UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

INTERNATIONAL FOREST FIRE NEWS

No. 11 – July 1994

UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

INTERNATIONAL FOREST FIRE NEWS

No. 11 – July 1994

CONTENTS

International Forest Fire New is prepared on behalf of the Joint FAO/ECE/ILO Committee on Forest Technology, Management and Training and its secretariat, the ECE/FAO Agriculture and Timber Division. Copies are distributed and available on request from:

ECE/FAO Agriculture and Timber Division
Palais des Nations
CH - 1211 GENEVA 10
Fax: ++41-22-917-0041

The publication is edited by Johann Georg Goldammer, Max Planck Institute for Chemistry, Mainz (Germany).

Please note the new address of the editor on the next page.

Mailing address, telephone and fax numbers have changed starting 10 October 1993

Johann Georg Goldammer
Fire Ecology Research Group
c/o Freiburg University
P.O.Box
D - 79085 FREIBURG

Fax: ++49-761-80 80 12
Phone: ++49-761-80 80 11
Telex: 41 87 674 mpch d
E-mail: jggold@sun1.ruf.uni-freiburg.de

Call for contributions: Readers of the International Forest Fire News are warmly invited to send written contributions to the editor at the above address. These may be in the form of concise reports on activities in wildland fire management, research, public relations campaigns, recent national legislation related to wildfire, reports from national organizations involved in fire management, publications, personal opinions (letters to the editor). Photographs (black and white) and graphs, figures and drawings (originals, not photocopies, also black and white) are also welcome. Contributions are preferably received by **e-mail or on diskettes (WP 5.1)**. Figures should be mailed separately.

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

The International Forest Fire News is produced under the sponsorship of the Joint FAO/ECE/ILO Committee on Forest Technology, Management and Training and in cooperation with:

The International Union of Forestry Research Organizations (IUFRO)
Subject Group S.1.09 Forest Fire Research

The International Global Atmospheric Chemistry (IGAC) Project (IGBP)
Focus Impact of Biomass Burning on the Atmosphere and Biosphere
("Biomass Burning Experiment" [BIBEX])

The International Boreal Forest Research Association (IBFRA)
Stand Replacement Fire Working Group

The International Association of Wildland Fire

EDITORIAL

At the begin of 1994 the Team of Specialists on Forest Fire, one of the groups of specialists in forest sciences and forestry established under the auspices of the Joint Committee of the International Labour Organization (ILO), the Economic Commission for Europe (ECE) and the Food and Agriculture Organization of the United Nations (FAO), has been reactivated. The work accomplished by the Team is well known to the readers of International Forest Fire News (IFFN): This newsletter is one of the expressions of the scope and continuity of the team's work since the decision was taken to create this information organ. The distribution of IFFN was first directed to forest and fire management agencies and researchers of the ECE region. The other task of the Team was - and still is - to periodically bring together fire specialists from the policy, management, and research levels and to discuss specific issues of importance within a seminar to be hosted by one of the ECE member states.

With a broader distribution of IFFN the Team began to expand its visions of international cooperation outside of ECE's forest domain. This is reflected by an increasing number of readers and contributions from non-ECE member countries and from non-forest environments in which fire is playing a significant ecological and economic role.

When the reactivated Team convened in Geneva in April 1994 it was unanimously decided to continue to foster international cooperation and information on a global base. Strong support toward this endeavour is given by many organizations, four of which are mentioned as co-sponsors of IFFN on the opposite page (p.iv). All of these organizations have a distinct task in international wildland fire research:

IUFRO is looking back to more than 100-years of tradition in international cooperation in forestry research. At present IUFRO is investigating structural/organizational changes which may also affect its role in fire research.

IGBP/IGAC/BIBEX offers the organizational frame for basic research on the impact of fire on the biosphere and the atmosphere. Its scope goes beyond the investigations of forest fires: It includes all vegetation fires and other plant biomass burning as well.

IBFRA is the most recent cooperative effort devoted to fires in the boreal system and specifically trying to link fire research with forest inventory and global carbon cycle research.

IAWF is the first and exclusive international association for professionals. It offers a variety of services to its members all over the world: A scientific journal (International Journal of Wildland Fire), an association newsletter (Wildfire), regularly updated information on recent publications (Current Titles in Wildland Fire), sale of books, etc. These publications are sharing tasks with IFFN, i.e. to avoid duplication of publication efforts.

This closely linked network of fire professionals throughout the world provides a sound base for new tasks in fire research, management, and even for mutual cooperation/assistance in case of critical fire situations. Thus, it offers a unique opportunity to implement the requirements of the UNCED process which should lead toward protection and sustainable development of the global vegetation resources.

It is now being investigated how to build structures for a system in which global fire programmes, e.g. global fire inventories, global fire monitoring, or fire disaster management assistance, will be handled on a permanent operational base.

This extremely challenging task will be supported by the ECE/FAO Team of Specialists on Forest Fire. It is hoped to receive further support through the community of fire professionals, e.g in one of the first steps, the initiative of a Global Vegetation Fire Inventory. Readers are kindly requested to observe the last pages of this issue and to contribute to a very first, quick survey of vegetation fires in their home area.

Johann G. Goldammer

COUNTRY NOTES

CANADA

The 1993 Forest Fire Season

The 1993 fire season in Canada was one of the lowest on record, with only 6,041 fires being recorded as of 31 December. The season began with low over winter precipitation bringing northern Alberta, Saskatchewan, and Manitoba, along with the southern half of the Northwest Territories into the fire season with extremely high drought codes (DC). Some of the DC's were exceeding 600 by mid May.

Dry lightning storms in mid May triggered multi-fire starts in northern Alberta and Saskatchewan, requiring the mobilization of additional land based tankers into Saskatchewan. On 3 June, Saskatchewan reported a fire originating on the Primrose Air Weapons Range (Deer Fire) at 47,000 ha. This fire was destined to plague them for the bulk of the 1993 season, with its final size being reported in excess of 300,000 ha.

