Fire management:

Review of international cooperation

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The purpose of these papers is to provide early information on ongoing activities and programmes and to stimulate discussion.

Comments and feedback are welcome.

Forestry Department

Food and Agriculture Organization of the United Nations

Fire Management Working Papers

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Contents

Foreword

As a result of the increasing incidence and impact of major fires globally, the 3rd International Wildland Fire Conference and the International Wildland Fire Summit (Sydney, Australia, 2003) highlighted the need to improve international cooperation in fire management. This view was further reinforced at the FAO-hosted Ministerial Meeting on Sustainable Forest Management and the FAO Commission on Forestry (Rome, Italy, 2005), which called upon FAO – together with the United Nations International Strategy for Disaster Reduction (UN-ISDR) and collaborating partners – to prepare a strategy to enhance international cooperation in fire management.

A follow-up Expert Consultation on Wildland Fire Management (Madrid, Spain, 2006) recommended that the foundation of the strategy should include: a global assessment of fire management; a review of international cooperation; voluntary guidelines for fire management; and an implementation partnership (to be established in 2007). The present working paper is the initial review of international cooperation.

Although FAO coordinated the preparation of the review – in order to complement *Fire management: global assessment 2006* and the voluntary guidelines – the Global Fire Monitoring Center (GFMC) was the author.

In order to enhance international cooperation in fire management, multistakeholder and multifaceted approaches are necessary to: (i) adopt a common language and common principles in fire management; (ii) better understand the underlying causes and environmental and human impacts of fires; (iii) increase collaboration between fire-related actors to render their specialist activities more effective and more widely used by fire managers; (iv) integrate the policies, plans, implementation and monitoring of diverse sectors; (v) develop international policies and fire management support systems; (vi) translate international agreements, conventions, declarations, processes and voluntary agreements into regional, national and local policies and actions; and (vii) create a framework and mechanisms for international donor support to fire management stakeholders in need.

The review highlights priority themes for international cooperation, current actors, their specialist activities and the potential for future synergies and cooperation. However, it is recognized that this is only a starting point. New actors are encouraged to add their specialist activities and to commit to international collaboration in the future. Consequently, the review of international cooperation will be reprinted as a working paper from time to time to reflect expansion through new actors and specialist activities.

The Eighteenth Session of the FAO Committee on Forestry (Rome, Italy, March 2007) and the 4th International Wildland Fire Conference (Seville, Spain, May 2007) provide ideal opportunities for FAO, the UN-ISDR Global Wildland Fire Network and their collaborators to outline the current status of international cooperation in fire management and to highlight the potential for even better cooperation in the future.

FAO encourages its Member Countries and organizations involved in the various aspects of fire management to come forward to strengthen this initial review and to commit to enhancing international cooperation in fire management.

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Acknowledgements

Acronyms and abbreviations

AGEE	Advisory Group on Environmental Emergencies (OCHA/UNEP)
ASEAN	Association of Southeast Asian Nations
BIRD	Bi-spectral Infrared Detection (BIRD) satellite mission (DLR)
CagM	Commission for Agricultural Meteorology (WMO)
CBD	Convention on Biological Diversity
CBFiM	community-based fire management
CFS	Canadian Forest Service
CoE	Council of Europe
COFO	Committee on Forestry (FAO)
CRC	Cooperative Research Centre
CTIF	Comité Technique International du Feu (International Technical Committee for the Prevention and Extinction of Fire/International Association of Fire and Rescue Services)
DLR	German Aerospace Center
EEP	Environmental Emergencies Partnership
EFFIS	European Forest Fire Information System
EFNCN	Eurasian Fire in Nature Conservation Network
EHS	Institute for Environment and Human Security (UNU)
EOS-DIS	Earth Observing System – Data and Information System
EUR-OPA	European and Mediterranean Major Hazards Open Partial Agreement
FRA	Global Forest Resources Assessment (FAO)
GEC	Global Environment Centre
GEF	Global Environment Facility
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GFP	Global Fire Partnership
GFMC	Global Fire Monitoring Center
GOFC-GOLD	Global Observation of Forest and Land Cover Dynamics (a project of GTOS, sponsored by IGOS)
GRID	Global Resource Information Database
GTOS	Global Terrestrial Observing System
GTZ	German Agency for Technical Cooperation
GWFN	Global Wildland Fire Network (UN-ISDR)
IAWF	International Association of Wildland Fire
IBFRA	International Boreal Forest Research Association
ICS	Incident Command System
IDNDR	United Nations International Decade for Natural Disaster Reduction (1990s; since 2000 UN-ISDR)
IEWP	International Early Warning Programme (UN-ISDR)
IFFN	International Forest Fire News
IGAC	International Global Atmospheric Chemistry Project
IGBP	International Geosphere-Biosphere Programme
IGOS	Integrated Global Observing Strategy
ILO	International Labour Organization
ITTO	International Tropical Timber Organization
IUCN	World Conservation Union
IUFRO	International Union of Forestry Research Organizations (OCHA)
JRC	Joint Research Centre
MCDA	Military, Civil Defence and Civil Protection Assets
MODIS	Moderate Resolution Imaging Spectroradiometer
NATO	North Atlantic Treaty Organization
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OFID	OPEC Fund for International Development
OPEC	Organization of the Petroleum Exporting Countries
PPEW	Platform for the Promotion of Early Warning

PPP	Public-Private Partnership
START	System for Analysis, Research and Training
STDM	Space Technology and Disaster Management Programme (UN-OOSA)
TCP	Technical Cooperation Programme (FAO)
TNC	The Nature Conservancy
UMD	University of Maryland
UNCCD	United Nations Convention to Combat Desertification
UNCED	United Nations Conference on Environment and Development
UNDRO	United Nations Disaster Relief Organization (founded 1971; since 1998 OCHA)
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UN-ISDR	United Nations International Strategy for Disaster Reduction
UNITAR	United Nations Institute for Training and Research
UN-OOSA	United Nations Office for Outer Space Affairs
UNOSAT	United Nations Operational Satellite Applications Programme of UNITAR (implemented in cooperation with the United Nations Office for Project Services)
UNU	United Nations University
USAID	United States Agency for International Development
USFS	United States Forest Service (United States Department of Agriculture)
UXO	Unexploded ordnance
WCDR	World Conference on Disaster Reduction
WFAG	Wildland Fire Advisory Group (UN-ISDR)
WHO	World Health Organization
WMO	World Meteorological Organization
WWF	World Wide Fund for Nature
WWRP	World Weather Research Programme

Executive summary

Vegetation fires have significant impacts on the global environment, economies and societies, and the role of natural and anthropogenic fire is an important factor in maintaining stability, biodiversity and the functioning of some ecosystems. In recognition of this, international consultations since the 1990s have recommended action related to: international collaboration, capacity-building and human resource development; review mechanisms to support cooperation in fire management at bilateral, regional and international levels; establishment of international agreements aimed at sharing resources, personnel and equipment; and examination of the components of such international agreements, including overall logistical, policy and operational considerations.

In 2003 the International Wildland Fire Summit recommended principles and procedures for international cooperation in fire management, while the Global Wildland Fire Network of the United Nations International Strategy for Disaster Reduction (UN-ISDR) and the UN-ISDR Wildland Fire Advisory Group undertook initiatives in international dialogue and cooperation. Following on these activities, the FAO Ministerial Meeting on Forests and the Seventeenth Session of the FAO Committee on Forestry (March 2005) called upon FAO – in collaboration with countries and other international partners including the UN-ISDR – to develop a strategy to enhance international cooperation on wildland fires that would advance knowledge, increase access to information and resources and explore new approaches to cooperation at all levels, and to formulate voluntary guidelines on the prevention and suppression of and recovery from forest fire.

In response, in 2006 FAO convened a technical core group of international fire specialists and then held an international expert consultation to consider drafts of the strategy and voluntary guidelines. The experts agreed upon a framework built upon four pillars: (i) principles and strategic actions, as detailed in the voluntary guidelines; (ii) an implementation partnership (to be established in 2007); (iii) a global assessment of fire management; and (iv) a review of international cooperation in fire management.

The present review of international cooperation, prepared by the Global Fire Monitoring Center, addresses:

- the principles and strategic actions as detailed in *Fire management: voluntary guidelines*;
- *Fire management: global assessment 2006*, developed from the 12 regional reports on forest fire management prepared within the framework of the Global Wildland Fire Network and UN-ISDR; and
- recommendations of international consortia and conferences and the fire science community.

These references highlight a lack of capacity in integrated fire management in many countries around the world – both in human and technical resources. Many of the identified gaps in fire management capability at local, subnational, national, regional and global levels can be addressed through international cooperation. Collectively agreed and developed standards, procedures and technologies, and their joint use, will facilitate implementation of the principles and strategic actions, economize action by sharing resources and provide ample opportunity to address fire management at interagency and intersectoral levels.

The priority themes for enhancing international cooperation in fire management are clustered into four broad areas: (i) development of international standards, methods and systems for fire early warning, monitoring, impact assessment and reporting; (ii) training and technology transfer, (iii) support to policy, legal, institutional and planning frameworks; and (iv) research. For each theme, the current contributions of international actors are briefly reviewed, and some future action is proposed related to the interests and activities of each.

Suggested time frames are based on a realistic assessment of priorities and the feasibility of implementation, considering the availability of funding and/or the time required for the development of systems and standards.

The review does not include all actors working at national or bilateral levels, and some actors working at multilateral or international levels may have been missed as well. Thus the review is considered an open document, which will be updated regularly as partners interested in contributing to international cooperation in fire management indicate their availability and potential contributions.

The availability of financing is essential to implementation of the strategic actions and of the coordinated action suggested in this review. In addition, active follow-up to the review – through FAO, the UN-ISDR Wildland Fire Advisory Group and members of the envisaged partnership for maintaining and implementing the principles and strategic actions – will be crucial to the success of coordinated and collective international action.

1.   Introduction

Over the past decade, many regions of the world have experienced a growing trend of excessive fire application in the forestry/agriculture interface, land-use systems and land-use change, and an increasing occurrence of extremely severe fires.[1] Some of the fire effects are transboundary, for example smoke and water pollution and their impacts on lives, human health and safety, livelihoods, material possessions, loss of biodiversity or site degradation at the 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. Observed and modelled consequences of regional climate change suggest an alteration of fire regimes, with consequences for ecosystem degradation and depletion of terrestrial carbon.

Although this trend is revealed by a wealth of scientific knowledge of the cultural, social, economic and environmental dimensions of fire in the Earth system, gaps in fire management capabilities from local to global levels are evident. The current situation and the expected trends are challenging the international community to address the problem collectively and collaboratively.

Vegetation fires have significant impacts on the global environment, economies and societies, and the role of natural and anthropogenic fire is an important factor in maintaining stability, biodiversity and the functioning of some ecosystems. In recognition of this, several international consultations in the 1990s – including the 2nd International Wildland Fire Conference in 1997 – recommended that a group and mechanisms be formally established under the auspices of the United Nations to facilitate international cooperation in addressing global fire needs.[2]

In 2001 a Working Group on Wildland Fire was established under the auspices of the Inter-Agency Task Force for Disaster Reduction of the United Nations International Strategy for Disaster Reduction (UN-ISDR). The working group provided an international platform and forum with the overall aim of bringing together technical members of the fire community and policy authorities at national to international levels to realize their common interests in fire management at a global scale. Among other activities, the working group initiated establishment of the UN-ISDR Global Wildland Fire Network (GWFN), under which the Regional Wildland Fire Networks would play a key role in developing international partnerships and cooperation in fire management.

FAO hosted expert consultations on forest fire policies in 1998 and on fire management, together with the International Tropical Timber Organization (ITTO), in 2001. These consultations considered actions in international collaboration, capacity-building and human resource development; review of mechanisms in support of cooperation in forest fire management at bilateral, regional and international levels; establishment of international agreements on the sharing of resources, personnel and equipment; and examination of

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[1] International English terminology uses the following definitions for fires occurring in vegetation: 'wildland fire' – any fire occurring on wildland regardless of ignition sources, damages or benefits; **'wildland'** – in fire management terminology, this general term includes all burnable vegetation resources; 'wildfire' – any unplanned and uncontrolled wildland fire that, regardless of ignition source, may require suppression response or other action according to agency policy. Due to the lack of adequate terminology in most other languages, the general term 'fire' is used in this report. However, names or designations of organizations, systems or publications using the term 'wildland fire' are respected.

[2] www.fire.uni-freiburg.de/summit-2003/Wildlandfire-97%20Outputs.pdf.

components of such international agreements, including overall logistical, policy and operational considerations.[3]

In 2003 the International Wildland Fire Summit recommended principles and procedures for international cooperation in fire management. The summit further recommended international dialogue through the Regional Wildland Fire Networks organized under GWFN and coordinated by the UN-ISDR Wildland Fire Advisory Group (WFAG).[4] In May 2004, FAO, the Global Fire Monitoring Center (GFMC), Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD) and UN-ISDR drafted the *Framework for the development of an international wildland fire accord*.[5]

Regional consultations in 2004 recommended the development of informal partnerships, joint projects and formal agreements between governmental and non-governmental institutions. These were essential to enabling nations to develop sustainable fire management capabilities. In 2004 FAO and WFAG/GWFN proposed the development of an international wildland fire accord to the FAO Ministerial Meeting on Forests and the Seventeenth Session of the FAO Committee on Forestry in March 2005 (COFO 2005). Both the Ministerial Meeting and COFO 2005 called upon FAO, in collaboration with countries and other international partners, including UN-ISDR, to (i) develop a strategy to enhance international cooperation on wildland fires that would advance knowledge, increase access to information and resources and explore new approaches to cooperation at all levels; and (ii) formulate voluntary guidelines on the prevention and suppression of and recovery from forest fire.[6]

In response, FAO convened a technical core group of international fire specialists in March 2006 and held an international expert consultation in Madrid in May of that year to consider drafts of the strategy and voluntary guidelines. The experts agreed upon the framework outlined in Figure 1.

