives, and are more costly to suppress. The intensity and extent of damage in any given season varies with the weather, but the overall trend is an increase in burned area and a greater variability between annual area burned and fire intensities.



Canadians report about 8,500 fires per year with an average annual area burned of 2.5 million ha. The variability in area burned ranges from as few as 300,000 ha to as much as 7.5 million ha annually. The past 4 years in the US, five states have reported their largest single fire since records have been kept.

In both countries, more people are living, working, and recreating in or adjacent to extremely flammable forest fuels causing a significant increase in fire protection costs. There is a growing recognition that changing demographics, droughts, and climate change, are all contributing to the problem. In many areas of the western US, after decades of successful fire suppression, insects and disease have become more widespread and some forest ecosystems have unnatural fuel loadings and structures. As a result, there are millions of acres more susceptible to large and damaging wildland fires.

Both Canada and the US are very successful at fire suppression. In Canada, 97% of all fires are extinguished before they reach 200 ha. In the US, using a slightly different definition, initial attack is successful on 98.5% of the fires. It is clear, however, that it is neither physically possible nor ecologically desirable to eliminate all fire from the landscape.

2. Projected trends

Most fire managers and researchers indicate the upward trends in fire occurrence, area burned, and suppression expenditures will continue. There is increasing concern in both countries that global warming will become a significant factor in increasing fire activity.

¹ Report prepared by the Fire Management Working Group (FMWG) of the North American Forestry Commission (NAFC)

3. Priority Issues for fire management

US priorities are defined in the National Fire Plan (NFP) and the Healthy Forest Initiative. The NFP recognizes the need to continue to suppress unwanted fire and protect property and citizens, but also provides for increased efforts in prevention, education, and restoration of fire prone ecosystems. Millions of acres of fuel treatment projects and extensive efforts in community involvement are planned in order to treat large landscapes that will result in healthier forest and less damaging fires.

In September 2004, the Canadian Council of Forest Ministers agreed to the development of a new Canadian Wildland Fire Strategy based on the principles of risk management and hazard mitigation. This strategy will seek a balanced approach to public safety, forest protection and health, and fire management expenditures that maintains a strong and effective fire suppression organization, but also includes innovative hazard mitigation, preparedness, and recovery programs. The Strategy recognizes the need for responsibility to be shared among property owner, industries, and local, provincial, and federal governments.

4. Established international cooperative arrangements

The US and Canada are participants in a wide range of international programs. Both Canada and the US have mutual aid border agreement covering all international borders for mutual aid in fire management. The agreements between the US and Canada and the US and Mexico also provide for cooperation in all fire management activities anywhere in the countries, as well as technical exchanges and mechanisms for annual operating plans and organizational meeting.

In addition to the border agreements, the US and Canada are finalizing arrangements with the States of Australia and New Zealand to provide fire suppression resources during critical fire season. Over the past four years, Australian and New Zealand fire fighters have been deployed in Montana, Idaho, Oregon, and other Western States, and US fire fighters were sent to the State of Victoria in Australia.

Over the past four decades there has also been extensive cooperation between Canada and the US in forest fire science and technology. Both formal and informal working relationships have evolved resulting in significant synergies in certain fields such as fire danger rating, fire behavior, and climate change.

5. Status of Regional Networking arrangements

The Fire Management Working Group (FMWG) of the North American Forestry Commission (NAFC) serves as the Regional Network for North America (including Mexico). Established in 1962, the FMWG meets annually. The membership includes key groups and agencies in all three countries. For the US, all Federal and State wildland fire agencies are represented as well as the National Fire Protection Association.

Canada's members are the Canadian Interagency Forest Fire Centre, the Canadian Forest Service (including fire research), and the Provincial Fire agencies. Mexico is represented by fire managers from the Forest Commission (CONAFOR), fire research, and a non-governmental forest ecology group active in fire management and fire research projects.

During the 2004 annual meeting, the FMWG agreed to update and revise their web site to provide better information and easier access to other North American links. The web site will be designed as the "first stop" for other regional network members to access information in the three countries. The FMWG also agreed to work with the Regional Wildland Fire Networks of South America, Central America, and the Caribbean, as well as with the Global Wildland Fire Network, and develop a program of cooperation based on mutual needs and interests.



Statement by M. Hosny El-Lakany, Assistant Director-General, FAO Forestry Department

Distinguished participants,
Guests and colleagues,
Good morning.

It is a pleasure and a privilege to join you on the occasion of the first Pan American Conference on Wildland Fire. On behalf of the Director-General of FAO, Mr Jacques Diouf, I welcome you all to this important meeting. I also wish to extend my thanks to the Government of Costa Rica for the excellent arrangements they have made for our meeting.

This is the first major event that is jointly organized by the FAO Latin American and Caribbean Forestry Commission, and the North American Forest Commission. I would be interested in hearing your views as to whether or not we should consider other joint activities along these lines in the future.

There is a growing body of evidence to indicate that unplanned forest fires are increasing in both frequency and severity. There are a number of reasons for this. In many countries in Latin America and the Caribbean, there is more pressure than ever to convert forests into other land uses, fuelled principally by poverty and the need to obtain food. In some countries, such as the United States, one of the major causes of catastrophic fires is the accumulation of fuels in unmanaged forests. Ironically, effective fire prevention programmes may have contributed to the problem. Fire strategies need to address the reasons and root causes for fires. The cost of mitigating the underlying causes of fire is usually more cost effective than investments in fire suppression technologies and resources.

Primary responsibility for managing forest fires lies with each country. FAO and other United Nations agencies can provide technical support, but we do not have the capacity or mandate to fight forest fires. But the reason we are here today is to consider how countries can help each other. Many of the problems that each country faces are similar those faced by other countries. By sharing information, technology, and expertise, all countries are better off. FAO and other United Nations organizations can exercise their comparative advantage by helping to facilitate cooperation among countries.

FAO is ready and willing to support this process. We believe that international cooperation is fundamental when it comes to monitoring, preventing, controlling, and managing forest fires. FAO is taking several specific actions to support international cooperation in forest fires:

- For many years, FAO has been providing technical assistance to individual countries to increase their fire management capacities. We have learned that an effective fire management strategy must be both bottom-up and top-down. When I say bottom-up, I refer to the importance of community – based fire management approaches. The people who are most affected by fires must be part of the solution. When I say top-down, I refer to the importance of effective fire management leadership and policies at the national level. And effective law enforcement is necessary at all levels.
- In the past five years, FAO has hosted two international expert consultations on forest fires.
- In collaboration with a number of partners, FAO is supporting community-based approaches to fire management. For example, a regional training programme will be carried out next week in South Africa.
- In collaboration with the United Nations International Strategy for Disaster Reduction (ISDR) and a number of other partners, FAO has supported the formation of regional fire networks, including the meeting in Curitiba in June of this year.

- The Fire Management Working Group was formed by the FAO North American Forest Commission over 40 years ago. This working group has co-sponsored all three of the global Wildland Fire conferences, including the recent Summit in Sydney, Australia.
- Recently, the Director-General of FAO approved funding for a regional project to develop a strategy for fire management in Latin America and the Caribbean. This project is helping to support this Conference, and funds will be available following the Conference to support follow-up activities. If you need more information about this project, please speak with Dr. Carneiro, is the project coordinator.

Last but not least, I have the pleasure to inform you that international cooperation on forest fires will be a major agenda item at two meetings in Rome in March 2005. The Director-General of FAO has invited Ministers responsible for forests to FAO Headquarters in Rome on 14 March 2005 to discuss international cooperation on forest fires, and to consider ways to strengthen the international commitment to sustainable forest management. The declaration that is adopted by the Pan American Fire Conference this afternoon will be presented to the Ministerial Meeting for consideration.

The Ministerial Meeting will be immediately followed by the Committee on Forestry, better known to most of us as COFO. The 17th session of COFO will take place in Rome from 15–19 March 2005. We will have a special side event on forest fires on 16 March, and on 17 March COFO will discuss specific ways to implement the recommendations of the Ministerial Meeting.

Today's Conference is a very ambitious undertaking for FAO. This is the first time that we have tried to bring together so many national forestry leaders from so many countries in two major regions of the world to address the matter of forest fires. I look forward to listening to your concerns and to participating in the discussions about what steps might be taken to strengthen international cooperation on forest fires throughout the Pan American region.

Thank you.



Wildland Fire Management's Multiple Dimensions

Speech by U.S. Forest Service Chief Dale Bosworth

I'm glad to be here today. I'd like to thank the Government of Costa Rica for hosting this conference, and I'd also like to thank the sponsors, the Latin America and Caribbean Forestry Commission and the North American Forest Commission. As U.S. Forest Service Chief, I'm a member of the North American Forest Commission, and after this conference I'm going to our meeting hosted this year by Mexico. I'm really looking forward to that.

I welcome opportunities like this to meet with professionals like Dr. Goldammer and with colleagues like Mr. Jorge Menendez from Argentina, my counterpart here today. These meetings give us a chance to compare notes and figure out how we might work better together across borders and boundaries for our mutual benefit. I value the opportunity to learn from your experience, especially when it comes to wildland fire.

I'm here on behalf of fire managers in Canada and the United States. I'd like to start by putting our fire environment in North America in perspective. Then I'll go into some of the things we're learning about managing the kinds of fires we're getting.

Fire Environment

You're probably generally aware of our fire environment in North America, so I won't say much, except that it is enormously complex and costly. Just to give you some idea:

- Most sites in North America have a natural history of fire that we can trace back for hundreds or even thousands of years. Wherever that's the case, fire has played a key role in shaping the structure, composition, and function of the ecosystem.
- In Canada, the boreal forests burn in huge fires at long intervals. These fires are natural events that function to keep these ecosystems healthy. However, they also put people and property at permanent risk, particularly because so many people are moving from cities into the wildland/urban interface, or WUI, for short. Canada gets thousands of these fires each year, and they burn an average of 2.5 million hectares. Fire suppression costs average about \$400 million per year, but it can vary from a fraction of that to two or three times that.
- In the United States, our biggest fire problem is in dry pine forests in the West. These forests are naturally adapted to frequent low-severity fires, not to the big fires that are typical of most boreal forests. But many of these dry pine forests have become so overgrown and unhealthy that they are now ecologically threatened by big fires. These forests are also getting some of our biggest WUI growth, so the threat is to people and property, as well. Since 2002, five western states have had record fires. In 2000, we had more acres burn than in any year since the 1950s, and in 2002, our fire suppression costs exceeded \$1.6 billion.

I believe that wildland fire is one of the most serious concerns we face in North America and that it will drive much of what we do in natural resource management for quite some time.

Lessons Learned

I want to make three points about what we're learning in this regard.

More Fire Use. First, we are learning that protection strategies for many forests and grasslands require *using* fire, not excluding it. Fire's ecological role means that fire can be the best tool we have to sustain ecosystem health. That can even be true in our boreal forest types, and I'll give an example.

Near Seeley Lake in the State of Montana, there are some of the biggest western larches in the world. They got their start up to a thousand years ago, when low-severity fires were introduced. Unless we carefully burn from time to time, other species come into the understory. Eventually, they will carry huge fires into the overstory and destroy the grove. Seeley Lake also happens to have a lot of homes in the vicinity. We can protect both the ecosystem and the community from huge fires by carefully thinning and burning in the right place at the right time.

More Social Science. That brings me to my second point: We need to better integrate the social sciences into our fire management policies and strategies. We are simply going to get big, dangerous fires in many of our forest types in North America. It's natural. What isn't natural is that so many of our forests are now filled with homes and communities, like at Seeley Lake.

Technically, we know what to do. Our science and technology have given us a lot of the means to protect people in the WUI. But that might not matter. If folks near Seeley Lake and elsewhere don't like the smoke, then we aren't going to get their agreement to use beneficial fire. And if they don't want government interference with what they see as natural processes, then we might not be able to remove vegetation to control fuels. Maybe most importantly, if people want to live in houses made of flammable materials and secluded by thick trees, then we aren't going to be able to protect them, no matter what. They've got to take more responsibility.

That's why we need more social science and better communication. We've got to reach folks in the WUI, understand where they're coming from, and get them to understand what they've gotten themselves into by moving into the WUI. We've got to get people in the WUI to take more responsibility for themselves so we can better integrate our risk management.

Less Focus on Suppression. If our fire problem has social and ecological dimensions, then it's more than just a suppression problem. That's my third point: Suppression isn't enough. In the early days of our fire organization in the United States, we tended to look at fire mainly as a technical problem of fire suppression. We thought that if only we had more firefighters and more equipment, then we could quickly control almost every fire.

And we did, but it didn't solve our problem. By the 1980s and 1990s, we had a fantastic fire organization in both Canada and the United States. Today, we quickly put out something like 97 or 98 percent of our wildfires all across North America. But the 2 or 3 percent that escape can just overwhelm us. Fewer than 1 percent of our fires account for about 85 percent of our suppression costs and close to 95 percent of our total burned acres.

Southern California is a perfect example. The combined operating budgets for wildfire preparedness in California, between federal, state, and local jurisdictions, is over \$3 billion per year. That gives California the largest fire department in the United States, maybe the largest in the world. By any measure, our fire services in California have enormous capacity, but every few years they get overwhelmed.

Last fall, we got over 900 fires within just 10 days in southern California. Fourteen of them became large incidents. The fires burned close to 300,000 hectares, destroyed 3,600 homes, and killed 24 people, including one firefighter. Suppression costs alone exceeded \$200 million, with billions of dollars more in damage to infrastructure, loss of property, and disruption of commerce. All this in a place with some of the best firefighting capacity in North America.

That's because our fire problem isn't just a suppression problem. It's also a social and ecological problem. Southern California has some of the most volatile fuel types in the world. It also has an enormous and growing population that wants the landscape managed for homesites, recreation, visual quality, and endangered species habitat—anything but reduced fire risk. We're emphasizing suppression while virtually ignoring the land's inherent fire risk. It's no wonder we get overwhelmed: We're not managing the land to address the dynamics of volatile fire regimes.

What To Do

What's the solution? Yes, we need sufficient suppression resources and good suppression strategies. But we also need to strike a better balance between our suppression response and our pre- and post-fire activities. For that, we need to involve local communities. The most effective way to address fire problems is by involving local communities in addressing their own needs in a way that is consistent with the ecological role of fire.

That needs to be done on several fronts:

- First, the fuels front. Consistent with the local fire regime, we need to involve communities in plans and projects for reducing fuels and restoring healthy ecological conditions, especially near homes, municipal watersheds, and social or ecological values at risk.
- Second, the home front. We need to get individuals and communities to take responsibility for protecting their properties from fire by using safe building materials and by clearing an area around their homes. We also need to get people to prepare themselves for what to do in case of an emergency.
- Third, the postfire recovery front. We need to involve communities in plans and projects to rehabilitate areas damaged by fire, especially municipal watersheds and ecologically sensitive areas.

I strongly believe that fire managers need to move beyond a focus primarily on suppression. We need to strike a better balance by bringing in more of the social and ecological dimensions of wildland fire management. We need a fire management strategy that incorporates local needs and builds local capacity in the context of the fire-adapted ecosystems we live in.

Three Points



In closing, I'd like to endorse several points made by the North American Forest Commission's Fire Management Working Group. It's a professional association of fire managers that has been building partnerships between Canada, Mexico, and the United States since 1962. The Group just met in Chihuahua, Mexico, and I'd like to repeat three points made at the meeting because I think they dovetail with my remarks:

- First, fire management today isn't simply a technical matter of fire suppression. Our commitment to sustainability has made fire management much more complex. It involves all kinds of social and human dynamics as well as complex questions about the ecological role of fire. If we're going to adequately address these issues, then we're going to need new and more effective kinds of international cooperation in fire management operations, policy, and research and development.
- Second, we know that fires are growing more damaging and worrisome in North America. Drought has something to do with it, as do changing demographics and the growth of the WUI. Climate change also contributes to the problem. For example, large parts of the western United States experienced several decades of above-normal precipitation and a lot of forest growth. Now that we're back to normal drier conditions, we're seeing explosive fire activity. But whatever the cause, the key is restoring forest health.
- Finally, we need a balanced approach to fire management. Yes, we need a strong and effective fire suppression organization. But we also need to engage the public in the principles of fire prevention and hazard mitigation. We need a strategy based on innovative approaches to risk sharing, and we need for property owners to take responsibility for getting involved.

Unprecedented Gathering

In closing, I'd like to salute everyone here. This meeting today is unprecedented in this hemisphere. I believe that it's long overdue, and I'd like to see more of this kind of thing, because this issue is critical for all of us.

We on the North American Forest Commission endorse the outcomes from last October's Fire Summit in Sydney, Australia. We also endorse the goals and work of the Global Wildland Fire Network. We believe that today's meeting constitutes one of the regional conferences called for by the Sydney Summit. I hope and trust that it will lead to further collaboration in an effort to reduce the fire risk and to restore fire-dependent ecosystems for generations to come.

 <p>Food and Agriculture Organization of the United Nations</p>	<p>Pan-American Conference on Wildland Fire</p> <p>San José, Costa Rica 23 October 2004</p>	 <p>Global Fire Monitoring Center (GFMC) Global Wildland Fire Network</p>
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San José Declaration on Pan-American Cooperation in Wildland Fire Management

On 23 October 2004 the Government of Costa Rica hosted the Pan-American Conference on Wildland Fire in San José. The conference was sponsored by the FAO Latin America and Caribbean Forestry Commission (LACFC), the FAO North American Forest Commission (NAFC) and the Global Fire Monitoring Center (GFMC). The objective of the conference was to strengthen international cooperation in wildland fire management. The participants adopted the following declaration:

The Conference participants:

Recognizing the importance of forests as providers of environmental services and social, economic, and ecological benefits to humankind;

Expressing concern about the increasing frequency and destructive force of unwanted wildfires in the Americas -- including the excessive use of fire in the conversion of forests into other land uses in South America, Central America, Mexico and the Caribbean -- affecting human lives, health and well-being, economic assets, property, biodiversity, water resources, soil, atmosphere and climate;

Noting that fire is playing an important role in the natural dynamics and maintenance of many ecosystems in the Pan-American region;

Noting that the use of fire in agricultural expansion in some parts of the Americas is resulting in increased vulnerability of ecosystems; likewise urban encroachment in wildlands resulting in increased vulnerability of human populations to fire, notably at the rural-urban interface;

Recognizing the reasons for changing fire regimes is due to increase in population pressure in many countries and associated socio-economic and conflicts in some rural areas;

Noting an increase in vulnerability of humans and ecosystems to secondary disasters following fires, including floods, landslides and soil erosion;

Noting that the effects of climate variability and climate change caused by human activities are already producing periods of extreme drought resulting in an increase in the severity of fires in some boreal, temperate, sub-tropical and tropical ecosystems, in particular in wetlands;

Concluding from the analyses and reports of the Regional Wildland Fire Networks presented to this conference on the fire situation in participating countries, it is evident that the majority of countries in the regions are ready to establish and strengthen a regional dialogue on cooperation and exchange of information, research and wildland fire management, including through agreements;

Expressing the intention to overcome current gaps and shortages in:

- Consistent information and statistics about fires, their causes and their effects
- Applied research in social sciences and humanities, and innovations in appropriate technology
- Integration of social, economic, environmental considerations and institutions in developing tangible policies and practices related to fire
- Fire becoming an integral component of land, resource, and forest management
- Balanced approaches and solutions, including mitigation, prevention, preparedness, response, and recovery
- Community-based approaches to fire management
- Skills and knowledge of rural people in fire management
- Training in the appropriate use of fire (for example, prescribed burning or the use of fire at the interface of critical risk)
- Long-term visions or plans with tangible short-term and medium-term milestones
- Compatible approaches, e.g., global implementation of the Incident Command System (ICS) and the International Wildland Fire Agreements Template

Recalling the recommendations of the World Summit on Sustainable Development (WSSD 2002) and the International Wildland Fire Summit (Sydney 2003) with respect to the management of wildland fires and the strategy to strengthen international cooperation in wildland fire management;

Endorsing the efforts of the United Nations International Strategy for Disaster Reduction (UN-ISDR) and its Wildland Fire Advisory Group to assist and strengthen the efforts of United Nations bodies, other international organizations, and non-governmental organizations, to reduce the negative impacts of wildland fires;

Supporting the objectives of the ISDR Global Wildland Fire Network (GWFN) and the Global Fire Monitoring Center (GFMC) to systematically increase the intra- and inter- regional cooperation in wildland fire management for the world;

Supporting the preparations by FAO for the Ministerial Meeting on Forests where wildland fire management will be a major agenda item (Rome, 14 March 2005);

Appreciating the support and hospitality of the government of Costa Rica, host of the Pan-American Conference on Wildland Fire;

Recommend to governments, international organizations and non-government organizations the following action plan for cooperation on wildland fire management:

- Implement national and regional strategies that recognize the importance of forests in alleviating poverty and increasing food security
- Elevate the priority of sustainable forest management on national political agendas
- Elevate the priority of sustainable forest management on the agendas of development assistance agencies and international organizations
- **Establish national centres for monitoring wildland fires**
- **Develop and standardize fire statistics that include common criteria for classification of vegetation types affected by fire**
- Develop and implement national laws and policies that promote integrated approaches to agriculture, forest management, fire management, economic development, social and human resources development, and environmental protection
- Develop long-term strategic approaches to fire, rather than only reacting to emergencies and recognize the beneficial use of fire as an ecosystem and resource management tool

- Strengthen the capacities of organizations responsible for managing fire in each country
- Strengthen formal and informal education programs in forest fire management
- Develop and implement national and regional fire research programs, including research in global carbon strategies
- Implement and consolidate the Incident Command System in countries to strengthen the capabilities of their organizations and to facilitate efficient multilateral cooperation in fire emergencies
- implement community-based policies and approaches to fire management, involving civil society, indigenous communities, farmers and forest workers in fire preparedness, prevention and response, as a fundamental principle to gain local commitment for the protection of ecosystems and integrated fire management, and incorporate them as national policies
- Recognize the need for applying economic evaluation of environmental damages caused by fires, as well as damages avoided by preventing or suppressing fires, as a planning and management tool
- In addition to existing funding agencies such as the Global Environment Facility (GEF), create national and regional financing mechanisms for fire management, including private mechanisms
- Recommend official recognition of regional fire management networks under the auspices of the United Nations ISDR, FAO, and GFMC, among others
- Endorse the Global Wildland Fire Network
- Recommend FAO and ISDR to facilitate the development of a regional fire management strategy for Latin America and the Caribbean which provides a framework of action for countries to address the problems of wildland fire
- Support agreements between institutions within countries, as well as between countries in each region, and between regions
- Request the FAO Committee on Forestry (COFO) and the Ministerial Meeting on Forests in Rome (March 2005) to consider the recommendations emanating from the regional consultations that took place in 2004 and support the Framework for the Development of the International Wildland Fire Accord developed by ISDR / FAO
- Establish bilateral and multilateral agreements on cooperation in integrated fire management and promote the development of an international accord for cooperation in the prevention and management of wildland fire, for example as a resolution of the General Assembly of the United Nations.

**The South East Asian Region:
Association of South East Asian Nations (ASEAN)**



The ASEAN Agreement on Transboundary Haze Pollution

Press Release - Kuala Lumpur, 11 June 2002

The ASEAN Ministers responsible for environment met today and resolved to continue their efforts to tackle comprehensively, and on a concerted and collaborative basis, the transboundary haze pollution problem that has plagued ASEAN periodically in recent years. The Ministers agreed to work towards ratifying the ASEAN Agreement on Transboundary Haze Pollution signed yesterday as soon as possible, to ensure that regional efforts are further enhanced through the legal mechanisms provided for in the agreement. The agreement requires at least 6 ratifications to enter into force.

Pending the establishment of the ASEAN Coordinating Centre for Transboundary Haze Pollution Control provided for in the agreement, the Ministers agreed on a set of interim arrangements using existing institutions and resources. The Ministers also agreed to conduct cross-border fire and haze disaster simulation exercises among some member countries to test regional preparedness for coordination, communication, and disaster relief, which are the key elements of the agreement.

The Ministers noted the likelihood of a weak to moderate El Niño evolving gradually in the next six to nine months. While the chances of a recurrence of the severe smoke haze of 1997/1998 are small, increased occurrence of slight to moderate haze can be expected within the affected countries during the dry season between July and October, 2002. The Ministers, therefore, resolved, during the dry period, to (i) intensify early warning efforts and surveillance programmes, (ii) consider banning open burning in plantation and forest areas, and (iii) have strict enforcement of controlled burning for small-scale farmers and local community, including regulating the timing for burning.

The Ministers expressed their satisfaction over the regional activities undertaken so far. These include timely and more accurate weather forecasts and early warning measures; strict enforcement of existing laws and enactment of new laws to regulate open burning; training of prosecution and law enforcement officers; dialogue sessions with traditional communities, NGOs, plantation companies and other stakeholders; development of preventive tools such as GIS database, fire danger rating systems and practical guidelines for implementing zero burning and controlled burning policy; information management through the *ASEAN Haze Action On-line* website; development of fire suppression mobilization plans for the region's fire-prone areas; and a pilot project to develop community-based model and approaches in fire management. The Ministers expressed appreciation to Indonesia for successfully prosecuting those engaged in open burning.

In addition to the subregional firefighting arrangements for Sumatra and Borneo, the Ministers agreed to establish similar arrangements in other areas of ASEAN.

The Ministers expressed their appreciation to international organizations and donor agencies for their support to ASEAN in the prevention, monitoring and mitigation of land and forest fires. The Ministers noted that the first World Conference on Land and Forest Fire Hazards being held concurrently aims to invigorate international commitment and support, by reviewing global perspectives, and to set in place more effective national and regional strategies in addressing land and forest fires and the resulting transboundary haze pollution.

The Ministers emphasized that land and forest fires are worldwide phenomena with increasing incidence not only in developing countries but also in developed countries. The national, regional and global impacts due to biodiversity loss and emissions of greenhouse gases are enormous. The

Ministers reiterated their call to the World Summit on Sustainable Development (WSSD) to accord special consideration to this complex issue. The Ministers urged the WSSD to demonstrate strong political commitment and agree on concrete targeted measures to tackle this problem on a sustained basis.

The Ministers reiterated their call to the Global Environment Facility (GEF) to continue supporting ASEAN regional efforts in addressing transboundary haze pollution through a full-sized regional programme, particularly in the context of implementing the provisions of the ASEAN Agreement on Transboundary Haze Pollution.