Early June saw another lightning incident hit the dry areas of central Canada with Alberta receiving 237 fires, from 7 to 10 June. Additional air tankers, ground pumps and hose were mobilized to meet the need. By late June the Saskatchewan "Deer Fire" had grown substantially and another fire named the "Dino Fire," required the evacuation of 350 people and had grown to project size, stretching their already depleted resources. Additional hand tools, pumps and accessory equipment were mobilized to assist. Problem fires in northern Manitoba necessitated the evacuation of Wabowden on 22 June and Lynn Lake on 30 June.

July seemed to be a repeat of the 1992 season with cool wet weather blanketing most of Canada and effectively reducing the fire threat, and fire incident for the month. The Northwest Territories was the exception with numerous lightning storms tracking along the Mackenzie Valley giving rise to 203 fires reported from 10 June to 10 July. Four additional DC-6 groups and a CL-215 group were mobilized to meet the demand. Numerous fires in the Norman Wells area, one of which posed a threat to an oil refinery site, resulted in the Wells being placed in an evacuation mode, but was not enacted.

Thirty-four resource orders were processed through CIFFC during the 1993 fire season. This number does not allow for the numerous quick strike arrangements, nor the many requests for information on available resources. Twenty one air tanker groups, 110 pumps, 3,800 lengths of hose, 400 shovels, 350 pulaskis, 70 radios and other assorted ground equipment, some specialty teams and a high level infrared line scanner were mobilized in support of fire management activities during the 1993 fire season. Although the 1993 fire season was generally speaking, very mild, the number of resources moved shows a growing reliance on resources housed in other agencies. This continued sharing of resources reinforces the need for nationally accepted exchange standards for all fire management resources.

As far as the fire numbers go, Canada has experienced a below average fire year with 6,041 fires for 1,917,913 ha reported as of 31 December 1993.

The following statistics (Tab.1) show that out of a total of 6,041 fires burning 1,917,913 ha, 437 were actioned under a Modified Response, burning 1,672,936 ha. A Modified Response fire is one that is allowed to burn within set policy and management guidelines or may be actioned in a limited manner to bring the fire back into those guidelines. The fires that received a Modified Response account for only 7.2% of the total number of fires but 87.2% of the total burned area.

Wildfires in which structures and or other human development have been lost or damaged, have become known as "Interface Fires." Table 2 shows the wildfire damage estimate for 1993 as compared to 1990, 1991 and 1992. There have been no fire related fatalities reported during the 1993 fire season compared to 2 in 1992, 4 in 1991, 3 in 1990, 0 in 1989, 3 in 1988, 3 in 1987 and 6 in 1986.

Tom Johnston

Canadian Interagency Forest Fire Centre
210-301 Weston Street
CDN - Winnipeg, Manitoba R3E 3H4

Tab.1. Canada forest fire statistics of 1993

	Number of Fires			Area Burned (ha)		
Province	Full Response	Modified Response	Total	Full Response	Modified Response	Total
BC	1,503		1,503	5,180		5,180
YT	99	37	136	9,340	76,775	86,115
AB	848		848	24,368		24,368
NT	333	136	469	132,956	725,621	858,577
SK	514	132	646	47,816	566,011	613,827
MB	192	47	239	3,685	63,590	67,275
ON	704	39	743	8,770	95,911	104,681
QC	517	25	542	984	127,250	128,234
NF	66	17	83	10,130	16,868	26,998
NB	430		430	551		551
NS	315		315	369		369
PE	29		29	87		87
PC	54	4	58	741	910	1,651
TOT	5,604	437	6,041	244,977	1,672,936	1,917,913

Tab.2. Losses caused at the wildland/residential interface in 1993 as compared to 1990-1992

Agency	Interface Losses (Canadian $)			
	1990	1991	1992	1993
BC	169,425	180,000	513,750	103,337
YT	50,600	--	30,300	--
AB	--	--	--	--
NT	--	--	--	10,000
SK	--	--	--	--
MB	--	--	--	--
ON	209,150	217,500	9,500	151,200
QC	70,100	80,896	69,300	5,745
NF	140,400	410	680	3,230
NB	--	125,000	19,500	--
NS	166,650	109,700	5,200	100,300
PE	--	--	--	--
PC	--	--	--	--
Total	873,825	713,106	648,230	573,812

CHILE

Forest Fires in Chile

The vegetated surface of Chile susceptible to the occurrence of wildfires is ca. 29 million ha (corresponding to approximately 45% of the continental area of Chile) made up basically of native forests, brushlands and prairies. In addition there are 1.6 million ha of plantations, principally of Monterrey Pine (*Pinus radiata*) and *Eucalyptus* species. The fire season normally begins in November, reaches its peak in January and February, decreases in March, and ends in April. However, years with a dry winter or an early finishing or a later beginning of the rainy season may extend the fire season in some regions. Lightning storms or other natural agents (e.g. volcanic activities) as wildfire causes are insignificant or not present. Fires escaping from controlled burning in forests and in the agricultural sector, and children playing with matches are the most important causes. In the last season arson showed a critical increase. An average of ca. 5,000 wildfires is affecting ca. 50,000 ha of land per year. Detailed statistics for the period 1989-94 are given in Table 1.

Under one of the Technical Departments of the Chilean Forest Service, the National Forest Corporation (Corporación Nacional Forestal [CONAF]), the Fire Management Department is in charge of coordinating and executing activities connected with the protection of natural resources against the occurrence of forest fires and damage. First priority is given to protect national parks, forest reserves and wilderness areas (under administration of CONAF) and to support actions in forest lands of medium and small farmers. Large forest companies are responsible for protecting their lands since 1979.

Since practically all of the fires have a human origin one of the fundamental activities of this programme is the prevention of forest fires. A recently launched nationwide public education campaign aims at influencing the attitude of Chileans with regard to natural resources, to publicize the new lines of action of National Fire Management, and to stop the indiscriminate use of fire in forests and agricultural land.