FIGURE 1
Components of the strategy to enhance international cooperation in fire management

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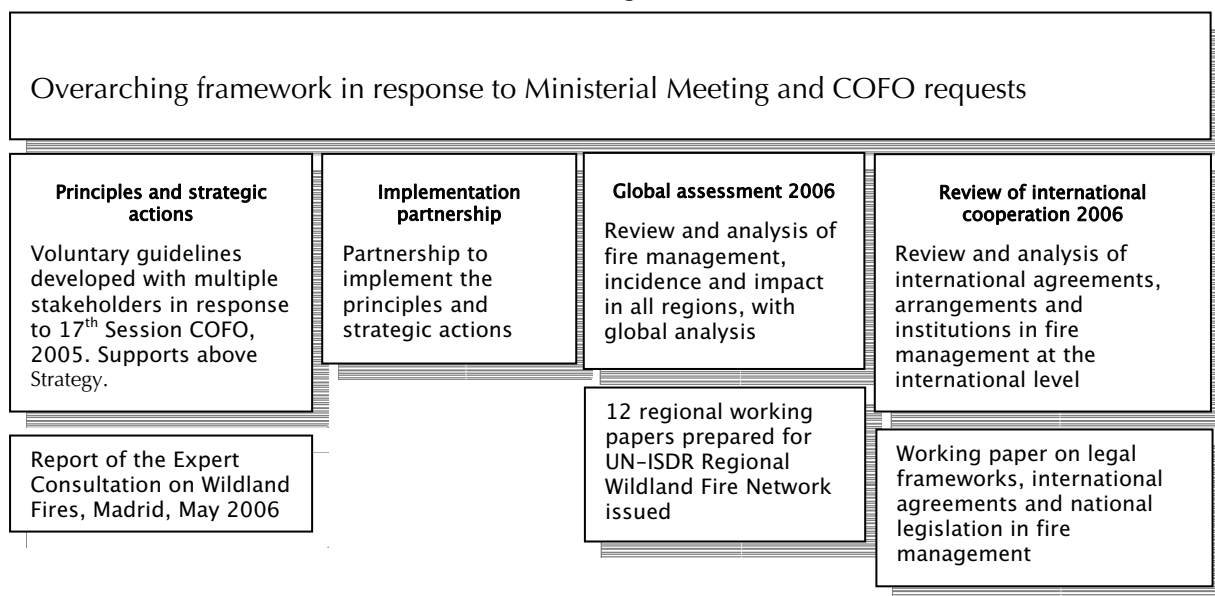
[3] www.fire.uni-freiburg.de/iffn/org/fao/fao_4.htm and follow-up report www.fire.uni-freiburg.de/emergency/FAO-ITTO-Follow-Up.PDF.

[4] www.fire.uni-freiburg.de/summit-2003/introduction.htm.

[5] www.fire.uni-freiburg.de/GlobalNetworks/Global-Wildland-Fire-Framework-12-April-2005.pdf.

[6] Documents of the FAO Ministerial Meeting and the 17th Session of COFO are available at www.fao.org/forestry/site/26480/en and www.fao.org/forestry/site/2960/en/.

The resulting strategy was built upon those four pillars:

- principles and strategic actions, as detailed in the voluntary guidelines;
- implementation partnership (to be established in 2007);
- global assessment of fire management;
- review of international cooperation in fire management

Fire management: review of international cooperation is a preliminary survey of current international actors, roles and objectives. Moreover, it sketches the potential synergies to be found through a more coordinated approach to future international cooperation in fire management. The review outlines priority activities, methodologies, tools and standards that must be addressed in order to enhance international cooperation in fire management.

The agencies or institutions listed have previously been involved in fire projects and programmes. However, only a few priority action items included in the review have matured into concrete project proposals or actions. Follow up to this review – through international partnerships, including the WFAG, for maintaining and implementing the voluntary guidelines for fire management – will be crucial to the success of coordinated and collective international action.

2. Identification of priority themes for cooperative action in fire management

The priorities for action are based on the outcomes of a range of international consultations, notably:

- *Fire management: voluntary guidelines. Principles and strategic actions*;
- findings of *Fire management: global assessment 2006*, developed from 12 regional working papers on forest fire management prepared within the framework of the GWFN and the UN-ISDR; and
- recommendations by international consortia and conferences and the fire science community.

These references highlight a lack of capacity in integrated fire management in many countries around the world – both in human and technical resources.

Table 1 summarizes the principles from *Fire management: voluntary guidelines* and outlines the priority actions for international cooperation. The priority themes relate to fire management from local, subnational, national and regional levels.

TABLE 1
Priority principles with derived implications for action

Voluntary guidelines: principles – relevant at all levels	Implications for international cooperation – priorities for action
Principle 1: Appropriate use and management of fire will promote sustainable livelihoods; and Principle 3: Traditional uses of fire on the lands of indigenous peoples and traditional rural communities should remain as a practice for those communities and be adapted to the current environment.	Promotion of and capacity-building in the use of traditional and advanced methods of prescribed burning for sustainable silviculture, agriculture and flora and fauna management, including fuel management and restoration of fire regimes
Principle 2: Human health and security will be improved by minimizing the adverse effects of fire.	Promotion of and capacity-building in firefighter and public safety; development and/or use of early warning systems by and for communities to reduce the health and security impacts of fires; conduction of community-based fire risk minimization activities during all stages of fire management activity (pre-fire, during fire events and post-fire)
Principle 4: Destructive impacts of unplanned fires on livelihoods, property and resources should be minimized, if not totally prevented.	Promotion of and capacity-building in minimizing risk through fire knowledge, training, participatory planning and preparation, and appropriate suppression systems
Principle 5: An effective and efficient fire management programme requires a balance between the benefits society receives from the use of fire and the costs, damages or undesirable impacts caused by unwanted fire.	Development of methodologies and standards to assess (a) benefits, costs, and economic outputs from the use of fire for resource management and the public good; (b) fire damages, including effects to non-economic or non-commodity values; and (c) benefits of mitigation of unwanted effects or damages to lands and resources. Development and use of early warning systems to provide seasonal severity predictions and inform citizens of mitigation measures and assist in the assessment of fire risk
Principle 6: Interactions of climate change with vegetation cover and fire regimes should be understood and appropriately considered in the planning and implementation of fire use.	Promotion of and capacity-building in integrated approaches to strategic fire management planning that include interactions between climate change and fire regimes, particularly the preparation of long-term fire management plans, land-use plans, silvicultural planning and management plans of protected areas that take into account: attributes of climate change, i.e. increasing occurrence and impacts of climate extremes (droughts, hurricanes, floods) on potential behaviour and severity of fire, fuel dynamics

	and shifting of vegetation zones; use of hazardous fuels for energy production,with the dual goal of reducing wildfire hazard and consumption of fossil fuels; and maximization of the storage of carbon in ecosystems – especially in restoration of degraded ecosystems – without increasing wildfire risk
Principle 7: Fire should be managed in an environmentally responsible manner to ensure properly functioning and sustainable ecosystems into the future.	Knowledge transfer and capacity-building in fire ecology and derived fire management practices, post-fire rehabilitation and management of invasive species
Principle 8: All fire management activities should be based on a legal framework and supported by clear policy and procedures.	Promotion of and capacity-building in enacting legislation and regulation at appropriate jurisdictional levels, e.g. to achieve goals ranging from those set by local communities to internationally agreed principles such as the Millennium Development Goals, notably those of eradication of extreme poverty and hunger, ensuring environmental sustainability and development of a global partnership for development
Principle 9: Successful fire management requires participatory approaches to leadership and management that are appropriately shared by public and private landholders, the fire services and communities of interest.	Promotion of and capacity-building in integrated planning approaches aiming at minimizing land tenure and boundary issues and involving community members at local, regional, state, national and international levels,by ensuring that processes are open and accessible to people of different backgrounds and cultures (especially indigenous communities)
Principle 10: Few nations and no single agencies or communities have the ability to manage every situation. As fires routinely affect multiple jurisdictions, agencies should develop cooperative arrangements to mitigate transboundary impacts.	Development and promotion of the use of common terminology, systems and standards to enhance international cooperation; promotion of exchange of knowledge, technology and resources to facilitate rapid international response to fires; participation in international organizations, networks, fora and activities to increase domestic agencies' capacities to manage fire; and use of available guidelines and examples of successfully implemented agreements as a framework to facilitate the development of binding and non-binding international instruments
Principle 11: Access to and appropriate transfer of knowledge are essential in all fire management activities.	Promotion of and capacity-building in high-quality scientific research and confirmation of the utility of practical knowledge in the creation of policies, regulations, guidelines and practices; use of science and technology transfer in local fire activities, including community-based approaches

Table 2 summarizes priorities for internationally coordinated action as recommended in *Fire management: global assessment 2006* and by international conferences and organizations.

TABLE 2
Priorities for action[a]

International priorities	Implications for action
Harmonization of terminology and definitions for better understanding	Development of a multilingual fire management terminology
Global fire monitoring, assessment and reporting standards, procedures for data collection and fire database management to provide a full picture of the occurrence and impacts of vegetation fires, including changes of fire regimes as a consequence of global change	Development of internationally agreed standards for fire monitoring, assessment and reporting of vegetation fires
Operational global fire early warning, detection and surveillance systems	Development of operational early warning and risk assessment systems (local to global) for decision support in fire management; development of a coordinated satellite-based system for operational detection and monitoring (surveillance) of fires
International fire disaster assistance	Enhancement and improvement of existing mechanisms of fire disaster support at the international level under an internationally agreed jurisdictional/legal framework; provision of appropriate funding and human and technical resources

Bilateral, multilateral and international cooperation: networking and agreements	Development (where not yet in place) of agreements to enhance international cooperation in fire management (capacity-building, sharing of fire management resources, development and joint implementation of policies addressing transnational issues in fire management
International cooperation in fire research	Development/enhancement of cooperative research projects and programmes, with a focus on the human and environmental implications of global change and changing fire regimes
International donor support	Creation of mechanisms for funding, e.g. an international partnership or a fire management programme facility, which would correspond to the National Forest Programme Facility[b]
Technical support to fire management	Regular evaluation of in-country capabilities in fire management in order to define stop-gap measures to improve political, policy and public awareness building, and to develop: • community-based fire management • fire management planning, institutional jurisdictions in integrated approaches in the rural-urban and forestry-agriculture interfaces • strengthening knowledge creation and sharing • greater commitments to education and training at local, subnational, national and regional levels, and international fora, seminars, conferences, workshops, study tours to share knowledge • strengthening UN-ISDR Regional Wildland Fire Networks

[a] Background documents on international cooperation in wildland fire management are available at www.fire.uni-freiburg.de/summit-2003/introduction.htm.

[b] The National Forest Programme 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, Finland, France, the Netherlands, Norway and Sweden, and hosted by FAO.

3. Goals of international cooperation in fire management

The goals of enhancing international cooperation in fire management are to:

- adopt a common language and common principles in fire management as a basis for international, intercultural and multilingual cooperation;
- better understand the issues related to fires, their underlying causes and environmental and human impacts;
- create synergies by increasing collaboration among actors and coordinating individual actions;
- achieve greater integration of policies, plans, management and monitoring among sectors;
- develop global and international policy and fire management support systems;
- implement relevant international agreements, conventions, declarations, processes and voluntary agreements in regional, national and local policies and actions; and
- create a framework and mechanisms for international donor support to fire management stakeholders in need.

Enhanced international cooperation can assist international, regional, national and local communities in:

- improving and making available knowledge, information and data on the extent and impacts of fire on a range of forest and non-forest ecosystems as a basis for decision-making;
- increasing the efficiency of fire management (land use and fire use, prediction, prevention, preparedness, rapid response to and control of fires and mitigation and restoration/rehabilitation following them);
- ensuring capacity-building in fire management;
- developing cross-sectoral policies, particularly with the land-use domain (agriculture, pastoralism), nature conservation, environmental management, climate change mitigation, etc.

4. Priority themes for international cooperation in fire management, contribution of current actors and future potential

The priority themes for enhancing international cooperation in fire management are clustered in four broad areas, covered in the subsections that follow. For each theme, the current contributions of international actors are briefly reviewed. Suggested time frames are based on a realistic assessment of priorities and the feasibility of implementation, considering the availability of funding and/or time required for the development of systems and standards.

The time frames attached to the proposed activities are categorized as short, medium and long term. They do not set thematic priorities, but rather reflect the time required for financing and developing projects and programmes:

- time frame 1: 2007–2008 (two years);
- time frame 2: 2007–2010 (four years);
- time frame 3: 2007–2012 (six years).

4.1 Development of international standards, methods and systems for early warning, monitoring, impact assessment and reporting

4.1.1 Terminology

A clearly defined and agreed fire management terminology is not available in many languages. Multilingual fire terminology is a prerequisite for enhancing bilateral and international dialogue and cooperation in fire management (Table 3).

The *FAO wildland fire management terminology* (first published in 1986 and updated jointly with GFMC in 2003) is available online. However, it currently includes only the English base definitions, a complete German counterpart terminology and outdated, incomplete French and Spanish terminology. In the updated version, very specific local terms were reduced to a minimum to favour its global use and acceptance. This terminology should serve as a starting point for translation to other languages.