Text of the ASEAN Agreement on Transboundary Haze Pollution Signed on 10 June 2002

The Parties to this Agreement,

REAFFIRMING the commitment to the aims and purposes of the Association of Southeast Asian Nations (ASEAN) as set forth in the Bangkok Declaration of 8 August 1967, in particular to promote regional co-operation in Southeast Asia in the spirit of equality and partnership and thereby contribute towards peace, progress and prosperity in the region,

RECALLING the Kuala Lumpur Accord on Environment and Development which was adopted by the ASEAN Ministers of Environment on 19 June 1990 which calls for, inter alia, efforts leading towards the harmonisation of transboundary pollution prevention and abatement practices,

RECALLING ALSO the adoption of the 1995 ASEAN Co-operation Plan on Transboundary Pollution, which specifically addressed transboundary atmospheric pollution and called for, inter alia, establishing procedures and mechanisms for co-operation among ASEAN Member States in the prevention and mitigation of land and/or forest fires and haze,

DETERMINED to give effect to the 1997 Regional Haze Action Plan and to the Hanoi Plan of Action which call for fully implementing the 1995 ASEAN Cooperation Plan on Transboundary Pollution, with particular emphasis on the Regional Haze Action Plan by the year 2001,

RECOGNISING the existence of possible adverse effects of transboundary haze pollution,

CONCERNED that a rise in the level of emissions of air pollutants within the region as forecast may increase such adverse effects,

RECOGNISING the need to study the root causes and the implications of the transboundary haze pollution and the need to seek solutions for the problems identified,

AFFIRMING their willingness to further strengthen international co-operation to develop national policies for preventing and monitoring transboundary haze pollution,

AFFIRMING ALSO their willingness to co-ordinate national action for preventing and monitoring transboundary haze pollution through exchange of information, consultation, research and monitoring,

DESIRING to undertake individual and joint action to assess the origin, causes, nature and extent of land and/or forest fires and the resulting haze, to prevent and control the sources of such land and/or forest fires and the resulting haze by applying environmentally sound policies, practices and technologies and to strengthen national and regional capabilities and co-operation in assessment, prevention, mitigation and management of land and/or forest fires and the resulting haze,

CONVINCED that an essential means to achieve such collective action is the conclusion and effective implementation of an Agreement,

Have agreed as follows:

PART I. GENERAL PROVISIONS

Article 1

Use of Terms

For the purposes of this Agreement:

1. "Assisting Party" means a State, international organisation, any other entity or person that offer and/or render assistance to a Requesting Party or a Receiving Party in the event of land and/or forest fires or haze pollution.
2. "Competent authorities" means one or more entities designated and authorised by each Party to act on its behalf in the implementation of this Agreement.
3. "Controlled burning" means any fire, combustion or smouldering that occurs in the open air, which is controlled by national laws, rules, regulations or guidelines and does not cause fire outbreaks and transboundary haze pollution.
4. "Fire prone areas" means areas defined by the national authorities as areas where fires are most likely to occur or have a higher tendency to occur.
5. "Focal point" means an entity designated and authorised by each Party to receive and transmit communications and data pursuant to the provisions of this Agreement.
6. "Haze pollution" means smoke resulting from land and/or forest fire which causes deleterious effects of such a nature as to endanger human health, harm living resources and ecosystems and material property and impair or interfere with amenities and other legitimate uses of the environment.
7. "Land and/or forest fires" means fires such as coal seam fires, peat fires, and plantation fires.
8. "Member State" means a Member State of the Association of Southeast Asian Nations.
9. "Open burning" means any fire, combustion or smouldering that occurs in the open air.
10. "Party" means a Member State of ASEAN that has consented to be bound by this Agreement and for which the Agreement is in force.
11. "Receiving Party" means a Party that accepts assistance offered by an Assisting Party or Parties in the event of land and/or forest fires or haze pollution.
12. "Requesting Party" means a Party that requests from another Party or Parties assistance in the event of land and/or forest fires or haze pollution.
13. "Transboundary haze pollution" means haze pollution whose physical origin is situated wholly or in part within the area under the national jurisdiction of one Member State and which is transported into the area under the jurisdiction of another Member State.
14. "Zero burning policy" means a policy that prohibits open burning but may allow some forms of controlled burning.

Article 2

Objective

The objective of this Agreement is to prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated, through concerted national efforts and intensified regional and international co-operation. This should be pursued in the overall context of sustainable development and in accordance with the provisions of this Agreement.

Article 3

Principles

The Parties shall be guided by the following principles in the implementation of this Agreement:

1. The Parties have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment and harm to human health of other States or of areas beyond the limits of national jurisdiction.
2. The Parties shall, in the spirit of solidarity and partnership and in accordance with their respective needs, capabilities and situations, strengthen co-operation and co-ordination to prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated.
3. The Parties should take precautionary measures to anticipate, prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated, to minimise its adverse effects. Where there are threats of serious or irreversible damage from transboundary haze pollution, even without full scientific certainty, precautionary measures shall be taken by Parties concerned.
4. The Parties should manage and use their natural resources, including forest and land resources, in an ecologically sound and sustainable manner.
5. The Parties, in addressing transboundary haze pollution, should involve, as appropriate, all stakeholders, including local communities, non-governmental organisations, farmers and private enterprises.

Article 4

General Obligations

In pursuing the objective of this Agreement, the Parties shall:

1. Co-operate in developing and implementing measures to prevent and monitor transboundary haze pollution as a result of land and/or forest fires which should be mitigated, and to control sources of fires, including by the identification of fires, development of monitoring, assessment and early warning systems, exchange of information and technology, and the provision of mutual assistance.
2. When the transboundary haze pollution originates from within their territories, respond promptly to a request for relevant information or consultations sought by a State or States that are or may be affected by such transboundary haze pollution, with a view to minimising the consequences of the transboundary haze pollution.
3. Take legislative, administrative and/or other measures to implement their obligations under this Agreement.

PART II. MONITORING, ASSESSMENT, PREVENTION AND RESPONSE

Article 5

ASEAN Co-ordinating Centre for Transboundary Haze Pollution Control

1. The ASEAN Co-ordinating Centre for Transboundary Haze Pollution Control, hereinafter referred to as “the ASEAN Centre”, is hereby established for the purposes of facilitating co-operation and co-ordination among the Parties in managing the impact of land and/or forest fires in particular haze pollution arising from such fires.
2. The ASEAN Centre shall work on the basis that the national authority will act first to put out the fires. When the national authority declares an emergency situation, it may make a request to the ASEAN Centre to provide assistance.
3. A Committee composed of representatives of the national authorities of the Parties shall oversee the operation of the ASEAN Centre.
4. The ASEAN Centre shall carry out the functions as set out in **Annex** and any other functions as directed by the Conference of the Parties.

Article 6

Competent Authorities and Focal Points

1. Each Party shall designate one or more Competent Authorities and a Focal Point that shall be authorised to act on its behalf in the performance of the administrative functions required by this Agreement.
2. Each Party shall inform other Parties and the ASEAN Centre, of its Competent Authorities and Focal Point, and of any subsequent changes in their designations.
3. The ASEAN Centre shall regularly and expeditiously provide to Parties and relevant international organisations the information referred to in paragraph 2 above.

Article 7

Monitoring

1. Each Party shall take appropriate measures to monitor:
 - a. all fire prone areas,
 - b. all land and/or forest fires,
 - c. the environmental conditions conducive to such land and/or forest fires, and
 - d. haze pollution arising from such land and/or forest fires.
2. Each Party shall designate one or more bodies to function as National Monitoring Centres, to undertake monitoring referred to in paragraph 1 above in accordance with their respective national procedures.
3. The Parties, in the event that there are fires, shall initiate immediate action to control or to put out the fires.

Article 8

Assessment

1. Each Party shall ensure that its National Monitoring Centre, at agreed regular intervals, communicates to the ASEAN Centre, directly or through its Focal Point, data obtained relating to fire prone areas, land and/or forest fires, the environmental conditions conducive to such land and/or forest fires, and haze pollution arising from such land and/or forest fires.
2. The ASEAN Centre shall receive, consolidate and analyse the data communicated by the respective National Monitoring Centres or Focal Points.

3. On the basis of analysis of the data received, the ASEAN Centre shall, where possible, provide to each Party, through its Focal Point, an assessment of risks to human health or the environment arising from land and/or forest fires and the resulting transboundary haze pollution.

Article 9

Prevention

Each Party shall undertake measures to prevent and control activities related to land and/or forest fires that may lead to transboundary haze pollution, which include:

- a. Developing and implementing legislative and other regulatory measures, as well as programmes and strategies to promote zero burning policy to deal with land and/or forest fires resulting in transboundary haze pollution;
- b. Developing other appropriate policies to curb activities that may lead to land and/or forest fires;
- c. Identifying and monitoring areas prone to occurrence of land and/or forest fires;
- d. Strengthening local fire management and firefighting capability and co-ordination to prevent the occurrence of land and/or forest fires;
- e. Promoting public education and awareness-building campaigns and strengthening community participation in fire management to prevent land and/or forest fires and haze pollution arising from such fires;
- f. Promoting and utilising indigenous knowledge and practices in fire prevention and management; and
- g. Ensuring that legislative, administrative and/or other relevant measures are taken to control open burning and to prevent land clearing using fire.

Article 10

Preparedness

1. The Parties shall, jointly or individually, develop strategies and response plans to identify, manage and control risks to human health and the environment arising from land and/or forest fires and related haze pollution arising from such fires.
2. The Parties shall, as appropriate, prepare standard operating procedures for regional co-operation and national action required under this Agreement.

Article 11

National Emergency Response

1. Each Party shall ensure that appropriate legislative, administrative and financial measures are taken to mobilise equipment, materials, human and financial resources required to respond to and mitigate the impact of land and/or forest fires and haze pollution arising from such fires.
2. Each Party shall forthwith inform other Parties and the ASEAN Centre of such measures.

Article 12

Joint Emergency Response through the Provision of Assistance

1. If a Party needs assistance in the event of land and/or forest fires or haze pollution arising from such fires within its territory, it may request such assistance from any other Party, directly or

through the ASEAN Centre, or, where appropriate, from other States or international organisations.

2. Assistance can only be employed at the request of and with the consent of the requesting Party, or, when offered by another Party or Parties, with the consent of the receiving Party.
3. Each Party to which a request for assistance is directed shall promptly decide and notify the requesting Party, directly or through the ASEAN Centre, whether it is in a position to render the assistance requested, and of the scope and terms of such assistance.
4. Each Party to which an offer of assistance is directed shall promptly decide and notify the assisting Party, directly or through the ASEAN Centre, whether it is in a position to accept the assistance offered, and of the scope and terms of such assistance.
5. The requesting Party shall specify the scope and type of assistance required and, where practicable, provide the assisting Party with such information as may be necessary for that Party to determine the extent to which it is able to meet the request. In the event that it is not practicable for the requesting Party to specify the scope and type of assistance required, the requesting Party and assisting Party shall, in consultation, jointly assess and decide upon the scope and type of assistance required.
6. The Parties shall, within the limits of their capabilities, identify and notify the ASEAN Centre of experts, equipment and materials which could be made available for the provision of assistance to other Parties in the event of land and/or forest fires or haze pollution resulting from such fires as well as the terms, especially financial, under which such assistance could be provided.

Article 13

Direction and Control of Assistance

Unless otherwise agreed:

1. The requesting or receiving Party shall exercise the overall direction, control, co-ordination and supervision of the assistance within its territory. The assisting Party should, where the assistance involves personnel, designate in consultation with the requesting or receiving Party, the person or entity who should be in charge of and retain immediate operational supervision over the personnel and the equipment provided by it. The designated person or entity should exercise such supervision in co-operation with the appropriate authorities of the requesting or receiving Party.
2. The requesting or receiving Party shall provide, to the extent possible, local facilities and services for the proper and effective administration of the assistance. It shall also ensure the protection of personnel, equipment and materials brought into its territory by or on behalf of the assisting Party for such purposes.
3. A Party providing or receiving assistance in response to a request referred to in paragraph (1) above shall co-ordinate that assistance within its territory.

Article 14

Exemptions and Facilities in Respect of the Provision of Assistance

1. The requesting or receiving Party shall accord to personnel of the assisting Party and personnel acting on its behalf, the necessary exemptions and facilities for the performance of their functions.
2. The requesting or receiving Party shall accord the assisting Party exemptions from taxation, duties or other charges on the equipment and materials brought into the territory of the requesting or receiving Party for the purpose of the assistance.

3. The requesting or receiving Party shall facilitate the entry into, stay in and departure from its territory of personnel and of equipment and materials involved or used in the assistance.

Article 15

Transit of Personnel, Equipment and Materials in Respect of the Provision of Assistance

Each Party shall, at the request of the Party concerned, seek to facilitate the transit through its territory of duly notified personnel, equipment and materials involved or used in the assistance to the requesting or receiving Party.

PART III. TECHNICAL CO-OPERATION AND SCIENTIFIC RESEARCH

Article 16

Technical Co-operation

1. In order to increase the preparedness for and to mitigate the risks to human health and the environment arising from land and/or forest fires or haze pollution arising from such fires, the Parties shall undertake technical co-operation in this field, including the following:
 - a. Facilitate mobilisation of appropriate resources within and outside the Parties;
 - b. Promote the standardisation of the reporting format of data and information;
 - c. Promote the exchange of relevant information, expertise, technology, techniques and know-how;
 - d. Provide or make arrangements for relevant training, education and awareness-raising campaigns, in particular relating to the promotion of zero-burning practices and the impact of haze pollution on human health and the environment;
 - e. Develop or establish techniques on controlled burning particularly for shifting cultivators and small farmers, and to exchange and share experiences on controlled-burning practices;
 - f. Facilitate exchange of experience and relevant information among enforcement authorities of the Parties;
 - g. Promote the development of markets for the utilisation of biomass and appropriate methods for disposal of agricultural wastes;
 - h. Develop training programmes for firefighters and trainers to be trained at local, national and regional levels; and
 - i. Strengthen and enhance the technical capacity of the Parties to implement this Agreement.
2. The ASEAN Centre shall facilitate activities for technical co-operation as identified in paragraph 1 above.

Article 17

Scientific Research

The Parties shall individually or jointly, including in co-operation with appropriate international organisations, promote and, whenever possible, support scientific and technical research programmes related to the root causes and consequences of transboundary haze pollution and the means, methods, techniques and equipment for land and/or forest fire management, including fire fighting.

PART IV. INSTITUTIONAL ARRANGEMENTS

Article 18

Conference of the Parties

1. A Conference of the Parties is hereby established. The first meeting of the Conference of the Parties shall be convened by the Secretariat not later than one year after the entry into force of this Agreement. Thereafter, ordinary meetings of the Conference of the Parties shall be held at least once every year, in as far as possible in conjunction with appropriate meetings of ASEAN.
2. Extraordinary meetings shall be held at any other time upon the request of one Party provided that such request is supported by at least one other Party.
3. The Conference of the Parties shall keep under continuous review and evaluation the implementation of this Agreement and to this end shall:
 - a. Take such action as is necessary to ensure the effective implementation of this Agreement;
 - b. Consider reports and other information which may be submitted by a Party directly or through the Secretariat;
 - c. Consider and adopt protocols in accordance with the Article 21 of this Agreement;
 - d. Consider and adopt any amendment to this Agreement;
 - e. Adopt, review and amend as required any Annexes to this Agreement;
 - f. Establish subsidiary bodies as may be required for the implementation of this Agreement; and
 - g. Consider and undertake any additional action that may be required for the achievement of the objective of this Agreement.

Article 19

Secretariat

1. A Secretariat is hereby established.
2. The functions of the Secretariat shall include:
 - a. Arrange for and service meetings of the Conference of the Parties and of other bodies established by this Agreement;
 - b. Transmit to the Parties notifications, reports and other information received in accordance with this Agreement;
 - c. Consider inquiries by, and information from, the Parties, and to consult with them on questions relating to this Agreement;
 - d. Ensure the necessary co-ordination with other relevant international bodies and in particular to enter into administrative arrangements as may be required for the effective discharge of the Secretariat functions; and
 - e. Perform such other functions as may be assigned to it by the Parties.
3. The ASEAN Secretariat shall serve as the Secretariat to this Agreement.

Article 20
Financial Arrangements

1. A Fund is hereby established for the implementation of this Agreement.
2. It shall be known as the ASEAN Transboundary Haze Pollution Control Fund.
3. The Fund shall be administered by the ASEAN Secretariat under the guidance of the Conference of the Parties.
4. The Parties shall, in accordance with the decisions of the Conference of the Parties, make voluntary contributions to the Fund.
5. The Fund shall be open to contributions from other sources subject to the agreement of or approval by the Parties.
6. The Parties may, where necessary, mobilise additional resources required for the implementation of this Agreement from relevant international organisations, in particular regional financial institutions and the international donor community.

PART V. PROCEDURES

Article 21
Protocols

1. The Parties shall co-operate in the formulation and adoption of protocols to this Agreement, prescribing agreed measures, procedures and standards for the implementation of this Agreement.
2. The Conference of the Parties may, at ordinary meetings, adopt protocols to this Agreement by consensus of all Parties.
3. The text of any proposed protocol shall be communicated to the Parties by the Secretariat at least six months before such a session.
4. The requirements for the entry into force of any protocol shall be established by that instrument.

Article 22
Amendments to the Agreement

1. Any Party may propose amendments to the Agreement.
2. The text of any proposed amendment shall be communicated to the Parties by the Secretariat at least six months before the Conference of the Parties at which it is proposed for adoption. The Secretariat shall also communicate proposed amendments to the signatories to the Agreement.
3. Amendments shall be adopted by consensus at an ordinary meeting of the Conference of the Parties.
4. Amendments to this Agreement shall be subject to acceptance. The Depositary shall circulate the adopted amendment to all Parties for their acceptance. The amendment shall enter into force on the thirtieth day after the deposit with the Depositary of the instruments of acceptance of all Parties.
5. After the entry into force of an amendment to this Agreement any new Party to this Agreement shall become a Party to this Agreement as amended.

Article 23
Adoption and Amendment of Annexes

1. Annexes to this Agreement shall form an integral part of the Agreement and, unless otherwise expressly provided, a reference to the Agreement constitutes at the same time a reference to the annexes thereto.
2. Annexes shall be adopted by consensus at an ordinary meeting of the Conference of the Parties.
3. Any Party may propose amendments to an Annex.
4. Amendments to an Annex shall be adopted by consensus at an ordinary meeting of the Conference of the Parties.
5. Annexes to this Agreement and amendments to Annexes shall be subject to acceptance. The Depositary shall circulate the adopted Annex or the adopted amendment to an Annex to all Parties for their acceptance. The Annex or the amendment to an Annex shall enter into force on the thirtieth day after the deposit with the Depositary of the instruments of acceptance of all Parties.

Article 24
Rules of Procedure and Financial Rules

The first Conference of the Parties shall by consensus adopt rules of procedure for itself and financial rules for the ASEAN Transboundary Haze Pollution Control Fund to determine in particular the financial participation of the Parties to this Agreement.

Article 25
Reports

The Parties shall transmit to the Secretariat reports on the measures taken for the implementation of this Agreement in such form and at such intervals as determined by the Conference of the Parties.

Article 26
Relationship with Other Agreements

The provisions of this Agreement shall in no way affect the rights and obligations of any Party with regard to any existing treaty, convention or agreement to which they are Parties.

Article 27
Settlement of Disputes

Any dispute between Parties as to the interpretation or application of, or compliance with, this Agreement or any protocol thereto, shall be settled amicably by consultation or negotiation.

PART VI. FINAL CLAUSES

Article 28
Ratification, Acceptance, Approval and Accession

This Agreement shall be subject to ratification, acceptance, approval or accession by the Member States. It shall be opened for accession from the day after the date on which the Agreement is closed for signature. Instruments of ratification, acceptance, approval or accession shall be deposited with the Depositary.

Article 29
Entry into Force

1. This Agreement shall enter into force on the sixtieth day after the deposit of the sixth instrument of ratification, acceptance, approval or accession.
2. For each Member State ratifying, accepting, approving or acceding to the Agreement after the deposit of the sixth instrument of ratification, acceptance, approval or accession, the Agreement shall enter into force on the sixtieth day after the deposit by such Member State of its instrument of ratification, acceptance, approval or accession.

Article 30
Reservations

Unless otherwise expressly provided by this Agreement no reservations may be made to the Agreement.

Article 31
Depositary

This Agreement shall be deposited with the Secretary General of ASEAN, who shall promptly furnish each Member State a certified copy thereof.

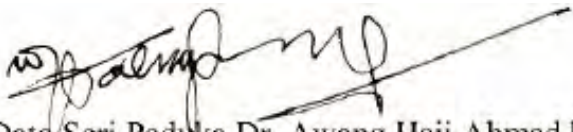
Article 32
Authentic Text

This Agreement shall be drawn up in the English language, and shall be the authentic text.

IN WITNESS WHEREOF the undersigned, being duly authorised by their respective Governments have signed this Agreement.

Done at **Kuala Lumpur, Malaysia** on the **tenth** day of **June** in the year **two thousand and two**.

For the Government of Brunei Darussalam



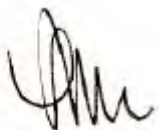
H.E. Dato Seri Paduka Dr. Awang Haji Ahmad bin Haji Juma
Minister of Development

For the Government of the Kingdom of Cambodia



H.E. Mr. Keo Puth Reasmey
Ambassador
Royal Embassy of the Kingdom of Cambodia in Malaysia

For the Government of the Republic of Indonesia



Ms. Liana Bratasida
Deputy Minister for Environment Conservation
State Minister of Environment

For the Government of Lao People's Democratic Republic



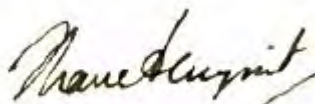
H.E. Prof. Dr. Bountiem Phissamay
Minister to the Prime Minister's Office
Chairman of Science, Technology and Environment Agency

For the Government of Malaysia




H.E. Dato' Seri Law Hieng Ding
Minister of Science, Technology and the Environment

For the Government of the Union of Myanmar



U Thane Myint
Secretary, National Commission for Environmental Affairs
Director-General of the Ministry of Foreign Affairs

For the Government of the Republic of the Philippines



H.E. Mr. Heherson T. Alvarez
Secretary, Department of Environment and Natural Resources

For the Government of the Republic of Singapore



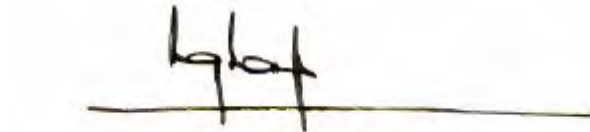
H.E. Mr. Lim Swee Say
Minister for the Environment

For the Government of the Kingdom of Thailand



H.E. Mr. Chaisiri Anamarn
Ambassador Extraordinary and Plenipotentiary
Royal Thai Embassy in Malaysia

For the Government of the Socialist Republic of Viet Nam



H.E. Mr. Nguyen Van Dang
Vice Minister of Agriculture and Rural Development

ANNEX

Terms of Reference of the ASEAN Co-ordinating Centre for Transboundary Haze Pollution Control

The ASEAN Centre shall:

1. Establish and maintain regular contact with the respective National Monitoring Centres regarding the data, including those derived from satellite imagery and meteorological observation, relating to:
 - a. Land and /or forest fire;
 - b. Environmental conditions conducive to such fires; and
 - c. Air quality and levels of pollution, in particular haze arising from such fires.
2. Receive from the respective National Monitoring Centres or Focal Points the data above, consolidate, analyse and process the data into a format that is easily understandable and accessible.
3. Facilitate co-operation and co-ordination among the Parties to increase their preparedness for and to respond to land and/or forest fires or haze pollution arising from such fires.
4. Facilitate co-ordination among the Parties, other States and relevant organisations in taking effective measures to mitigate the impact of land and/or forest fires or haze pollution arising from such fires.

5. Establish and maintain a list of experts from within and outside of the ASEAN region who may be utilised when taking measures to mitigate the impact of land and/or forest fires or haze pollution arising from such fires, and make the list available to the Parties.
6. Establish and maintain a list of equipment and technical facilities from within and outside of the ASEAN which may be made available when taking measures to mitigate the impact of land and/or forest fires or haze pollution arising from such fires, and make the list available to the Parties.
7. Establish and maintain a list of experts from within and outside of the ASEAN region for the purpose of relevant training, education and awareness-raising campaigns, and make the list available to the Parties.
8. Establish and maintain contact with prospective donor States and organisations for mobilising financial and other resources required for the prevention and mitigation of land and/or forest fires or haze pollution arising from such fires and preparedness of the Parties, including fire-fighting capabilities.
9. Establish and maintain a list of such donors, and make the list available to the Parties.
10. Respond to a request for or offer of assistance in the event of land and/or forest fires or haze pollution resulting from such fires by:
 - a. Transmitting promptly the request for assistance to other States and organisations; and
 - b. Co-ordinating such assistance, if so requested by the requesting Party or offered by the assisting Party.
11. Establish and maintain an information referral system for the exchange of relevant information, expertise, technology, techniques and know-how, and make it available to the Parties in an easily accessible format.
12. Compile and disseminate to the Parties information concerning their experience and any other practical information related to the implementation of the Agreement.
13. Assist the Parties in the preparation of standard operating procedures (SOP).

Status of Ratification:

As of September 2003, six countries (Brunei Darussalam, Malaysia, Myanmar, Singapore, Thailand, Viet Nam) have ratified the Agreement. The ASEAN Secretariat has received instruments of ratification/ approval from these countries as the following details:

Member Country	Date of Ratification/Approval	Date of Deposit of Instrument of Ratification/Approval with the Secretary-General of ASEAN
Brunei Darussalam	27 February 2003	23 April 2003
Malaysia	3 December 2002	18 February 2003
Myanmar	5 March 2003	17 March 2003
Singapore	13 January 2003	
Thailand	10 September 2003	26 September 2003
Viet Nam	24 March 2003	29 May 2003

Source: ASEAN Secretariat

Eleventh Joint Meeting of the ASEAN Working Groups on Sub-Regional Fire Fighting Arrangements (SRFAs) for Sumatra and Borneo

Singapore, 12-13 August 2002

Extract for the Regional South East Asia Wildland Fire Network Website

1. The Eleventh Joint Meeting of the ASEAN Working Groups on SRFAs for Sumatra and Borneo was held in Singapore on 12-13 August 2002. The Meeting was attended by delegates from Brunei Darussalam, Indonesia, Malaysia, Singapore and representatives from the ASEAN Secretariat. Representatives from CIDA-Fire Danger Rating System Project, Global Environment Centre, Global Fire Monitoring Centre of Germany, Haze Prevention Group, New South Wales Rural Fire Service of Australia, US Forest Service, and WWF-Indonesia were also in attendance.

Agenda Item 10: International Assistance Programme and Collaborative Partnership

10.2. A Proposal on the Formation of a Southeast Asian/ ASEAN Regional Network on Wildland Fire within the Global Network on Wildland Fire by the Global Fire Monitoring Center

30. The Meeting noted the proposal on the formation of Southeast Asian Regional Network on Wildland Fire and agreed to collaborate with the Global Fire Monitoring Center using the existing mechanisms of ASEAN. The Status of Building Regional Wildland Fire Networks, which includes the formation of the SEA network, appears as ANNEX 15. The Meeting noted the information on the Third International Wildland Fire Conference and Exhibition scheduled to be held on 4-8 October 2003 in Sydney and the Global Fire Summit to be held following the conference. The Meeting noted the importance of having the region well represented during the conference and agreed to explore having an SRFA meeting back to back with the Summit in Sydney. The Meeting noted with appreciation the offer by the Global Fire Monitoring Center to publish the outcome of the World Conference and Exhibition on Land and Forest Fire Hazards 2002 in the next issue of International Forest Fire News and UN-ISDR publication. Prof. Goldammer also briefed the Meeting on the technology for monitoring fires and detecting fire intensity (BIRD), and indicated that the network will facilitate exchange of such information.