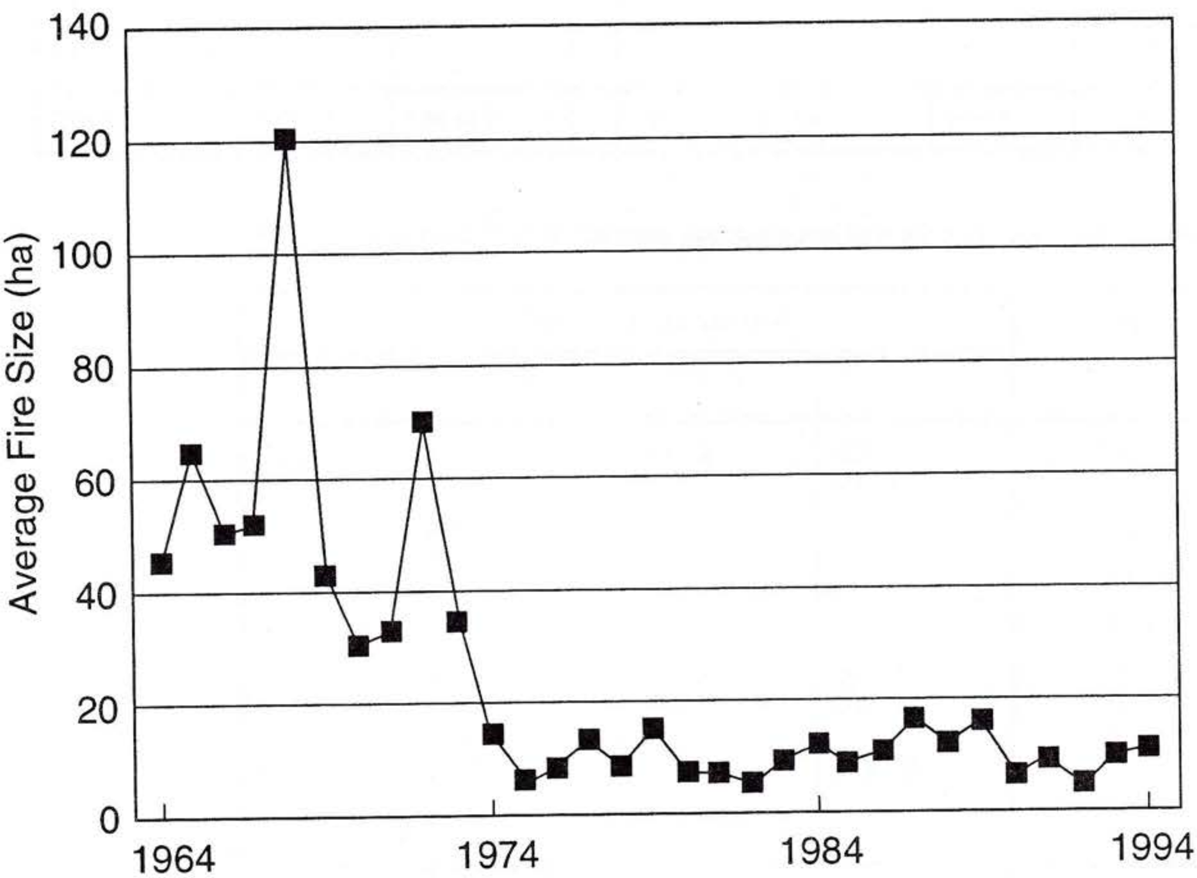

Fig.1. Average size of forest fires in Chile between 1964 and 1994.

Tab.1.: Number of wildfires and vegetated area affected by fire in Chile between 1989 and 1994

Fire Season	Number of Fires	Vegetated Area Burned (ha)										
		Forest Plantations				Natural Vegetation				Forest Total [1]	Other Areas [2]	Grand Total
		Pines	Eucalypts	Other	Total	Natural Forest	Brush-lands	Grass-lands	Total			
1989-90	4,130	2,026	519	16	2,561	5,353	9,356	6,685	21,394	23,955	4,026	27,961
1990-91	5,194	4,848	998	55	5,901	7,677	14,401	12,687	34,765	40,666	9,607	50,273
1991-92	4,786	1,187	653	26	1,866	1,942	8,347	9,499	19,788	21,654	2,505	24,159
1992-93	6,114	8,637	2,096	98	10,831	5,914	14,504	15,142	35,560	46,391	4.034	50,425
1993-94	4,893	3,110	2,839	13	5,962	9,893	19,633	18,961	48,487	54,449	2,142	59.591

[1] Total of Forest Plantations and Natural Vegetation
[2] Agricultural Lands

The Fire Management Programme is carried out by a permanent staff of forest engineers and technicians. During each fire season CONF hires 1,400 temporary labourers for activities such as aerial and ground-based fire detection, radio operators, dispatchers, suppliers, crew bosses, squad bosses, and fire-fighters. Some positions, like dispatchers and crew bosses, are generally maintained during the off-season.

Each fire season CONF operates with 75 crews, the number of hired fire fighters in each crew is 23, with the age from 19 to 29. The equipment and water pumps were purchased from Canada. During each season CONF rents two light air tankers (Dromader M-18) and 7 helicopters (Bell Jet Ranger, Long ranger, Alouette, and Bell 204 B), depending on the available market and budget. Some fire-fighting operations have been carried out using Sims PTF-150 or Bambi buckets. For fire detection 59 lookout towers are operated and 27 light planes are rented for air patrol from air clubs or private companies.

Due to the fast response and efficiency of the organization, 86.3% of the fires are extinguished before burning an area of 5 ha. Only 0.9% of the total fires exceed 200 ha. Figure 1 shows the average size of forest fires between 1964 and 1994.