TABLE 3
Fire terminology

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Development of a multilingual fire terminology, based on the updated *FAO wildland fire terminology*, in all languages spoken in countries with major fire problems	Online *FAO wildland fire terminology* (updated jointly with GFMC in 2000) Russian version in preparation	Experienced research institutes and individual scientists of the UN–ISDR Regional Wildland Fire Networks to be involved in adding languages to the terminology. Existing regional initiatives to be taken into account	**Time frame**: 1 **Finances:** FAO as initiator of the original and updated terminologies to support regional networks
Information sources/portals:	International fire glossaries portals: www.fao.org/forestry/site/13530/en www.fire.uni–freiburg.de/literature/glossary.htm		

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4.1.2 Fire statistics: development of a coherent global database

Internationally agreed methodologies and procedures for the establishment of fire databases and formats for national fire reporting are not in place. Both databases and national fire assessments are important in decision support at national, regional and global levels, as well as in assessment of needs and impacts.

FAO's *Global forest fire assessment 1990–2000* – an element of the *Global forest resources assessment 2000* (FRA 2000) and the reports from the 12 UN-ISDR Regional Wildland Fire Networks, summarized and evaluated in *Fire management: global assessment 2006*, revealed the lack of current and consistent statistical data sets. The concept of the detailed *Global wildland fire assessment 2004*, initiated by GFMC, was used for a number of national reports submitted to the Regional Wildland Fire Networks. However, the assessment covered only a fraction of countries.

Information flow must be ensured from national and regional levels to a global clearing house for receiving, processing and disseminating fire data, as well as the flow of other fire information back to countries and other users, connected with a network of national fire management agencies.

A task force should be established to produce a proposal for a harmonized and coordinated data-collection and reporting system that will meet the demands of various user communities – as recommended by FAO, the International Labour Organization (ILO) and the United Nations Economic Commission for Europe (UNECE) in 1996 (Annex IV) – and build on the concept of the *Global wildland fire assessment 2004* (Table 4).

4.1.3 Fire monitoring

Currently available space-borne systems for the detection and monitoring of vegetation fires and fire impacts are not yet fully used by all countries. Satellite-derived information generated by institutions with satellite data receiving and processing capabilities must be systematically disseminated and used by all countries. Political and financial support must be increased for the further development of dedicated satellite instruments and information systems designed to support fire management.

TABLE 4
Global fire database

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Revision of existing national data–collection mechanisms and terminology	Initial concepts developed by the UNECE/FAO seminar on Forest, Fire, and Global Change (1996) (Annex IV)	Creation of a task force under the joint auspices of GFMC, FAO and GOFC–GOLD to develop standard methodology	**Time frame**: 2 **Finances:**
Revision of the applicability/feasibility of the *Global wildland fire assessment 2004* format	Concept of the *Global wildland fire assessment 2004*	Gathering and processing of information through the Regional Wildland Fire Networks by the network focal points and/or by FRA focal points	
Agreement on a common international format to be harmonized with FRA 2010		Harmonization of regional databases (e.g. European Union, UNECE) and major national data–collection systems (e.g. Australia, Canada, USA)	
Development of mechanisms of exchange of information on this data		GOFC–GOLD to support assessment by remote sensing (see Subsection 4.1.3) National governments to provide	

		access to national data and agreement upon and adoption of data–collection methodology	
Information sources/portals:	Initial proposal for global fire datasets by UNECE/FAO seminar on Forest, Fire, and Global Change: www.fire.uni–freiburg.de/iffn/org/ecefao/ece_3.htm#Appendix%20I		
	FAO Global forest resources assessment 2005 (FRA 2005): www.fao.org/forestry/site/fra2005/en		
	Global wildland fire assessment 2004: www.fao.org/docrep/006/ad653e/ad653e00.htm		
	12 working papers reporting on fires by the UN–ISDR Regional Wildland Fire Networks: www.fao.org/forestry/site/35853/en		

The GOFC-GOLD project is an element of the Global Terrestrial Observing System (GTOS) programme, sponsored by the Integrated Global Observing Strategy (IGOS). The project provides a forum for international information exchange, observation and data coordination, including calibration and validation of sensors and algorithms, and a framework for establishing the necessary long-term monitoring systems. The GOFC-GOLD Fire Mapping and Monitoring Theme is aimed at refining and articulating the international observation requirements and making the best possible use of fire products from existing and future satellite observing systems, for fire management, policy decision-making and global change research. In particular, GOFC-GOLD is functioning in:

- specifying requirements for products;
- assessing algorithms and data assimilation procedures;
- ensuring the availability of observations;
- harmonizing and developing protocols and standards;
- ensuring that operational products meet accuracy requirements;
- capacity-building and the role of regional networks;
- creating GOFC-GOLD products and services;
- providing information to support international assessments;
- advocating, especially in relation to the continuity of observations and validation.

The GOFC-GOLD fire goals are to:

- increase user awareness and data use;
- establish a geostationary global fire network;
- secure *operational* polar orbiters with adequate fire monitoring capability;
- determine product accuracies;
- develop fire emissions product suites;
- develop long-term fire data records;
- establish enhanced user products and improved data access;
- promote experimental fire observation systems and related research.

GOFC-GOLD and GFMC are interacting closely with the United Nations Office for Outer Space Affairs (UN-OOSA), the United Nations Operational Satellite Applications Programme (UNOSAT) of the United Nations Institute for Training and Research (UNITAR), the International Charter "Space and Major Disasters", and the Group on Earth Observations (GEO), with its Global Earth Observing System of Systems (GEOSS).

The involvement of the fire community in the implementation of GEO tasks offers an opportunity to shape Tasks DI-06-13 (initiation of a globally coordinated warning system for fire and monitoring for forest conversion), DI-06-09 (expansion of the use of meteorological geostationary satellites for the management of non-weather-related hazards) and DI-06-12 (initiation of knowledge-transfer programmes to developing countries in order to ensure a basic capacity to use Earth observations for disaster management).

A coordinated research and development programme will require close cooperation between a number of international environmental research programmes (Table 5). Such cooperation will include the development of capabilities of global real-time to near-real-time detection and monitoring of active wildfires and land-use fires based on polar-orbiting and geostationary satellite assets, and integration of these observations into a coordinated global observing network to be used for both operational and research purposes.

In this context, the efforts to develop a public/private partnership approach to the installation of a new generation of small satellites for operational fire detection and monitoring should be supported, such as the proposed follow-up to the Moderate Resolution Imaging Spectroradiometer (MODIS) mission and the Bi-spectral Infrared Detection (BIRD) satellite mission (led by the German Aerospace Center – DLR).

4.1.4 Early warning

Methods and dissemination of information on early warning of fire risk and fire danger have been developed in some countries and could be applied in others lacking such systems. Priority must be given to the end-users of early warning information – particularly local communities (i.e. people-centred early warning systems).

TABLE 5
Fire monitoring

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Development and strengthening of capabilities for use of existing satellite systems	GOFC–GOLD Fire Implementation Team: development of standards UN–OOSA and UNOSAT (UNITAR): UN support to countries in need International Charter "Space and Major Disasters": provision of remote–sensing data for disaster response operations GEOSS: long–term framework for coordinated efforts of countries contributing to Earth Observation	GOFC–GOLD to develop a START–funded global vegetation fire inventory in cooperation with the UN–ISDR Global Wildland Fire Network Systematic cooperation and information flow between UN–OOSA, UNOSAT and the International Charter to be enhanced Implementation of GEO Tasks DI–06–13, DI–06–09 and DI–06–12 Joint Research Centre and DLR to expand regional Europe/North Africa coverage	**Time frame**: 2 **Finances:** Global Change System for Analysis, Research and Training (START) GEO Secretariat support: see Subsection 4.1.4
Capacity–building at national/local levels for the user community Development of new space technologies and platforms for operational purposes	GOFC–GOLD regional outreach workshops Design and concept for a BIRD successor satellite mission	GOFC–GOLD regional outreach workshops with/through United Nations University (UNU) DLR Public–Private Partnership (PPP) project to develop BIRD successor mission	DLR/PPP to continue seeking partners and finances
Information sources/portals:	GOFC–GOLD Fire Implementation Team: http://gofc-fire.umd.edu/ UN–OOSA: www.oosa.unvienna.org/ UNOSAT: http://unosat.web.cern.ch/unosat/ International Charter "Space and Major Disasters": www.disasterscharter.org/		

	Global Earth Observation System of Systems: www.earthobservations.org/index.html
	Global Fire Monitoring Center (GFMC): www.fire.uni–freiburg.de/ www.fire.uni–freiburg.de/current/globalfire.htm
	European Forest Fire Information System (EFFIS) http://effis.jrc.it/Home/
	Moderate Resolution Imaging Spectroradiometer (MODIS) http://modis.gsfc.nasa.gov/
	Bi–spectral Infrared Detection (BIRD) satellite mission www.eid.dlr.de/os/forschung/projekte/bird/

A Global Multi-Hazard Early Warning System has been proposed in the Hyogo Framework for Action – an outcome of the World Conference on Disaster Reduction (WCDR), Kobe, Japan, January 2005, and was explicitly requested by the United Nations Secretary General in 2005. A global survey of existing capabilities, gaps and needs for further development has been conducted by the UN-ISDR Early Warning Programme and supported by GFMC and WFAG. A project proposal for the development of a Global Wildland Fire Early Warning System, submitted by an international consortium, was endorsed by the United Nations and presented at the Third International Conference on Early Warning (EWC-III) in March 2006 (Table 6).

Objectives of the Global Wildland Fire Early Warning System:

- develop a global early warning system for fire, based on existing and demonstrated science and technologies;
- develop an information network to quickly disseminate early warning that reaches from global to local communities;
- develop a historical record of global fire danger information for early warning product enhancement, validation and strategic planning purposes;
- design and implement a technology transfer programme to provide the following training for global, regional, national, and local community applications:
  - early warning system operation;
  - methods for local to global calibration of the system;
  - using the system for prevention, preparedness, detection and, where appropriate, fire response decision-making.

Expected impacts:

- Early warning of fire danger, on a global basis, will provide international agencies, governments and local communities with an opportunity to mitigate fire damage by assessing threat likelihood and the possibility of extreme behaviour, enabling implementation of appropriate fire prevention, detection, preparedness and fire response plans before wildfire problems begin.
- A globally robust operational early warning framework with an applied system will provide the foundation on which to build resource-sharing agreements among nations during times of extreme fire danger.
- Development of local expertise and capacity-building in fire management to achieve system sustainability through technology transfer and training.

The initiative will be supported by the GEO secretariat and will cooperate closely with the UN-ISDR Platform for the Promotion of Early Warning (PPEW) and the World Meteorological Organization (WMO) (see Subsection 4.3.2).

TABLE 6
Fire early warning

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Development/strengthening of wildfire early warning/fire danger forecasting capabilities at the global level with national/local application	International consortium facilitated by GFMC has submitted a proposal and is seeking financial support (2006–2007).[a] UN–ISDR International Early Warning Programme (IEWP)/PPEW	Consortium to be supported by UN–ISDR IEWP/PPEW, GEO secretariat in conjunction with WMO Commission for Agricultural Meteorology (CAgM)	**Time frame**: 2 **Finances:** GEO Secretariat Consortium
Information sources/portals:	Global Wildland Fire Early Warning Portal: www.fire.uni-freiburg.de/fwf/fwf.htm UN–ISDR IEWP/PPEW: www.unisdr.org/ppew/ Group on Earth Observations (GEO): www.earthobservations.org/index.html WMO Commission for Agricultural Meteorology www.wmo.ch/web/wcp/agm/CAgM/CAgMmenu.htm		

[a] Members of the consortium: GFMC, on behalf of WFAG/GWFN and UNU; Canadian Forest Service (CFS), Edmonton, Canada; WMO; World Weather Research Programme (WWRP); Bureau of Meteorology Research Centre, Melbourne, Australia; GOFC–GOLD secretariat, Edmonton, Canada; University of Maryland (UMD), College Park, MD, United States; Bushfire Cooperative Research Centre (CRC), Melbourne, Australia; European Centre for Medium–Range Weather Forecasts.

4.1.5 International sharing of data and information

Collection, processing and evaluation of global fire data and related information (see Subsection 4.2.1) are prerequisites for the development of informed international policies. The flow of data and information from national and regional levels to an international monitoring centre/clearing house is essential for global analysis (Figure 2), as was mentioned in Subsection 4.1.2.

Vice versa, countries and regions are dependent on receiving data and information generated or processed by international application centres, for example for fire management (space-borne fire monitoring, early warning) or in support of the development of national policies.

In some countries, national fire information systems are operational. Coordinators of Regional Wildland Fire Networks are already cooperating with national focal points, agencies and academic institutions, and GFMC is functioning as a global information clearing house.

However, the flow of data and information from some countries and regions is limited. There is also a lack of adequate funding for the comprehensive collection and processing of global fire data and information. This gap could be closed by the establishment of regional wildland fire monitoring/information centres (Table 7). GFMC is offering suitable structures for the development of such regional clearing-house centres/information portals, while support to improve the functions of a global information clearing house and fire information portal is required.