21st Meeting of ASOEN Haze Technical Task Force (8-9 November 2004) and 11th ASEAN Ministerial Meeting on Haze (AMMH) (10 November 2004)

Ha Noi, Viet Nam

Extracts of written views/ decisions of the 21st Meeting of the ASOEN Haze Technical Task Force (HTTF) (8-9 November 2004) with regard to the global wildland fire accord (text provided to the Global Fire Monitoring Center (GFMC) by the ASEAN Secretariat, 23 November 2004):

"36. The Meeting noted the ongoing initiatives to develop the International Wildland Fire Accord. Member Countries would keep abreast of the development and explore their participation at the FAO Ministerial Meeting in March 2005 in Rome, Italy where the proposed Accord will be discussed."

The 11th AMMH (10 Nov 04) adopted the Report of the Chairperson of ASOEN-HTTF. The Chairperson in her report to the Ministers expressed appreciation to the inputs and cooperation of a number of organisations and projects, among others, is the GFMC, and indicated that continuous interaction with these organisations and projects is very important to ensure that there is no overlapping of activities and that regional activities can be further synergised for better and more effective results.

The FAO Ministerial Meeting in March 2005 has been included in the Calendar of Events for 2005, which was noted by the Ministers.



Regional Northeast Asia Wildland Fire Network Foundation and Follow-up Meetings 2004 -2005

Background and Objective for the Regional Northeast Asia Wildland Fire Network

The forests in the Northeast Asia region provide space for human occupation and a basis for economic activities. Agricultural activities are concentrated in river valleys and have formed community culture along the mountain borders.

Forest lands constitute a potential region for development to meet the demand for new land use due to an increase in population and industrial development.

Most wildfires in the Northeast Asian region occur due to human activities – mainly due to careless land-use. Agriculture, collection of medical and eatable plants, industrialization accompanied by recent economic growth, hiking, recreation, tourism such as hunting and fire at cemetery conformed to religious significance, and social customs mainly cause forest fires; children playing with fire is another significant cause of wildfires. Altogether the density of population is directly proportional to fire occurrence.



Especially in Northeast Region there will be more active development and use of forest in accordance with the demand for new land use caused by an increase in population and economic growth. The probability of forest fire occurrence will increase as well.

The currently observed trend of global warming involves a change of regional climate patterns. According to climate models and the recent weather records an increase of temperatures as well as an increasing occurrence of prolonged droughts has been observed in Central, Northern and North East Asia. Associated with the regional weather patterns it is already noted that wildland fires are becoming more frequent in the sub-arctic tundra and forests. As a consequence of climate change and fire effects the northern ecosystems, including discontinuous and continuous permafrost sites, will be extremely damaged. One of the consequences will be the release of additional greenhouse gases due to melting of permafrost.

Wildland fire not only burns forest but also destroys the living ground and industrial facilities in the wildland-urban interface, causing serious social and economic problems.

Despite these concerns the countries of the region so far have not yet not shared information and have not yet cooperated to jointly address these problems.

In this situation, on 6 March 2004, representative from countries in the North East Asia region countries – including South Korea, China, Japan, and Russia – assembled and reached an agreement that they should recognize the significance of the negative impacts of forest fire and other wildland fires and consider it as a regional issue. As a first step to diminish occurrence and negative impacts of wildland fires. The fire specialists from different government and non-government institutions agreed to build up the Regional Northeast Asia Wildland Fire Network for the purpose of exchanging and sharing information and resources and to establish the multilateral cooperation system in the future.

Breaking off the wall between severed countries, they hope to share the education for diminishing the occurrence and damages of wildland fires, prevention programs, fire suppression training programs, and incrementally exchange the physical and human extinction resources. This development will be closely connected with the efforts to diminish occurrence and negative impacts of forest fire by the Global Fire Monitoring Center (GFMC) under the auspices of the United Nations International Strategy for Disaster Reduction (UN-ISDR).

Objectives and Modus Operandi of the Regional Northeast Asia Wildland Fire Network

In Northeast Asia Region forest fire management and the restoration of damaged area are very important issues in the social, cultural, and economic aspect as well as in the environment. The following activities of the Regional Northeast Asia Wildland Fire Network will be implemented to diminish occurrence and negative impacts of forest fires:

- reinforce the partnership among countries by exchanging and sharing information
- develop common studies and programmes for forest fire management
- establish mutual agreements for delivering mutual assistance in fire extinction and exchange of fire management resources
- interchange the technology and resources for the restoration of damaged area

Network Coordination

The Regional Northeast Asia Wildland Fire Network is coordinated by the Korean Forest Research Institute (KFRI), Seoul, South Korea. The network members are composed as follows

- Individuals or institutions related to wildland fire research and / or an education, training in each country
- To strive for an administrative development, it is able to consider an administrative official and/or an suppression official
- Advisors: responsible person in charge of the region in the FAO Forestry Department and the GFMC



Participants from China, Japan, South Korea, the Russian Federation, the ISDR and FAO attended the foundation meeting of the network in Seoul, South Korea, 6 March 2004

Northeast Asia Wildland Fire Network - Second Meeting
Tohoku University, Sendai, Japan, 18 January 2005

At the 2nd meeting of the Regional Northeast Asia Wildland Fire Network the plan and activities after the first meeting (5-6 March 2004, at the Korea Forest Research Institute, Seoul, Korea) were discussed. The NEA Wildland Fire Network Situation assessment is a review of the proposed key issues decided at the foundation meeting of the network. The meeting was held at Tohoku Univ., Sendai, Japan, 18 January 2005, in conjunction with the International Symposium of Northeast Asia Forest Fire from Cosmos (17 January 2005). Topics of discussion and planning included a review of key issues and annual plans as agreed at the foundation meeting:

Definition of the region

China and Russia belong only partially to the North East Asia region (both countries are also belonging to the Regional Central Asia Wildland Fire network, Russia also to the Baltic Network). It was suggested to define the provinces that are actively participating in the NEA network.

Country reports

The standard form developed by the GFMC shall be used for country reports and provincial reports respectively. The final form was circulated after the meeting.

Database of human resources and equipment for fire suppression

In addition to the country reports a separate database containing human resources and equipment for fire suppression that can be used in border-crossing wildland fire emergencies or in any other transnational cooperation. A database format was circulated before and after the meeting.

Development of Memoranda of Understanding (MoU) or Letters of Agreement (LoA)

The development of agreements is recommended: Within countries: Connecting partners within countries: Securing contributions of and providing guidance to the different stakeholders (administrations / agencies, NGOs, academia etc.). Between countries: Suggest the development of bilateral or multilateral agreements i.a.w. the international experiences (see FAO database on international agreements)

Regional Wildland Fire Homepage and Newsletter (or Bulletin)

Several options of hard or soft information dissemination by a newsletter and a website were discussed. A joint effort with ECE/FAO International Forest Fire News (IFFN) and GFMC was recommended.

Funding of Network Activities

Fund rising difficulties were reported by several network members.

Regional joint research project or programme

Discussion about the objectives and finances for a joint research project / programme addressing the social, culture, and environment aspects of wildland fire in NEA.

Publication

The publication of a book "The Status and Future of the Wildland Fire Situation in the NE Asia Region" and a "Regional Wildland Fire Analysis for Policy Makers" is underway.

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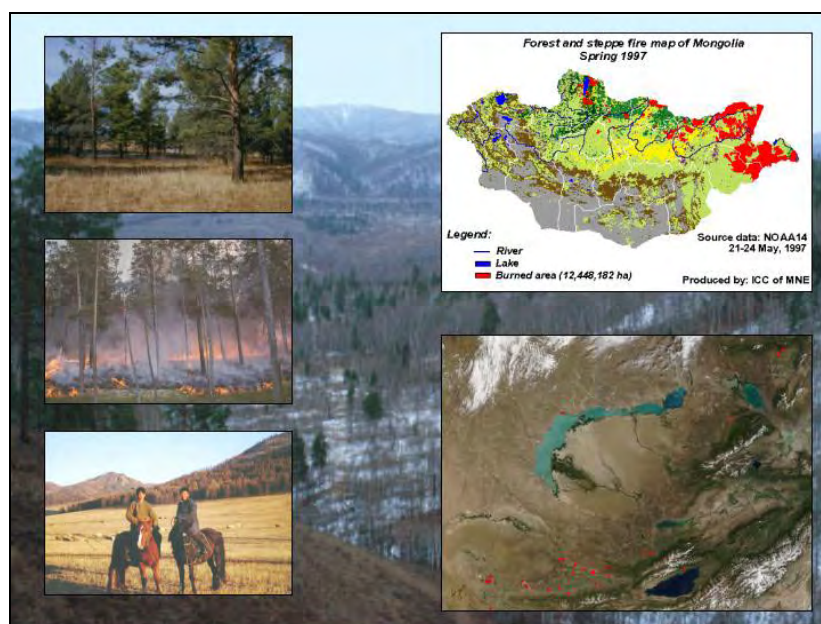
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Towards Building the Regional Central Asia Wildland Fire Network

Central Asia has recently suffered major forest and other wildland fire problems. The causes of an increasing occurrence of wildfires in forests and other wildlands, including the underlying reasons for increasing human-caused fires, vary within the region and are due to:

- transition from centrally planned to market economies
- national to regional conflicts, creation of new nations, involving political tensions and war
- increasing population growth and land-use pressure
- regional climate change towards increase of extreme droughts

It has been proposed that a Regional Central Asia Wildland Fire Network would assist to promote cooperation and sharing of resources in wildland fire management, including wildland fire science. In this context a major regional conference was held in Antalya, Turkey, 30 March - 3 April 2004.



Several reasons supported the idea for holding such a regional conference in Turkey. First, the Balkan countries, some of them being in a post-war situation and under reconstruction, as well as the South Eastern European countries which are still in economic and political transition, have not participated in recent activities of the ECE/FAO Fire Team of Specialists on Forest Fire and other international wildland fire research and development projects. Second, the neighbouring countries of Turkey, such as the Caucasus states, Iran, Turkmenistan, Uzbekistan, and Kazakhstan, are quite isolated from recent scientific and technological developments in fire management. Third, the fire problems in Mongolia and northern China, and to a limited extent in Afghanistan, call for cooperation with the ECE region.

From the point of view of the ECE/FAO/ILO Team of Specialists on Forest Fire and the Global Fire Monitoring Center (GFMC), which coordinates the work of the team in the ECE region and keeps close contacts with non-ECE countries, the countries listed above deserve full attention and support to bring them into the family of the international community of forest fire scientists, managers and policy makers.

The conference was concluded successfully and resulted in the "Antalya Declaration on Cooperation in Wildland Fire Management in the Balkans, Eastern Mediterranean, Near East and Central Asia". Follow-up discussions were held in Almaty, Kazakhstan, 20-21 July 2004 (participants: Focal Points from Kazakhstan, Russian Federation and GFMC). At the Regional Central Asian Forest Congress "Forest Policy: Problems and Solutions", Bishkek, Kyrgyz Republic, 25-27 November 2004, the GFMC presented the status of the regional network and the Global Wildland Fire Network. In the resolution of the congress the forest services of Kyrgyzstan, Uzbekistan, Tajikistan and Kazakhstan endorsed the

participation in the Global Wildland Fire Network and the development of an international wildland fire accord.

In the following a background paper and the resolution of the Regional Central Asian Forest Congress are presented.

Recent Trends of Forest Fires in Central Asia and Opportunities for Regional Cooperation in Forest Fire Management

1. Introduction

Over the past decade, many countries have witnessed a growing trend of wildfires of extreme severities in forest and non-forest lands. This has been noted also in Central Asian countries where large fire situations in forest and steppe ecosystems have resulted in considerable ecological and economic damages. Sometimes these wildland fires have transnational impacts, for example smoke pollution and its impacts on human health and safety; loss of biodiversity; or site degradation at landscape level leading to desertification, flooding, and reduced food security. The depletion of terrestrial carbon by fires burning under extreme conditions in some vegetation types, especially in temperate and boreal wetlands, is an important factor in causing disturbance in the global carbon cycle.

Increasing vulnerability of human populations living in or around forest environments – in the wildland-residential / urban interface – has been noted throughout the world. Projected trends of climate change impacts on vegetation cover and fire regimes, as well as observed demographic and socio-economic trends suggest that wildland fire may continue to play a major role in the destruction of vegetation cover resulting, among other, in increasing occurrence of weather-related secondary ecological and humanitarian disasters such as mass movement of soil cover and extreme flooding.

2. The Wildland Fire Situation in Central Asia

In the recent years the Global Fire Monitoring Center (GFMC) has monitored the fire occurrence in some parts of Central Asia. In the GFMC database there is almost no information available on forest fires in Azerbaijan, Dagestan, Georgia, Kyrgyzstan Tajikistan, Turkmenistan and Uzbekistan. Thus, examples are given for countries for which more detailed knowledge is available (Mongolia, Kazakhstan and the Central Asian part of the Russian Federation).

Mongolia

Some data are available on fire occurrence in Mongolia (Goldammer 2001). Here the highest forest fire hazard is found in the submontane larch (*Larix sibirica*) and pine (*Pinus sylvestris*) stands growing on seasonally freezing soils. These stands are distributed on Khentey, East Khentey and Khubsugul foothills that are characterised by an extremely continental climate. Forest fire statistics for the period 1963 to 1997 reveal that the majority of fires burned within the central and eastern parts of the forested area. This can be attributed to the predominance of highly fire susceptible (highly flammable) pine and larch stands. Moreover, economic activity is much higher here as compared to other parts of the region. Extreme fire seasons are caused by long droughts. Fires burn from April to July under such conditions. The average fire season usually has two peaks. One peak is during spring (from March to mid June) and accounts for 80 per cent of all fires. The other fire peak falls within a short period in autumn (September to October) and accounts for 5 to 8 percent of all fires. In summer, fires occur very rarely (only 2 to 5 percent of the total) because of heavy rains.

In one of the most sparsely populated countries in the world, it is difficult to get accurate information on fire causes. It is known, however, that during the main fire seasons (spring and late fall), no natural fire causes exist. The recent increase in the number of fires is related to the opening of markets once highly controlled or restricted. The vast majority of fires are not deliberately set to clear land. Rather, it is a function of carelessness. One example is the collection of elk antlers for sale to European and Chinese markets. During the previous regime, a single, state run enterprise managed this market under strict controls and guidelines. Today, it is open to virtually anyone.

Fires start for three reasons:

1. Antler collection starts in the bitter cold of February when fire is simply a survival tool.
2. Sparks from vehicle exhaust pipes in remote forests.
3. Tracer bullets left by the Russian military have entered the game hunting market and are used to hunt elk for the blood antlers which have a higher value in the market place.

The most obvious consequence of frequent and intense fires is the loss of forested land. The current fire pattern is affecting 14 percent of this resource annually. The brief growing season and low growth capacity of the trees means that these forests may take 200 years or more to regenerate. In addition to their commercial value, these forests are a precious ecological resource. They contain the sources of virtually all rivers in the country including the inflow to Lake Baikal (Russia), the largest fresh water lake in the world. They protect soil, rangelands, provide habitat for wildlife and serve as windbreaks.

The intra-annual distribution of fires has been documented by seven forest protection air bases for the period 1985 to 1994. In these zones, fire activity is the highest in April and May with 33.3 percent and 48.1 percent of their total number in a fire season, respectively. Fires start in late March and early April, immediately after snow melt when forest fuels are drying rapidly on southern- and western-facing slopes.

Mongolia is experiencing a dangerous increase in wildfires. From 1981 to 1995, forest and steppe fires burned an average of 1.74 million ha annually. In 1996 and 1997, the area affected by fire was 10.7 and 12.4 million ha respectively – an increase of more than six-fold. The areas hardest hit by these increases have been the forested regions. The typical forest fire season (1981-95) swept through some 140 000 ha (on average 8 percent of the total area burned), already a large area. However in 1996 and 1997, this figure radically increased to nearly 18 times the previous average - some 2.5 million ha annually, corresponding to ca. 22 percent of the total land area affected by fire. In these two years alone more forested areas burned than were harvested over the last 65 years. Figures 1 provides a map showing the forest and steppe areas burned in 1997.

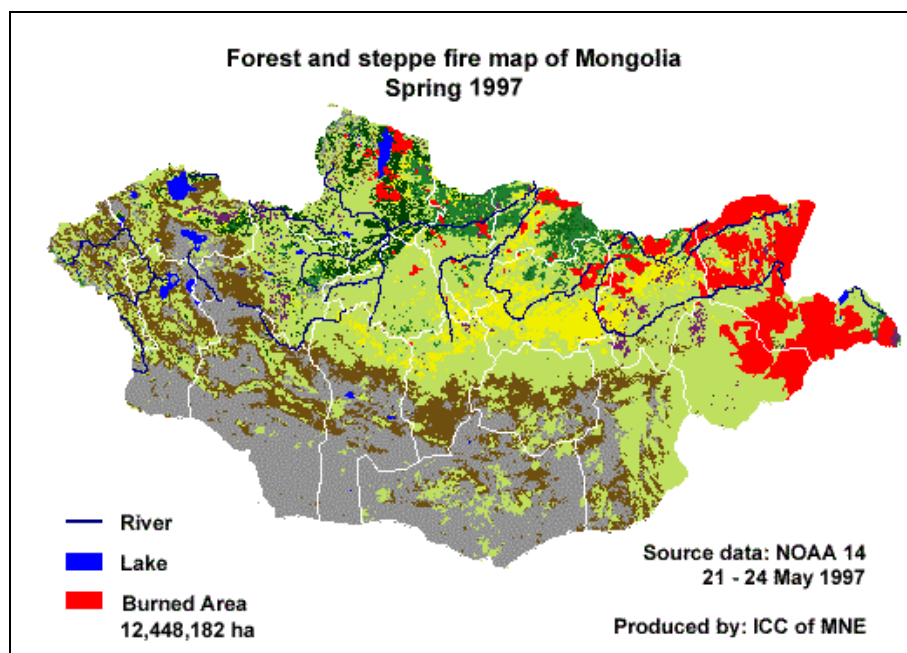


Figure 1. Forest and steppe fire map of Mongolia for the spring fire season 1997. Source: Information & Computer Center (ICC), Ministry for Natural Resources and Environment.

Kazakhstan

In Kazakhstan fire and pest management has become an increasing concern (Arkhipov et al. 2000). Fires are part of the natural ecosystem cycle, but the great majority (over 80%) are caused by humans. The average area damaged by fire annually in Kazakhstan increased from about 4,000 hectares over the 1985-90 period to 20,000 hectares over the 1996-2000 period (with an additional catastrophic high of 200,000 hectares in 1997). This was only partly due to the increased public access to forests (the number of fires has increased insignificantly); the main reason for a major increase in severity and extent of fire impact (i.e. area burned) is due to the lack of timely fire detection and control which deteriorated because of the lack of financing. Also rural people on farm land adjacent to forests, tend to burn off vegetation and such fires may accidentally spread to forests. Public budgets for fire and pest management have declined, and there is a need to shift expenditures from suppression of fires or pest outbreaks which have already started, to fire prevention and public awareness (which is much more cost-effective). In addition, and linked to budget, finance and governance issues, some fires may have been deliberately started to circumvent the 'no cutting' rule for healthy forests. Fire-damaged timber is presently allowed to be harvested for sanitary reasons at low stumpage prices, and can be a lucrative source of income. Fires and pests are a major concern in the north and northeast, especially in the relic pine forests of the Irtysh River watershed where over 100,000 hectares were severely damaged by fires in 1997 and are being increasingly damaged by pests and uncontrolled 'sanitary' cutting since then.

Table 1. Classes of natural fire danger by V. Arkhipov (Arkhipov et al. 2000)

Danger Class	Groups of Forest Types, Planted and Deforested Territories	Characteristic Fire Types and phases of their origin
1 Very High	Coniferous saplings. Logged sites of dry and fresh pines, larch, fir and grassy cedar forests, bushy broad grassy silver fir forests. Dry and rocky pine forests. Damaged and dying tree stands (died dry stands, sites of storm debris and wind Falls, unfinished harvest sites, slash, insect-damaged stands).	Surface fires during the whole fire season. Crown fires occur on sites with high fuel loads.
2 High	Young pine forests, especially with pine undergrowth. Periodically dry larch forests. Cedar forests on country rocks of southern slopes. Dry growing conditions of flood-plain forests.	Surface fires are possible during the whole fire season. Crown fires occur during the phase of highest fire intensity.
3 Medium	Continuous harvest areas of coniferous forests in moist and wet sites. Dry fir forests, fresh larch and fir forests, wet pine forests. Mountainous-valley silver fir and fir forests. Cedar forests of remaining types of a forest. Fresh growing conditions of flood-plain forests. Radical and derivative fresh birch and aspen groves and their cut sites.	Surface and crown fires are possible in phases of summer fire maxima, and in mountain forests - in phases of spring and autumn maxima.
4 Low	Wet pine forests. Wet dark-coniferous taiga forests. Wet larch forests. Mossy-grassy silver fir forests, wet fir forests. Mossy fir forests. Bushy, dog-rose and aspen fir forests. Apple, birch and aspen groves. Wet growing parts of flood-plain forests. Black saksaul.	The occurrence of fires is possible in phases of spring and autumn fire maxima. In a phase of summer maxima the fires are possible in pine forests
5 Very Low	Sub-alpine coniferous forests. Cedar forests on bare rocks. Wet birch and aspen groves. Damp poplar groves. Willow groves of all types. All types of saksaul (except black saksaul).	The start of a fire is possible only under extraordinarily unfavourable conditions.

Russian Federation

The ecology and management of forest fires in Russia have been subject of a large number of publications (see summary by Goldammer and Furyaev 1996). In this paper we concentrate on the question of statistical data. The official statistics show that in Russia between 20,000 and 40,000 fires occur annually affecting an area of 2 to 3 million ha of forest and other lands (Davidenko et al. 2003). They are detected and controlled only in protected forests and protected pasture lands. However, the use of the space-borne sensors such as the NOAA/AVHRR (Advanced Very High Resolution Radiometer) and more recently Terra/Aqua/MODIS (Moderate Resolution Imaging Spectroradiometer), ENVISAT/MERIS (Medium Resolution Imaging Spectrometer) and Terra/ASTER (Advanced Spaceborne Thermal Emission and Reflection Radiometer), permitted considerable improvement in the detection of active fires along with better estimation of areas burned and impacts (Siegert et al. 2005).

For example, before the 1980s it was reported that, on average, fires annually burned 1.5 million ha in the boreal forests on the territory of the former Soviet Union. Recent investigations based on satellite imagery revealed that the magnitude of fires had been underestimated. Surveys using remote sensing ascertained that boreal zone fires burned annually an average of 8 million ha with considerable fluctuation between years. For example in 1987 satellite image evaluation revealed a total area burned in the East-Asian regions of Russia of about 14 million ha (Figure 2). It must be noted, however, that this fire-affected area derived from satellite imagery included forests, other wooded lands and other land, including wetlands.

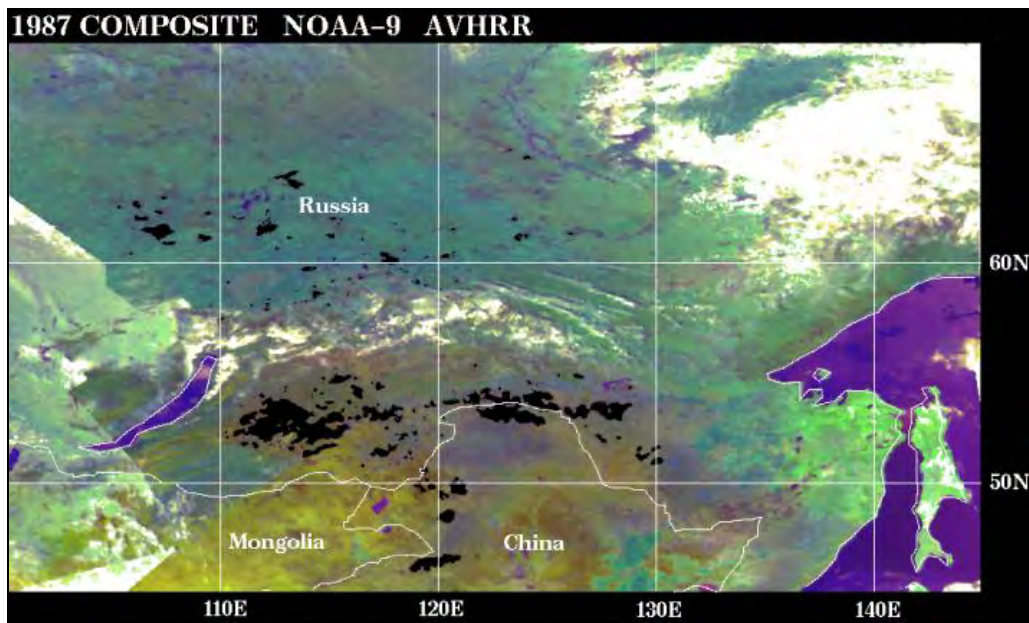


Figure 2. NOAA-AVHRR-derived burn scar map of the fire season of 1987 (Cahoon et al. 1994).

A number of severe fire seasons followed, especially the seasons 2002 and 2003. Table 2 shows the magnitude of fires affecting the territory of the Russian Federation as reported by the government agencies and as depicted by satellite-based remote sensing.

The table reveals the problems of accurate fire size and impact assessment. There are obvious discrepancies between the reported sizes of area burned by ground or aerial observations versus the data derived from satellite sensors. The area under protection and monitoring by *Avialesookhrana* covers a total of 690 million hectares of vegetated land, primarily forests. *Avialesookhrana* relies on aircraft and ground-based means to monitor ongoing fires and report fire summaries for daily updated statistics. The organization is facing severe financial and logistical constraints resulting in reduced

availability of modern equipment, personnel and flight hours to adequately monitor and map fires from the air and on the ground. Thus, the reported total area affected by wildfires in 2002-2003 on the area of jurisdiction does not reflect the complete picture.

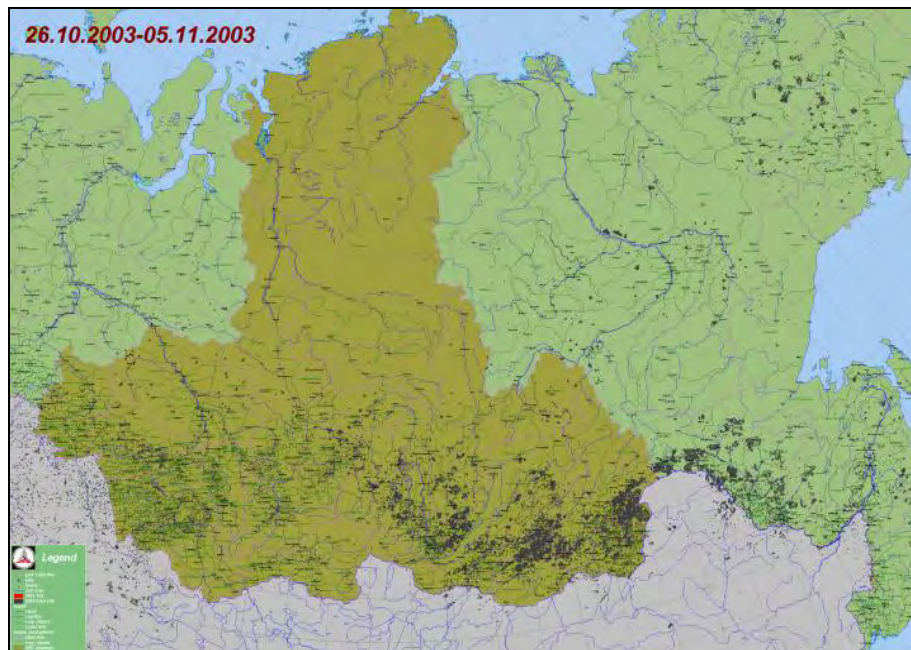


Figure 3. NOAA-AVHRR-derived burn scar map of the fire season of 2003. Source: Sukachev Institute for Forest.