Herbert Haltenhoff
Chief, National Prevention Program

National Forest Corporation CONF
Av. Bulnes 285, of. 401
Santiago de Chile
Chile

Fax: + +56-02-6712007

SOUTH AFRICA

Wildfires in Industrial Plantations

Even-aged pine and eucalypt plantations have been established in South Africa since the late 1800's to supplement the dwindling indigenous timber resources. By 1991 the area covered by these plantations reached a total area of more than 1.5 million ha, by far the biggest man-made forest on the African continent.

Most of the natural vegetation of the country where the plantations were established have a natural fire history and need fire regularly to survive (e.g. fynbos, montane grassland and savanna), and the species introduced for commercial purposes also originate from habitats where fire plays a significant role in these ecosystems. It is no wonder that the almost total exclusion of fires from these managed plantations gives rise to regular wildfire situations as fuel accumulates to alarming proportions, particularly during adverse weather conditions. The history of wildfires during the 1979-1989 period reflects this regular occurrence, although there were surprisingly fewer larger fires experienced during this period (Tab.1 and 2). However, it must be noted that these statistics exclude State-owned plantations, thus representing only ca. 57% of the total planted area.

The year 1989 was disastrous for the State-owned plantations, when during the course of a few weeks, first 2,500 ha were lost at Entabeni in the Northern Transvaal, and then 5,400 ha at Nyalazi and Dukuduku plantations in Zululand.

During 1992 a serious drought affected most of the Transvaal and Natal forest regions, when many large areas of plantations died as a result of moisture stress, adding a lot of fuel to the already tender-dry forest floor material in plantations. Although there were far more periods of high fire danger experienced in 1992 than in 1991, losses from wildfires were surprisingly lower than the previous year: Although 792 fires were recorded and attacked from the air, only a total area of 9,333 ha was lost during this season (Meikle et al., 1992).

Tab.1. Summary of plantation areas affected by wildfires during the period 1.4.1979-31.3.1985 (Le Roux 1988).

Geographical Area	Total area afforested (ha)	Total area burnt (ha)	Percentage of total area burnt (%)	Total financial losses (Rand)
Eastern Transvaal Highveld	39,644	5,496	13.86	973,818
Eastern Transvaal Lowveld	185,277	2,290	1.23	476,253
Southern Transvaal Highveld	132,317	4,411	3.33	1,726,453
Sabie Area	83,033	5,544	6.68	30,420
Northern Transvaal	38,941	541	1.39	44,370
Natal Midlands	213,740	14,420	6.75	8,562,028
Natal Interior	42,028	7,866	18.72	222,798
Zululand	16,259	217	1.33	35,985
Southern Cape	2,000	4	0.20	---
TOTAL	753,239	40,789	5.41	12,074,866

Tab.2. Summary of plantation areas affected by wildfires during the period 1.4.1985-31.3.1989 (Kromhout 1990)

Geographical Area	Total area afforested(ha)	Total area burnt (ha)	Percentage of total area burnt (%)	Total financial losses (Rand)
Eastern Transvaal Highveld	38,593	3,055	7.92	4,024,660
Eastern Transvaal Lowveld	225,079	1,825	0.81	271,519
Southern Transvaal Highveld	212,092	2,804	1.32	1,535,180
Sabie Area	61,747	377	0.55	59,991
Northern Transvaal	45,868	236	0.51	94,451
Natal Midlands	177,705	2,605	1.47	1,590,317
Natal Interior	49,430	438	0.89	271,161
Zululand	46,240	873	1.89	358,990
Southern Cape	1,000	1	0.10	-
TOTAL	857,754	12,214	1.42	8,206,269

Although some time was spent on ad-hoc fire impact studies during the preceding 2-3 years, fire research studies in plantations reached an all time low level, with only the writer involved in some ad-hoc research experiments. Nevertheless, prescribed burning was successfully introduced in *Pinus patula* stands in Kangwane plantations near Swaziland, while wildfire damage assessment resulted in significant savings of timber volumes.

References

De Ronde, C., J.G.Goldammer, D.D.Wade and R.V.Soares 1990. Prescribed fires in industrial pine plantations. In: Fire in the tropical biota (J.G.Goldammer, ed.), 216-272. Ecological Studies Vol.84, Springer-Verlag, Berlin-Heidelberg-New York, 489 p.

Kromhout, C. 1990. Analysis of fires in privately-owned plantations in the Republic of South Africa. South Africa Forestry Journal 146, 74-87.

Le Roux, P.J. 1988. Analysis of fires in privately-owned plantations in the Republic of South Africa. South Africa Forestry Journal 146, 55-66.

Meikle, S. 1992. 1992 fire season analysis. Inferno Magazine Jan./Feb.1993, 6-7, 17.

Neels De Ronde

Division of Forest Science and Technology
Private Bag X11227
SA - Nelspruit 1200

The Forest Fire Association: A Portrait

The Forest Fire Association (FFA) is a private forest fire fighting organisation which was started in 1976 in the Eastern Transvaal province of South Africa, covering a total land area of 5 million ha of which 600,000 ha are planted with trees. FFA's main base is situated at the town of Nelspruit with three regional bases at Peat Retief, Warburton and Tzaneen. These regional bases have permanently staffed operation centres with aircraft based between 1 June and 31 October every year. The FFA operates off 60 secondary bases from which water, chemicals, and aircraft fuel are available. They are ideally not more than 20 km apart.

The following service is provided by the FFA to its members:

Four operation centres: These centres coordinate the movements of all spotters, bombers and helicopters, including the Air Force helicopters which come in to assist from time to time. The operational centres supply weather forecasts daily, calculated locally at each centre with computer programmes, as well as coordinate the planning, containing and reaction to all fires in the area.

Seven spotter aircraft: Cessna C-182 and C-206 are used which are equipped with the most up to date radio and communication equipment (NAT AMS 44) and flown by spotter pilots with individually more than 3 years of fire fighting experience (at present an experience of 38 years of spotter flying has been accumulated). These aircraft play a vital role in fire fighting and are used as a control platform for fire bosses as well as controlling and directing ground resources, bombers and helicopters.