FIGURE 2
International sharing of fire data and information
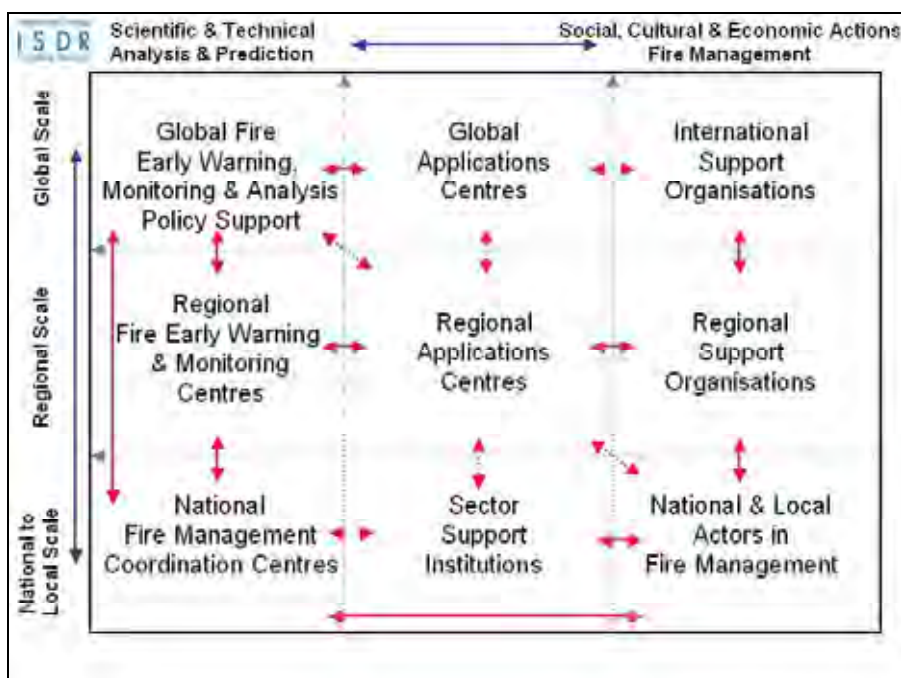
TABLE 7
International sharing of data and information

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
General and current country information made available	Cooperation initiated between focal points of the UN–ISDR Regional Wildland Fire Networks and national agencies and academic institutions for collection of data	Establishment of regional wildland fire monitoring/information centres; creation of internet–based national and regional fire information systems Establishment of regional wildland fire advisory boards: see Subsection 4.3.3 Establishment of a coordinated global observing network to be used for both operational and research purposes (through an international fire observation data centre)	**Time frame**: 1 **Finances:**
Information sources/portals:	Global Fire Monitoring Center Web portal: www.fire.uni–freiburg.de/ UN–ISDR Global Wildland Fire Network: www.fire.uni–freiburg.de/GlobalNetworks/globalNet.html GOFC–GOLD Fire Implementation Team: http://gofc–fire.umd.edu/		

4.2   Training and technology transfer

4.2.1 Training of fire management personnel

Capacity-building of human resources is a key prerequisite for efficient planning and implementation of sustainable fire management.

Many countries in need of developing or reviewing fire policies or upgrading existing fire management methods and/or technologies do not have their own resources or expertise in capacity-building. International cooperation in fire management is critical to support these countries (see Section 4.3).

Priorities for international cooperation should include advanced capacity-building of those target groups influential in or responsible for developing fire policies, fire management planning and implementation. Multistakeholder, intersectoral and interagency approaches will be key considerations. Non-governmental organizations and the private sector are important target groups. Capacity-building of instructors (training for trainers) will be a key prerequisite for success in building capacities at local to national levels.

Advanced international training courses for fire management specialists working at high-level positions in their home countries and in the private sector will support the development of a culture of transnational cooperation. Experience has been gained by United Nations interagency training courses conducted by UNU and GFMC in Africa.

Training courses dedicated to advanced-information and remote-sensing technologies or fire early warning should preferably be conducted at regional and international levels. The outreach work of the GOFC-GOLD Fire Implementation Team, in collaboration with the partners mentioned in section 4.1.3 or FAO's e-learning network Proyecto FODEPAL[7] in Latin America and the Caribbean, is offering suitable expertise.

In 2005 UNU and GFMC, in partnership with the UNU Institute for Environment and Human Security (EHS) and GWFN, undertook an initiative to provide advanced fire management training involving United Nations interagency contributions. Its vision is to work through a decentralized worldwide network of training institutions in which donor organizations would collaborate. The development of international training materials is needed – by a range of organizations and for a range of actors and purposes.

Capacity-building programmes will take advantage of numerous bilateral and multilateral assistance projects and programmes. Thus the list of current actors is not at all exhaustive, and institutions interested in advertising their courses, projects and programmes *are encouraged to submit information to GMFC.*[8]

Suggested contributions of international institutions or consortia are derived from previous institutional involvements and/or mandates (Table 8).

TABLE 8
Fire management training

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
National and regional advanced fire management training courses	UNU through GFMC and EHS, in cooperation with FAO, United Nations Environment Programme (UNEP), United Nations Office for the Coordination of Humanitarian Affairs (OCHA), The Nature	UNU: advanced fire management courses (interdisciplinary, intersectoral target group)	**Time frame**: 1 **Finances:** UNU: limited annual funding through GFMC UNEP/OCHA: limited

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[7] Proyecto Regional de Cooperación Técnica para la Formación en Economía y Políticas Agrarias y de Desarrollo Rural en América Latina.

[8] As indicated in the Foreword, this document will be updated in accordance with new developments. The author of the report, GFMC, will collect suggestions for additions or changes and update the paper regularly for publication by FAO.

	Conservancy (TNC) UN–OOSA FAO (notably FAO's e–learning programme) TNC Comité Technique International du Feu (CTIF) and GFMC: development of training materials for the European Fire Services (EURO–FIRE) *Wildland fire management handbook for trainers* (2nd edn.), Ministry of Foreign Affairs, Finland European Union's Fire Paradox project: extension programme to partner countries outside the EU (Africa, Central Asia, South America) Bilateral programmes, e.g.: GTZ USAID/U.S. Forest Service (USFS) CFS European Union (….)	UNEP/OCHA: emergency/disaster assessment methodologies and harmonization FAO, TNC: community–based fire management (see Subsection 4.2.2) UNITAR/UNOSAT/UN–OOSA with GOFC–GOLD Regional Fire Network: to join efforts in capacity–building of use of space–borne remote sensing of fires and fire effects UNU with partners (CFS, World Weather Research Programme): outreach workshops in fire early warning systems Development of training materials for international use.	funding FAO, TNC: use of trust funds (FAO) and combination with TNC Latin American and Caribbean Fire Learning Network and GFMC/UNU outreach projects GTZ (currently being negotiated) European Union through 6th Framework Programme (Fire Paradox, in progress until 2010) and Leonardo Da Vinci (CTIF with GFMC, in progress until 2008).
Information sources/portals:	EHS/GFMC website: www.fire.uni–freiburg.de/programmes/un/unu/unu.htm TNC Latin American and Caribbean Fire Learning Network: www.tncfire.org/training_LACfln.htm	

4.2.2 Public/community involvement in fire management

Valuable experiences and methods in the prevention of wildfires and application of fire in land-use systems have been developed in several regions of the world and could be applied elsewhere. Community involvement (integrated fire management, joint fire management, community-based fire management – CBFiM) is essential for success in fire prevention and fire management at the local level.

Countries and Regional Wildland Fire Networks should seek support for conducting training where needed and implementing CBFiM as part of national fire management policies. Special emphasis should be given to capacity-building in the use of prescribed fire in land-use and resource management.

Additional options include CBFiM approaches that consider mitigation of the impacts of climate change by improving management of terrestrial carbon resources and contributing to the maintenance or enhancement of ecosystem integrity and functioning. This would also contribute to reducing the vulnerability of affected communities to climate-change-induced fires and land degradation.

The prevention and combating of fires along national borders must be addressed cooperatively. Local authorities and communities should work together in the border regions where fires and fire-generated smoke cross national borders, and where cooperation and mutual support are required in order to work together directly and efficiently.

Based on the experience of the first international CBFiM training courses, with United Nations interagency involvement, donor organizations should consider offering opportunities to promote capacity-building in participatory fire management and public involvement in fire management (Table 9). The development of training and demonstration materials for joint international use would be beneficial to the economizing of resources.

TABLE 9
Public/community Involvement

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Promotion of principles and application of community–based fire management (CBFiM)	FAO outreach work UN–ISDR outreach work	Outreach work in CBFiM: FAO, UN–ISDR Expand learning networks from national/regional to global, e.g. TNC, Bushfire CRC (Australia)	**Time frame**: 2 **Finances:** FAO, TNC: use of trust funds (FAO) and combination with TNC Latin American and Caribbean Fire Learning Network and GFMC/UNU outreach projects
Promotion of public involvement in prevention activities (educational, informational)	United Nations Educational, Scientific and Cultural Organization (UNESCO): 2006–2008 World Disaster Reduction Campaign – Disaster Risk Reduction Begins at School	UNESCO: disaster reduction programmes for schools	
Establishment of border–crossing agreements operational at the local level	GTZ tri–national project TRIFINIO: CBFiM along the borders of El Salvador, Guatemala and Honduras CBFiM as an element of the GTZ–UNEP/Global Environment Facility (GEF) project Integrating Vulnerability and Adaptation to Climate Change into Sustainable Development Policy Planning and Implementation in Southern and Eastern Africa	Bilateral technical development programmes in CBFiM and climate mitigation/adaptation projects	
Information sources/portals:	International CBFiM portal: www.fire.uni–freiburg.de/Manag/CBFiM.htm UNESCO Earth Science – Disaster Reduction: www.unesco.org/science/disaster/index_disaster.shtml UN–ISDR Public Relations Campaign on Wildland Fire: www.unisdr.org/eng/public_aware/world_camp/2000/pa–camp00–kit–eng.htm Bushfire CRC Fire Knowledge Network: www.bushfirecrc.com/fkn/		

4.2.3 Fire management guidelines

Guidelines are needed for the various user levels, ranging from practical guidelines for local fire managers to guidelines for land-use planning and policy development (Table 10). They must consider the specific natural (ecological) conditions of vegetation fire, as well as the social, cultural, economic and political environment. Valuable guidelines exist for local to global use. In many countries, however, these guidelines are not known or not applied, or they need to be adapted for specific conditions or translated.

Examples of international guidelines include the *ITTO guidelines on fire management in tropical forests*, the FAO *Guidelines on fire management in temperate and boreal forests*, the World Health Organization (WHO)/WMO/UNEP *Health guidelines for vegetation fire events*, or specific handbooks such as the GFMC *Wildland fire management handbook for sub-Sahara Africa* or the *Manual Centroamericano de prevención de incendios forestales* of the Central American Fire Management Group. Some of these guidelines require updating or review, while in some regions or countries, guidelines are lacking and must be developed.

In addition, other, specific guidelines are needed, e.g. on integrated fire management of tropical and boreal peatlands, or on vegetated terrain contaminated by radioactivity, landmines or unexploded ordnance (UXO) (see Subsection 4.3.3).

TABLE 10
Fire management guidelines

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Develop, update and translate existing guidelines	*ITTO Guidelines on fire management in tropical forests* FAO Guidelines on fire management in temperate and boreal forests WHO/WMO/UNEP Health guidelines for vegetation fire events (see Subsection 4.3.2) GFMC Wildland fire management handbook for sub–Sahara Africa Wildland fire management handbook for trainers (2nd edn.) (Ministry of Foreign Affairs, Finland) Manual centroamericano de prevención de incendios forestales (Central American Fire Management Group)	Update/revision of ITTO and WHO/WMO/UNEP guidelines Translation of guidelines into key languages Support to countries for development of national fire management guidelines (in conjunction with definition of fire management policies and strategies; see Subsection 4.3.1) Development of specific guidelines (e.g. for peatland fire management, fire management on terrain contaminated by radioactivity, landmines and UXO)	**Time frame**: 1 **Finances**:
Information sources/portals:	Portal for international fire management guidelines: www.fire.uni–freiburg.de/literature/Fire–Management.htm FAO *Guidelines on fire management in temperate and boreal forests*: www.fao.org/forestry/site/28168/en *ITTO guidelines on fire management in the tropical forests*: www.itto.or.jp/live/Live_Server/150/ps06e.doc WHO/WMO/UNEP *Health guidelines for vegetation fire events*: www.who.int/docstore/peh/Vegetation_fires/vegetation_fires.htm Namibia: example for development of national guidelines: www.fire.uni–freiburg.de/iffn/country/na/na_8.htm		

4.3   Support to policy, legal, institutional and planning frameworks

4.3.1 Policies, legislation and strategies: national and regional

Some countries will require international cooperation and support in developing national fire policies based on state-of-the-art science and technologies. Fire-induced transboundary processes or global-level issues (conservation and restoration of natural ecosystems; management of biodiversity and fire regimes; combating of desertification; fire-related disaster risk reduction; atmospheric and climate change; poverty reduction) require joint, internationally concerted responses based on policies and best practices, as well as dedicated zonal and thematic guidelines (Table 11 – see also Subsection 4.2.3).

Over the last six years, a number of projects have supported the development of national policies, legislation and strategies, mainly through bilateral technical cooperation projects.

The experience gained in the facilitation of multistakeholder participation and the models developed may be suitable for adaptation in other countries.

Through harmonization of the principles in policies, legislation and strategies, synergies could be achieved in meeting the requirements for regional or international action or reporting, e.g. for international conventions and agreements.

Regional agreements and initiatives (such as the Association of Southeast Asian Nations (ASEAN) Agreement on Transboundary Haze Pollution) or the development of initial regional strategies (such as FAO/GFMC support to the development of a Regional Strategy on International Cooperation in Wildland Fire Management in Latin America and the Caribbean) have resulted in awareness and commitments at the national level to developing national policies, legislation and strategies accordingly.

In addition to the need to set up regional wildland fire monitoring/information centres (see Subsection 4.1.5), the establishment of regional wildland fire advisory boards has been proposed. These advisory boards would constitute permanent bodies in which the countries of a region would be represented and they could promote regional cooperation activities in fire management, monitor the implementation of regional strategies and provide advice to governments. They would maintain contact and exchange information with the advisory boards of other regions and, at the international level, with the UN-ISDR Wildland Fire Advisory Group/Global Wildland Fire Network. The advisory boards would actively contribute to the series of International Wildland Fire Conferences.

Bilateral projects could follow the model of the Twinning Projects of the European Union. These projects, granted by the European Commission to candidate member states, screen national legislation and recommend harmonization with European regulations. In the case of forest fire regulations, the European Union has supported Bulgaria and Hungary in harmonizing their legislation with the requirements of the Union's Forest Focus scheme. A similar procedure could be used to develop national regulations and legislation to address the *Fire management: voluntary guidelines. Principles and strategic actions*.