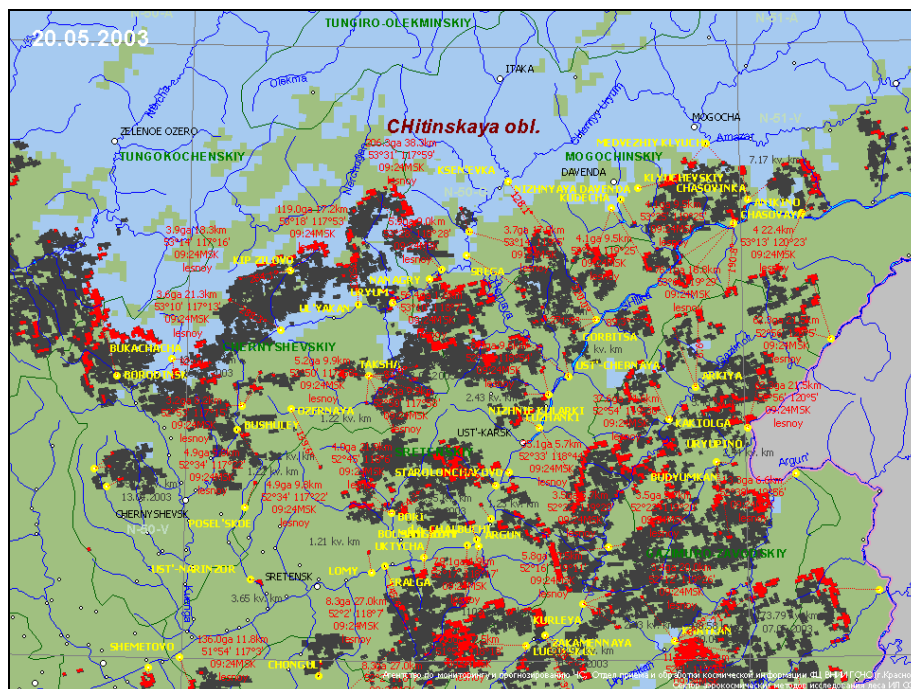


Figure 4. Example of a satellite-derived (NOAA-AVHRR) daily burn scar map, showing a fragment of Yakutia, 20 May 2003. These maps are generated daily by the Fire Laboratory of Sukachev Institute for Forest and displayed on the website of the Global Fire Monitoring Center (GFMC).

The Krasnoyarsk satellite receiving station at the Sukachev Institute for Forest, Krasnoyarsk, is now capable of downloading and processing both AVHRR and MODIS data. The region covered includes the Asian part of Russia, approximately one billion ha of vegetated land area between the Urals in the West and Sakhalin Island in the Far East. The surveyed area includes all vegetation types (forest, tundra, steppe, etc.) and are therefore much higher (Table 2).

Another recent study of the fires of 2003 occurring in the region between 110.27°E to 131.00°E and 49.89°N to 55.27°N evaluated data from MODIS, MERIS and ASTER sensors and compared these with NOAA AVHRR. The study revealed that more than 20.2 million ha of forests and other lands had been affected by fire in this region in 2003 (Siebert et al., 2004).

There are also other datasets on fires in the Russian Federation which are not directly comparable with the observations of 2003. For instance, the initiative "Global Burnt Area 2000" (GBA-2000) of the Global Vegetation Monitoring (GVM) Unit of the Joint Research Center (JRC), conducted in partnership with other six institutions, has produced a dataset of vegetated areas burnt globally for the year 2000. GBA-2000 used the medium resolution (1 km) satellite imagery provided by the "SPOT-Vegetation" system to derive statistics of area burned per type of vegetation cover. The global dataset available for the year 2000 provides area burned by nations. The dataset shows a total area burned in all vegetation types of Russia during the fire season 2000 of 22.38 million ha, thereof 3.11 million ha of forest, 3.31 million ha of woodland, 5.3 million ha of wooded grassland, and 10.66 million ha of other land (including 7 million ha prescribed burning of croplands). The GBA-2000 number of 6.4 million ha of forest and woodland burned must be compared with the reported area burned for the *Avialesookhrana* region of 1.64 million ha (Avialesookhrana 2002) and for the Asian region of Russia (that is covered by the Krasnoyarsk satellite receiving station) of 9.7 million ha of all vegetation types (Sukhinin 2003, pers. comm.). Table 3 shows all GBA data for the Central Asian Countries, including the Russian Federation, and its immediate neighbours.

For the future use of satellite data for operational and ecological monitoring purposes it is now very important to be able to distinguish between fires that are causing damages to forests and other ecosystems (e.g., peatlands) and those fires burning in forests and open lands that are not harmful or that are even beneficial for ecosystem stability and productivity.

Table 2. Comparison of wildland fire data for the Russian Federation: Agency reports vs. satellite-generated data. For details: See text.

Year	Agency Reports based on Ground and Aerial Observations			Satellite Derived Data (NOAA AVHRR) Based on Fire Counts and Derived Area Burned		
	Number of fires reported	Total area burned (ha)	Forest area burned (ha)	Number of fire events investigated	Total area burned (ha)	Forest area burned (ha)
2002	35,000	1,834,000	1,200,000	10,355	11,766,795	n.a.
2003	28,000	2,654,000	2,074,000	16,112	17,406,900	14, 474, 656

Table 3. Data of total area burned in Central Asian countries and its immediate neighbours in the year 2000, obtained from the Global Burnt Area 2000 initiative (GBA-2000).

Country	Area Burned in 2000 (ha)	Country	Area Burned in 2000 (ha)
Afghanistan	69 200	Russia	22 384 100
Azerbaijan	54 200	Tajikistan	42 900
Georgia	16 500	Turkmenistan	26 600
Kazakhstan	8 165 200	Ukraine	2 165 500
Kyrgyzstan	108 300	Uzbekistan	51 100
Mongolia	2 628 700	Total	35 712 300

Other Central Asian Countries

Very limited amount of information on occurrence and impacts of wildland fires in other Central Asian countries is available to the GFMC. The data based on the remote sensing study "Global Burnt Area 2000" (Table 3), however, shows that outside of the three countries described above the fires do occur in forest, grasslands and steppes. An emergency situation was monitored in Afghanistan where on 12 June 1999 a fire broke out in the forest of the Sholake valley, Kunar province of Afghanistan. On 17 June 1999 the local authorities reportedly were unable to control the fires. On 18 June the fire advanced rapidly through Dara Pech valley, some 30 kilometers south of the provincial capital Asadabad. The Islamic Emirate of Afghanistan in Islamabad which provided the update to the United Nations Office for the Coordination of Humanitarian Assistance to Afghanistan (UN-OCHA) in Islamabad has transmitted updated information via the United Nations Office for the Coordination of Humanitarian Assistance to Afghanistan in Islamabad that over 10 km² of forest had been completely destroyed. Some 300 livestock had been killed and 10 villages burned. No human casualties have been reported. On 21 June 1999 several thousand families reportedly fled their homes and international help was requested to fight the fires. According to that report at least four people have been killed.

In this case the international community was unable to assist Afghanistan in fighting these disastrous fires. However, the Afghanistan case was a reason to reflect about the creation of international mechanisms for mutual (bilateral, multilateral) assistance in wildland fire emergencies (see final part of this paper).

3. Transboundary Effects of Wildland Fires: Fire Emissions, Public Security and Health

Short- to long-distance transport of smoke within Central and East Asia has been noted during the last years. The fire episode of 1998 caused severe smoke pollution in the Far East of Russia. In 2003 the extended wildfires in the Trans-Baikal region resulted in severe smoke pollution of Mongolia and China. Smoke plumes generated by fires burning in forests, grasslands and swamps in Irkutsk, Chita and Buryatia regions travelled as far as Sakhalin, Japan, North America and finally Europe.

The consequences of smoke pollution were recorded in Khabarovsk. The situation worsened starting midday of 15 October 2004. Some air quality parameters are recorded by six monitoring stations in Khabarovsk city. Together with smoke the wind transported dust in the city. The dust content before 15 October was 0.4 mg/m³, between 15 and 18 October 2004 – 0.9 mg/m³, and after 18 October 2004 – 0.5 mg/m³. In the center of the city at 13.00 of 18 October the value was 0.9 mg/m³ (equivalent to 1.8 maximum permissible concentration - MPC), at 19.00 the same day – 2.3 mg/m³ (= 4.6 MPC).

Highest concentrations of carbon monoxide (CO) – the trace gas most dangerous to human health – were recorded close to the fires burning in the Jewish Autonomous Region. In the center of Khabarovsk city CO values reached 7.3-7.7 mg/m³ (= 1.5 MPC); in other monitoring stations the values between 15 to 20 October 2004 ranged from 7.8 mg/m³ (= 1.6 MPC) to 25.8 mg/m³ (= 5.3 MPC).

Elevated radioactivity transported airborne from fires occurring in radioactively contaminated vegetation of Eurasia, notably radioactive caesium (CS-137), has been observed after forest fires in the Chernobyl nuclear accident zone (Dusha-Gudym 1996, 1999, 2002, 2005). It is assumed that wildfires burning on former nuclear weapons test sites in Central Asia, e.g. in Semipalatinsk Region (Kazakhstan), result in release and uncontrolled aerial transport of radionuclides and may affect neighbouring countries.

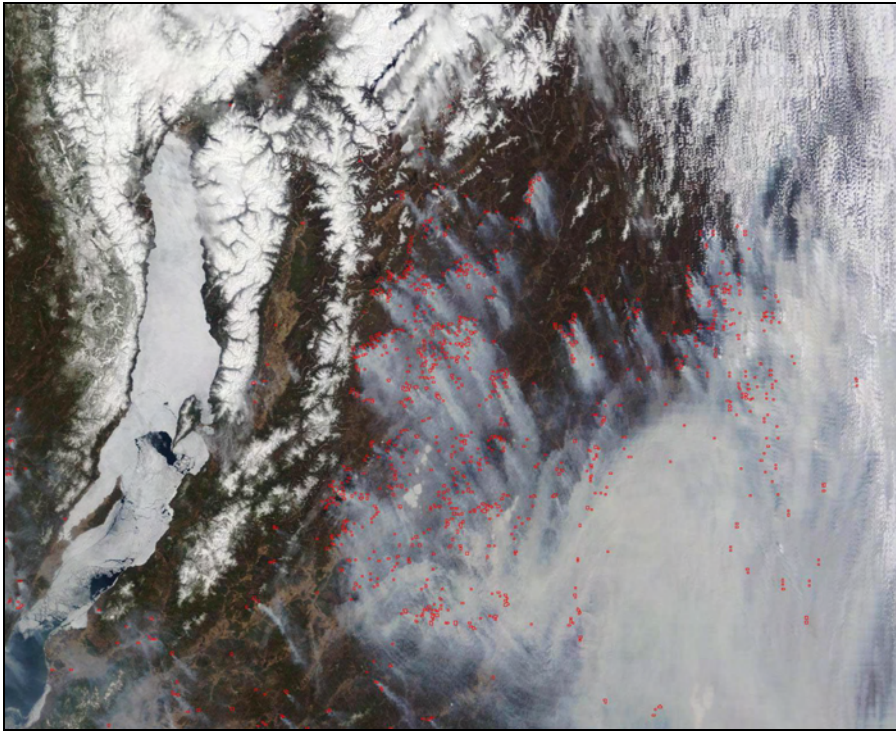


Figure 5. Smoke produced by fires burning on 8 May 2003 at 0400 UTC (11:00 local time) in the region Southeast of Baikal Lake. Source: Moderate-Resolution Imaging Spectroradiometer (MODIS).

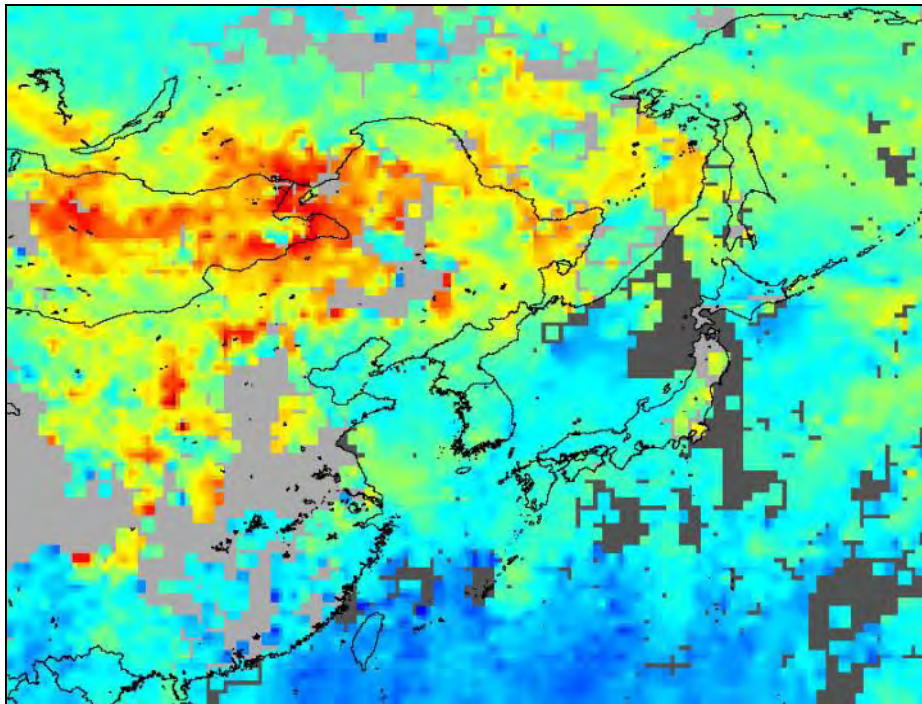


Figure 6. Accumulated carbon monoxide concentration for the period 3-8 May 2003 originated by smoke from wildland fires in the Transbaikal Region. The image shows measurements of carbon monoxide captured by the Measurements of Pollution in the Troposphere (MOPITT) sensor on the Terra satellite, with values ranging from zero (dark blue) to 360 parts per billion (red). Source: NASA Earth Observatory (<http://earthobservatory.nasa.gov/>)

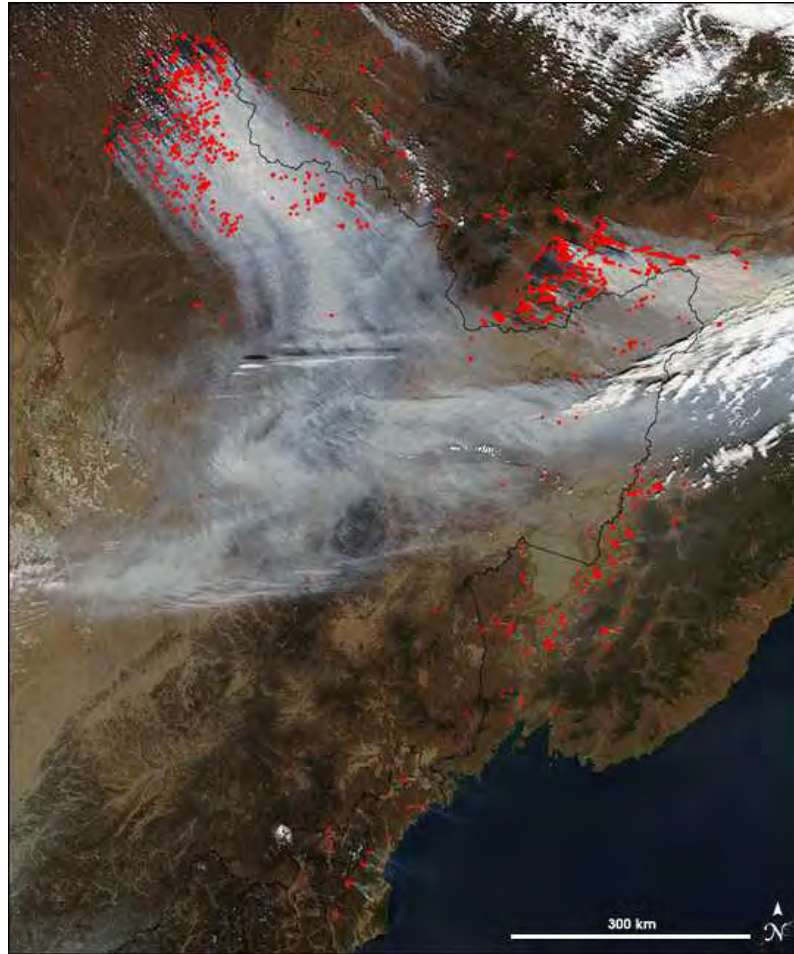


Figure 7. Smoke transport from fires (marked in red) in northern China (top left) and south-eastern Russia (right) on 15 October 2004 as depicted by the Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite. Source: <http://earthobservatory.nasa.gov>



Figure 8. View of smoke-haze pollution of Khabarovsk city center on 16 October 2004.

4. The Challenge for Central Asia

Fire is an important natural process in some forest and steppe ecosystems of Central Asia. People have also traditionally used fire as a land-management tool. The challenge is to develop information tools and management capabilities that recognize both the beneficial and traditional roles of fire, while reducing the incidence and extent of uncontrolled burning and its adverse impacts.

The trend of increasing fire occurrence throughout the world and also in Central Asia is stirring the international community to address the problem collaboratively. The development of informal partnerships, joint projects and formal agreements among governments and between government and non-governmental institutions is essential to enable nations to develop sustainable fire management capabilities.

In order to share human and technical resources in wildland fire management, a number of collaborative activities have been initiated throughout the world during recent years. Representatives from Central Asia already have participated in international and regional conferences such as the 3rd International Wildland Fire Conference (Sydney, Australia, October 2003) and the "ECE/FAO conference on Cooperation in Wildland Fire Management in the Eastern Mediterranean, Near East, Balkans, Central Asia (Turkey, 30 March – 2 April 2004)". In Antalya the establishment of a Regional Central Asia Wildland Fire Network to be tied to the Global Wildland Fire Network has been discussed (see Annex).

Based on the presentation of this report and the discussion at the Central Asian Forest Congress the delegates of the Central Asian countries are encouraged to endorse the GFMC/FAO "Framework for the Development of the International Wildland Fire Accord" and formulate specific recommendations to the FAO Ministerial Meeting on Forests in March 2005.

Source: Paper prepared for the Regional Forest Congress «Forest Policy: Problems and Solutions» 25-27 November 2004, Bishkek, Kyrgyzstan, by

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Resolution of the Regional Forest Congress «Forest Policy: Problems and Solutions»
Bishkek, Kyrgyz Republic, 25-27 November 2004

Countries of the post-Soviet area have common historical, cultural and economic routes predetermining their regional cooperation. Nevertheless, their ecological interrelation is more important for their cooperation, not depending on political or economic direction of countries. The nature predetermined common inhabitation of these countries at common ecosystems and following from such common inhabitation - their mutual dependence on forests, water, energy, transport, tourism and many other issues.

At the World Summit on Sustainable Development (2002) conducted in Johannesburg and the EU Ministerial Conference in Kiev (2003), within the Global Development Program framework (Agenda-21), Governments of Central Asian countries, Russian Federation and Ukraine identified common targets and responsibilities. International organizations and developed countries also took obligations on supporting the efforts (programs and projects) to achieve such goals. Experience of the new independent states, accumulated since more then ten years, proved that fragmented efforts of specific sectors, countries or international organizations do not bring to expected results and do not solve serious problems of environment and regional development. A clear example of this is destroyed ecosystem of the Aral Sea, degradation of mountain ecosystems, reduction of fertility of land areas, irrational water usage, reduction of forest area and etc.

We, participants of the Regional Forest Congress, representatives of the Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Republic of Uzbekistan, Russian Federation, Ukraine, international, non-government organizations and private sector, having discussed key issues of forest management and sustainable forest usage:

- state high vulnerability of ecosystems from first of all anthropogenic impact and irrational utilization of natural resources;
- welcome and support global and regional partnership initiatives, such as International partnership on sustainable development of mountain territories, partnership "East-West" on Ecological Strategy of countries from East Europe, Caucasus and Central Asia and development of the Central Asian initiative on sustainable development declared at World Summit on Sustainable Development;
- underline importance of involvement on the acting in the region organizations, programs and projects in the area of protection of environment and their further development on principles of integrated management, ecosystem and intersectoral approaches, here it is necessary to insist on priority of solving issues on protection and rehabilitation of forests;
- note that in countries and regions measures and actions have been taken on implementation of forest policy involving cooperation between the different stakeholder sectors of society;
- note that the status of forests in the region is of big concern due to a low percentage of forest land, weak natural renewal and insufficient funding;
- note, at present time potential of public organizations, local communities and educational institutions at the programs implemented is not used full enough. Nevertheless, solution of environmental problems is not possible without partnership. A partnership in the sense is a new type of relationship between state, public, international organizations, local community and business;
- underline the necessity of important changes in the role of state, and therefore of top-priority structural and political reforms, based on the generally accepted principles and criteria, adapted to the concrete situation in the each country.
- We consider necessary:
- To promote forestation increase of territories by implementation of projects on planting seedlings and implementation of programs on reduction of desertification and deforestation and guarantee there full scale of nature protection regime;
- To ensure increase of percentage of protected natural territories up an optimal level for preservation of a biological diversity in accordance with international commitments;
- To merge efforts, directed at inter-national, inter-regional, inter-agency and inter-sectoral cooperation within the frame of improvement of ecological policy and by-laws in the area of environment protection, efficient use of nature and sustainable development as at national, as well as at international levels;

- To attract attention of governments of the countries from the region, as well of publicity to the development and consequent implementation of the forest policy;
- Facilitate improvement of coordination, collection and exchange of information and partnership, using existing information networks (Econet, CARNET);
- To facilitate the obligatory inclusion of social-economic aspects into the plans of the forest sector management;
- To develop and implement regional projects, aimed at cooperation in the area of sustainable development of forest sector in the region;
- To search for adequate funding of the forest programs' actions on monitoring and evaluation of the impact of implementation of the decisions taken;
- To join the United Nations International Strategy for Disaster Reduction (UN-ISDR), Global Wildland Fire Network, and support the development of an international accord on cooperation in wildland fire management;
- To undertake political, institutional and legal reforms leading to the sustainable management of forests, and forestry arrangements, supporting involvement of the local population and private sector;
- To turn with proposal donor-countries, EEC, to international organizations: NFG, UNEP, UNDP, FAO, WWF, GEF on provision of financial, technical and consultative support for issues of sustainable management over forest sector of the region;
- To generate environment for local population to increase their awareness, and ensure participation in decision making;
- To undertake regularly exchange of information on the forest policy.

We support the initiative of the Kyrgyz Republic State Forest Service on undertaking the Regional Forest Congress. Within broadening the international cooperation to achieve Goals of Millennium Development, and also in view of bilateral and multilateral agreements, we consider useful to conduct periodically (once in two years) the Regional Forest Congress, using the principle of rotation for selection of hosting country.

We express sincere gratitude for support of the initiative on undertaking the First Regional Forest Congress to the SDC, Intercooperation in Kyrgyzstan, Norway Forest Group (NFG), UNFAO, OSCE, European Union, Europeaid, GEF, World Bank, GTZ, JUMP.



UNITED NATIONS



UN-ISDR Wildland Fire Advisory Group / Global Wildland Fire Network
First Meeting, GFMC, Freiburg, Germany, 3-4 December 2004

Recommendations of the First Meeting in support of

The Framework for the Development of the International Wildland Fire Accord (International Accord on Cooperation in Wildland Fire Management)

Directed to the FAO and UNFF Ministerial Meetings on Forests
(Rome, March 2005 - New York, May 2005)

and the

UN World Conference on Disaster Reduction (WCDR)
(Kobe, Japan, 18-22 January 2005)

Introduction

On 3-4 December 2004 the Wildland Fire Advisory Group / Global Wildland Fire Network of the United Nations International Strategy for Disaster Reduction (UN-ISDR) met at the Global Fire Monitoring Center (GFMC), Freiburg, Germany. The objective of the conference was to evaluate the current status of wildland fires globally, to evaluate the consultations of the Regional Wildland Fire Networks held in 2004 and to prepare recommendations to support the Framework for the Development of the International Wildland Fire Accord (International Accord on Cooperation in Wildland Fire Management), directed to the FAO Ministerial Meeting on Forests (Rome, March 2004), the UNFF Ministerial Meeting on Forests (New York, May 2005) and the UN World Conference on Disaster Reduction (Kobe, Japan, 18-22 January 2005).

Rationale

Over the past decade, many regions of the world have witnessed a growing trend of excessive fire application in land-use systems and land-use change, and an increasing occurrence of wildfires of extreme severities. Some of the effects of wildland fires cross borders, for example smoke pollution and its impacts on human health and safety, loss of biodiversity or site degradation at landscape level leading to desertification or flooding. The depletion of terrestrial carbon by fires burning under extreme conditions in some vegetation types, including organic terrain in peatland biomes, is one of the driving agents of disturbance of global biogeochemical cycles, notably the global carbon cycle. This trend is stirring the international community to address the problem collectively and collaboratively. The consultations of the Regional Wildland Fire Networks in 2004 recommended to develop informal partnerships, joint projects and formal agreements between government and non-governmental institutions that are essential to enable nations to develop sustainable fire management capabilities. The Wildland Fire Advisory Group proposes the development of an International Wildland Fire Accord.

An increasing frequency and destructive force of unwanted wildfires worldwide -- including the excessive use of fire in the conversion of forests into other land uses in the tropical countries -- is affecting human lives, health and well-being, economic assets, property, biodiversity, water resources, soil, atmosphere and climate. Agricultural expansion in some parts of the world is resulting in increased vulnerability of ecosystems; likewise urban encroachment in wildlands is resulting in increased vulnerability of human populations to fire, notably at the rural-urban interface.

Conversely, the role of fire in the natural dynamics and maintenance of many ecosystems as well as the need to use prescribed fire in the maintenance of some wildlands, agricultural and pastoral systems is recognized to maintain habitats for biodiversity, and enhance agricultural productivity and pastoral carrying capacity.

The reason for changing fire regimes is due to increase in population pressure in many countries and associated socio-economic conflicts in some rural areas. In other countries the influence of society has altered historic fire cycles leading to a dangerous and difficult build-up of vegetation fuels on our lands.

The effects of climate variability and climate change are producing periods of extreme drought, resulting in an increase in the severity of fires in some boreal, temperate, sub-tropical and tropical ecosystems, in particular in wetlands.

The need is recognized to formally acknowledge the accountabilities which land management agencies must have in control and management of fire on those lands that include a legislative mandate, that fire is a legitimate land management tool, and that combat fire agencies have a supporting role not a lead role.

In recent years, a number of international conferences and fora have highlighted a need for an international strategy and action to manage wildland fire. For example, with reference to the World Summit on Sustainable Development (WSSD 2002) the International Wildland Fire Summit (Sydney 2003) recommended the development of a strategy to strengthen international cooperation in wildland fire management. The UNFF Resolution 3/2 called countries to develop forest fire management strategies and in this context, consider regional and international cooperation.