Twelve water bombers: The M-18 Dromaders and Ayres Thrushes are used to bomb fires because of the terrain and landing areas limiting the operations to single-engine agriculture type aircraft with a delivery rate of 17,000 litres of foam/hr. Up to a maximum of eight water bombers are used on an individual fire, giving a total delivery rate of 136,000 litres of foam/hr. All water is loaded on land based airstrips with a loading time from wheels touch to wheels off of maximum three minutes. These aircraft are flown by pilots with no less than at least 3 years of fire-fighting experience or 3 years of crop spraying experience. At this stage the bomber pilots have combined 49 years of fire fighting experience.

One Helicopter: One MI-8 Russian helicopter is used and has the capacity to carry 22 fire fighters or a Bambi bucket with a capacity of 3,500 l. The airborne team is normally made up to 4 rapattackers (or: helirapellers) and ±16 unit crew members. In 1993 operations were extremely successful, and the system will be operational again in 1994.

The FFA is called to ± 200 fires and is flying ±800 hours per season. It has managed to reduce both the size and duration of fires by 50% over the first five years of operation.

The directors of the Forest Fire Association have introduced a number of changes to transform the organisation into a more efficient and economic body. The reorganized FFA is based on four related and integrated elements: a strong central organisation with regional control centres, aerial fire fighting services under a single resource-sharing umbrella, a rapid initial attack and a swift, effective deployment of resources to fires.

This decision has necessitated the FFA to shed other non-fire activities such as crop spraying and charters. The FFA has been reorganised into a leading edge organization characterized by centralization, by strategic decision making at the directors' level, and by autonomy of tactical decision making at branch level. With this streamlined chain of command, the decision-making process is greatly simplified. The great strength of centralisation is the reduced number of resources that are needed to provide an efficient and affordable service. This is the only way to combat the rising cost. One of the fundamental goals of the FFA is to control efficiently forest fires at the lowest possible costs. In this context, fire must be detected practically at the moment of ignition and then effectively and correctly fought in the first stages in order to guarantee that the initial attack will be a success and the overall cost minimized.

At present it is being negotiated to install the highly successful SRI-10 fire detection system on a trial basis at Warburton. If it proves to be of benefit it will be expanded as necessary. The FFA has agreed to make available the operation centres at Warburton for the installation of Alenia Equipment. The intention is to operate the FFA equipment parallel to the Alenia equipment. The suppliers Degli/Alenia will be responsible for the installation and setting up of the equipment in the Warburton operation centre as well as at the local tower observation post. In addition the company will provide FFA with an implementation schedule to coordinate the installation with the Warburton personnel. In turn, personnel at this centre will offer advice on the existing equipment and procedures at the centre.

FFA personnel at Warburton have agreed to undergo a short training course presented by Degli/Alenia on the operation of the equipment at the Warburton centre. They have also agreed to operate the equipment according to the training, and where necessary record and provide Degli with data as required to accurately access the equipment.

The degree of the effectiveness of the initial attack ultimately determines the magnitude of a forest fire. The planning of the attack, its launching and its conduct are an integral part of the FFA. At the fire control centre, the success of an initial attack relies on the strategic management of aerial and land-based resources as well as rapid decision making. The immediate deployment of forces on alert, swift intervention and close monitoring of results are critical to success. Considering this statement FFA is negotiating the establishment of a radio network using latest trunking technology, taking into consideration a business plan and feasibility study, network design, site selection and radio coverage prediction.

Considering the achievements, technical developments and operational experiences of key fire fighting systems worldwide, to make a success of aerial fire fighting in South Africa, we must focus on a new structure to achieve smaller fire losses at lower costs, uniform standards and policies, and the involvement of all members. With this in mind, the new FFA structure has been changed to a total of five directors elected by the members at the annual general meeting. In addition four branch chairmen will be elected at branch level and will have representation on the board of directors. One full time general manager will be employed by the FFA. Four branch managers will be contracted for the fire season to service the Nelspruit, Warburton, Piet Retief and Tzaneen branches. Services and equipment such as spotters, bombers, helicopters and administrative contacts will be negotiated with specialist companies. This then relieves the FFA of the responsibility of employing pilots and personnel, acquiring capital items such as aircraft, hangars, and buildings. All risks are thus removed from the FFA operators and exposure is minimized.

The FFA will concentrate on providing its members with the best service possible. Services will continue to include spotters, bombers, helicopters, communication, centralisation, resource sharing, effectiveness, initial attack, fire management systems, fire weather monitoring systems, training, statistical gathering and many more fire-related subjects that are continually being developed to help to overcome the ever threatening problem of fire destroying natural resources and environment.

Johann Heine
General Manager

Forest Fire Association
Operations Centre, Nelspruit Airport
P.O. Box 4555
SA - Nelspruit 1200