The development of the Regional Strategy on International Cooperation in Wildland Fire Management in Latin America and the Caribbean with subregional strategies for South America, Central America and the Caribbean, supported by FAO in 2004–2006, may serve as a guiding example for other regions. The Southeast European Wildland Fire Network has put forward an initial proposal.

An ITTO programme launched in 2002 is providing external expert advice to countries to assist them in evaluating their forest fire management situations, identifying pragmatic strategies and actions and, as appropriate, developing pre-project or project proposals. The instrument would seem to be suitable for expansion in the future.

TABLE 11
Policies, legislation and strategies: national and regional

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Support for the development of national policies, legislation and strategies Support for the development of regional policies Establishment of	Various countries supported through facilitation of consultations (multistakeholder, with interagency involvement): e.g. Bulgaria (Switzerland/GFMC); Ethiopia (GTZ/GFMC); Namibia (Finnish International Development Agency – FINNIDA/GFMC); FAO (Technical Cooperation Programmes –TCPs – in Bulgaria, Croatia, Nicaragua,	Regional Wildland Fire Networks to play a role in encouraging countries to develop national policies, legislation and strategies Possible catalytic role for development of regional strategies in encouraging countries to develop national policies and harmonize	**Time frame**: 2 **Finances:** FAO TCPs to be granted to regions in need

regional wildland fire advisory boards	Syria) EU Twinning Projects granted to candidate countries to harmonize legislation with EU requirements ITTO support to country assessments Development of a Regional Strategy for Latin America and the Caribbean (TCP FAO/GFMC) ASEAN Agreement on Transboundary Haze Pollution	legislation (donor support required)	
Information sources/portals:	Regional Wildland Fire Networks: www.fire.uni–freiburg.de/GlobalNetworks/globalNet.html Regional Fire Management Strategy for Latin America and the Caribbean: www.fao.org/Regional/LAmerica/organos/coflac/2006/pdf/lacfc1s.pdf ASEAN Agreement on Transboundary Haze Pollution online: www.haze–online.or.id/ ITTO/GFMC joint activities: www.fire.uni–freiburg.de/programmes/itto/itto_start.htm		

4.3.2 Human safety and health

Provision for firefighter and public safety must be considered paramount in all fire activities, and this requires collective planning at community and interagency levels (Table 12). Early warning and response to transboundary smoke pollution require bilateral and multilateral tools, as well as protocols for smoke transport prediction and mitigation of smoke pollution.

Smoke from vegetation fires contains several hundreds of gaseous compounds, such as carbon monoxide, aldehydes, volatile organic compounds, polycyclic aromatic hydrocarbons and fine particulate matter. While some of these compounds can affect firefighters and people living close to fires, others, such as fine particulate matter, may disperse over hundreds of kilometres and seriously affect exposed populations. An example is the concentrations of PM_{10} (particles smaller than 10 micrometres in aerodynamic diameter) monitored in many parts of the world, where they substantially exceed the air quality guidelines recommended by WHO and national air quality standards. Increasing incidences are reported of respiratory diseases and hospital admissions. In past years, advanced space-borne sensors have repeatedly depicted long-range fire smoke transport at transboundary (transnational) and intercontinental distances.

The WHO/WMO/UNEP *Health guidelines for vegetation fire events* advocate a comprehensive strategy and contingency plans that are harmonized among countries to the utmost extent possible, which would help mitigate the air pollutant burden suffered by the public. Developed in the late 1990s, they are based on broad international consensus and intend to avoid or mitigate the health effects of exposure of the population to smoke from vegetation fires.

The strategy involves: development of a rapid detection and monitoring capability for smoke emissions generated by vegetation fires; development of a health surveillance system; dissemination of information to all affected parties for appropriate decision-making; and development of national environmental and health response plans to vegetation fire emergencies. The strategy considers environmental as well as health aspects, cause-and-effect relationships, long-range pollution transport, land-use planning and fire prevention and other related issues.

However, only a few countries are in a position to take appropriate action in case of fire smoke emergencies. WHO currently does not have any capabilities to address the problem.

Regional agreements in place in the ASEAN and UNECE regions have not yet prevented or reduced the occurrence and impacts of smoke episodes and their consequences on human health.

TABLE 12
Human health

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Development of locally applicable firefighter and public safety standards and guidelines Building of early warning capabilities for smoke transport and impact prediction	Expertise regularly discussed and published in Wildland Fire Safety Summits organized by the International Association of Wildland Fire (IAWF), to be expanded to regions with less expertise and high risk of public health and security European and Mediterranean Major Hazards Open Partial Agreement (EUR–OPA) (Council of Europe – CoE) through the European Center for Forest Fires (ECFF)	Capacity–building by bilateral and regional projects Global Wildland Fire Early Warning System, part of the future UN Multi–Hazard Global Early Warning System, to include a public health component Implementation: UN interagency (WHO, WMO Expert Team on Non–Nuclear Emergency Response Activities, UN–ISDR IEWP….) with EUR–OPA (CoE) through ECFF	**Time frame**: 2 **Finances:**
Information sources/portals:	International Wildland Fire Safety Summits: www.iawfonline.org/summit/ European Center for Forest Fires (ECFF): www.coe.int/t/dg4/majorhazards/centres/presentation/ecff_en.asp		

4.3.3 Human security and peace

Countries at war or in tension continue to suffer wildfires as a consequence of military operations. Post-conflict situations or former military exercise areas are often characterized by large-scale contamination of unexploded ordnance (UXO) and landmines. Wildfires occurring on contaminated terrain are threatening human lives or cannot be suppressed due to safety considerations.

Confidence-building measures during conflicts and post-conflict efforts in stabilization, reconstruction and rehabilitation may include integrated fire management approaches and cooperation with specialized entities such as Halotrust (a non-governmental organization operating worldwide in UXO and landmine clearing), as well as national ordnance disposal services.

Experience can be drawn from the confidence-building forest fire exercises in the Balkan region by the Euro-Atlantic Disaster Response Coordination Centre (EADRCC) in 2002 and EASTEX FIRE by the UN-ISDR Regional Southeast Europe/Caucasus Wildland Fire Network in 2005. Bilateral efforts by Italy in support of post-crisis stability measures in Kosovo and the confidence-building environmental operation in the Caucasus by the Organization for Security and Co-operation in Europe (OSCE)/UNEP/GFMC in 2006 provide further relevant experience. Framework agreements on civil/military cooperation should be used, e.g. the United Nations Register of Military, Civil Defence and Civil Protection Assets. The MCDA Register contains data on the military, civil defence and/or civil protection expertise, capacities and range of services that may be offered in emergencies by member states and multinational organizations for international humanitarian disaster relief operations. CoE, through the European and Mediterranean Major Hazards Open Partial Agreement (EUR-OPA), is offering suitable structures for cooperation in the region. EUR-OPA is an

intergovernmental platform for cooperation between European countries and those south of the Mediterranean in the event of major natural and technological disasters, with its field of action covering knowledge and risk prevention, risk management, post-crisis analysis and rehabilitation.

Fires burning in vegetation that is radioactively contaminated as a consequence of nuclear accidents or nuclear weapons tests may result in uncontrolled redistribution of radioactivity and represent a major threat to human health and security. Cooperation is needed in monitoring transport of radioactivity and issuing relevant early warnings (Table 13). Joint international efforts may be necessary to develop fire management concepts for contaminated terrain, and cooperation with the International Atomic Energy Commission/Agency (IAEO/IAEA) is advisable.

TABLE 13
Human security and peace

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Confidence building between countries in tension	GFMC/UN–ISDR Regional Southeast Europe/ Caucasus Wildland Fire Network: stabilization in the Balkans and Caucasus region	Development of a regional strategy for cooperation in fire management (OSCE, UNEP, GFMC)	**Time frame**: 1 **Finances:**
Reduction of wildfire risk in radioactively and UXO contaminated terrain	Experience gained by international forest fire response exercises of North Atlantic Treaty Organization (NATO) EADRCC (2002) and Global Wildland Fire Network (EASTEX Fire 2005) in the Balkan Region OSCE/UNEP/GFMC environmental operation as confidence–building measure in the Caucasus region 2006	International Atomic Energy Commission/Agency (IAEO/IAEA), OSCE, CoE/EUR– OPA, Halotrust, GFMC to cooperate on principles in UXO disposal and fire management in contaminated terrain	
Information sources/portals:	Halotrust: www.halotrust.org/ OSCE confidence–building mission: www.osce.org/item/21681.html MCDA Register: http://ochaonline.un.org/webpage.asp?Page=1005 NATO EADRCC: www.fire.uni–freiburg.de/programmes/nato/nato.htm E:\fire\htdocs\programmes\nato\nato.htm www.nato.int/eadrcc/tdragon/exercice2002.htm Council of Europe – EUR–OPA: www.coe.int/T/DG4/MajorHazards/Default_en.asp		

4.3.4 International agreements for cooperation in fire management, including mutual assistance in fire emergencies

During extreme fire situations, a country may be short of fire suppression resources, including command and coordination personnel. Protocols, agreements and standardized command systems and methods would ensure that countries delivering to, or receiving assistance from other countries can cooperate effectively (Table 14). The International

Wildland Fire Management Agreements Template – as adopted by the 2003 International Wildland Fire Summit and regularly updated by FAO – may serve as a guiding document.

In addition to bilateral or multilateral agreements, it will be important to adopt the Incident Command System (ICS) as a unified standard procedure for multinational cooperation in wildfire incidents. This procedure should regulate the details of cooperation in order to ensure efficient communication and cooperation among personnel from two or more countries.

National fire monitoring centres or national agencies responsible for fire management should provide national databases of the fire management resources available for international cooperation. A standard format could be developed (e.g. based on the draft GFMC Format of Country Profiles of Fire Management Resources).

TABLE 14
International policies and agreements

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Development of protocols between countries	Template available for development of agreements	UN–ISDR Regional Wildland Fire Networks to develop bilateral and multilateral initiatives	**Time frame**: 2 **Finances:**
Clarification of procedures for requesting assistance	International procedures (UN: Joint UNEP/OCHA Environment Unit) and regional procedures available in EU and NATO member states	Interface procedures to be developed between UN (UNEP/OCHA) and international/regional bodies	
Adoption of ICS as international standard	ICS adopted as standard for international collaboration in Australia, Canada, New Zealand and USA	UN–ISDR Regional Wildland Fire Networks and bilateral projects to promote adoption of ICS as standard for international cooperation (bilateral, regional) Regional mechanisms, e.g. the EU Community Mechanism for Civil Protection (and its Monitoring and Information Centre – MIC) or the ASEAN Transboundary Haze Agreement, to adopt ICS as common system	
Establishment of regional databases on fire management resources		Databases to be developed together with the establishment of regional fire monitoring centres/wildland fire advisory boards	
Information sources/portals:	International Wildland Fire Summit: www.fire.uni–freiburg.de/summit–2003/introduction.htm UN Coordination/Assistance to Fire Emergences: www.fire.uni–freiburg.de/emergency/un_gfmc.htm Joint UNEP/OCHA Environment Unit: http://ochaonline.un.org/webpage.asp?Page=640 Templates and examples of international agreements: www.fire.uni–freiburg.de/emergency/Legal–Frameworks–September–2004.pdf Proposed establishment of regional wildland fire advisory board in eastern Mediterranean: www.fire.uni–freiburg.de/course/meeting/ECE–FireConference2004–1stannouncement–sem–55–1.pdf		

4.4   Research

Fire research in the coming years is challenged to address the interactions between 'global changes' – i.e. the environmental, demographic, social, political and land-use changes –

and fire regimes. Similarity of conditions in countries within a region should encourage the development of fire research projects in which resources will be economized and shared and synergies created (Table 15). The involvement of academia (the fire research community) in the overall concept of regional cooperation will contribute to the sustainability of cooperation.

TABLE 15
Fire research

Specific activities	Current actors, activities and/or products	Proposed activities and potential actors for further development	Time frame, finances/donors
Improved knowledge of changes in fires regimes Prioritization of research on the role of humans in the vegetation fire arena (underlying socio-economic processes and problems of fire use and wildfires; effects of fires on human populations; human response to fire) Assessment of the role of and required response to fire in relation to international agreements	Large number of coordinated and non-coordinated fire and fire-related research projects underway	Establishment of long-term monitoring programmes in those ecosystems expected to undergo the widest range of changes as a consequence of global changes Expanded interdisciplinary research to forecast potential fire season severity and improve seasonal weather forecasts under future climate change scenarios Conferences or symposia to enhance communication among researchers and managers and to engage the general public in discussions on how best to adapt public land management to cope with fire in a changing environment Interdisciplinary teams of researchers, including fire ecologists and climate scientists, to identify and pursue emerging areas of climate and fire research	**Time frame**: 3 **Finances:**
Information sources/portals:	San Diego Declaration on Climate Change and Fire Management: http://emmps.wsu.edu/firecongress/ www.fire.uni-freiburg.de/course/meeting/2006/meet2006_03.htm United Nations University and fire research and training: www.fire.uni-freiburg.de/programmes/un/unu/unu.htm		

Research programmes – such as projects sponsored by the International Geoshere-Biosphere Programme (IGBP) and numerous projects conducted by universities and other research facilities, including initiatives by non-governmental organizations – should be instrumental in establishing a global fire atlas. The atlas would contain information on ecosystem characteristics related to fire (fire regimes, ecosystem sensitivity/vulnerability, wildfire risk and hazard maps, etc.) and appropriate fire management solutions.

In the context of several international agreements and conventions (e.g. the Convention on Biological Diversity (CBD), United Nations Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC)/Kyoto Protocol, Ramsar Convention on Wetlands), the impact of vegetation fires on biodiversity, desertification, composition and functioning of the atmosphere, and climate change must be fully understood and translated into action.