The United Nations International Strategy for Disaster Reduction (UN-ISDR) and its Wildland Fire Advisory Group are working to assist and strengthen the efforts of United Nations bodies, other international organizations, and non-governmental organizations, to reduce the negative impacts of wildland fires. Similarly, the UN-ISDR Global Wildland Fire Network (GWFN), the Global Fire Monitoring Center (GFMC) and the FAO are working systematically to increase the intra- and inter-regional cooperation in wildland fire management in the world. Consultations of the Regional Wildland Fire Networks in 2004 revealed that the majority of countries worldwide is ready to establish and strengthen regional and international dialogues on cooperation and exchange of information, research and wildland fire management, including through agreements.

International cooperation is urgently required to share resources in overcoming current gaps and shortages in:

- Consistent information and statistics about fires, their causes and their effects
- Applied research in social sciences and humanities, and innovations in appropriate technology
- Integration of social, economic, environmental considerations and institutions in developing tangible policies and practices related to fire
- Fire becoming an integral component of land, resource, and forest management
- Balanced approaches and solutions, including mitigation, prevention, preparedness, response, and recovery
- Community-based approaches to fire management
- Skills and knowledge of rural people in fire management
- Training in the appropriate use of fire (for example, prescribed burning or the use of fire at the interface of critical risk)
- Long-term visions or plans with tangible short-term and medium-term milestones
- Compatible approaches, e.g., global implementation of the Incident Command System (ICS) and the International Wildland Fire Agreements Template
- Operational satellite-based remote sensing system for the detection, monitoring and impact assessment of wildland fires

Proposed Action – National, Regional and International

Summarizing the outcomes of the international consultations held in accordance with the GFMC-ISDR-FAO "Framework for the Development of the International Wildland Fire Accord" the Wildland

Fire Advisory Group recommends to governments, international organizations and non-government organizations, including the academic sector, the following action plan for cooperation on wildland fire management:

- Implement national and regional strategies that recognize the importance of forests in alleviating poverty and increasing food security
 - Elevate the priority of sustainable forest management on national political agendas
 - Elevate the priority of sustainable forest management on the agendas of development assistance agencies and international organizations
 - Develop and implement national laws and policies that promote integrated approaches to agriculture, forest management, fire management, economic development, social and human resources development, and environmental protection
 - Develop long-term strategic approaches to fire, rather than only reacting to emergencies and recognize the beneficial use of fire as an ecosystem and resource management tool
 - Strengthen the capacities of organizations responsible for managing fire in each country
 - Develop and implement national and regional fire research programs
 - Develop an effective communication strategy which delineates that fire is an essential natural process, that land management agencies are committed to a balanced fire programme that will reduce risks on the one hand and realise benefits of fire on the other hand
 - Strengthen formal and informal education programs in forest fire management
 - Establish national centres for monitoring wildland fires
 - Implement community-based policies and approaches to fire management, involving civil society, indigenous communities, farmers and forest workers in fire preparedness, prevention and response, as a fundamental principle to gain local commitment for the protection of ecosystems and integrated fire management, and incorporate them as national policies
 - Implement and consolidate the Incident Command System in countries to strengthen the capabilities of their organizations and to facilitate efficient multilateral cooperation in fire emergencies
 - Build partnerships among federal and state agencies, tribal governments, fire departments, communities and that land owners, and promote public education necessary to the success of fire management programmes
-
- Develop and standardize fire statistics that include common criteria for classification of vegetation types affected by fire
 - Recognize the need for applying economic evaluation of environmental damages caused by fires, as well as damages avoided by preventing or suppressing fires, as a planning and management tool
 - Request the European Space Agency and other space agencies to establish a satellite system for operational detection, monitoring and impact assessment of wildland fires
 - Prioritise research on global carbon strategies and the implications of the Kyoto Protocol on wildland fire management
 - In addition to existing funding agencies such as the Global Environment Facility (GEF), create national and regional financing mechanisms for fire management, including private mechanisms
-
- Support the efforts of the United Nations Forum on Forests (UNFF) in formulating appropriate policies to promote sustainable forest management, including on wildland fire management, and to implement these policies through, inter alia, the Collaborative Partnership on Forests (CPF)
 - Endorse the ISDR Global Wildland Fire Network and recommend official recognition of Regional Wildland Fire Networks under the auspices of the United Nations ISDR, FAO, and GFMC, among others
 - Instrumentalize the networks as effective platforms for dialogue and communication to achieve a level of mutual cooperation and synergy within regions, between regions, as well as between the Rio conventions UNCCD, UNCBD, and UNFCCC.
 - Support the Regional Wildland Fire Networks and the Secretariat of the Global Wildland Fire Network with appropriate funding to ensure efficient outreach activities and desired political impacts

- Support agreements on cooperation in integrated fire management between institutions within countries, as well as between countries in each region, and between regions
- Promote the development of an international accord for cooperation in the prevention and management of wildland fire (for example an International Wildland Fire Accord)

Recommendations to the Ministerial Meetings

Based on this action plan, the Wildland Fire Advisory Group specifically requests the FAO Committee on Forestry (COFO), the FAO Ministerial Meeting on Forests and the UNFF Ministerial Segment to

- Consider the recommendations emanating from the regional and global consultations that took place in 2004
- Support the Framework for the Development of the International Wildland Fire Accord developed by UN-ISDR / FAO / GFMC
- Consider the recommended action plan concerning a coordinated effort in international cooperation in wildland fire management as a basis for a resolution of the General Assembly of the United Nations

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UNITED NATIONS



UN-ISDR Wildland Fire Advisory Group / Global Wildland Fire Network
 Coordinator and Secretariat: Global Fire Monitoring Center (GFMC), Freiburg, Germany ¹

Recommendations for the Development of an International Wildland Fire Accord

1. Introduction

This statement reflects the outcomes of the consultations of the UN-ISDR Wildland Fire Advisory Group (WFAG) / Global Wildland Fire Network (GWFN) during 2003-2004, in particular the recommendations directed to the FAO and UNFF Ministerial Meetings on Forests (Rome, March 2005 - New York, May 2005) and the UN World Conference on Disaster Reduction (WCDR) (Kobe, Japan, January 2005).²

Statement on the utilized terminology: The UN-ISDR Wildland Fire Advisory Group (WFAG) / Global Wildland Fire Network (GWFN) and the documents prepared by the FAO for the Ministerial Meeting on Forests and the 17th Session of COFO are calling for the development of an "International Wildland Fire Accord". In many circumstances the term "Accord" is used to refer to a formal, approved, and binding instrument. However, the drafters of the declarations of the Regional Wildland Fire Networks and the FAO Regional Forestry Commissions did not intend the Accord to be a formal document, such as a Convention or Agreement, that would require ratification by governments, nor did they intend this to be a binding arrangement under international law. They rather intended that the term "International Wildland Fire Accord" would express a consensus of the international community to coordinate and strengthen international cooperation in wildland fire management.

In order to clarify that intention, some have suggested changing the term Accord to either "Framework" or "Strategy". It is recognized, however, that these terms may not accurately describe the intended document or the ministerial statement. The final term to be chosen should be agreeable by the international community.

2. Rationale

Over the past decade, many regions of the world have experienced a growing trend of excessive fire application in land-use systems and land-use change, and an increasing occurrence of extremely severe wildfires. Some of the effects of wildland fires are transboundary, for example smoke and water pollution and its impacts on human health and safety, loss of biodiversity or site degradation at a landscape level leading to desertification or flooding. The depletion of terrestrial carbon by fires burning under extreme conditions in some vegetation types, including organic terrain in peatland biomes, is one of the driving agents of disturbance of global biogeochemical cycles, notably the global carbon cycle. This trend is causing the international community to address the problem collectively and collaboratively. The consultations of the Regional Wildland Fire Networks in 2004 recommended the development of informal partnerships, joint projects and formal agreements between government and non-governmental institutions that are essential to enable nations to develop sustainable fire management capabilities. Therefore the Wildland Fire Advisory Group / Global Wildland Fire Network proposes the development of an international wildland fire accord.

¹ <http://www.fire.uni-freiburg.de/>

Contact: GFMC Director Johann G. Goldammer: johann.goldammer@fire.uni-freiburg.de

² http://www.fire.uni-freiburg.de/GlobalNetworks/Rationale%20and%20Introduction_1.html

3. Transition From Individual Projects to a Coordinated International Response to the Escalating Global Wildland Fire Problem

In response to increasing wildland fire problems in recent years governments, non-government organizations and the international community began to address the underlying causes of unwanted wildfires and the lack of understanding of the proper use of natural fires and management fires (prescribed burning). Since the late 1990s projects and programmes conducted at country, regional and international levels began to work cooperatively, aiming at sharing resources in wildland fire management – including mutual support in wildland fire emergencies - and capacity building. Examples include:

- ♦ SE Asia: International donors coordinated their response to the fire and smoke episode during and after the El Niño of 1997-98 (e.g., cooperation between GTZ, USFS/USAID, EU, JICA, CIDA)
- ♦ ASEAN: Agreement on Transboundary Haze Pollution signed in 2002 and being implemented
- ♦ Exchange of fire fighting personnel and mutual support based on bilateral memoranda of understanding and other agreements between countries, e.g. between the USA, Australia, New Zealand, Canada, Mexico and others.
- ♦ Border-crossing wildfire emergency response in the Mediterranean region (Portugal, Morocco, Syria, France, Spain)
- ♦ Recommendation for the development of international standards in wildland fire management and response mechanisms by the UN and the International Wildland Fire Summit
- ♦ Establishment of the Global Fire Monitoring Center (GFMC), the ISDR Global Wildland Fire Network which is operating through Regional Wildland Fire Networks, involving government, non-government and academic bodies
- ♦ Agreement on a roadmap toward the development of an international accord for cooperation in wildland fire management (by GFMC, FAO and GOFCC-GOLD)¹
- ♦ Establishment of the ISDR Wildland Fire Advisory Group as an advisory body to the UN

With this level of effort and success comes the responsibility of the international community to build and assist those who are attempting to address this issue. While more people, groups and governments are involved than ever before, the majority of the world can benefit from a stronger level of cooperation. Many individuals are working without the full support of government agencies or receiving any local financial support needed to make their work successful in the management of wildland fires within the context of the numerous social, political, and environmental issues involved.

The Global Wildland Fire Network is a good example of success and the need to do more. Most areas of the globe are involved in the network. Some networks, North America, for example, have a history of years of cooperation, have formal, signed agreements between the member countries and use the authorities in those agreements to assist with fire suppression, develop and conduct joint training, and hold annual meetings to plan future projects. The North American network membership comes from all sectors involved with wildland fire management; Federal and State governments, private industry, non-profit organizations and groups of citizens, Tribal governments and organization and local governments. Members also have formal and informal arrangements with other agencies and groups outside the North American network.

Other regions are not so fortunate. There are networks in some regions with membership of a few interested and dedicated people but they do not have the support or participation of all of the primary wildland fire agencies in the member countries. While the network is functioning as a forum for information exchange, it is not effective operationally.

Many countries and agencies do not have agreements with their neighbours and do not participate in joint training and exercises.

The agreements from the International Wildland Fire Summit and the Pan American Wildland Fire Conference, as well as the paper prepared for COFO “Needs and Opportunities for International Cooperation in Forest Fire Preparedness” outline the wide range of activities and opportunities. A formal framework or strategy, presented and debated before global bodies such as the COFO and the

¹ <http://www.fire.uni-freiburg.de/GlobalNetworks/RationaleandIntroduction.html>

UN Forum on Forests, tied to the Hyogo Framework for Action 2005–2015 “Building the Resilience of Nations and Communities to Disasters”¹, and then taken up by the UN General Assembly is a critical next step if we are to take advantage of the momentum from the past years activities.

4. The Development of an International Wildland Fire Accord

The “Framework for the Development of the International Wildland Fire Accord”², agreed between GFMC and FAO in May 2004 and endorsed in principle by the FAO Regional Forestry Commissions and the Technical Forestry Bodies for the Attention of the Committee on Forestry³, provides a roadmap from the first global conferences, the process of building the Global Wildland Fire Network and the consultations of the Regional Wildland Fire Networks in support of the preparation of the ministerial meeting.⁴ The recommendations of the UN-ISDR Wildland Fire Advisory Group / Global Wildland Fire Network of December 2004 (see ANNEX) provide a comprehensive list of high-priority action items that need to be addressed by the international community. The Advisory Group / WFNW recommended that the ministers:

- ♦ Consider the recommendations emanating from the regional and global consultations that took place in 2004
- ♦ Support the Framework for the Development of the International Wildland Fire Accord developed by UN-ISDR / FAO / GFMC
- ♦ Consider the recommended action plan concerning a coordinated effort in international cooperation in wildland fire management as a basis for a resolution of the General Assembly of the United Nations.

An International Wildland Fire Accord will:

- ♦ Provide a basis for governments and agencies to develop a domestic program of support.
- ♦ Provide the format and structure for regional cooperation.
- ♦ Provide a climate where agencies, organizations, and individuals can focus on the cooperative efforts using systems and processes already effective throughout the world.
- ♦ Provide formal acknowledgement that the “Strategy for Future Development of International Cooperation in Wildland Fire Management” as agreed by the International Wildland Fire Summit, the Declaration from the Pan American Wildland Fire Conference, the declarations from the other regions, as well as the FAO and ITTO guidelines that outline methods, techniques, and processes are valuable and effective.
- ♦ Provide support for the use of a common, inter-country operable organizational system when agencies and countries agree to request and/or provide assistance during wildland fire emergencies.
- ♦ Provide incentive for greater membership in the Regional Wildland Fire Networks.
- ♦ Tie together the work from a wide range of agencies, organizations, and agencies into a common framework.
- ♦ Develop standards for global wildland fire assessments that would meet the needs of FAO's Global Forest Resources Assessments, the implementation of the Kyoto Protocol and the mandates of the UN conventions.

¹ Programme Outcome Document of the World Conference on Disaster Reduction, 18-22 January 2005, Kobe, Hyogo, Japan - <http://www.unisdr.org/wcdr/official-doc/intergov-official-docs.htm>

² <http://www.fire.uni-freiburg.de/GlobalNetworks/Global-Wildland-Fire-Framework-01-February-2005.pdf>

³ COFO/2005/2: <http://www.fao.org/docrep/meeting/009/J3916e.htm>

⁴ More details on the achieved work of the Global Wildland Fire Network in 2004: Special issue of UN-ECE/FAO International Forest Fire News No. 31: http://www.fire.uni-freiburg.de/iffn/iffn_31/content31.htm

Taking into account that the development of an international wildland fire accord in the long term may need to be pursued in conjunction with or as part of an international convention or agreement on forests or on disaster reduction, the UN-ISDR Wildland Fire Advisory Group proposes a three-phase procedure in preparation for enhanced efficiency in international coordinated action. The FAO Ministerial Meeting on Forests is encouraged to endorse this approach:

Near-term

- a) Strengthen and support the UN-ISDR Wildland Fire Advisory Group / Global Wildland Fire Network as well as the interface procedures developed between the UN-OCHA / UNEP Joint an Environment Unit / Environmental Emergency Services and the Global Fire Monitoring Center (GFMC).
- b) Develop standards for global wildland fire assessments that would meet the needs of FAO's Global Forest Resources Assessments, the implementation of the Kyoto Protocol and the mandates of the UN conventions.
- c) Provide support for the use of a common, inter-country operable organizational system when agencies and countries agree to request and/or provide assistance during wildland fire emergencies.

Mid-term

- a) Develop regional strategies and agreements under the aegis of ISDR and FAO in the context of natural disaster reduction and / or forest protection programmes, including the implementation of the Kyoto Protocol and the mandates of the UN Conventions CCD and CBD, as well as the Ramsar Convention on Wetlands.
- b) Following the example of the UN General Assembly Resolution A/57/L.60 of 2002 on "Strengthening the effectiveness and coordination of international urban search and rescue assistance", develop a GA resolution on "Strengthening the effectiveness and coordination of international cooperation in wildland fire management". A General Assembly Resolution would be a high-level statement constituting visible political support of the need for internationally concerted action to respond to the wildland fire situation.
- c) Entrust the FAO to establish a Wildland Fire Management Programme Facility (WFPP) corresponding to the National Forest Programme Facility¹.

Long-term

Support the process of development of an international accord on cooperation in wildland fire management.

¹ The National Forest Programme Facility (Facility) is a funding mechanism and information unit created in response to recent intergovernmental meetings which recognized the essential role of national forest programmes in addressing forest sector issues. It is governed by a Donor Support Group and a Steering Committee which includes representatives of beneficiary countries, FAO, the World Bank, funding partners, research institutions, non-governmental organizations, foundations and the private sector. The Facility is currently funded by the European Commission, Sweden, the Netherlands, Finland, France and Norway and hosted by FAO.

Background Papers of the UN-ISDR Wildland Fire Advisory Group

Assessment of Global Emissions from Vegetation Fires

Abstract

A large amount of information on emissions from the various types of vegetation fires has been accumulated over the past decade. However, because this information is scattered over a large number of publications, and has been reported in numerous different units and reference systems, it has so far not been readily accessible to the scientific and decision-making communities. This paper provides a critical evaluation of the presently available data, integrated into a consistent format. On the basis of this analysis, we present a set of emission factors for key species emitted from biomass fires. Using these emission factors, we have derived global estimates of pyrogenic emissions for important species emitted by the various types of biomass burning and compared our estimates with results from inverse modelling studies. Given the magnitude of the emissions from biomass burning, one must expect significant impacts on air quality, human health, climate and the water cycle.



Figure 1. A “pyro-cumulus” forming over a land-use fire in Amazonia. This photograph visualizes symbolically the effects of fire on the atmosphere by releasing gaseous and particle emissions. Pyrogenic emissions influence the composition and functioning of the atmosphere, including the formation of cloud condensation nuclei that change radiation and precipitation budgets. Photo: M.O. Andreae

Introduction

Air pollution from the smoke of biomass fires has been humanity's constant companion for some two million years, ever since the origin of our species in the savannas and woodlands of Africa. The impact of biomass smoke on human health is reflected, for example, in soot deposits in the lungs of mummies. In spite of the long history of biomass smoke as a pollutant, the first scientific papers on the impact of biomass burning on the chemistry of the atmosphere were only published in the 1970s

and early 1980s (e.g., Radke et al. 1978, Crutzen et al. 1979). Scientific interest in this topic grew, when early estimates of pyrogenic emissions suggested that, for some atmospheric pollutants, biomass burning could rival fossil fuel use as a source of atmospheric pollution (Seiler and Crutzen 1980, Crutzen and Andreae 1990), and when it became evident that these emissions could affect large areas of the world, especially in the tropics (Andreae 1983, Reichle et al. 1986, Fishman et al. 1990).

Satellite and airborne observations have shown elevated levels of O₃, CO, and other trace gases over vast areas of Africa, South America, the tropical Atlantic, the Indian Ocean, and the Pacific. Smoke aerosols perturb regional and global radiation budgets by their light-scattering and absorbing effects and by their influence on cloud microphysical processes. Following well-publicized large fire catastrophes in recent years and intensive scientific efforts over the last decade, the general public as well as the scientific community are now aware that emissions from biomass burning represent a large perturbation to global atmospheric chemistry.

To assess the atmospheric impact of biomass burning, and especially to represent it quantitatively in atmospheric models, accurate data on the emission of trace gases and aerosols from biomass fires are required. In the last couple of decades, the efforts of individual groups to characterize fire emissions have been greatly extended by a number of coordinated biomass burning experiments in various ecosystems throughout the world, often under the auspices of the IGAC (International Global Atmospheric Chemistry) Project of the IGBP (summarized in Scholes et al. 2002). These coordinated studies and numerous independent smaller investigations have resulted in a large body of information on the emission characteristics of biomass fires. These data describe qualitatively and quantitatively the pyrogenic emission of chemically and radiatively important gases and aerosol species, but, unfortunately, this information is scattered through the scientific literature and presented in a large variety of formats and units, making its use very difficult.

This paper provides a synthesis of the currently available data on fire emission characteristics for a number of important chemical species in a consistent set of units. In contrast to some previous summaries that gave only generic estimates independent of the type of fire (e.g., Andreae 1993), separate emission factors for the different types of biomass burning, such as deforestation fires in the tropics, savanna fires, etc. are provided. The emission factor data are combined with activity estimates for the various fire categories to provide global estimates of emissions of biomass burning.

Methods

Definitions: Emission information is usually represented in one of two basic forms, as emission ratios or emission factors. The emission ratio relates the emission of a particular species of interest to that of a reference species, such as CO₂ or CO, while the emission factor makes reference to the amount of fuel burned. Here, we will use emission factors only; a detailed discussion of the definitions and merits of the various emission units and their conversion can be found in Andreae and Merlet (2001). Briefly, the emission factor is defined as the amount of a compound released per amount of dry fuel consumed by combustion, expressed in units of g kg⁻¹. Calculation of this parameter requires knowledge of the carbon content of the biomass burned and the carbon budget of the fire; both parameters are difficult to establish in the field as opposed to laboratory experiments where they are readily determined. Emission factors from field experiments are therefore usually derived from field measurement of emission ratios, combined with estimates of the emission factor of the reference species.

Pyrogenic emissions and the combustion process

The emission factors of the various smoke constituents are determined by the composition of the fuel and by the physical and chemical processes during combustion. Since the carbon content of fuels varies only over a fairly limited range (typically 37-54%), the emission factors for compounds that contain only carbon, oxygen, and hydrogen are predominantly a function of combustion conditions. These, in turn, depend on parameters such as fuel structure, fuel and air moisture, temperature, wind speed, etc. The emission of substances containing minor elements, such as nitrogen, sulfur, and the halogens, is determined both by the concentrations of those elements in the fuel and by the combustion conditions.

The processes during the combustion of biomass have been described in detail (Lobert and Warnatz 1993, Yokelson et al. 1997), and will be reviewed here only briefly. Combustion of the individual fuel elements proceeds through a sequence of stages - ignition, pyrolysis, flaming+pyrolysis, glowing+pyrolysis (smouldering), glowing, and extinction - each with different chemical processes that result in different emissions. Plant biomass consists of cellulose and hemicelluloses (typically 50-70% d.m.), lignin (15-35%), proteins, aminoacids, and other metabolites, including volatile substances (alcohols, aldehydes, terpenes, etc.). In addition, it contains minerals (up to 10%) and water (up to 60%). Thermal degradation begins with a drying/distillation step, in which water and volatiles are released, followed by pyrolysis, during which thermal cracking of the fuel molecules occurs. This results in the formation of char (less volatile solids of high C content), tar (molecules of intermediate molecular weight), and volatile compounds in the form of a flammable white smoke. When temperatures in the fuel bed exceed 450 K, the process becomes exothermic and, at about 800 K, glowing combustion begins. At this point also, a complex mixture of tar and gas products are released, which, when diluted with air, form a flammable mixture. When this mixture ignites, flaming combustion occurs, which converts the complex mixture of relatively reduced substances emitted during pyrolysis to simple molecules, particularly CO₂, H₂O, NO, N₂O, N₂, and SO₂. Depending on the interaction between chemical kinetics and physical dynamics in the flame, intermediate products of flame radical chemistry, like CO, CH₄, H₂, C₂H₄, C₂H₂, PAH, and soot particles are also released during this stage.

When most volatiles have been released from the near-surface region of the fuel, flaming combustion ceases, and smouldering begins, dominated by the gas-solid reaction between oxygen and carbon in the char layer at the fuel surface. This lower-temperature process emits large amounts of CO, as well as incompletely oxidized pyrolysis products that are similar to the products of the initial solid phase decomposition. It is thus this mode of combustion that is responsible for the vast diversity of emission products, some of which is shown in Table 1. Overall, several hundreds of organic compounds have been found in the gas and aerosol phases of biomass smoke. The amount of substances emitted from a given fire and their relative proportions are thus determined to a large extent by the ratio of flaming to smouldering combustion.

Open vegetation fires are typically dynamic fires, in which a moving fire front passes through a fuel bed, such as a savanna or forest. Consequently, all combustion types are present at any given time, and their combined emissions are released into the smoke plume. Their proportions vary over time, typically dominated by flaming in the earlier part of the fire, and smouldering during the later part. Especially in forest fires, this late smouldering stage can continue for days or even weeks.

Each of the types of vegetation fires differentiated in Table 1 has characteristic fuel composition and structure, and typical ways in which these fires occur naturally or are managed by people. Therefore, they tend to have characteristic ratios of flaming and smouldering combustion, which to a large extent determines their pattern of emission factors. In savanna fires, for example, flaming combustion dominates and the emission factors for reduced species are fairly low. Charcoal making, on the other hand, is almost exclusively a smouldering and glowing process. Even in a given fire type, however, the proportion of flaming combustion can vary considerably as a function of internal parameters, particularly fuel moisture and structure, and external parameters, such as the movement of the flame front relative to wind direction or terrain slope. As a result, the emission pattern from a particular fire can be quite different from the average values presented in Table 1.

Emission factors for chemical species from fires in various vegetation types or burning practices

In Table 1, we present emission data for the most important types of fire regimes (savannas and grasslands, tropical forest, extratropical forest, domestic biofuel burning, charcoal production and combustion, and agricultural waste burning) for a wide variety of gaseous and particulate emission products. These emission factors are based on an analysis of some 140 publications. One problem encountered in compiling Table 1 was that the amount of information available for each data cell was quite different between chemical species and fire types. For the major carbon species emitted from fires, such as CO₂, CO, and CH₄, sufficient data are available for all fire types. For many other chemical species, data exist only from a few of the fire types. In order to represent the different levels of information upon which the estimates in Table 1 are placed, we have adopted the following convention: When 3 or more values (based on independent studies) are available for a given cell, the results are given as means and standard deviations ($\bar{x} \pm s$). In the case of two available measure-

ments, they are given as a range, and where only a single measurement is available, it is given without an uncertainty estimate. For single measurements, it can usually be assumed that the uncertainty is no less than a factor of three. For combinations of species and fire type without data available, we have supplied estimates (in *Italics*) using various techniques of extrapolation (Andreae and Merlet 2001).

Because of the fairly low combustion temperatures in biomass fires (compared to fossil fuel combustion) atmospheric N_2 is not significantly converted to NO_x ($NO + NO_2$), and the nitrogen species emissions are based only on the fuel nitrogen. As a consequence, linear relationships have been found between fuel nitrogen content and N_2O and NO_x emission (Lobert et al. 1991, Lacaux et al. 1993). NO , NO_2 , N_2O , and molecular N_2 are released predominantly during flaming combustion, whereas NH_3 , amines and nitriles are associated with smouldering combustion. The most abundant NO_x species in the emissions is NO , but NO_2 typically represents some 10-20% of NO_x (Griffith et al. 1991, Yokelson et al. 1996). NH_3 emissions dominate in the smouldering stage, and can account for most of the N emissions in that stage. NH_3 used to be considered a minor N species in smoke, but studies with improved analytical techniques, particularly FTIR, have shown that it is often emitted at roughly equimolar amounts to NO_x (Griffith et al. 1991, Yokelson et al. 1997, Goode et al. 1999). Some 30-40% of the fuel nitrogen is released in the form of molecular N_2 (Kuhlbusch et al. 1991).

The methyl halides, CH_3Cl , CH_3Br , and CH_3I , are formed predominantly in the smouldering stage, probably due to reaction between methanol and HCl etc. catalyzed at glowing char surfaces or by radical reactions in flames. Since the emission factors depend both on the halogen content of the fuel and on the proportion of flaming to smouldering combustion (Andreae et al. 1996), considerable variability in the emission ratios has been observed.