Fax: ++27-1311-41761
Phone: ++27-1311-41030/1

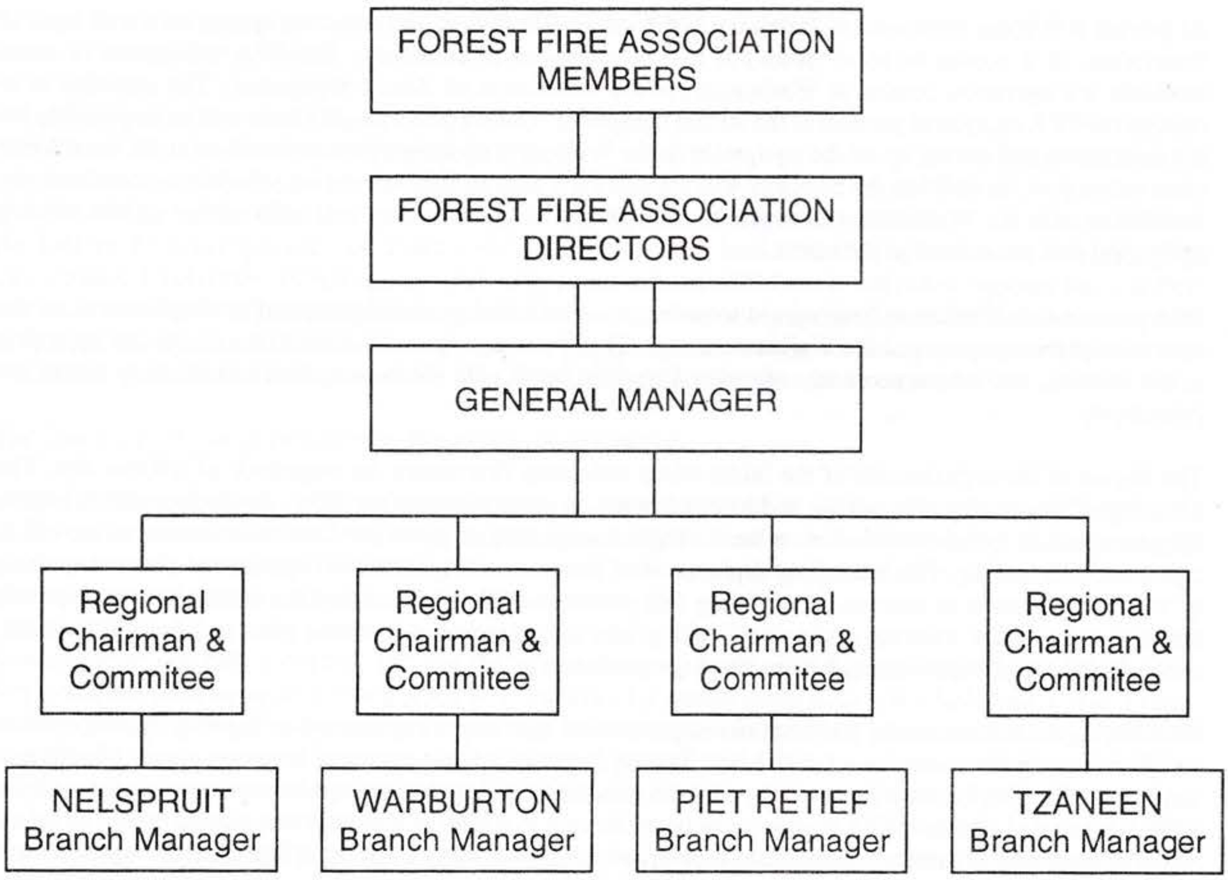

Fig.1. Organizational diagram/line of command of the Forest Fire Association (FFA)

Some Notes on Current Fire Research in South Africa

Fire research in South Africa has traditionally been based in the fields of forestry and agriculture, particularly pasture science, with significant inputs from academic institutions. Both the forestry and agriculture approaches have been based to a large extent on long-term research sites. While this emphasis is declining in response to changing priorities in government funding, many useful reviews have been published (see, for example, Booysen and Tainton 1984, van Wilgen et al. 1990, 1992, Scholes and Walker 1993), and these form the basis for a continuing interest in fire ecology and also for the formulation of fire management policies in the country[1].

A number of current developments in the field of fire research will be of interest to readers. The first of these is the SAFARI experiment. SAFARI, the Southern African Fire-Atmosphere Research Initiative, forms part of the Southern Tropical Atlantic Regional Experiment (STARE) and is jointly conducted with its Eastern component TRACE-A (Transport and Chemistry near the Equator in the Atlantic)(see IFFN No.7, p.22-24, and No.8, p.22-23).

SAFARI is an international cooperative research programme aimed at quantifying the role of savanna fires in the global carbon cycle and the production of ozone and greenhouse gases. The programme is highly interdisciplinary and stresses major inputs from local African scientists and extensive international participation, particularly from Germany, the U.S.A., France and Canada. The project combined observation from a DC-8 aircraft over the ocean and with the measurements carried out by smaller aircraft and ground based facilities. An important focus on the measurement campaign was South Africa, where prescribed experimental fires took place in the Kruger National Park in savannas whose history and ecology are well documented. The climax of the research campaign was in September 1992, when two prescribed burns of about 2,000 ha each were carried out, and extensive ground and aerial measurements were made. Additional, and more widespread, measurements were made in Swaziland, Zimbabwe, Namibia and Zambia.

Several scientific papers of topical scientific interest in a globally important field have been produced. The papers were presented at a data workshop held in Stellenbosch, South Africa, in May 1993. Results of the data workshop are to be published in a dedicated issue of the *Journal of Geophysical Research* (ca. end of 1994). A second product aimed at a wider readership of managers, policy makers and environmentalists, is being written by participating scientists. The book will be published locally, to ensure a reasonable price and local impact, by the Witwatersrand University Press (ca. early 1995). The book will be edited by two overseas editors (M.O. Andreae and J.G. Goldammer) and two local editors (Janette Lindesay and Brian van Wilgen).

---

[1] **References:**

Booysen, P.de V., N.M.Tainton (eds.) 1984. Ecological effects of fire in South African ecosystems. Ecological Studies Vol.48, Springer-Verlag, Berlin-Heidelberg-New York, 426 p.

Richardson, D.M., B.W.van Wilgen, D.C.le Maitre, K.B. Higgins, G.G.Forsyth 1994. Using computer technology in fire management: an example from the mountain catchment areas of Cape Province, South Africa. International Journal of Wildland Fire 4(1)(in press).

Scholes R.J., B.J.Walker 1993. An African savanna: Synthesis of the Nylsvley study. Cambridge University Press, Cambridge.

van Wilgen B.W., C.S.Everson, W.S.W.Trollope 1990. Fire management in southern Africa: some examples of current objectives, practices and problems. In: Fire in the tropical biota (J.G.Goldammer ed.), 179-215. Ecological Studies Vol.84. Springer-Verlag, Berlin-Heidelberg-New York, 489 p.

van Wilgen B.W., D.M.Richardson, F.J.Kruger, H.J.van Hensbergen (eds.) 1992. Fire in South African mountain fynbos: Ecosystem, community and species response at Swartboskloof. Ecological Studies Vol. 93, Springer-Verlag, Berlin-Heidelberg-New York, 325 p.