The Third International Fire Ecology and Management Congress, held in San Diego, California, 13–17 November 2006, produced the San Diego Declaration on Climate Change and Fire Management. The declaration includes recommendations reflecting the priorities for research, education and outreach:

- implement long-term biodiversity and fuels monitoring programmes in the fire-adapted ecosystems that are expected to undergo the widest range of change and variability as a result of climate change, such as those that once experienced frequent, low-to-moderate-intensity fire regimes;
- expand interdisciplinary research to forecast potential fire season severity and improve seasonal weather forecasts under future climate change scenarios;
- integrate the subject of climate change and its influence on ecosystem disturbance into curricula within natural resource management programmes at university and continuing education levels, and in science programmes within primary schools;
- disseminate information to the general public and government agencies regarding the potential impacts of changing climate on local natural resources and disturbance regimes, particularly those that interact with fire;
- hold conferences or symposia to enhance communication among researchers and managers and to engage the general public in discussion on how best to adapt public land management to cope with fire in a changing environment;
- form interdisciplinary teams of researchers that include fire ecologists and climate scientists to identify and pursue emerging areas of climate and fire research.

A list of fire research themes and current or future partners in collaborative and interdisciplinary research is not provided because it would need to be exhaustingly comprehensive. Table 16 presents several major international organizations or associations involved in cooperative vegetation fire research. Table 17 provides selected examples of international research programmes that have been or are addressing interdisciplinary fire themes relevant for consideration in fire management and fire policy development at the international level.

TABLE 16
Contributions of major fire R&D organizations, consortia, projects and programmes to regionally and globally concerted cooperative fire management programmes

Non–governmental organization	Related activity, programme or product	Potential contribution to synergy
Global Terrestrial Observing System (GTOS) programme, sponsored by the Integrated Global Observing Strategy (IGOS)	Global Observation of Forest Cover/Global Observation of Land Cover Dynamics (GOFC–GOLD) – Fire Mapping and Monitoring Theme with regional implementation teams	Development of a global database on vegetation fires and fire effects; contribution to the development of a Global Wildland Fire Early Warning System as part of the planned UN Multi–Hazard Global Early Warning System
World Weather Research Programme (WWRP)	Development of a Global Wildland Fire Early Warning System as part of the planned UN Multi–Hazard Global Early Warning System (UN–ISDR, WWRP, CFS, GFMC)	Contribution to the development of a Global Wildland Fire Early Warning System as part of the planned UN Multi–Hazard Global Early Warning System (UN–ISDR, WWRP, CFS, GFMC)
International Geosphere–Biosphere Programme (IGBP)	International Global Atmospheric Chemistry (IGAC) Project: Biomass Burning Experiment (BIBEX)	Clarification of the impact of vegetation fire emissions on atmosphere and climate
International Boreal Forest Research Association (IBFRA)	Wildland Fire Working Group (formerly Stand Replacement Fire Working Group – SRFWG)	Facilitation of cooperative international and multidisciplinary boreal forest fire research between Russia and western boreal countries

International Union of Forestry Research Organizations (IUFRO)	Unit 8.01.10 Forest Fire Research	Platform of dialogue with other forestry research disciplines
International Association of Wildland Fire (IAWF)	International Journal of Wildland Fire	Scientific. peer-reviewed magazine ensuring quality control of fire research publications

TABLE 17
Examples of international fire research programmes

Designation	Description and objectives
SAFARI-92 SAFARI 2000	International scientific initiatives to study the linkages between fire (and other land) and atmospheric processes in the southern African region SAFARI 2000 examined the relationship of biogenic, pyrogenic and anthropogenic emissions and the consequences of their deposition for the functioning of the biogeophysical and biogeochemical systems of southern Africa. http://diotima.mpch-mainz.mpg.de/bibex/ www-eosdis.ornl.gov/S2K/safari.html
Northern Eurasia Earth Science Partnership Initiative (NEESPI)	Development of a comprehensive understanding of northern Eurasian terrestrial ecosystem dynamics, biogeochemical cycles, surface energy and water cycles, and human activities – and of how they interact with and alter the biosphere, atmosphere and hydrosphere of the Earth. The anticipated outcome of this research programme is the ability to measure, monitor and model the processes, including vegetation fires, that will provide accurate future projections of climatic and environmental changes in the region. http://neespi.org/
International Crown Fire Modeling Experiment (ICFME)	Cooperative international experiment, bringing together fire modelling experts from Canada, Russia and the USA, to address the prediction of high-intensity fire behaviour www.nofc.forestry.ca/fire/research/environment/icfme/icfme_e.htm
Fire Paradox	Regional European fire research programme with the participation of 14 countries (2006–2010): development of innovative methods in fire management for European conditions; transfer of advanced fire science to fire management www.fireparadox.org/#
Bushfire Cooperative Research Centre (CRC)	Research collectively aimed at enhancing management of the bushfire risk to the community in a manner that is economically and ecologically sustainable www.bushfirecrc.com/

5.   Conclusions and recommendations

This review and assessment of the role of international partners (UN and non-UN) in international cooperation in fire management concentrates on themes and disciplines that require a cooperative and collective approach. As mentioned in the introduction, most of the agencies or institutions have previously been involved in fire projects and programmes. However, only a few action items included in this review have matured into concrete project proposals or actions.

Availability of financing for implementation of the strategic actions and of the coordinated action suggested in this review is essential. Apart from some existing mechanisms for financing projects on a limited scale that were mentioned in the review, there has been no intent to speculate about larger financing schemes. However, the World Bank, regional and subregional development banks and other multilateral financial institutions mentioned in Annex 1 (Table 1.1) – many involved in financing fire management projects in the past – may become important partners in a wildland fire management programme facility, as proposed in this review (see Chapter 2, Table 2).

Active follow-up to the review will be crucial to the success of coordinated and collective international action. Such follow-up can be effected through the UN-ISDR Wildland Fire Advisory Group and the members of the envisaged "partnership to maintain and implement the principles and strategic actions" – one of the four pillars of the strategy to enhance international cooperation in fire management. It is assumed that, in addition to nations, the governmental and non-governmental institutions participating in the UN-ISDR Regional Wildland Fire Networks will be interested and available to serve as partners.

ANNEXES

Annex 1: Activities of international actors in fire management (UN, non-UN and civil society)

Table 1.1 shows contributions of United Nations specialized agencies and programmes and financial institutions to a globally concerted, cooperative fire management programme. Country programmes are not yet listed (agencies for international development or for technical cooperation) and will be added in updated versions of the paper (see Foreword and footnote 7).

TABLE 1.1
Contributions of United Nations specialized agencies and programmes and financial institutions

Organization, programme or secretariat	Related activity, programme or product	Contribution to synergy
Food and Agriculture Organization (FAO)	In addition to details in Table 1: outreach work of the FAO Regional Forestry Commissions Instrument: technical cooperation programmes and government cooperative programmes Support to international fora	Capacity-building in fire prevention, community-based fire management; global fire assessments
International Strategy for Disaster Reduction (UN-ISDR)	Global Wildland Fire Network and Wildland Fire Advisory Group Coordination: Global Fire Monitoring Center (GFMC)	Interagency and intersectoral platform for harmonization of approaches and coordination of synergies; facilitation of cooperation in fire management within and between regions; advisory body to the United Nations system
World Health Organization (WHO)	*Health guidelines for vegetation fire events*	Public health policy advice
World Meteorological Organization (WMO)	International standards for weather observation and forecasting through WMO member states and their national hydro-meteorological services	Global weather station network to be used in the Global Wildland Fire Early Warning System
UN Environment Programme (UNEP), with UN Office for the Coordination of Humanitarian Affairs (OCHA)	Joint Environment Unit Advisory Group on Environmental Emergencies (AGEE) Environmental Emergencies Partnership (EEP)	Mobilization and coordination of the international response to environmental emergencies: support to the UN and countries in vegetation fire emergencies through on-site assessment and coordination of international response; promotion of prevention and preparedness for vegetation fire disasters
UN Office for Outer Space Affairs (UN-OOSA)	Space Technology and Disaster Management (STDM) Programme	Facilitate access and incorporate space technology for risk reduction and disaster management, including the application of the International Charter "Space and Major Disasters"
United Nations University (UNU)	UNU institute for Environment and Human Security (EHS) and UNU	Contribute, through research and capacity-building, to efforts to resolve

	associate institute Global Fire Monitoring Center (GFMC)	the pressing global problems that are of concern to the United Nations, its peoples and members
International Tropical Timber Organization (ITTO)	Follow–up to/implementation of *ITTO guidelines on fire management in tropical forests*	Contribute to national and international efforts in the area of prevention and management of fire in relation to tropical timber–producing forests
World Bank	World Bank Country Assistance Strategies (CAS)	Financing of national fire management projects (grants or loans)
Regional and subregional development banks, multilateral financial institutions	African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, Inter–American Development Bank Group Corporación Andina de Fomento (CAF), Caribbean Development Bank (CDB), Central American Bank for Economic Integration (CABEI), East African Development Bank (EADB), West African Development Bank (BOAD) European Commission and European Investment Bank (EIB), International Fund for Agricultural Development (IFAD), Islamic Development Bank (IDB), Nordic Development Fund (NDF) and Nordic Investment Bank (NIB), OPEC Fund for International Development (OFID)	Financing of national fire management projects (grants or loans)
Global Environment Facility (GEF)	Independent financial organization providing grants to developing countries for projects that benefit the global environment and promote sustainable livelihoods in local communities	Cooperation in financing fire management projects through GEF implementing agencies (UNDP, UNEP, The World Bank)

Table 1.2 offers examples of contributions of non-UN international/non-governmental organizations and initiatives to a globally concerted, cooperative fire management programme.

TABLE 1.2
Contributions of non–UN international/non-governmental organizations and initiatives

International organization	Related activity, programme or product	Potential contribution to synergy
Global Fire Monitoring Center (GFMC)	UN–ISDR facility providing: • Early warning portal of fire danger and near-real-time monitoring of fire events • Interpretation, synthesis and archiving of global fire information • Support to local, national and international entities in developing long-term strategies or policies for fire management, including community-based fire management approaches and advanced fire management training for decision-makers in accordance with the UNU mandate • Advisory body to the UN system as member of the UN–ISDR Global Platform for Disaster Reduction, through coordination of WFAG and GWFN	In conjunction with the mandates of UN–ISDR and the Inter-Agency Task Force for Disaster Reduction (from 2006, the UN–ISDR Global Platform for Disaster Reduction): facilitation of an interagency and cross-sectoral platform for international cooperation in the area of fire management, and secretariat of GWFN and WFAG.

	• Emergency hotline and liaison capabilities providing assistance for rapid assessment and decision support in response to fire emergencies, under cooperative agreements with OCHA, Emergency Services Branch, and AGEE • Production of UNECE/FAO International Forest Fire News (IFFN) (printed and online)	
Global Environment Centre (GEC)	Assessment and management of wetlands at local, national and global levels, including fire management	To provide expertise in peatland/wetland fire management
Global Fire Partnership (GFP)	Joint activity of the World Conservation Union (IUCN), World Wide Fund for Nature (WWF) and TNC to promote awareness and catalyse action to reduce the threat of altered fire regimes to biodiversity conservation Latin American and Caribbean Fire Learning Network	To maintain or restore ecologically and socially acceptable fire in ecosystems that depend upon it, and reduce the incidence of unwanted fire in ecosystems where it is detrimental
Eurasian Fire in Nature Conservation Network (EFNCN)	Eurasian network for research and development in the area of cultural and natural history and prehistory of fire; application of prescribed fire in nature conservation and landscape management and fire ecology	To maintain or restore ecologically and socially acceptable fire regimes and fire management in ecosystems that depend upon it
Comité Technique International du Feu (CTIF – International Technical Committee for the Prevention and Extinction of Fire/International Association of Fire and Rescue Services)	Forest Fires Commission	To develop interface procedures and training materials for interagency cooperation in fire suppression

Annex 2: Overview of cooperation among international stakeholders

FIGURE 2.1
Strategy to enhance international cooperation in implementing the principles and strategic actions of *Fire management: voluntary guidelines*
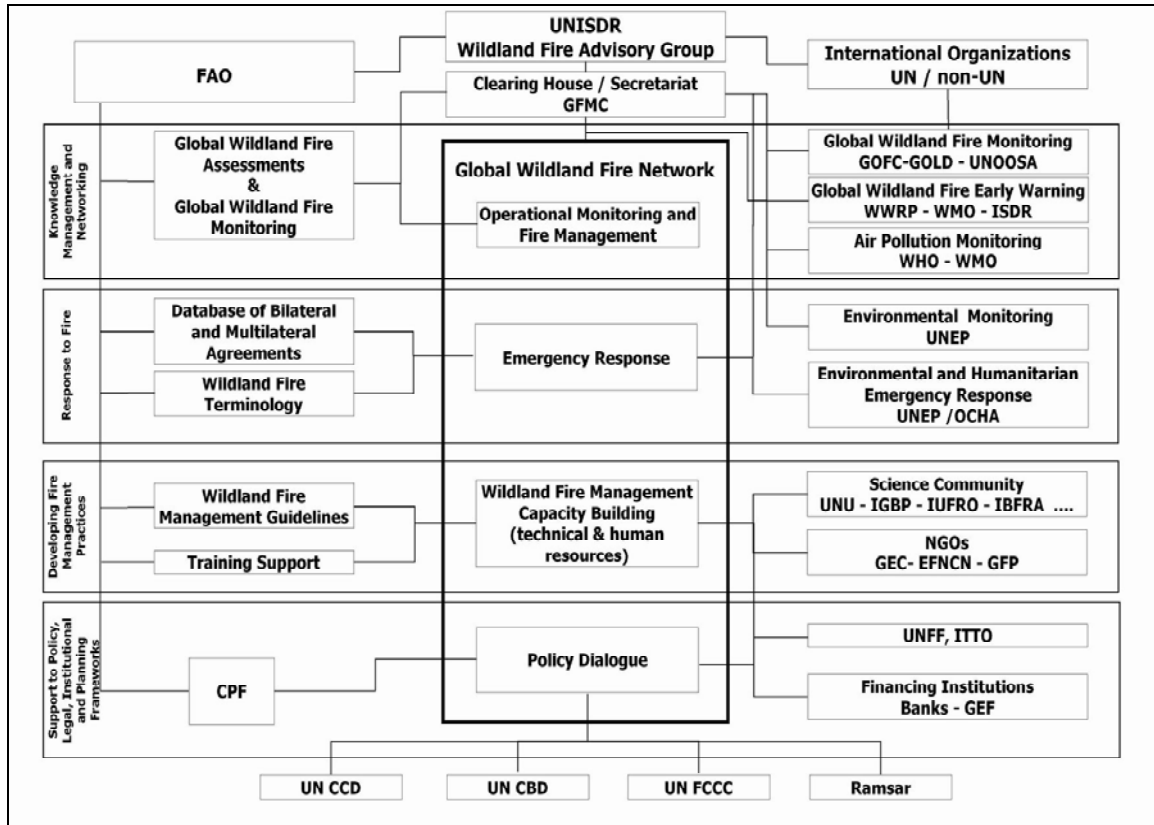
Annex 3: FAO work programme in fire management

Building upon the FAO hosted Ministerial Meeting on Forests (Rome, 14 March 2005), the 17th Session of COFO (Rome, 15–19 March 2005) requested FAO:

- in collaboration with countries and other international partners, including the United Nations International Strategy for Disaster Reduction, to develop a strategy to enhance international cooperation on wildland fire (para 28);
- to provide support for countries to develop and consolidate their national fire management systems and to build the technical and operational capacity required to engage in effective international cooperation (para 32).