Fairly good information is now available on aerosol mass emission factors from most types of burning, with the exception of agricultural fires and charcoal use. This does not apply, however, to measurements of the number of particles emitted per amount of biomass burned. The determination of this parameter is problematic, since particle number concentrations changes very rapidly in the initial phase of plume development. Just outside of the flames, particle concentrations are very high (ten thousands to millions per cm^3) and rapid reduction of particle numbers by coagulation takes place. This is a highly non-linear process, which slows down rapidly when the particle concentration drops due to coagulation and dilution. At the same time, the particle size grows, both due to coagulation and condensation of vapours as the plume cools down. The ability of the particles to act as cloud condensation nuclei (CCN) also increases sharply during plume aging, presumably because of condensational uptake of water-soluble material on the particles and because of chemical transformation (oxidation) of the organic aerosol. For these reasons, the values in Table 1 given for particle number emission factors must be considered as fairly rough estimates. They are meant to apply to a slightly aged (1-2 hours) smoke plume, to avoid the large temporal variations shortly after emission. The results for the different particle classes appear reasonably internally consistent, even though they come from a variety of sources. The ratio of ~ 3 between total particle number and the size fraction >0.12

μm is consistent with the number median diameters of $\sim 0.1 \mu m$ typically observed for slightly aged smoke (e.g., Hobbs et al. 1996, Reid and Hobbs 1998). The CN/CCN (1%) ratio of ~ 1.7 agrees with the observation that biomass smoke particles tend to be good CCN after short aging (Warner and Twomey 1967, Rogers et al. 1991, Pham-Van-Dinh et al. 1994, Hobbs et al. 1996).

As already alluded to above, the level of information available on the different fire types and chemical species varies dramatically across Table 1. While savanna fire emissions are reasonably well characterized, glaring deficiencies prevail for other fire types, e.g. biofuel use, including charcoal making and burning. The limited data on emissions from wood and dung burning have proven to cause serious problems in the interpretation of the measurements of aerosol and trace gas composition downwind of regions where domestic biomass burning is a major contributor, e.g. India. Here, the relative contributions of biomass and fossil fuel burning have proven difficult to assess, and emission inventories and ambient measurements have proven difficult to reconcile, not the least due to the poor state of knowledge concerning emission factors (Mayol-Bracero et al. 2002). In India, particularly, dung cakes contribute significantly to the biofuel budget (Streets and Waldhoff 1999). Because of their high N, S, and Cl content, they have high emission factors for species such as NO , NH_3 , SO_2 , and CH_3Cl . They have, however, not been included in the average given for biofuels in Table 1, because of the limited availability of emission data and because of the difficulty of assessing a broadly representative dung cake contribution to the fuel mix.

Emissions from global biomass burning

While the average emission factors for many important species, such as CO and CH₄, are now known with an uncertainty of about 20-30%, large uncertainties persist for regional and global fire emissions because of the difficulties inherent in estimating the amount of biomass burned. The estimation of the amounts of biomass combusted per unit area and time is still based on rather crude assessments and has not yet benefited enough from the remote sensing tools becoming available at this time. Where comparisons between different approaches (e.g., inventories vs. remote sensing) to combustion estimates have been made, they have shown large differences for specific regions. In southern Africa, for example, a difference of almost an order of magnitude has been found between regional estimates based on average fire frequencies in the various vegetation types, and those based on fire counts obtained from remote sensing (Scholes et al. 1996, Scholes and Andreae 2000).

Table 2 provides a set of global emission estimates for the late 1990s, based on the emissions factors in Table 1 and the biomass burning estimates of Logan and Yevich (R. Yevich, personal communication, 2001). Uncertainties are not explicitly stated in Table 2, in part because there is not enough information to estimate them quantitatively. For each entry in Table 2, the appropriate error would result from error propagation from the emission factor data in Table 1 and the estimates of biomass burned. The inventory-based estimates for biomass burned have changed little over the last decade (Scholes et al. 2002), but this is more due to the use of a relatively constant underlying information base and methodology than to actual accuracy of the data. Until tools become available to perform independent validation of these estimates, we must assume that they are uncertain to at least $\pm 50\%$.

Some support for the accuracy of the estimates in Table 2 comes from the application of inverse models to the analysis of the budgets of CO and CH₄. Our estimate of pyrogenic CH₄ (41 Tg a⁻¹) agrees very well with the inverse-modeling estimate of 40 ± 12 Tg a⁻¹ by Hein et al. (1997). In the case of CO, an inverse model considering both concentration and isotopic composition data predicted CO emissions of 483-633 Tg a⁻¹, 140-245 Tg a⁻¹, and 0-87 Tg a⁻¹ for tropical forest burning, savanna burning, and burning at latitudes $>30^\circ\text{N}$, respectively (Bergamaschi et al. 2000). The total pyrogenic CO emission was estimated between 663 and 807 Tg a⁻¹. Comparison with Table 2 shows very good agreement between our a priori estimate and the inversion results for the total CO source, but poorer agreement for the individual contributions, especially that of forest burning. This is probably due to the fact, that Table 2 includes emission from fire types not included in the model (biofuel burning, agricultural burning, and charcoal making). While the agreement between our inventory-based estimates and the results of inverse modelling does not provide very narrow constraints on the accuracy of our estimates, it suggests that the pyrogenic emissions of CO and CH₄ lie within $\pm 50\%$ of the values in Table 2. Since the emission factors for CO and CH₄ are fairly well known, this implies that the total amount of biomass burned annually is also within an uncertainty range of about $\pm 50\%$ around the value of 9200 Tg dry matter used in Table 2.

Environmental impact of biomass burning

While in this brief assessment there is not adequate space to discuss the environmental impacts in extenso, an indication can be gleaned from a comparison of the emissions of key pollutants from biomass burning and from fossil fuel burning. In the last column of Table 2 we list data on emissions from fossil fuel burning (and some industrial activities) taken from the Third Assessment Report of the IPCC (Houghton et al. 2001).

Biomass burning releases about two-thirds as much CO₂ as fossil fuel burning. It can be argued that a substantial fraction of the CO₂ released from vegetation burning is taken up into the biosphere again after a short time. This only applies, however, as long as burning is done in a sustainable manner, which is not the case for deforestation fires and much of domestic biofuel use. For two other greenhouse gases, methane and nitrous oxide, pyrogenic emissions are very significant as well. In the case of methane, fires emit about one-third as much as fossil-fuel related activities (including pipeline losses, etc.). For N₂O, pyrogenic sources rival the sum of all industrial emissions.

Table 1. Emission factors (in g species per kg dry matter burned) for pyrogenic species emitted from various types of biomass burning. See text for the conventions used for reporting uncertainties.

Species	Savanna and grassland ¹	Tropical forest ²	Extratropical forest ³	Biofuel burning ⁴	Charcoal making ⁵	Charcoal burning ⁵	Agricultural residues ⁶
CO ₂	1613±95	1580±90	1569±131	1550±95	440	2611±241	1515±177
CO	65±20	104±20	107±37	78±31	70	200±38	92±84
CH ₄	2.3±0.9	6.8±2.0	4.7±1.9	6.1±2.2	10.7	6.2±3.3	2.7
total nonmethane hydrocarbons	3.4±1.0	8.1±3.0	5.7±4.6	7.3±4.7	2.0	2.7±1.9	7.0 ^c
benzene	0.23±0.11	0.39-0.41	0.49±0.08	1.9±1.0	---	0.3-1.7	0.14
toluene	0.13±0.06	0.21-0.29	0.40±0.10	1.1±0.7	---	0.08-0.61	0.026
methanol	1.3 ^c	2.0 ^c	2.0±1.4	1.5 ^c	0.16	3.8 ^c	2.0 ^c
formaldehyde	0.26-0.44	1.4 ^c	2.2±0.5	0.13±0.05	---	2.6 ^c	1.4 ^c
acetone	0.25-0.62	0.62 ^c	0.52-0.59	0.01-0.04	0.02	1.2 ^c	0.63 ^c
acetonitrile	0.11	0.18 ^g	0.19	0.18 ^g	---	0.18 ^c	0.18 ^c
formic acid	0.7 ^c	1.1 ^c	2.9±2.4	0.13	0.20	2.0 ^c	0.22
acetic acid	1.3 ^c	2.1 ^c	3.8±1.8	0.4-1.4	0.98	4.1 ^c	0.8
NO _x (as NO)	3.9±2.4	1.6±0.7	3.0±1.4	1.1±0.6	0.04	3.9	2.5±1.0
N ₂ O	0.21±0.10	0.20 ^g	0.26±0.07	0.06	0.03	0.20 ^g	0.07
NH ₃	0.6-1.5	1.30 ^g	1.4±0.8	1.30 ^g	0.09	1.30 ^g	1.30 ^g
SO ₂	0.35±0.16	0.57±0.23	1.0	0.27±0.30	---	0.40 ^g	0.40 ^g
COS	0.015±0.009	0.04 ^g	0.030-0.036	0.04 ^g	0.04 ^g	0.04 ^g	0.065±0.077
CH ₃ Cl	0.075±0.029	0.02-0.18	0.050±0.032	0.04-0.07	0.01 ^g	0.012	0.24±0.14
CH ₃ Br	0.0021±0.0010	0.0078±0.0035	0.0032±0.0012	0.003 ^g	0.003 ^g	0.003 ^g	0.003 ^g
Hg ⁰	0.0001	0.0001 ^g	0.0001 ^g	0.0001 ^g	---	0.0001 ^g	0.0001 ^g
PM _{2.5}	5.4±1.5	9.1±1.5	13.0±7.0	7.2±2.3	---	9 ^g	3.9
TPM	8.3±3.2	6.5-10.5	17.6±6.4	9.4±6.0	4.0	12 ^g	13
TC	3.7±1.3	6.6±1.5	6.1-10.4	5.2±1.1	---	6.3	4.0
OC	3.4±1.4	5.2±1.5	8.6-9.7	4.0±1.2	---	4.8	3.3
BC	0.48±0.18	0.66±0.31	0.56±0.19	0.59±0.37	---	1.5	0.69±0.13
K	0.34±0.15	0.29±0.22	0.08-0.41	0.05±0.01	---	0.40	0.13-0.43
CN	2.6·10 ¹⁵	3.4·10 ¹⁵ (^l)	3.4·10 ¹⁵ (^l)	3.4·10 ¹⁵ (^l)	---	3.4·10 ¹⁵ (^l)	3.4·10 ¹⁵ (^l)
CCN (at 1% SS)	2·10 ¹⁵ (^g)	2·10 ¹⁵ (^g)	(2.6±4.2)·10 ¹⁵	2·10 ¹⁵ (^g)	---	2·10 ¹⁵ (^g)	2·10 ¹⁵ (^g)
N _(>0.12 μm dia.)	1.2·10 ¹⁵	1·10 ¹⁵ (^g)	1·10 ¹⁵ (^g)	1·10 ¹⁵ (^g)	---	1·10 ¹⁵ (^g)	1·10 ¹⁵ (^g)

^c) Extrapolation based on emission ratios to CO

^g) Best guess

^l) Estimate based on laboratory studies

Abbreviations: PM_{2.5}: particulate matter <2.5 μm diameter, TPM: total particulate matter, TC: total carbon, BC: black carbon, CN: condensation nuclei, CCN: cloud condensation nuclei at 1% supersaturation, N_(>0.12 μm dia.): particles > 0.12 μm diameter.

Table 2. Global emission of selected pyrogenic species in the late 1990s (in mass of species per year; Tg a⁻¹), based on the emission factors in Table 1 and the biomass burning estimates of Logan and Yevich (R. Yevich, personal communication, 2001).

	Savanna and grassland	Tropical forest	Extra- tropical forests	Biofuel burning	Charcoal making and burn- ing	Agricul- tural resi- dues	Total pyro- genic	Fossil fuel burning
Tg dm burned	3160	1330	640	2663	196	1190	9200	---
CO ₂	5096	2101	1004	4128	169	1802	14,300	23,100
CO	206	139	68	206	19	110	750	650
CH ₄	7.4	9.0	3.0	16.2	1.9	3.2	41	110
NMHC	10.7	10.8	3.6	19.3	0.4	7.6	53	200
Methanol	3.8	2.6	1.3	3.9	0.16	2.1	13.8	---
Formaldehyde	1.1	1.8	1.4	0.4	0.10	1.4	6.3	---
Acetaldehyde	1.6	0.86	0.32	0.36	0.05	0.68	3.9	---
Acetone	1.4	0.83	0.35	0.06	0.05	0.65	3.3	---
Acetonitrile	0.33	0.24	0.12	0.48	0.01	0.21	1.4	---
Formic acid	2.1	1.4	1.8	0.35	0.11	0.3	6.0	---
Acetic acid	4.2	2.8	2.5	2.4	0.30	1.0	13.1	---
NO _x (as NO)	12.2	2.2	1.9	2.9	0.16	3.0	22.3	45
N ₂ O	0.67	0.27	0.17	0.16	0.01	0.08	1.4	2.0
NH ₃	3.4	1.7	0.88	3.5	0.06	1.5	11.0	0.4
SO ₂	1.1	0.76	0.64	0.73	0.015	0.48	3.7	228
COS	0.05	0.05	0.02	0.11	0.01	0.07	0.31	---
CH ₃ Cl	0.24	0.10	0.03	0.14	0.0005	0.28	0.80	---
CH ₃ Br	0.006	0.010	0.002	0.008	0.00011	0.004	0.031	---
PM _{2.5}	16.1	12.0	8.3	19.1	0.34	4.6	60	---
TPM	26.2	11.3	11.3	25.1	1.1	15.5	91	---
TC	11.7	8.7	5.3	13.8	0.24	4.8	45	27
OC	10.6	7.0	5.8	10.5	0.18	3.9	38	20
BC	1.5	0.88	0.36	1.6	0.06	0.82	5.2	6.6
K	1.09	0.39	0.16	0.14	0.02	0.33	2.1	---
CN	1.1E+28	4.5E+27	2.2E+27	9.1E+27	1.3E+26	4.0E+27	3.1E+28	---
CCN (1% SS)	6.3E+27	2.7E+27	1.7E+27	5.3E+27	7.6E+25	2.4E+27	1.8E+28	---
N _(>0.12 μm dia.)	3.7E+27	1.3E+27	6.4E+26	2.7E+27	3.8E+25	1.2E+27	9.6E+27	---

The large releases of the photochemically active hydrocarbons and NO_x lead to the formation of ozone and photochemical smog. Ozone concentrations in regions affected by biomass smoke are comparable to those in industrial regions. Together with the vast amounts of smoke aerosol particles emitted from fires, these smog gases constitute a serious health hazard. Beyond their health effects, smoke particles influence the Earth's climate and hydrological cycles in ways that are still inadequately understood. Light-absorbing ("soot") particles absorb solar radiation, and thereby warm the atmosphere, cool the Earth's surface, and reduce the evaporation of water from oceans and land. On the other hand, smoke particles scatter sunlight back into space and change the properties of clouds, including their ability to produce rain. Given the uneven distribution of aerosols in space and time, we must expect substantial regional impacts on climate and water availability.

Conclusions

Considerable progress has been made over the last decade with regard to the determination of emission factors from biomass burning. A critical evaluation of the available data shows that a vast number of chemical species have been identified in biomass burning smoke, and that reliable emission information exists for most of the key species, at least for savanna fires. There remain, however, serious gaps for important species, including ones that could be valuable atmospheric tracers, such as acetonitrile. Some combustion types also need further study, e.g., the various types of biofuel use, including charcoal making. The global emission estimates from biomass burning have been refined, but require further validation. This applies particularly to the estimates of biomass burned as a function of space, time, and type of combustion. The agreement between the results from inverse models and the inventory-based estimates presented here is encouraging, but more rigorous constraints of emission estimates could come from regional experiments designed to test the agreement between emission inventories and transport and chemistry models. The emissions from biomass burning have significant impacts on air quality, human health, climate and the water cycle.

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Forest Fires in the Boreal Zone: Climate Change and Carbon Implications

Introduction

The global boreal zone, situated generally between 45 and 70 degrees north latitude, stretches in two broad transcontinental bands across Eurasia and North America. Covering approximately 12 million square kilometres, two-thirds in Russia and Scandinavia and the remainder in Canada and Alaska, the boreal zone contains extensive tracts of coniferous forest which provide a vital natural and economic resource for northern circumpolar countries. Although terrestrial ecosystems found in the boreal zone cover less than 17% of the earth's land surface, these ecosystems contain in excess of 30% of global terrestrial carbon. The export value of forest products from global boreal forests is ca. 47% of the world total (Kusela 1990, 1992).

Boreal forests are generally bounded immediately to the north by lichen-floored open forests or woodlands which in turn become progressively more open and tundra-dominated with increasing latitude. To the south the boreal forest zone is succeeded by temperate forests or grasslands. These closed-crown forests have a moist and deeply-shaded forest floor where mosses predominate, the result of a distinct seasonality in which a short growing season and low temperatures. The partially decomposed and compacted organic layer takes many years to accumulate and stores a large amount of carbon. The boreal forest is composed of hardy species of pine (*Pinus*), spruce (*Picea*), larch (*Larix*), and fir (*Abies*), mixed, usually after disturbance, with deciduous hardwoods such as birch (*Betula*), poplar (*Populus*), willow (*Salix*), and alder (*Alnus*), and interspersed with extensive lakes and organic terrain.

Forest fire has been the dominant disturbance regime in boreal forests since the last Ice Age, and is the primary process which organizes the physical and biological attributes of the boreal biome over most of its range, shaping landscape diversity and influencing energy flows and biogeochemical cycles, particularly the global carbon cycle (Weber and Flannigan 1997). The physiognomy of the boreal forest is therefore largely dependent, at any given time, on the frequency, size and severity of forest fires (Kasischke and Stocks 2000). The overwhelming impact of wildfires on ecosystem development and forest composition in the boreal forest is readily apparent and understandable. Large contiguous expanses of even-aged stands of spruce and pine dominate the landscape in an irregular patchwork mosaic, the result of periodic severe wildfire years and a testimony to the adaptation of boreal forest species to natural fire over millennia. The result is a classic example of a fire dependent ecosystem, capable, during periods of extreme fire weather, of sustaining the very large, high intensity wildfires which are responsible for its existence.

For a number of reasons, boreal forests and boreal fires have taken on an added significance in a wide range of global change science issues in recent years. Climate change is expected to be most significant at northern latitudes, and the distribution of ecosystems in this region will change dramatically in response to climate change. This will have serious economic implications for many northern countries relying on forest industries. In addition, forest fire activity is expected to increase significantly with climate change, acting as a catalyst to a wide range of ecosystem processes controlling carbon storage in boreal forests, and likely resulting in a loss of terrestrial carbon to the atmosphere.

Forest Fire Activity in the Boreal Zone

Over the past century, human settlement and exploitation of the resource-rich boreal zone has been accomplished in conjunction with the development of highly efficient forest fire management systems designed to detect and suppress unwanted fires quickly and efficiently. During this period people throughout northern forest ecosystems have coexisted, at times somewhat uneasily, with this important natural force, as fire management agencies attempted to balance public safety concerns and the industrial and recreational use of these forests, with costs, and the need for natural forest cycling through forest fires. Canadian, Russian, and American fire managers have always designated parts of the boreal zone, usually in northern regions, as "lower priority" zones that receive little or no fire protection, since fires occurring there generally have little or no significant detrimental impact on public safety and forest values. This policy has become more widely accepted with the realization that total fire exclusion is neither possible nor ecologically desirable, which initiated a gradual move toward the widespread adoption of fire management strategies that prioritize protection of high-value resources while permitting natural fire in more remote areas. This is particularly true in the boreal

forest regions of Canada, Russia, and Alaska where lower population densities and forest use allow more flexible fire management strategies.

Even a cursory examination of forest fire statistics from northern circumpolar countries shows that, while humans have had an influence on the extent and impact of boreal fires, fire still dominates as a disturbance regime in the boreal biome, with an estimated 5-15 million hectares burning annually in this region (Stocks 1991; Kasischke and Stocks 2000; Conard et al. 2002). Canada and Alaska, despite progressive fire management programs, still regularly experience significant, resource-stretching fire problems. In contrast, Scandinavian countries do not seem to have major large fire problems, probably due to the easy access resulting from intensive forest management over virtually all of the forested area of these countries, and will not be considered here. Russian fire statistics are available over the past four decades but, until recent years, these statistics are considered very unreliable. In addition, the Russian fire management program has been severely crippled by a struggling economy over the past decade.

Alaska

In Alaska, forest fire statistics are available for the past half-century, and generally indicate that the area burned in this northernmost US state has decreased steadily while fire incidence has increased (Barney and Stocks 1984; Stocks 1991, Murphy et al. 2000)). During the 1940s Alaska recorded an annual average of 114 fires, which burned over an annual average area of ~500,000 hectares. By the 1980s the number of fires and area burned averaged 590 and ~200,000 hectares annually. During the 1990s the average annual number of fires increased to 625, averaging ~400,000 hectares burned annually (Kasischke and Stocks 2000). Increased accessibility has influenced both fire incidence and area burned. Road and rail access meant both an increase in forest use, which resulted in increased fire occurrence, but also a corresponding enhanced detection capability and a shortened response time. Faster initial attack, particularly using smoke jumpers, coupled with aerial detection, are the major contributors to the reduction in area burned. Lightning fires, generally occurring in areas where response intervals are longer, account for a large percentage of the area burned in Alaska (38% of Alaska fires are lightning-caused and these fires account for 80% of the area burned). In addition, many fires in Alaska are fought on a priority basis, with extensive zones of limited protection, resulting in recent area burned statistics being somewhat inflated as a result of selective fire suppression.

Canada

Forest fire statistics have been archived since 1920 in Canada and, within limits, this extensive record permits a general analysis of trends in this country. The Canadian fire record prior to the early 1970s (when satellite coverage began) is relatively incomplete, as various parts of the country were not consistently monitored during this period. This problem likely increases as one goes back in time, being more of a problem in the earlier part of the century than during the mid-1900s. Keeping this uncertainty in mind, annual fire occurrence in Canada, without fluctuating greatly on a year-to-year basis, has increased rather steadily from approximately 6,000 fires annually in the 1930-1960 period, to almost 9,000 fires during the 1980s and 1990s. This is a reflection of a growing population and increased forest use, but is also due to an expanded fire detection capability. The area burned by Canadian forest fires fluctuates tremendously on an annual basis, with the 1980-99 period significant in this regard, due to major fire years in 1981, 1989, 1994, 1995 and 1998. While fire occurrence numbers were relatively constant over the 1920-1959 period, and have increased steadily since that time, area burned actually decreased over the first four decades of record only to increase over the last three decades. The most dramatic increase occurred during the 1980s, and 1990s, primarily due to periods of short-term extreme fire weather in western and central Canada. During the 1980-1999 period an average of ~9,000 fires annually burned over an average of 2.7 million hectares in Canada, with annual area burned fluctuating by more than an order of magnitude (0.62 million to 7.56 million hectares). Lightning accounts for 35% of Canada's fires, yet these fires result in 85% of the total area burned, due to the fact that lightning fires occur randomly and therefore present access problems usually not associated with human-caused fires, with the end result that lightning fires generally grow larger, as detection and subsequent initial attack is often delayed.

Recent analysis and evaluation of Canadian fire statistics (e.g. Stocks 1991; Stocks et al. 1996; Stocks et al. 2002) also identified some of the reasons why Canadian fire impact varies significantly. Sophisticated provincial and territorial fire management programs are largely successful at controlling

the vast majority of forest fires at an early stage, such that only ~2% of fires grow larger than 200 hectares in size, but these fires account for ~98% of the area burned across Canada. In addition, the practice of “modified” or “selective” protection in remote regions of Canada results in many large fires in low-priority areas being allowed to perform their natural function. Recent studies comparing fire sizes relative to levels of protection indicate that, on average, fires in the largely unprotected regions of the boreal zone are much larger than fires in intensively protected regions (Stocks 1991; Ward and Tithecotte 1993), accounting for ~50% of the annual area burned across Canada (Stocks et al. 2002). Examinations of the spatial distribution of all large (>200 hectares) Canadian fires (Stocks et al. 1996; Stocks et al. 2002) showed that by far the greatest area burned occurred in the boreal region of west-central Canada, and attributed this to a combination of fire-prone ecosystems, extreme fire weather, lightning activity, and reduced levels of protection in this region.

Russia

While northern Russia and Siberia have long been noted as areas where extensive forest fire activity is common (Lutz 1956), no documented statistics were ever published by the former Union of Soviet Socialist Republics (USSR) which would allow accurate quantification of the magnitude of the problem in that country. Documentary accounts from the early 1900s describe enormous forest fire losses covering thousands of square kilometres in Siberia, and giving the impression that it was difficult to find areas where evidence of recent fire was not present. In the particularly dry year of 1915, an estimated total of 14,000,000 hectares burned in Siberia (Shostakovitch 1925). Periodically some qualitative accounts of the role of fire in the Siberian forests were published, but these contained only partial statistics at best, which did not permit even rudimentary analysis. 1987 was a particularly severe fire year in Inner Mongolia and Siberia. The well-publicized Great China Fire burned in excess of one million hectares near the China-USSR border during the early spring of that year (Stocks and Jin 1988, Cahoon et al. 1991). NOAA AVHRR satellite imagery revealed that a much larger area was burning in central Siberia during the same period. Analysis of this low-resolution imagery revealed 40-50 fires, ranging in size from 20,000 to 2,000,000 hectares, had burned over a total of approximately 10,000,000 hectares in this part of the USSR (Cahoon et al. 1994). While the absolute accuracy of this estimate may be questionable due to the coarse resolution of the NOAA imagery, it still provides, in the absence of any official statistics from the USSR, a reasonable indication of the enormous forest fire problems that existed in this region in 1987, and is supported in a recent paper by Rylkov (1996). While fire activity in the USSR can be assumed to fluctuate dramatically from year to year, as is the case in other countries, the 1987 scenario is strong evidence that a major proportion of the earth's large boreal forest fires occur in Siberia. Korovin (1996) presented fire statistics for the 1956-1990 period, which indicated that, on average, 16,500 fires burned over ~650,000 hectares annually in the former USSR, with very little annual variation. Russian fire managers agree, however, that these numbers are a gross underestimation of the actual extent of boreal fire in Russia, primarily due to an incomplete reporting structure that emphasized under-reporting actual fire statistics. Recent satellite monitoring (e.g. Kasischke et al. 1999) and analysis (Conard and Ivanova 1997; Conard et al. 2002) has resulted in new estimates that show the annual area burned in Russia averaging close to 12,000,000 hectares, but more study is required before accuracy can be assured. The strongly continental climate of Russia, and in particular Siberia, produces fire weather and fire danger conditions that match, or even exceed, those observed in Canada and Alaska (Stocks and Lynham 1996) over a much larger land base. It seems likely then that Russian fire statistics should show significant annual variation in area burned, with periodic major fire years, as is the case in both Canada and Alaska. Given the importance of Russia's boreal forests in a global context, it is critical that an accurate representation of fire activity in that major part of the boreal zone be obtained, and extensive satellite monitoring should provide that information in the near future.