Another current development is aimed at the creation of a GIS-based fire management system for the mountain areas of the Western Cape province, to provide objective procedures for managing fire. Prescribed burning is carried out in the mountain catchments to rejuvenate the indigenous fynbos (shrubland) vegetation, to reduce fire hazard, and to control invasive alien plants. Fire is the only practical tool for achieving these aims in the mountainous terrain. Although recent research has improved understanding of the response of these systems to fire, managing fire to achieve goals is very difficult. The system comprises a central geographical information system for managing and processing spatial data, linked to personal computers with DBase IV databases and simple rule-based models for decision-making. Current applications are:

- prioritization of areas for burning
- monitoring the success of fire management
- mapping fire hazard for fire control planning
- production of management summaries and statistics.

The results of this work have been recently been published (Richardson et al. 1994).

Researchers at South African Universities, and notably at the Botany Department of the University of Cape Town, continue to do pioneer work in the field of fire ecology. The challenge in South Africa today is to ensure that the research remains relevant and contributes to the development of solutions to management problems.

Brian van Wilgen

Division of Forest Science and Technology
Jonkershook Forestry Research Center
Privat Bag X5011
SA - Stellenbosch 7600

Fax: +27-21-8838394
Phone: +27-21-8839771

TECHNOLOGY NEWS

CANADA

Aircraft and Forest Fire Control in Canada

A pioneer in the use of aircraft for forest fire patrol, Canada has become a recognized world leader in the development of effective and cost-efficient ways of using aircraft for forest fire fighting. In recent years, several foreign countries with forest protection problems have either sent their personnel to Canada or hosted visits by our experts to learn how we use forest fire attack aircraft.

It's now a little over 42 years since an Ontario Lands and Forests Beaver aircraft made the first recorded fire bombing attack in Canada, dropping water-filled paper bags on a fire north of Sault Ste. Marie, Ontario. Since then, federal, provincial and territorial forestry services, as well as private industry, have made a concentrated effort to determine how best to use the airplane, the most valuable single weapon in their fire fighting arsenal.

There was a time when aircraft were considered so expensive, compared to other fire control methods, they were used only when all other measures had failed: a costly practice that did nothing to reduce fire losses. Now, forest fire fighters know the key to efficient fire suppression is rapid initial attack; hitting each potentially dangerous fire while it's still small. It's the aircraft's ability to attack fast, hard and often, in the most difficult terrain, that makes it the fire fighter's best initial attack resource.

Since the adoption of the initial attack concept in Canada, more fires are being controlled sooner and the area burned per fire is decreasing, hence most other negative effects of forest fires are also declining.

The Attack Aircraft

Our forest services use a wide range of forest protection aircraft including light single-engine planes for detection patrol, faster twin-engine types for air attack control and the ubiquitous helicopter for transportation, observation and fire bombing. But it's the fixed-wing fire attack aircraft that represents the heavy artillery in the continuing war against fire.

Canada's current fleet of fixed-wing attack aircraft consists of two types: scoopers and tankers. Scoopers are amphibians or floatplanes capable of scooping water "on the fly" from a lake or river near the fire, injecting a foam concentrate into the water load and dropping it on the fire as a smothering foam.

Scoopers can attack single or multiple fires for several hours at a time, scooping and dropping thousands of litres of water and foam as fast as they can shuttle to and from the nearest water. Tankers are land-based planes which carry fire-retardant chemicals to fires from mixing installations at strategically located airports.

The major deciding factor as to whether a particular region uses scoopers or tankers is the availability of scoopable water. Provinces with an abundance of lakes and rivers such as Newfoundland, Nova Scotia, Quebec, Ontario and Manitoba, use scoopers, while other jurisdictions including British Columbia, New Brunswick and the Yukon use tankers. Alberta, Saskatchewan and the Northwest Territories operate a mix of scoopers and tankers. P.E.I. doesn't have fire fighting aircraft of its own but borrows their services from neighbouring provinces when the situation demands.

In 1992, about 200 fixed-wing attack aircraft, ranging from 1,000-litre-capacity floatplanes to the mighty 20,000-litre-capacity Mars flying boat, and a similar number of helicopters, fought forest fires in Canada. Altogether they dropped about 200 million litres of water, foam and retardants. The mainstay of the scooper force is a fleet of 48 Canadair CL-215s, each carrying 5,350 litres, while the major portion of the tanker fleet is divided equally between the 4,500-litre B-26 and the 3,300-litre Firecat/Tracker.

Solving the Problem of Deployment

There is no doubt that, when compared to other methods of controlling forest fires, aircraft are expensive to buy and operate, but when used effectively, they are fully capable of saving the equivalent of an entire season's operating cost in a single mission by stopping one potentially disastrous fire. The perennial question facing the individual fire control officer is, however, which of several fires burning simultaneously in the region are potentially disastrous?

How to pinpoint the most threatening fires and when and how best to use attack aircraft have been subjects of considerable research ever since the airplane arrived on the forest fire scene. The computer eventually provided researchers with the tool that enabled them to integrate the results of 50 years of studies into a fire behaviour model able to predict the direction and rate of spread of a fire.

By applying more recent high-tech developments to fire management, researchers are now able to forecast, with remarkable accuracy, under what circumstances fires are most likely to occur.

Today, sophisticated communication systems transmit weather forecasts and the degree of fire hazard twice daily to all forest centres across the country. Weather conditions in the forest are reported regularly by unmanned automatic weather stations. Storms are tracked by radar, and lightning strikes are plotted by lightning detectors.

This information, combined in a computer program with the history of fire in the locality and the type and condition of the forest obtained from satellite remote sensing, helps the fire control officer predict where a fire is likely to start and how serious it could become.

Armed with this intelligence, the control officer knows where and when to send out fire detection patrols. With the aid of the Global Positioning System (GPS) the pilot can determine the precise position of a fire and save precious minutes by guiding the air attack controller and fire attack aircraft directly to the scene.