It was further recommended that FAO:

- enhance its role in fire management, including through: (i) advocating fire management within the context of an integrated approach to forest management; (ii) promoting awareness that forest management is an effective means of fire prevention; (iii) underscoring the role of fire as a management tool in both agriculture and forestry; (iv) providing technical support for improved management of fuel loads in forests; (v) helping design and implement training, education and awareness-raising programmes on forest fire management, especially at the local level; and (vi) strengthening its efforts to monitor and manage information on forest fire management and disseminate such information, especially at regional and subregional levels (para 33);
- include forest fire management in its dialogue with the international assistance agencies of developed countries, with the World Bank and with the regional development banks (para 34);
- inform the fifth session of the United Nations Forum on Forests (UNFF) of the importance attached by the Ministerial Meeting on Forests and by the 17th Session of the Committee to international cooperation on forest fire management (para 35);
- continue its support for regional and national networks to manage fire as well as insects and disease, in collaboration with relevant organizations such as the United Nations International Strategy for Disaster Reduction and the Global Wildland Fire Network, and further requested that FAO work with partners to develop voluntary guidelines on the prevention, suppression and recovery from forest fire (para 53).

The overall work programme and mandate of FAO were recognized. FAO and its partners have already initiated cooperation (e.g. ITTO, GFMC, UNEP-Global Resource Information Database (GRID)/UMD, TNC), but further strengthening and development are necessary.

Table 3.1 shows current and planned contributions of FAO to the strategy to enhance international cooperation in implementing the strategic actions for fire management. The main beneficiaries and partners are countries. Beneficiaries listed in this table are international actors potentially interested in cooperation towards developing collective solutions.

TABLE 3.1
Contributions of FAO

FAO activity or product	Objectives for joint use or joint activity	Key implementing partners	Primary beneficiaries (countries, UN agencies/ programmes, other international organizations)
Terminology	Compatible and consistent definitions/language	GFMC	All
Global Wildland Fire Assessments	Improved knowledge of the extent and impacts of fire on a range of ecosystems	GOFC–GOLD, UMD, UNEP, GFMC	All, but notably UNFCCC, CBD and science community (atmospheric sciences, global change…)
Information and data–collection and sharing	Systematic collection; archive and information sharing	GFMC and other stakeholders	All
Support to Regional Wildland Fire Networks	Strengthening of Regional Wildland Fire Networks	GFMC, UN ISDR/GWFN	All
Public/community involvement in wildfire prevention and use of fire	Guiding countries in developing community–based fire management capabilities	NGOs: TNC, IUCN, WWF	UN ISDR/GWFN
Monitoring	Global fire Information for resource management: transition from a research to an operational system, with an emphasis on protected areas	GOFC–GOLD, UMD, UNEP, GFMC	All, but notably UN ISDR/GWFN, CBD, UNCCD, TNC
Reporting	*Fire management: global assessment 2006* and 12 regional fire management reports	UN ISDR Wildland Fire Networks, GFMC	All
Capacity–building; strengthening partnerships; training courses	Dissemination of standards, strengthening of international cooperation and implementation, particularly CBFiM	UNU, GFMC; TNC, IUCN, all partners will be invited to offer	UN ISDR/GWFN
Guidelines on fire management in temperate and boreal forests	Temperate and boreal forests	ITTO, CTIF, UN ISDR/GWFN	UN ISDR/GWFN
Fire management: voluntary guidelines. Principles and strategic actions	Framework of principles and strategic actions	USFS, GFMC and international expert group	UN ISDR/GWFN, including policy–makers, decision–makers and fire managers
Global strategy for enhancing international cooperation in fire management	Enhancing international cooperation in fire management	UN ISDR/GWFN, USFS, GFMC, TNC, other stakeholders	All, but notably UN ISDR/GWFN, CBD, UNCCD, TNC
Emergency response agreements – international, national and subnational	Providing templates and legal advice	UN ISDR/GWFN	UN ISDR/GWFN

Annex 4: Draft proposals for the development of a standardized fire inventory system

The following proposal was included in the conclusions and recommendations of the ECE/FAO/ILO Seminar on Forest, Fire, and Global Change, Shushenskoye (Russian Federation), 4–9 August 1996. *Note: the proposal is included in its original version* and does not reflect any changes of designations or mechanisms at the international level, including within the United Nations system.

1.   General statement on the role of fire in the global environment

a.   Both anthropogenic and natural fires are an important phenomenon in all vegetation zones of the globe. Their impacts, however, are not uniform. Fires may lead to the temporary damage of forest ecosystems, to long-term site degradation and to alteration of hydrological regimes which may have detrimental impacts on economies, human health and safety.

b.   As a consequence of global population growth and land-use changes, the cumulative effects of anthropogenic disturbances, and the over-use of vegetation resources, many forest types, which over evolutionary time periods became adapted to fire, are now becoming more vulnerable to fire.

c.   On the other hand, in many vegetation types, of the temperate, boreal and tropical ecosystems, fire plays a central role in maintaining the natural dynamics, biodiversity, carrying capacity and productivity of these ecosystems. In many parts of the world sustainable forestry and agricultural practices, as well as pastoralism, depend on the use of fire.

d.   Vegetation fires produce gaseous and particle emissions that have significant impacts on the composition and functioning of the global atmosphere. These emissions interact with those from fossil fuel burning and other technological sources, which are the major cause for anthropogenic climate forcing.

e.   Global climate change is expected to affect fire regimes and lead to an increase of occurrence and destructiveness of wildfires, particularly in the boreal regions of continental North America and Eurasia.

f.   Fire control has been the traditional fire policy in many parts of the world. An increasing number of countries have adopted fire management policies instead, in order to maintain the function of fire in removing the accumulation of fuel loads that would otherwise lead to damaging wildfires, and in order to arrest succession at stages that are more productive to humans than are forests and brushlands that would predominate in the absence of fire.

g.   In many countries, however, inappropriate choices are made – often because the responsible authorities and managers are not provided adequately with basic fire information, training, technologies and infrastructures. Large-scale wildfire disasters which occurred in the past years, especially in the less developed countries, may have been less severe and extended if national fire management capabilities had been developed and assistance through the international community provided.

h.   Although the global fire science community has made considerable progress to investigate global impacts of fire, using available and developing new technologies, no international mechanisms exist for systematically collecting, evaluating and sharing global

fire information. There are also no established mechanisms at the international level to provide fire disaster management, support and relief.

i.   Therefore the participants of the ECE/FAO/ILO Seminar on Forest, Fire, and Global Change adopted the following conclusions and recommendations:

2.   Conclusions

a.   The economic and ecological impact of wildland fire at local to global levels has been demonstrated at this seminar. The possibility of major world disasters, such as the transfer of radioactive materials in wildland fire smoke, and the substantial loss of human life in recent fires, has been scientifically documented. The lack of, and need for, a global statistical fire database, by which the economic and ecological impact of fires could be spatially and temporally quantified, was identified. Such a reliable database is essential, under current global change conditions, to serve sustainable development and the urgent needs of fire management agencies, policy makers, international initiatives, and the global modelling community.

b.   Similarities in wildfire problems throughout the world are evident, particularly increasing fire incidence and impact coupled with declining financial resources for fire management, underlying the urgent need to coordinate resources at the international/global level in order to deal effectively with impending major wildland fire disasters.

c.   As climate change is a virtual reality, with predicted significant impacts at northern latitudes, seminar participants recognize that boreal and temperate zone fire activity will increase significantly in the future, with resulting impacts on biodiversity, forest age-class distribution, forest migration, sustainability, and the terrestrial carbon budget. It is essential that future fire regimes in these regions be accurately predicted, so informed fire management decisions can be made.

3.   Recommendations

a.   Quantifiable information on the spatial and temporal distribution of global vegetation fires is urgently needed relative to both global change and disaster management issues. Considering the recent various initiatives of the UN system in favour of global environmental protection and sustainable development, the ECE/FAO/ILO Seminar on Forest, Fire, and Global Change strongly urges the formation of a dedicated United Nations unit specifically designed to use the most modern means available to develop a global fire inventory, producing a first-order product in the very near future, and subsequently improving this product over the next decade. This fire inventory data will provide the basic inputs into the development of a Global Vegetation Fire Information System.

b.   The FAO should take the initiative and coordinate a forum with other UN and non-UN organizations working in this field, e.g. various scientific activities of the International Geosphere-Biosphere Programme (IGBP), to ensure the realization of this recommendation.

c.   The information given in the Annexes I to III (Draft Proposals for the Development of a Standardized Fire Inventory System) to these recommendations describe the information requirements (classes of information, information use), the establishment of mechanisms to collect and distribute fire inventory data on a global scale.

d.   The development of a satellite dedicated to quantifying the geographical extent and environmental impact of vegetation fires is strongly supported. Such an initiative is currently being evaluated by NASA, and this seminar strongly recommends that this and similar initiatives (e.g., NOMOS sensor on MIR space station) be encouraged and supported.

e.   A timely process to gather and share information on ongoing wildfire situations across the globe is required. The creation of a WWW Home Page to handle this information flow is recommended. This could be coordinated with an ongoing G7 initiative, the Global Emergency Management Information Network Initiative (GEMINI), which includes a proposal to develop a Global Fire Information Network using the World Wide Web.

f.   Mechanisms should be established that promote community self reliance for mitigating wildfire damages and would also permit rapid and effective resource-sharing between countries as wildfire disasters develop. Since the United Nations Disaster Relief Organization (UNDRO) is an organization recognized and established to coordinate and respond to emergency situations, including wildfires, it is recommended to entrust this organization, in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO), to prepare the necessary steps. The measures taken should follow the objectives and principles of the United Nations International Decade for Natural Disaster Reduction (IDNDR).

g.   The unprecedented threat of consequences of fires burning in radioactively contaminated vegetation and the lack of experience and technologies of radioactive fire management requires a special, internationally concerted research, prevention and control programme. Such programme should be implemented under the auspices of the FAO/ECE/ILO.

h.   The Wildland Fire '97 International Conference in Canada should be used as a forum to further promote the recommendations of this seminar. This can be realized through co-sponsorship of this conference by the FAO, UNDRO, UNESCO, IDNDR and the ECE/FAO/ILO Team of Specialists on Forest Fire.

4.   Draft proposals for the development of a standardized fire inventory system

I.   Preamble

A Vegetation Fire Inventory System at both national and international levels serves a large number of practical needs:

1   Regional – national fire management
a.   budget – resource requirements
b.   daily to annual tracking of activity compared to normal
c.   long-term trends
d.   interagency – intergovernmental assistance
e.   changes in long-term trends

2   Regional – national non–fire
a.   integrated assessments – monitoring of fire impacts on other resources
b.   policies and regulations on
  i.   air quality
  ii.   global change
  iii.   biodiversity

3   International use of fire inventory
a.   updated forest inventory; availability of timber; fire integrated in resource availability salvage
b.   market strategies
c.   import- export policies – strategies
d.   food and fibre availability rangelands
e.   interagency – intergovernmental assistance agreements
f.   national security
  i.   food and fibre assessment grass and fodder
  ii.   water supply and quality

g. research
  i. global change
  ii. integrated assessments monitoring
h. international treaties, agreements
  i. UNCED
    - climate convention
    - biodiversity
  ii. CSD, IPF
  iii. Montreal protocol on ozone
  iv. IDNDR, others

4 Economic data utility national, but not international compatibility of assumptions

Annex II – Information requirements

A. Classes of information

1. Alpha type
- fire start and end dates
- fire location (lat, long; resolution?)
- fire size
- cause of fire

2. Beta type
- fuels – biome classification
- fuel loading forest inventory, age class, size class

3. Gamma type
- fire characterization (crown, surface, etc.)
- fuel consumption
- structural involvement (wildland urban interface)

4. Delta type (current ECE/FAO)
- number of fires
- area burned (by forest type)
- cause of fires (number)

5. Epsilon type
- gas and aerosol emission data

6. Eta type
- total expenditure of fire programme
- total fire suppression costs
- total direct losses of merchantable timber, structural losses

B. Decision space table

Information use	Information type					Frequency of info
	alpha	beta	gamma	delta	eta	
Regional/national (fire)						
1. Budget resource	X	X			X	A
requirements	X	X	X		X	DWMA
2. Daily to annual fire activity	X	X	X		X	A
3. Long-term trends	X				X	DWMA
4. Interagency agreements	X	X	X		X	
5. Resource allocation						

Regional/national (non-fire)
6. Assessment monitoring
7. Air quality policy
  regulations
8. Global change policy
  regulations
9. Habitat change
	X
	X
	X
		X
		X
		X
			
			X
				
				X
						A
						A
						A
						A

International (fire) 10. Intergovernmental assistance	X	X	X		X	A
International (non-fire) 11. Treaties and agreements 12. National security 13. Research 14. Market import/export forecasting	X X X	X X X X	X X X	X X X	 X X	A DWM A A

Frequency of Information: D = daily; W = weekly; M = monthly; A = annual

C. Parsimonious fire inventory

Intergovernmental assistance at bilateral or regional level does not require a global database. These agreements are regional and may differ in requirements from one region to another. If we exclude national security, we need only annual data for a global database. The gamma data type is assembled from the alpha data so there is no need to report this separately. The beta data on fuels can be obtained from other inventories, but must be standardized. The gamma data type will also require development of international standards before it can be considered. All vegetation fires must be included in this database.