Characteristics of Boreal Forest Fires

Boreal forest fires may be classified, based on their physical fire behavior characteristics, into three general categories (Van Wagner 1983): smoldering fires, surface fires, and crown fires. Crown fires can be either intermittent (trees torching individually) or active (with solid flame development in the crowns), with active crown fires being by far the most common. Crown fire development depends on a number of interacting factors: the height of the crown layer above the ground, the bulk density of crown foliage, the crown foliage moisture content, and the initial surface fire intensity. In general, surface fires must generate sufficient intensity to involve the crown layer, resulting in ready access to

the ambient wind field which largely determines the rate of spread of the fire. The surface and crown phases of the fire advance as a linked unit dependent on each other. The fast-spreading active crown fires that dominate the boreal landscape are primarily the result of strong winds, and are aided by both short- and long-range spotting of firebrands ahead of the flame front.

The frequency of fires in a given area depends on both the climate and the rate at which potential fuels accumulate following each fire. The fire frequency must be in long-term equilibrium with the longevity of the primary tree species and their reproductive ages. The natural fire cycle averages 50-200 years in the boreal forest (Heinselman 1981). However, human use/protection of the boreal zone has created a much wider gap in fire return intervals than would be the case under natural conditions. Stocks et al (1996), based on 1980s data for Canada, showed mean fire return intervals ranging from <100 years in remote, modestly-protected regions of the northern boreal to >500 years in heavily protected boreal zones.

Fire-adapted forests can generally be divided into two categories (Van Wagner 1983): those species able to regenerate although all trees have been killed over a large area, and those species of which some individuals must remain alive to provide seed for the next generation. Species of the first type are either conifers that store seed in insulated serotinous cones that require heat to open, or hardwoods that regenerate through suckering from the root layer following fire. Species of the second type are conifers that release seed every year when the cones mature. Canadian and Alaskan boreal forests are dominated by species (e.g. *Pinus banksiana* [jack pine] and *Picea mariana* [black spruce]) that bear serotinous cones and require lethal fire to regenerate, and the boreal landscape in North America reflects this, consisting almost entirely of large tracts of pure, even-aged stands of fire-origin species resulting from high-intensity, active crown fires. Alternatively, Eurasian boreal forests are dominated by conifer species not generally considered serotinous. Many Eurasian species have adapted to periodic, lower-intensity surface fires (e.g. thicker basal bark), releasing seed annually and creating a much more heterogeneous, uneven-aged forest. It can be assumed then, that active crown fires are far less common in the Eurasian boreal forest, and this is borne out in the Russian fire literature (e.g. Artsybashev 1967) which shows that crown fires account for ~25% of the total area burned in Russia.

Fuel consumption and spread rates can vary considerably, both within and between boreal fires. In general, however, boreal crown fires consume 20-30 tonnes/ha of fuel (Stocks 1991, Stocks and Kauffman 1997) with roughly 2/3 of this total associated with consumption of forest floor (litter, moss, humus layer) and dead woody surface fuels. Crown fuels (needles and fine twigs) account for the remaining 1/3 of the total fuel consumed. Spread rates can vary between ~5 m/min in intermittent (torching) crown fires and >100 m/min in fully-developed crown fires (Stocks and Kauffman 1997). In a recent comparison of the dynamics of boreal and savanna fires, Stocks et al. 1997 showed that boreal fires consume, on average, an order of magnitude more fuel than savanna fires. Despite similar spread rates, this large difference in fuel consumption means boreal fires develop very high energy release rates, and produce towering convection columns that can reach the upper troposphere and lower stratosphere directly. Conversely, savanna fires usually develop less well-defined convection columns, usually only 3-4 kilometres in height. The differing convection column dynamics of boreal and savanna fires are important in terms of the long-range transport of smoke products from biomass burning. Although much larger areas burn in the savannas annually than in the boreal zone (Crutzen and Andreae 1990), smoke transport mechanisms are likely much different. Regionally-generated savanna fire emissions must be transported vertically at the Inter-tropical Convergence Zone (ITCZ) to have a more global impact, whereas boreal fire emissions are injected at much higher atmospheric heights, promoting the likelihood of wider-ranging transport and impacts.

Climate Change and Boreal Forest Fire Activity

Reconfirming earlier analyses (IPCC 1995), the Intergovernmental Panel on Climate Change (IPCC) has recently concluded (IPCC 2001) that "the global average surface temperature has increased over the 20th Century by 0.6°C, lower atmosphere temperatures are rising, snow cover and sea ice extent have decreased, sea levels are rising, atmospheric greenhouse gas concentrations continue to increase due to human activities, and that global temperatures and sea levels will continue to rise under all modelling scenarios". Extreme weather and climate events are also projected to continue to increase in frequency and severity. There is also evidence of an emerging pattern of climate re-

sponse to forcings by greenhouse gases and sulphate aerosols, as evidenced by geographical, seasonal and vertical temperature patterns. In North America and Russia this pattern of observed changes has taken the form of major winter and spring warming in west-central and northwestern Canada, Alaska, and virtually all of Siberia over the past three decades, resulting in temperature increases of 2-3°C over this period (Environment Canada 1995, Hansen et al. 1996).

Numerous General Circulation Models (GCMs) project a global mean temperature increase of 0.8-3.5°C by 2100 AD (IPCC 2001) a change much more rapid than any experienced in the past 10,000 years. Most significant temperature changes are projected at higher latitudes and over land. In addition, greatest warming is expected to occur in winter and spring, similar to the trends measured recently, although warming is projected for all seasons. While GCM projections vary, in general winter temperatures are expected to rise 6-10°C and summer temperatures 4-6°C over much of Canada and Russia with a doubling of atmospheric carbon dioxide. Global precipitation forecasts under a 2xCO₂ climate are more variable among GCMs, but indications are that large increases in evaporation over land due to rising air temperatures will more than offset minor increases in precipitation amounts. In addition, changes in the regional and temporal patterns and intensity of precipitation are expected, increasing the tendency for extreme droughts and floods. Recent transient GCMs, which include ocean-atmosphere coupling and aerosols, and project climate continuously through the next century, support these earlier predictions.

Despite their coarse spatial and temporal resolution, GCMs provide the best means currently available to project future climate and forest fire danger on a broad scale. However, Regional Climate Models (RCMs) currently under development (e.g. Caya et al. 1995; Caya and Laprise 1999) and validation (Wotton et al. 1998), with much higher resolution, will permit more accurate regional-scale climate projections. In recent years GCM outputs have been used to estimate the magnitude of future fire problems. Flannigan and Van Wagner (1991) used results from three early GCMs to compare seasonal fire weather severity under a 2xCO₂ climate with historical climate records, and determined that fire danger would increase by nearly 50% across Canada with climate warming. Wotton and Flannigan (1993) used the Canadian GCM to predict that fire season length across Canada would increase by 30 days in a 2xCO₂ climate. An increase in lightning frequency across the northern hemisphere is also expected under a doubled CO₂ scenario (Fosberg et al 1990, 1996; Price and Rind 1994). In two recent studies, Fosberg et al.(1996) used the Canadian GCM, and Stocks et al.(1998) used four current GCMs, along with recent weather data, to evaluate the relative occurrence of extreme fire danger across Canada and Russia, and showed a significant increase in the geographical expanse of severe fire danger conditions in both countries under a warming climate. This increase does not appear to be universal across Canada though, as Flannigan et al. (1998) report results using the Canadian GCM that indicate increased precipitation over eastern Canada could result in a decrease in fire activity in that region. In addition, a dendrochronological analysis of fire scars from northern Quebec indicates a decrease in fire activity during the warming period since the end of the Little Ice Age (ca. 1850). However, most paleoecological studies of lake sediments in North America show fire frequency and intensity have increased in past warmer and drier climates (e.g. Clark 1988, 1990)

In addition to increased fire activity and severity, climate warming of the magnitude projected can be expected to have major impacts on boreal forest ecosystem structure and function in northern circumpolar countries (see Weber and Flannigan 1997). Based on GCM projections large-scale shifting of forest vegetation northward is expected (Solomon and Leemans 1989; Rizzo and Wilken 1992; Smith and Shugart 1993), at rates much faster than previously experienced during earlier climate fluctuations. Increased forest fire activity is expected to be an early and significant result of a trend toward warmer and drier conditions (Stocks 1993), resulting in shorter fire return intervals, a shift in age-class distribution towards younger forests, and a decrease in biospheric carbon storage (Kasischke et al. 1995; Stocks et al. 1996). This would likely result in a positive feedback loop between fires in boreal ecosystems and climate change, with more carbon being released from boreal ecosystems than is being stored (Kurz et al. 1995). Reinforcing this point, a retrospective analysis of carbon fluxes in the Canadian forest sector over the past 70 years (Kurz and Apps 1999) found that Canadian forests have been a net source of atmospheric carbon since 1980, primarily due to increasing disturbance regimes (fire and insects). It has been suggested that fire would be the likely agent for future vegetation shifting in response to climate change (Stocks 1993; Weber and Flannigan 1997).

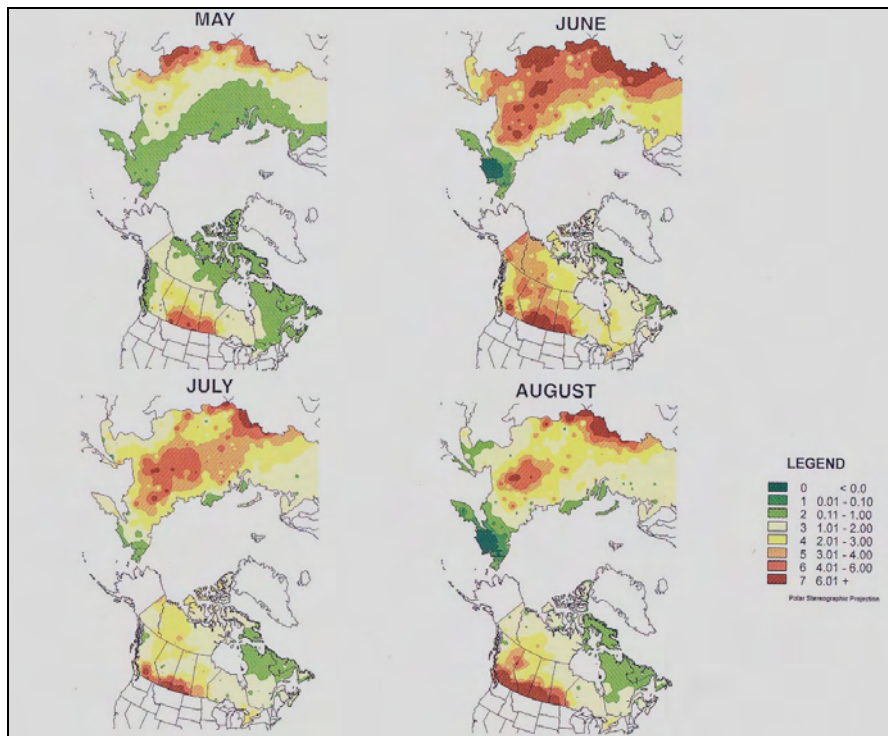


Figure 1. Average Monthly Severity Rating (MSR) maps for Canada and Russia, based on measured 1980-1989 daily weather.

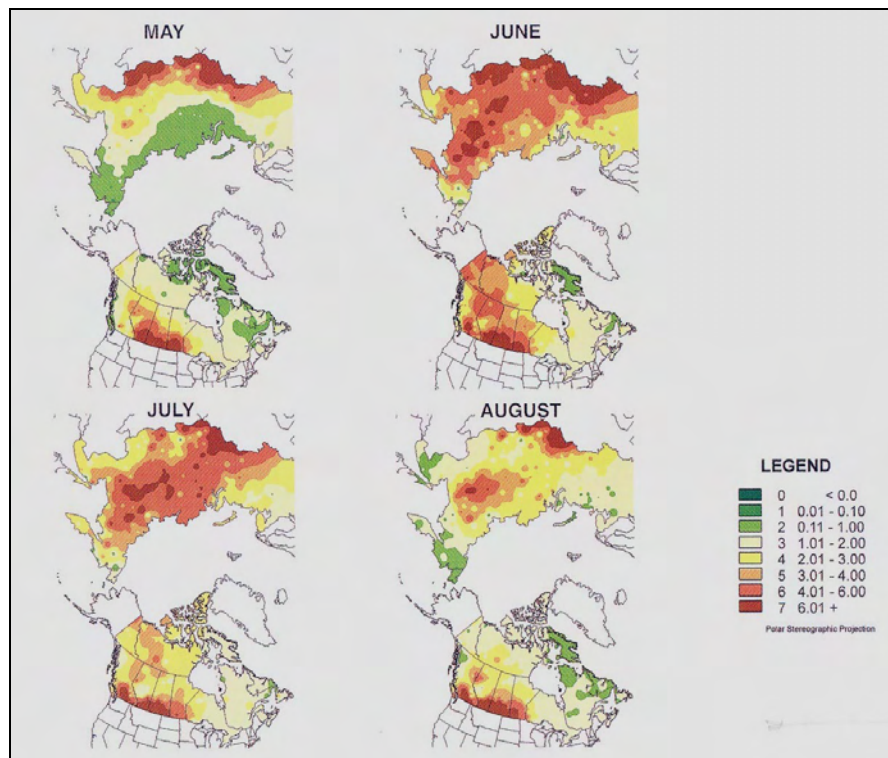


Figure 2. Average Monthly Severity Rating (MSR) maps for Canada and Russia under a 2xCO₂ climate using the Canadian General Circulation Model.

While fossil fuel burning contributes most significantly to increasing atmospheric greenhouse gas concentrations, emissions from biomass burning of the world's vegetation (forests, savannas, and agricultural lands) has recently been recognized as an additional major source of greenhouse gas emissions (Crutzen and Andreae 1990). Recent cooperative international experiments (e.g. Andreae et al. 1994, FIRESCAN Science Team 1996) have confirmed that biomass burning produces up to 40% of gross carbon dioxide and 38% of tropospheric ozone, along with a suite of less common, but equally important greenhouse gases (Levine et al. 1995). While most biomass burning emissions originate from savanna and forest conversion burning in the tropics, there is a growing realization that boreal and temperate forest fire emissions are likely to play a much larger role under a warming climate. Cofer et al. (1996) recently outlined a number of reasons why the importance of atmospheric emissions from boreal fires may be underestimated: the tremendous fluctuations in annual area burned in the boreal zone, the fact that boreal fires are located at climatically sensitive northern latitudes, the potential for positive feedback between climate warming and boreal fire activity, and the high energy level of boreal fires which traditionally produce smoke columns reaching into the upper troposphere. A recent analysis of forest fires in Canada post-1959 determined that an average of 27 Tg of carbon was released to the atmosphere annually through direct combustion (Amiro et al. 2001).

The 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change calls for the "protection and enhancement of sinks and reservoirs of greenhouse gases", and will require all countries to monitor and understand the major factors influencing the exchange of carbon between the biosphere and the atmosphere. With a large amount (37%) (Kurz and Apps 1999) of the total global terrestrial carbon stored in boreal forests, boreal countries will be required to be in the forefront of these efforts. As discussed here, fire is the major disturbance regime affecting carbon cycling in the boreal zone and, with the likelihood of significant increases in forest fire activity in this region, predicting future boreal fire regimes is an urgent international research goal. Policy development and adaptation strategies require this information as soon as possible.

Wildland Fire Advisory Group / IFFN Contribution by

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The WHO/UNEP/WMO Health Guidelines for Vegetation Fire Events - An Update

Abstract

Forest fires are a recurrent phenomenon around the globe. Most recently, about 20 000 Australian fire fighters tried to control more than 80 extensive fires that raged around Sydney. These fires were extinguished only by sufficient rainfall after weeks of drought. The World Health Organization (WHO), in its Health Guidelines for Vegetation Fire Events, strongly advocates the use of all technical capacities for an early warning system. For this purpose, three documents entitled "Health Guidelines for Vegetation Fire Events – Guideline Document", – "Teachers' Guide", and – "Background Papers" were published in 1999 as the outcome of the deliberations as the outcome of an expert meeting, convened in the aftermath of the huge forest fires in South East Asia, 1997. This meeting was co-sponsored by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) and funded by the Japanese Ministry of Health. In this meeting experts from different fields of expertise - public health, ground-based monitoring, remote sensing, and administrators - set the stage for an early warning system for the protection of public health from the impacts of smoke from vegetation fires. This paper highlights background and essential results of the guideline document. The guideline document was widely distributed to administrations of countries exposed to smoke from vegetation fires. The early warning system can help to decrease the frequency of fires and to protect the population from the adverse health impacts from smoke of such fires. Recommendations given in the guideline document can also prevent health impacts from smoke of vegetation fires by proper land-use policies.

Introduction

Vegetation fires are caused by slash and burn land clearing, clearing of plantations following logging operations, and by natural events such as lightning or extreme drought. During dry seasons fires usually reach a peak and can present a transboundary problem when prevailing winds disperse the smoke across borders to other countries. It can happen that extensive fire fighting activities do not help to extinguish the fires, especially when peat soil is burning. In recent years after the devastating fires in South East Asia from July to October 1997 (Heil and Goldammer 2001), intensive fires occurred in Mexico in 1999, in the United States in August-September 2000, in Australia in December 2001, and in Russia in 2002 (GFMC 2002). As the statistics from the Global Fire Monitoring Centre show, fires are a global phenomenon that occurs in every country around the world (GFMC 2002).

The smoke from vegetation fires contains of several hundreds of compounds including fine particulate matter, carbon monoxides, aldehydes, volatile organic compounds, polycyclic aromatic hydrocarbons, and free radicals. While some of these compounds can affect fire fighters and people living close to the fires, others such as fine particulate matter may disperse over hundreds of kilometres and may seriously sicken exposed populations. An example in case are the concentrations of PM₁₀ (particles smaller than 10 micrometers in aerodynamic diameter) as monitored in Malaysia and Singapore during the outbreak of the vegetation fires in Indonesia from July to October 1997 which substantially exceeded the air quality guidelines recommended previously by WHO (WHO 1987) and national air quality standards several hundred kilometres away from the sources. Increased numbers of incidences of respiratory diseases and hospital admissions were reported. Quite recently, in Sydney, whole suburbs had to be evacuated because of the closeness of many wildfires to residential areas and a huge smoke cloud in all parts of the city.

The costs incurred with of vegetation fires may be quite substantial: The South East Asian forest fires, which from July to October 1997 engulfed a large part of the South East Asian region in smoke were estimated to cost US \$ 4.5 billion in forest loss alone. A recent study (Awang et al. 2000) estimated the haze-related costs for short-term health effects, production losses, tourism-related losses, and the cost of mitigation action in Malaysia to amount to US \$ 265 million, and considered this result likely to be an underestimate.

The WHO/UNEP/WMO Health Guidelines for Vegetation Fire Events (WHO/UNEP/WMO 1999a; b; c) advocate a comprehensive strategy and contingency plans harmonised between countries and States within a country to the utmost extent possible, which would help to mitigate the air pollutant burden suffered by the general public. These guidelines are based on broad international consensus and intend to avoid or mitigate the health effects due to exposure of the population to smoke from vegetation

fires. The comprehensive strategy includes a rapid detection capability of uncontrolled vegetation fire emergencies on a global scale; the gathering of useful and reliable data on monitoring and a health surveillance system; the dissemination of information to all affected parties for appropriate decision making; and the development of national environmental and health response plans to vegetation fire emergencies. The strategy considers environmental as well as health aspects, cause-effect relationships, long-range pollution transport, land-use planning and fire prevention, and other related issues.

Health impacts of smoke from vegetation fires

Smoke from biomass burning contains a large and diverse number of chemicals, many of which have been associated with adverse health impacts (WHO/UNEP/WMO 1999b). Nearly 200 distinct organic compounds were identified in wood smoke aerosol, including volatile organic compounds and polycyclic aromatic hydrocarbons. Available data indicate high concentrations of inhalable particulate matter in the smoke of vegetation fires. Since particulate matter produced by incomplete combustion of biomass are mainly less than 1 μm in aerodynamic diameter, both PM_{10} and $\text{PM}_{2.5}$ (particles smaller than 2.5 micrometers in aerodynamic diameter) concentrations increase during air pollution episodes caused by vegetation fires. Carbon monoxide and free radicals may well play a decisive role in health effects of people who live and/or work close to the fires.

Inhalable and thoracic suspended particles move further down into the lower respiratory airways and can remain there for a longer period and deposit. The potential for health impacts in an exposed population depends on individual factors such as age and the pre-existence of respiratory and cardiovascular diseases and infections, and on particle size. Gaseous compounds adsorbed by particles can play a role in long-term health effects (cancer) but short-term health effects are essentially determined through particle size (WHO/UNEP/WMO 1999b). Quantitative assessment of health impacts of air pollution associated with vegetation fires in developing countries is often limited by the availability of baseline morbidity and mortality information. Air pollutant data are of relatively higher availability and quality but sometimes even these data are not available or reliable.

According to recent epidemiological studies, the levels of suspended particulate matter currently monitored in many urban areas in the world are associated with increased daily mortality, increased outpatient emergency room visits and hospital admissions, and exacerbation and increase in number of respiratory diseases (see e.g. Pope 2000). Increases in restricted activity days and in school absenteeism have been observed with increased levels of fine particulate matter as well as increases in the frequency of cough and bronchodilator use. Infants are a particularly sensitive group with respect to acute respiratory infections (ARI) exacerbated in the presence of smoke. ARI is worldwide the main cause of death in infants. These impacts were derived from time-series and cohort studies, which investigated the health impacts of particulate matter in the urban airshed.

The association between increases in daily mortality and particulate matter concentrations exists primarily for the elderly and for individuals with pre-existing respiratory and/or cardiovascular illness (POPE 2000; Pope and Dockery 1999). A threshold for the onset of health effects in suspended particulate matter in the general population was not established. Therefore, the WHO Guidelines for Air Quality (WHO 2000) did not quote a guideline value for PM_{10} and $\text{PM}_{2.5}$ but rather recommended essentially linear exposure-response relationships be used as guidance for deriving air quality standards and a means to estimate the burden of disease due to exposure to particulate matter. The health-related considerations in the Guideline Document concentrate essentially on particulate matter since the potential effects of the many compounds, acting alone or together, in smoke from vegetation fires is not well studied. Concentrating on particulate matter and its health effects observed in urban airsheds and caused by vehicular and industrial emissions bases on the assumption that "urban" particulate matter and particulate matter emitted from vegetation fires may have comparable health impacts. No studies are known that indicated that fine particulate matter in the smoke from vegetation fire would lead to different health impacts (Brauer 1997).

Specific studies of exposure to biomass smoke or "haze" of children and adults indicate a consistent relationship between exposure and increased respiratory symptoms, increased risk of respiratory illness and decreased lung function (see WHO/UNEP/WMO 1999b). A limited number of studies also indicate an association between biomass smoke exposure and visits to hospital emergency rooms. Asthmatics are a particularly sensitive group. During the smoke episode caused by the vegetation

fires in Indonesia, the Malaysia Ministry of Health reported a two- to three-fold increase in the number of outpatient visits for respiratory diseases during high PM_{10} concentration events. A study by the Universiti Kebangsaan Malaysia has demonstrated a 14% lung function decrease in a group of Kuala Lumpur schoolchildren during the smoke episode. A crude analysis of surveillance monitoring of ARI, asthma and conjunctivitis incidence in August-September 1997 at three hospitals in the Klang Valley in comparison to the Malaysian air pollution index indicates a clear relationship between incidence and PM_{10} concentration. The Indonesian Ministry of Health indicated a total of 210000 clinically affected individuals as of 22 October 1997, one month after the peak of the episode. Pneumonia cases in South Sumatra, in 1997, increased 1.5-5 fold as compared to 1996. In September 1997, in the province of Jambi, Indonesia, an increase of 50% of upper respiratory tract infections as compared to the previous month was observed. Pneumonia cases in South-East Kalimantan, Malaysia, in 1997 increased 5- to 25-fold as compared to 1995/1996. Surveillance data by the Ministry of Health, Malaysia indicated a 2-3-fold increase in number of outpatient visits for respiratory diseases during the 1997 episode. An increase of PM_{10} from 50 to $150 \mu g/m^3$ in Singapore was associated with increases of 12% of cases of upper respiratory tract illnesses, 19% of asthma, and 26% of rhinitis; however, an increase in mortality and admissions was not observed in Singapore during the 1997 episode (Emmanuel 2000). While most of these reports are more anecdotal statements and lack scientific consideration of confounding variables, a recent study of the RAND institution in Santa Monica, CA, USA, showed that the smoke from the South East Asian fires had a deleterious effect on public health in Malaysia (Sastry 2002). Sastry observed the following.

In Kuala Lumpur, for the entire population, total deaths due to non-traumatic causes were 21% higher after a high-pollution day; deaths due to non-traumatic causes increased by 75% in the people aged 65-74, and those for cardiovascular and respiratory deaths by 100% in the same age group, respectively. In Kuching, Sarawak, Malaysia, deaths due to non-traumatic causes increased by 260% in the people aged 75+, those for cardiovascular deaths by 310% in the same age group, and those for respiratory deaths by 240%; in the group 65-74, respiratory deaths increased by 260%. These results were not substantially changed by an autoregressive analysis. For the week of highest contamination in Kuching this would correspond to 17.5 excess deaths. This result, extrapolated *ceteris paribus* to Sarawak with 5 times the population of Kuching would amount to 88 excess deaths.

In 1998, the WHO estimated the increase in premature deaths due to exposure to smoke from forest fires in various regions of the world, using a simple model, published by Schwela (1996). The results for various States in Brazil, Malaysia and Indonesia are presented in Figure 1. As can be inferred from this figure, the excess death rate in the week of highest particulate matter pollution in Sarawak, as evaluated in the paper of Sastry (2002) lies well in the range of the rough estimate of WHO for Sarawak of between 47 and 203 deaths.

Sastry points out that in Indonesia, the effects from the smoke of vegetation fires must have been very large as the presence of significant mortality effects in Malaysian cities that are several hundreds miles away from the main fires suggests. For Sumatera and Kalimantan, the estimates of WHO in Figure 1 underline this expectation. Unfortunately, no appropriate health or mortality data have as yet been analysed for Indonesia to study this issue directly. Preliminary evaluations show, however, that there was a significant increase in respiratory conditions, lung function complaints and other related impacts due to the haze (Aditama 2000).

In other parts of the world health impacts from smoke of forest fires were also noted: The number of respiratory disease outpatients in Alta Floresta, Brazil, 1997, was before the burning season 2-3 outpatients per week, while this number increased during burning to 40 outpatients per week (Mims 1997). During California forest fires in 1987, a 40% increase in emergency visits for asthma and 30% increase in emergency visits for chronic obstructive pulmonary diseases were observed (Duclos et al. 1990).