Annex III – Establishment of mechanisms to collect and distribute fire inventory data on a global scale

A. Current state of fire inventory

1. Data consisting of individual fire reports are developed by many nations, but many regions of the world are not covered.
2. Only ECE and EU nations have established mechanisms to share data.
3. Current shared data consists of statistics aggregated from individual fire reports.
4. Data from remote sensing is rapidly becoming available, but only for fires that can be defined by either heat signature or by fire scars on the landscape.

B. Issues

1. A large number of uses of an international fire inventory have been identified in fire management, environmental policy and agreements, and in economic growth of nations.
2. A parsimonious inventory has been identified which can be utilized by all nations (see statement on standardized fire inventory).
3. There needs to be international agreement to provide fire inventory (similar to the FAO global forest inventory).

C. Implementation

1. Fire inventory at the global scale should consist of individual fire data of date of fire start and end, location of fire, size of fire, and cause of fire. Fire location from individual fire reports normally report origin of fire. Remote sensed data are more likely to report centre of burned area. Should fire reports contain centre rather than origin, in addition to origin?
2. Two additional forms of data will be needed in the future, biome classification and fire characterization. Standard for these additional information will need to be developed
3. Rapid electronic communication is available for nearly all parts of the globe. Fire inventory data can be made available through World Wide Web. FAO is an appropriate centre to compile and distribute these data.

4. Remote sensed data will need to be placed in the same format as individual fire reports and be made available on World Wide Web (WWW). Images can also be made available through WWW. Appropriate potential centres for compilation and distribution of these data are Ispra (EU) or NASA's Earth Observing System – Data and Information System (EOS-DIS).

5. Those nations which cannot provide data in electronic format, should agree upon a hard copy format which can be scanned and readily placed in electronic format

Annex 5: Selected references relevant to the strategy

This list of references includes those international organizations, institutions or programmes involved in the international fire arena that are mentioned in the document. Other key information sources are provided as well.

Advisory Group on Environmental Emergencies (AGEE) (OCHA/UNEP)
http://ochaonline.un.org/webpage.asp?Page=640

Association of Southeast Asian Nations (ASEAN)
www.haze-online.or.id/

Bi-spectral Infrared Detection (BIRD) satellite mission of the German Aerospace Center (DLR)
www.eid.dlr.de/os/forschung/projekte/bird/

Bushfire Cooperative Research Centre (CRC)
www.bushfirecrc.com/

Canadian Forest Service (CFS)
www.nrcan.gc.ca/cfs-scf/

Comité Technique International du Feu (CTIF – International Technical Committee for the Prevention and Extinction of Fire/International Association of Fire and Rescue Services)
www.ctif.org/
www.ctif.org/index.php?page_id=2024
www.ctif.org/index.php?page_id=1998&bloc_id=1659

Commission for Agricultural Meteorology (CagM) (WMO)
www.wmo.ch/web/wcp/agm/CAgM/CAgMmenu.htm

Community-based fire management (CBFiM)
www.fire.uni-freiburg.de/Manag/CBFiM.htm

Council of Europe (CoE)
www.coe.int/t/dg4/majorhazards/default_EN.asp

Convention on Biological Diversity (CBD)
www.biodiv.org/default.shtml

Earth Observing System – Data and Information System (EOS-DIS)
http://spsosun.gsfc.nasa.gov/eosinfo/EOSDIS_Site/index.html

Economic Commission for Europe (ECE)
www.unece.org/trade/timber/ff-stats.html

Environmental Emergencies Partnership (EEP)
www.humanitarianinfo.org/eep/projectupdates.htm

Eurasian Fire in Nature Conservation Network (EFNCN)
www.fire.uni-freiburg.de/programmes/natcon/natcon.htm

European and Mediterranean Major Hazards Open Partial Agreement (EUR-OPA)
www.coe.int/t/dg4/majorhazards/default_EN.asp

European Forest Fire Information System (EFFIS)
http://effis.jrc.it/Home/

Food and Agriculture Organization of the United Nations (FAO)
www.fao.org/forestry/site/infonote/en

FAO Committee on Forestry (COFO)
www.fao.org/forestry/site/2962/en

FAO Technical Cooperation Programme (TCP)
www.fao.org/tc/tcp/

Global Earth Observation System of Systems (GEOSS)
www.earthobservations.org/index.html

Global Environment Centre (GEC)
www.gecnet.info/

Global Fire Monitoring Center (GFMC)
www.fire.uni-freiburg.de/
www.fire.uni-freiburg.de/GlobalNetworks/globalNet.html
www.fire.uni-freiburg.de/GlobalNetworks/RationaleandIntroduction.html
www.fire.uni-freiburg.de/summit-2003/introduction.htm

Global Fire Partnership (GFP)
www.nature.org/initiatives/fire/partnership/art15303.html

Global Forest Resources Assessment (FRA) (FAO)
www.fao.org/forestry/site/fra2005/en

Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD – a project of GTOS, sponsored by IGOS)
http://gofc-fire.umd.edu/

Global Wildland Fire Network (GWFN) (UN-ISDR)
www.fire.uni-freiburg.de/GlobalNetworks/globalNet.html

Group on Earth Observations (GEO)
www.earthobservations.org/index.html

Incident Command System (ICS)
www.fire.uni-freiburg.de/iffn/iffn_29/IWFS-3-Paper-3.pdf

Institute for Environment and Human Security (EHS) (UNU)
www.ehs.unu.edu

International Association of Wildland Fire (IAWF)
www.iawfonline.org/

International Boreal Forest Research Association (IBFRA)
www.ibfra.org/

International Forest Fire News (IFFN)
www.fire.uni-freiburg.de/iffn/iffn.htm

International Geosphere-Biosphere Programme (IGBP)
www.igbp.kva.se/cgi-bin/php/frameset.php
http://diotima.mpch-mainz.mpg.de/bibex/

International Global Atmospheric Chemistry (IGAC)
www.igac.noaa.gov/
http://diotima.mpch-mainz.mpg.de/bibex/

Integrated Global Observing Strategy (IGOS)
www.igospartners.org/Part.htm
http://gofc-fire.umd.edu/

International Tropical Timber Organization (ITTO)
www.itto.or.jp/live/index.jsp

International Union of Forestry Research Organizations (IUFRO) (OCHA)
www.iufro.org/science/divisions/division-8/80000/80100/80110/

Moderate Resolution Imaging Spectroradiometer (MODIS)
http://modis.gsfc.nasa.gov/

OPEC Fund for International Development (OFID)
www.opecfund.org/about/about.aspx

Organization of the Petroleum Exporting Countries (OPEC)
www.opec.org/home/

Platform for the Promotion of Early Warning (PPEW)
www.unisdr.org/ppew/

Space Technology and Disaster Management (STDM) (UNOOSA)
www.unoosa.org/oosa/SAP/stdm/index.html

The Nature Conservancy (TNC)
http://www.nature.org/initiatives/fire/science/index.html
www.nature.org/initiatives/fire/partnership/art15303.html

Unexploded ordnance (UXO)
www.halotrust.org/

United Nations Conference on Environment and Development (UNCED)
www.un.org/geninfo/bp/enviro.html

United Nations Convention to Combat Desertification (UNCCD)
www.unccd.int/

United Nations Disaster Relief Organization (UNDRO – founded 1971; since 1998 OCHA)

United Nations Economic Commission for Europe (UNECE)
www.unece.org/trade/timber/ff-stats.html

United Nations Educational, Scientific and Cultural Organization (UNESCO)
www.unesco.org/

United Nations Environment Programme (UNEP)
http://grid2.cr.usgs.gov/

United Nations Forum on Forests (UNFF)
www.un.org/esa/forests/index.html

United Nations Framework Convention on Climate Change (UNFCCC)
http://unfccc.int/2860.php

United Nations Institute for Training and Research (UNITAR)
www.unitar.org/

United Nations International Decade for Natural Disaster Reduction (IDNDR – 1990s; since 2000 UN-ISDR)

United Nations International Strategy for Disaster Reduction (UN-ISDR)
www.unisdr.org/eng/task%20force/tf-working-groups4-eng.htm

United Nations Office for Outer Space Affairs (UNOOSA)
www.unoosa.org/oosa/SAP/stdm/index.html

United Nations Office for the Coordination of Humanitarian Affairs (OCHA)
www.reliefweb.int/ochaunep/

United Nations Operational Satellite Applications Programme (UNOSAT) (UNITAR) – implemented in cooperation with the United Nations Office for Project Services)
http://unosat.web.cern.ch/unosat/

United Nations Register of Military, Civil Defence and Civil Protection Assets (MCDA)
http://ocha.unog.ch/cr/register.asp?MenuID=1&MenuEntryID=2&SearchTypeID=1

United Nations University (UNU)
www.unu.edu/

Wildland Fire Advisory Group (WFAG) (UN-ISDR)
www.unisdr.org/eng/task%20force/tf-working-groups4-eng.htm

World Conference on Disaster Reduction (WCDR)
www.unisdr.org/eng/hfa/hfa.htm

World Conservation Union (IUCN) (formerly International Union for the Conservation of Nature and
Natural Resources)
www.iucn.org/

World Health Organization (WHO)
www.who.int/docstore/peh/Vegetation_fires/vegetation_fires.htm

World Meteorological Organization (WMO)
www.wmo.ch/index-en.html

World Weather Research Programme (WWRP)
www.wmo.int/web/arep/wwrp/wwrp_homepage.shtml

World Wide Fund for Nature (WWF)
www.panda.org/about_wwf/what_we_do/forests/problems/forest_fires/index.cfm

Annex 6: Publications available on fire management

Fire Management Working Papers: Thematic Paper series

Note: In code "Working Paper FFM/xx", "x" indicates the WP series number and a suffix E, F or S indicates: E = English, F = French, S = Spanish, in case of multilingual papers. No suffix indicates E only.

Available at the Fire Management Web site: www.fao.org/forestry/site/35853/en

Working Paper FPF/1E   *Guidelines on Fire Management in Temperate and Boreal Forests*. November 2002.

Working Paper FM/2E   *International Wildland Fire Management Agreements Template*. Tom Frey, Ricardo Vélez Muñoz. January 2004.

Working Paper FM/3E   *Legal Frameworks for Forest Fire Management: International Agreements and National Legislation*. Fernando Fernández Arriaga, Frédéric St-Martin, Tom Frey, Ricardo Vélez Muñoz. March 2004.

Working Paper FM/4E   *Community-Based Fire Management in Spain*. Ricardo Vélez Muñoz. April 2005.

Working Paper FM/5E   *Report on Fires in the South American Region*. María Isabel Manta Nolasco. March 2006.

Working Paper FM/6E   *Report on Fires in the North East Asian Region*. Leonid Kondrashov. March 2006.

Working Paper FM/7E   *Report on Fires in the Baltic Region and adjacent countries*. Ilkka Vanha-Majamaa. March 2006.

Working Paper FM/8E   *Report on Fires in the Mediterranean Region*. A.P. Dimitrakopoulos and I.D. Mitsopoulos. March 2006.

Working Paper FM/9E   *Report on Fires in the Sub-Saharan Africa (SSA) Region*. Alexander Held. March 2006.

Working Paper FM/10E   *Report on Fires in the South East Asian Region*. B.J. Shields, R.W. Smith and D. Ganz. March 2006.

Working Paper FM/11E   *Report on Fires in the Balkan Region*. N. Nikolov. March 2006.

Working Paper FM/12E   *Report on Fires in the Caribbean and Mesoamerican Regions*. A.M.J. Robbins. March 2006.

Working Paper FM/13E   *Report on Fires in the Australasian Region*. P.F. Moore. March 2006.

Working Paper FM/14E   *Report on Fires in the South Asian Region*. A.M. Benndorf and J.G. Goldammer. March 2006.

Working Paper FM/15E   *Report on Fires in the North American Region*. R. Martínez, B.J. Stocks and D. Truesdale. March 2006.

Working Paper FM/16E   *Report on Fires in the Central Asian Region and adjacent countries*. Johann G. Goldammer. March 2006.

Working Paper FM/17E   *Fire Management: Principles and Strategic Actions. Voluntary Guidelines for Fire Management.* Forest Resources Development Service. December, 2006

Working Paper FM/18E   *Fire Management: Review of International Cooperation.* Forest Resources Development Service. December 2006.