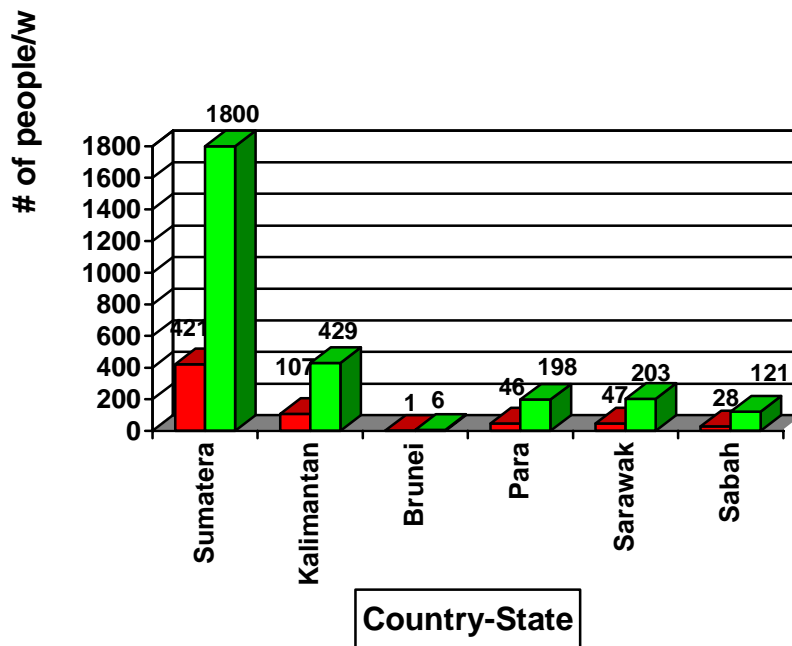


Figure 1. Number of people estimated to have died prematurely due to smoke from forest fires in South East Asia and Brazil in the week of most pollution in Southeast Asia, September 1997

Health Guidelines For Vegetation Fire Events

Based on background papers, the WHO, in collaboration with UNEP and WMO, and with funds from the Ministry of Health of Japan, convened in October 1998 in Lima, Perú, a group of high-level experts with personal experience covering collectively all pertinent aspects of the problem, including:

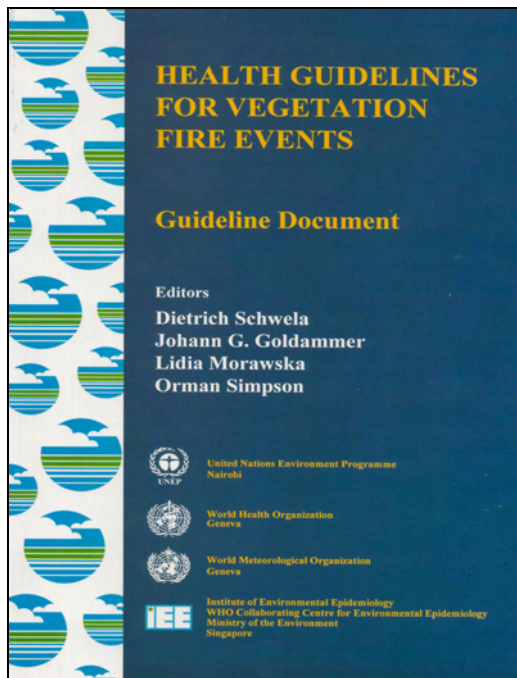
- Methods of health surveillance
- Air pollution (particulate matter) epidemiology
- Bio-mass fuel health effects
- Medical case studies of induced health effects resulting from large area vegetation fires
- Air pollution exposure assessment
- Chemical properties/speciation of smoke compounds
- Ground based environmental monitoring technologies
- Global and regional meteorological mass transport modelling, forecasting, prediction of concentrations
- Advanced regional and global satellite, aircraft mounted environmental monitoring technologies
- Regulatory environmental and health government policies, including early warning procedures

This expert meeting developed the WHO/UNEP/WMO Health Guidelines on Vegetation Fire Events. These guidelines refer to

1. Review and summary of globally available information and case studies on the health impacts of vegetation fires;
2. Review and summary of globally available monitoring information and data from measurement campaigns on vegetation fires;
3. Characterisation of air pollutant components in vegetation fires and their associated health effects;
4. Recommendations on the interpretation and use of monitoring data, global and regional meteorological data, and atmospheric mass transport modelling to determine source apportionment of smoke episodes (i.e., large area source emissions characterisation) and determine or predict down wind air quality impact on human population;

5. Review and summary of existing national policies and guidelines on vegetation fires emergencies;
6. Guidance on scientific methodologies for studying vegetation-fire-induced health effects;
7. Guidance for contingency plans, including a series of recommended steps to be used in decision making during a vegetation fire episode and actions to taken;

Three documents of the Health Guidelines for Vegetation Fire events were published: Guideline Document (WHO-UNEP-WMO 1999a), Background Papers (WHO/UNEP/WMO 1999b) and a Teachers' Guide (WHO/UNEP/WMO 1999c). The cover page of the Guideline Document is depicted in figure 2.



The Guideline Document, in a chapter on air pollution from vegetation fires and health, discusses the topics

- Global fire occurrence
- Hazard Assessment at the basis of fire risk
- Source characterisation: Emission and post-emission processes
- Ground-based monitoring
- Space monitoring, climate monitoring and modelling of fire emissions distribution; and
- Existing emergency response procedures

Figure 2. Cover page of the Guideline Document

In its chapter on the guidelines the Guideline Document describes the acute and chronic health effects of particulate matter from the smoke of biomass and gives public advisories on how to inform the public with respect to

- Ambient air quality
- National action
- Health effects

Mitigation measures are discussed in detail such as

- Remaining indoors
- Use of air cleaners
- Use of respirators
- Outdoor precautionary measures, and
- Evacuation to emergency shelters

Methodologies are also given for the assessment of forest-fire-induced health effects treating the issues of

- Important potential components
- Study designs/acute exposures
- Study designs/chronic exposures
- Evaluation of data, and
- Priority setting

A final chapter of the Guideline Document elaborates on the prevention of future health-affecting events by discussion of the source of the problem – land-use and fire policies – and addressing gaps in knowledge, technologies, and programmes.

The document of Background Papers contains background papers, prepared by experts of the different scientific communities, which cover the issues

- Ground based and remote monitoring of vegetation fire events
- Assessment of health impacts of vegetation fires
- Case studies of health effects of vegetation fires, and
- Management of vegetation fire emergencies

The goal of the Teachers' Guide is to enable national trainees of the guidelines become trainers, and disseminate the information in the guidelines to the staff of national agencies, fire fighters and other stakeholders involved in the fighting, suppression and prevention of vegetation fires. The Teachers' Guide contains the complete set of slides used in three training courses and may serve for further training courses in all regions around the world, after appropriate updating and revision with respect to scientific and technological development.

The Guideline Document was translated into French and Spanish. In 2001, the AMIS CD-ROM was prepared, which among other topics contains all three documents in English and the French and Spanish editions of the Guideline Document. The CD-ROM contains the slides in English and Spanish used in the above-mentioned training courses in Kuala Lumpur and the one held in Brasilia, Brazil. The AMIS CD ROM is depicted in Figure 3, and can be obtained from WHO free of charge (WHO 2001).

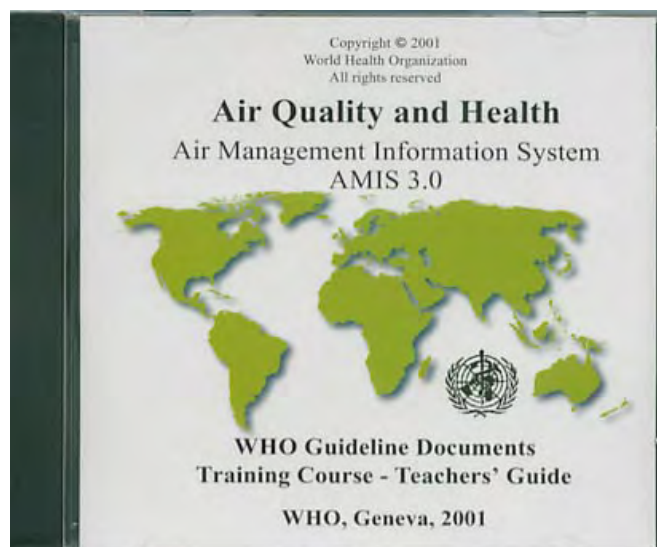


Figure 3.

The CD ROM of the Air Management Information System AMIS

In summary, the WHO/UNEP/WMO Guidelines for Vegetation Fire Events are useful documents, which serve to advise Governments and the general public to prevent health impacts of smoke/haze caused by vegetation fires by use of an early warning system against such events, mitigation measures, and appropriate land use planning. Although the Guidelines for Vegetation Fire Events were widely distributed to Governments of countries at hazard to impacts from forest fires, efficient action to prevent vegetation fires and mitigate their health impacts in future episodic events is only slowly emerging.

In the aftermath of the South East Asian fires in 1997, the Association of South East Asian Nations (ASEAN) adopted a plan to deal with forest fires, with Malaysia overseeing preventive measures, Indonesia fire-fighting resources and deployment and Singapore, a regional-monitoring mechanism. A workshop on transboundary atmospheric pollution, in November 1998, produced a framework for dealing with large fires. In April 1999, ASEAN adopted a "zero-burning" policy and urged all countries to quickly implement the necessary laws and regulations to enforce this major decision aimed at controlling the transnational environment pollution caused by forest and land fires. In March 2000, ASEAN has put into operation its Fire Suppression Mobilisation measures in the districts of Riau

Province, Indonesia to contain the spread of forest fires and smoke haze. These mobilisation measures are part of the broader Action Plan for the Prevention and Control of Land and Forest Fire and Haze in Sumatra and Kalimantan.

As part of ASEAN's efforts to develop a long-term capability to undertake fire suppression, field-training exercises for the prevention and control of land and forest fires and haze have been held in Sumatra and West Kalimantan. ASEAN's Regional Haze Action Plan Co-ordination and Support Unit continuously monitors the haze situation on a day-to-day and region-wide bases and shares its findings through its website called the ASEAN Haze Action Online (ASEAN HAO 2002). This website provides the following information:

- Hyperlinks to institutions involved in regional monitoring and prediction of fire and smoke haze
- ASEAN Transboundary Haze daily update
- Intranet: Information and possible participation in the ASEAN Haze Action Online Intranet Information Services
- Model Fire Suppression Mobilization Plan
- Inventory and analysis of forest and land fire suppression capabilities
- Communication platform on fire and smoke-haze issues in the ASEAN region
- Calendar of fire and haze-related events.

These activities certainly are a step in the right direction. It has to be seen, however, whether scientific measures are sufficient; whether national and regional arrangements are adequate, appropriate, or in place at all, and whether they are supported by policies, procedural guidelines and information availability, and if not, which policies and legislative measures are required to back up the regional haze action plan. It is, moreover, important to address the causes of vegetation fires, to develop rational options for land-use planning, and to develop a community and social-based approach, in which local populations' methods and habits are influenced. Such approaches were advocated in the WHO/UNEP/WMO guidelines.

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Collection of Forest Fire Statistics in the Countries of the United Nations Economic Commission for Europe (UNECE)

Since 1980, the Joint FAO/ECE Working Party on Forest Economics and Statistics, a subsidiary body of the Timber Committee and the European Forestry Commission, has been collecting information, at the national level in the countries of the United Nations Economic Commission for Europe, on the number of fires, the area burnt, and as well as information on causes. FAO/ECE now has a data base with national information for practically all member countries. The results are published annually under the title *Forest Fire Statistics* in the *Timber Bulletin* and are also available at the Timber Committee website: <<http://unece.org/trade/timber>>.

The Resolution S3 of the Ministerial Conference at Strasbourg committed the signatories (including the EU) to creating a decentralised data base on forest fires. Since then a data base, with fire-by-fire information, has been built up, in those countries/regions of the European Union with a particularly severe forest fire problem. In this system, for each fire, information is collected on first alert and extinction times, location, area, cause etc. according to a "common core" of parameters ("socle minimum"). 19 countries of the 27 signatories of Resolution S3 expressed their willingness to adhere to a data base network based on the common core system adopted by EU members, considering it a good, feasible starting point of collecting data on a common base at the pan-European level.

FAO Silva Mediterranea, like the Working Party a subsidiary body of the European Forestry Commission (EFC), covers a region where forest fires are one of the most serious dangers to sustainable forest management, and has also stated its interest in moving towards a fire-by-fire information system, based on the EU system.

At the global level, FAO has collected data on forest fires, using the FAO/ECE conceptual framework and definitions, as part of its monitoring of the state of the world's forests within the context of the Global Forest Resource Assessment.

International Forest Fire News (IFFN), prepared by Mr. J.G. Goldammer, leader of the ECE/FAO Team of Specialists on Forest Fires, contains both technical and statistical information on forest fires world wide. Mr. Goldammer is also developing a Global Vegetation Fire Inventory (GVFI), collecting information by a network of correspondents. GVFI is an activity of the International Global Atmospheric Chemistry (IGAC) project, a core project of the International Geosphere-Biosphere Programme (IGBP).

There is a strong need for a comprehensive international set of comparable data on forest fires and other wildland fires, as a tool for policy makers, and for operational planning (for both prevention and suppression), as an essential part of improving understanding of climate change and the factors influencing it, and as a part of an effort to monitor the state of the world's forests.

In recent years the scientific community has shown renewed interest in forest (vegetation) fires, notably because of their significant role in climate change, and new methods of collecting information are being developed, using remote sensing techniques. Furthermore, the research community needs geo-referenced data (although not necessarily at a very fine degree of resolution).

The approach pioneered in the EU is very valuable and should be extended within the framework of Resolution S3 to other countries, chiefly in Europe and around the Mediterranean, but also in other regions where institutions and resources made it possible to collect fire-by-fire data. Countries starting to collect this information should use the "common core" ("socle minimum") already developed in the EU as a starting point, in order to promote comparability between data for different regions. The Commission of the European Communities has offered to provide technical support to this work and to process data for new countries (including non-EU countries and non-signatories of Resolution S3) in its existing structure. The Silva Mediterranea forest fire network would also contribute to establishing contacts, encouraging the setting up of such systems and ensuring international comparability.

However, it would be many years before all countries, even in Europe, were able to supply the type of detailed information required by the fire-by-fire approach. In order to avoid a short term reduction in the coverage of forest fire information, it was essential to maintain the existing FAO/ECE system of data collection at the national level, until a more comprehensive and detailed system, with at least as

wide a geographic coverage, was operational. Indeed the terms and definition, based on the Global Forest Resource Assessment, and the questionnaire itself, could be used as the basis for data collection in other regions.

FAO/ECE continues to collect and publish annually forest fire statistics, as almost all countries in the ECE region are able to provide reasonably good information on number of fires, area burnt and causes of fires. Collection of information on value of losses and costs of suppression and prevention was discontinued in 1995 as few countries provided this type of information. Furthermore, the latter was not really comparable between countries, in the absence of a commonly agreed international method of evaluation. The European Commission collects and transmits this information to FAO/ECE for the 15 member countries, thus also contributing to a harmonisation of fire statistics in Europe.

At the global level IFFN has a leading role in making available fire reports. All those involved should continue to share the information acquired, in order to build up over time a more accurate picture of the situation. In the context of the FAO Global Forest Resource Assessment the Global Fire Monitoring Centre has made an important contribution to this effort.

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II International Symposium on Fire Economics, Planning, and Policy: A Global View² Findings and Conclusions

Introduction

During this symposium we had the opportunity to exchange ideas regarding the economics of fire management, and to share the latest in development and technologies available for optimizing fire management expenditures. We heard representatives from public fire management agencies in Chile, Mexico, Spain and the United States of America give us a regional and global vision of the forest fire problem in four major regions of the world: South America, Mexico and Central America, Europe and North America. These four presentations set the tone for the whole symposium and highlighted many of the common concerns with the problems of wildland fires throughout the world. Some of the most prominent reasons presented for the continuous and increasing wildland fire problem were related to social and economic factors such as poverty in rural areas, particularly in developing countries economies, and land abandonment of the rural areas in Europe. A related problem is the population increase and higher concentrations along forested areas, creating the new coined problem of the wildland urban interface (WUI). This problem is most prevalent in developed economies of the west, although not exclusive of developed countries. Another significant concern affecting negatively the problem of wildfires is changes in forestry policies. Other significant contributors to the problem are changes in global weather patterns, changes in land use patterns, and fire exclusion policies.

It was also evident from these regional presentations that the costs associated with the wildland fires problem and fire management programs are substantial ranging in the billion of dollars. For example, since 2000, the United States Department of Agriculture Forest Service (USDAFS) alone has spent more than \$1 billion annually in forest fires suppression. Canada spends an average of \$400 to \$800 million annually. Neither of these figures includes timber, health, recreation or personal property related expenditures. In the South American continent losses are estimated as high as \$1.6 billion annually. Recent estimates of the impacts of the Indonesian fires of 1997 on the economies of Indonesia, Malaysia, and Singapore were as high as \$4.5 billion.

The problem is not any simpler in terms of the land area affected. In the US an average of close to 2 million hectares of forest lands annually have been affected. In Canada the equivalent amount is 2.5 million hectares. During 1998, 2.3 million hectares were affected in Mexico and Central America. When added to the 5.3 million hectares of agricultural burns in the area the total jumps to 7.7 million hectares. In the South American continent more than 3 million hectares burned on average during the 1990s. On average Europe burns more than half million hectares of forest land annually. During 2003, Portugal alone burned more than 450,000 hectares of forest lands; France's average annual area burned increased by more than 30% from the 90s decade; the Russian Federation burned 23.7 million hectares, and Australia lost more than 60 million hectares! Worldwide estimates are that more than 350 million hectares of forest lands are burned annually.

In response to the overwhelming evidence of the magnitude of the problem the presentations and discussion following the regional overview dealt with the topic of strategic fire management planning. Divided into three sessions authors presented different approaches used by several world organizations to best plan their forest fire protection programs. Presentations varied from developing a global wildland fire strategy to specific planning techniques for individual countries from Chile to the USA, and to Europe. Some had developed models for allocating fire fighting resources using Geographic Information Systems, other developed tools for strategic budget processes for initial attack response. Experiences and models from different parts of the world were presented and discussed.

The wildland fire program has been traditionally discussed in terms of fire ecology and fire management but by and large not from the perspective of its economic dimension. Two full sessions were devoted to the fire economics issues. Non-market valuation techniques were presented on how to include non-market values information into strategic fire planning. The economic implications of wild-fire management were discussed and some "myths" about fire management presented. The cost and

² An abbreviated version of this paper was presented at the II International Symposium on Fire Economics, Planning, and Policy: A Global View, April 19-22, 2004, Córdoba, Spain.

benefits of the application of prescribed burning as a tool for sediment reduction was presented among others.

Sustainability of fragile and non fire dependent ecosystems is threatened by catastrophic fires. These fires also affect large expanses of forest plantations. A session was devoted to discuss the relationship between forest fires and sustainable forest management. Examples from Spain and Chile highlighted the difficulties in trying to practice sustainable forestry while confronting wildland fire problems of the magnitude presented here.

The regional presentations made clear the importance of public policies in shaping government agencies response to the problem of wildland fires. At the same time these policies affect the manner in which society reacts to the established programs. The issue of wildland urban interface was discussed extensively as one

that is shaping the new approaches public agencies at the local, regional, and national level will use in establishing wildland fire management programs. The factors that affect the views of homeowners about wildfire hazard and fuels management were also discussed.

There is common held believe in the wildland fire community that increasing the level of forest fuels treated by prescribed burning activities would decrease fire suppression expenditures. A full session was devoted to this topic with mixed results. Results show that there are analytical problems in assessing treatment effectiveness and these may be compounded by deficiencies in type of data typically collected by public agencies. Other problems are related to the relatively scant information available on treatments applied on a landscape scale.

Problems Identified

After three intense days of presentations the following list of problems were identified as having a significant impact on the wildland fire problem.

1. Socio-economic
 - a. Poverty in rural areas
 - b. Abandonment of rural areas
 - c. Population increases and concentration in urban areas
 - d. Shift in forestry policies
 - e. Wildland urban interface
 - f. Low forest land values
2. Programmatic
 - a. Lack of clear and sometimes conflictive policies
 - b. Lack of continuous well financed prevention and education campaigns
 - c. Lack of coordination (local, regional, national, and international levels)
 - d. Lack of fire management programs funds
 - e. Lack of good information databases
 - f. Lack of fire insurance programs
3. Political
 - a. Lack of political will to promote effective forest protection
 - b. Lack of community involvement
 - c. Agricultural policies resulting in agricultural burns being a major agent of forest fires.

Conclusions

From this list of problems the following conclusions were reached:

1. Increasing fire severity observed in many regions as a consequence of direct and indirect impacts of human interference and environmental change
2. Different regions experiencing the consequences of fire suppression or reduced fire use, with its impacts on biodiversity, carrying capacity, landscape patterns, etc
3. Alarming trend of fire-induced carbon transfer from the terrestrial sphere to the atmosphere, especially from drained or climatically altered wetlands
4. Main cause of fire is agricultural burning
5. Globalisation of markets influences fire use and fuel loads

6. The wildland/urban interface problem is growing rapidly requiring a new paradigm for a workable solution
7. Larger and more expensive fire suppression organizations are not necessarily the answer.
8. Preventive silviculture programs & education programs in urban and rural areas may not be enough, without adequate funding.
9. Community involvement programs are necessary (integrated fire management—social, ecological, economic and operational issues)
10. Economic analysis of forest fires protection programs are essential (including valuation of fire impacts)
11. Development of a wide-reaching system of personnel certification and qualification is needed
12. Establishment of cooperative agreements at the local, regional, national & international levels is necessary
13. New policies are needed to deal with:
 - a. abandonment of rural areas
 - b. poverty in rural areas
 - c. wildland/urban interface issues
14. Development of national databases
 - a. Fire history
 - b. Intentional fires (arsonists profile)
 - c. Fire costs (local, regional, national)
 - d. WUI (definition of term, inventory by country, structures lost, economic impact)
15. Research needs
 - a. Social, economic, and human behavior studies in fire awareness
 - b. Home and safety research in WUI
 - c. Proportion of budget needed for fire education, prevention to achieve reduction in number of fires
 - d. Verification of global (country) remote sensing data (total area burned, fire history, etc)
 - e. Use of fuel treatments to reduce fire hazard and occurrence
 - f. Economic impacts of forest fires

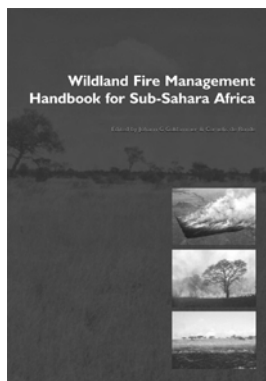
In closing the general consensus of the audience was that this kind of international conference dealing with issues of fire economics, planning and policies should be continued on a regular schedule. It was recommended that the next symposium be scheduled for 2008.

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Wildland Fire Management Handbook for Sub-Sahara Africa



Edited by Johann G Goldammer & Cornelis de Ronde

Hardcover, 448 pages, 245 x 168 mm, ISBN 1- 919833-65-X

Price South African edition: R160; African Edition R80; European edition Euros35; International edition US\$40
All prices excluding postage

The policy to offer the book in the above price categories is based on the fact that The Global Fire Monitoring Center (GFMC) has subsidised the preparation and printing of the handbook by using funds of the German Foreign Office that were dedicated to support capacity-building in wildland fire management in Sub-sahara Africa. With a nominal fee plus shipping costs the book shall be made available easily and at low total costs for African users outside of South Africa. A slightly higher price for South Africa considers the low costs involved in shipping the book within the country or purchasing it at net price in bookstores. The book is also offered to the non-African customers at a higher, non-subsidised price

Published by the Global Fire Management Center and distributed by Oneworldbooks www.oneworldbooks.com

Fire has been used as a land-use tool for controlling the environment since the early evolution of humanity. Fire continues to be used as such by people living in different ecosystems across sub-Sahara Africa. Consequently, the rich biodiversity of tropical and subtropical savannas, grasslands and fire ecosystems is attributed to the regular occurrence and influence of fire. However, wildfires have been harmful to ecosystems, economies and human security. This is due to increasing population pressure as well as increased vulnerability of agricultural and residential lands.

The Wildland Fire Management Handbook provides scientific guidelines for maintaining and stabilising ecosystems and for state-of-the art fire prevention and control. The handbook features contributors from diverse backgrounds in wildland fire science and fire management. It deals with topics ranging from fire behaviour and controlled burning to fire ecology and the effects of burning on Cape fynbos. In addition the *Wildland Fire Management Handbook* includes fire regimes and fire history in West Africa. Thus, the handbook is groundbreaking in its furthering of sub-Saharan Africa's capacity for fire management and consequent preservation of the environment.

The Wildland Fire Management Handbook is an important resource for strategic sustainable land-use planning, disaster management and land security. The handbook is well suited to the needs of wildland fire management practitioners, scientists, academics, and students of universities and technical schools. Thus, environmental consultants, conservationists, ecologists and those dealing with wildland fire disaster prevention, preparedness and mitigation will be interested in the book.

CONTENTS

- Introduction
- Fire Ecology: Characteristics of Some Important Biomes of Sub-Sahara Africa
- Fire Behaviour
- Fire Effects on Flora and Fauna
- Fire Effects on the Maintenance of Biodiversity, Soil and Nutrients
- Regional Fire Management: Objectives, Practices and Prescribed Burning Application
- Fire Management in Rural Areas and Industrial Forestry Plantations
- Remote Sensing of Vegetation Fires and its Contribution to a Fire Management Information System
- Fire Protection Planning, Regional Integration and Fire Danger Rating
- Fire Detection and Control
- Veld and Forest Fire Equipment
- Application of Prescribed Burning
- Wildfire Suppression
- Wildfire Investigation, Fire Insurance, Economics and Training
- Fire History, Fire Regimes and Fire Management in West Africa: An Overview

Annexure I: Community Participation in Integrated Forest Fire Management: Some experiences from Africa

Annexure II: Biogenic and Pyrogenic Emissions from Africa and their Impact on the Global Atmosphere

Glossary

Contributing Authors

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SOUTHERN AFRICAN JOURNAL OF ENVIRONMENTAL EDUCATION, VOLUME 20 (2003)

Environmental Education, Ethics and Action: Policy-in-Practice

Heila Lotz-Sisitka, Godwell Nhamo, Charles Obol, Rob O'Donoghue, Johann Hattingh (eds)

240mm x 175mm | 160pp | ISBN: 1-919833-60-9 | R 240.00 | 2004

Environmental policy development and implementation is a 'hot topic' in southern Africa, following global imperatives for countries around the world to articulate their intentions to become more sustainable through public policy. Papers in the journal reflect a broad spectrum of views on policy-in-practice, with contributions from South Africa, Swaziland, Zimbabwe, Zambia, Tanzania and Lesotho, as well as the USA, UK, India, Italy and Denmark. With a concern for democratic orientations to policy-in-practice processes, the contributions included go far towards illustrating how environmental and environmental education policy processes are intertwined.

WILD LAW

Cormac Cullinan

198mm x 130mm | 264 pp | ISBN: 0-9584417-8-2 | R 180.00

It is becoming clear that many of the treaties, laws and policies concluded in recent years have failed to slow down, let alone halt or reverse, the destruction of our habitat. Like Fritjof Capra, who argues that our survival requires a radically different social and economic structure, Cormac Cullinan shows that the survival of the community of life on Earth (including humans), requires us to alter fundamentally our understanding of the nature and purpose of law and governance, rather than merely changing laws. In describing what this new "Earth governance" and "Earth jurisprudence" might look like, he also gives practical guidance on how to begin moving towards it. Thomas Berry, the leading environmental philosopher, says 'This book of Cormac Cullinan explains with great clarity how we can change our entire approach to governance so that we can continue life on a liveable planet. In its basic outlines this book is one of the finest contributions to the entire field of jurisprudence in recent times.'

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