Another recent innovation provides the air attack controller with Forward Looking Infra-red Radar (FLIR) to see through smoke and locate targets and hazards for the attack aircraft. Similar airborne infrared scanning devices map large fires to help the ground attack boss plan strategy. Fire researchers are now using artificial intelligence to devise ways of forecasting resource needs and providing the fire control officer with a decision tool to help determine the resources to use and how best to deploy them.

CIFFC and the National Air Tanker Fleet

It is obvious the fire control officer is getting some much-needed help determining where and when to send available resources, but what does the officer do if all aerial resources are deployed and the situation is still not under control? This is where the Canadian Interagency Forest Fire Centre (CIFFC), the Mutual Air Resource Sharing Agreement (MARS), the CL-215 Cooperative Supply Agreement and the National Air Tanker Fleet enter the picture. Formed in 1982 and based in Winnipeg, Manitoba, CIFFC coordinates the MARS agreement between provinces and territories regarding the sharing of information and fire fighting equipment, personnel and aircraft. During the fire season, the Centre issues daily reports regarding fire situation and resource availability and controls the movement of elements of the National Air Tanker Fleet. The fleet consists of 17 Canadair CL-215s purchased by the Federal Government under the CL-215 cooperative Supply Agreement of September 1983.

Under this agreement, developed by members of the Canadian Council of Resource and Environment Ministers concerned at the rapidly approaching obsolescence of fixed-wing fire attack aircraft, the federal and six provincial governments acquired a total of 29 CL-215s to supplement the 20 CL-215s already operated by Quebec, Ontario and Manitoba.

The federally-owned fleet aircraft are leased to Newfoundland, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and the Northwest Territories for a period of 15 years. The lessee provinces are responsible for operating and maintaining them and making them available to other members, as directed by the Centre, when not required for higher priority situations in their own jurisdictions. Title to the aircraft will be transferred to the lessees when the leases expire.

The problems usually accompanying equipment transfers between operating agencies are largely avoided in the case of fleet transfers because almost all regions have their own CL-215s and can rapidly integrate transferred aircraft into their operations; so rapidly in fact that, on occasion, visiting CL-215s have been directed to fires while still en route to the host destination.

Further performance improvements to Canada's scooper fleet have already begun with the introduction into service of the CL-215T, a turboprop-powered conversion of the piston-engine CL-215. The 215T reaches fires faster and drops over 25 per cent more suppressant in a typical three-hour mission. And fire fighting productivity will be further improved when, in 1994, Canadair begins delivering its CL-415, a new-generation amphibian carrying 15 percent more fire fighting load than its predecessors.

Canada's expertise in producing aircraft expressly for fire control is generating valuable export business. To date, Canadair has sold 102 CL-215s, 215T conversions and 415s to foreign customers: transactions worth, with spares and support, over $650 million. And Conair of Abbotsford, B.C., has sold or leases twenty Firecats and other tankers overseas and is presently developing a fire control centre and initial attack system for Mexico. Forest fire control in Canada has come a long way from being largely a matter of intuition and personal experience. Today, the growing list of achievements resulting from a combination of thorough research, imaginative planning and modern technology, while unlikely to ever win the war against fire, will certainly help turn many potential battles into minor skinnishes.

Ron Pickler

Bombardier Inc.
Canadair Amphibious Aircraft Division
P.O.Box 6087
CDN - Montreal, Quebec H3C 3G9

RUSSIAN FEDERATION

New Technologies for Aerial Forest Fire-Fighting

Russia has launched a series of development activities in aerial fire control technology. A brief introduction to the ongoing activities in airtanker construction is given below. The performance data are summarized together with the Ukrainian planes (Tab.1).

Antonov AN-2 P

The single-engine land airplane AN-2 is well known among fire fighters. It is one of the planes used for smokejumping operations all over the CIS. The AN-2 P is a STOL (Short Take-Off and Landing) plane ("P" version is derived from "Pozharnik", which means Fire Fighter). Its conversion to a water bomber was specifically designed to control wildfires in the regions contaminated by radionuclides. The extinguishant load is 1,200 l. Two of these planes are in use, two modified models are being built at present.

Antonov AN-26

The AN-26 is a transport plane widely used in the civilian and military sector and in fire control operations (long distance transport of fire fighters, aerial observation, rain seeding, smokejumping). One of the recent developments is the construction of external tanks for extinguishants: Two tanks, each of which with a capacity of 2 tons, can be attached to the plane and used for initial attack once a fire has been spotted. The tanks can be removed from the plane within a short space of time.

Berijev Be-12 P

The Berijev B-12 is a military amphibious airplane. Two of these planes have been converted to a fire fighting version (BE-12 P). The plane is a scooping plane and carries up to 6 t of water. In 1993 a total of 200 experimental drops were made to test the performance of the plane (Fig.1).

Berijev Be-200 P

The Be-200 is a multipurpose amphibious aircraft of which configurations are available for fire fighting, passenger, and cargo transport. The two D-436 turbofan engines are top-mounted (Fig.2) and allow the scooping of water for aerial delivery over forest fires at wave heights of up to 1.2 m. In addition to the capacity of 12 tons of water (or retardants) a 1.2-m^3 tank for liquid chemical is installed on the aircraft.

Contact Address for more information:

Irkutsk Aircraft Production Association
Chief Engineer Alexei Fyodorov
RU - 664020 Irkutsk

Fax: ++7-3952-45-9460

The performance data of the AN-32 P, AN-2 P, AN-26 P, Be-12 P, and BE-200 are given in Table 1.

Eduard P. Davidenko and Johann G. Goldammer

National Aerial Forest Fire Center *Avialesookhrana*
Gorkogo St. 20
RU - 141200 Pushkino, Moscow Region

Editor, IFFN

1:1.4

Fig.1. The Berijev BE-12 P amphibious water bomber during test flights in the Russian Federation

1:1.4

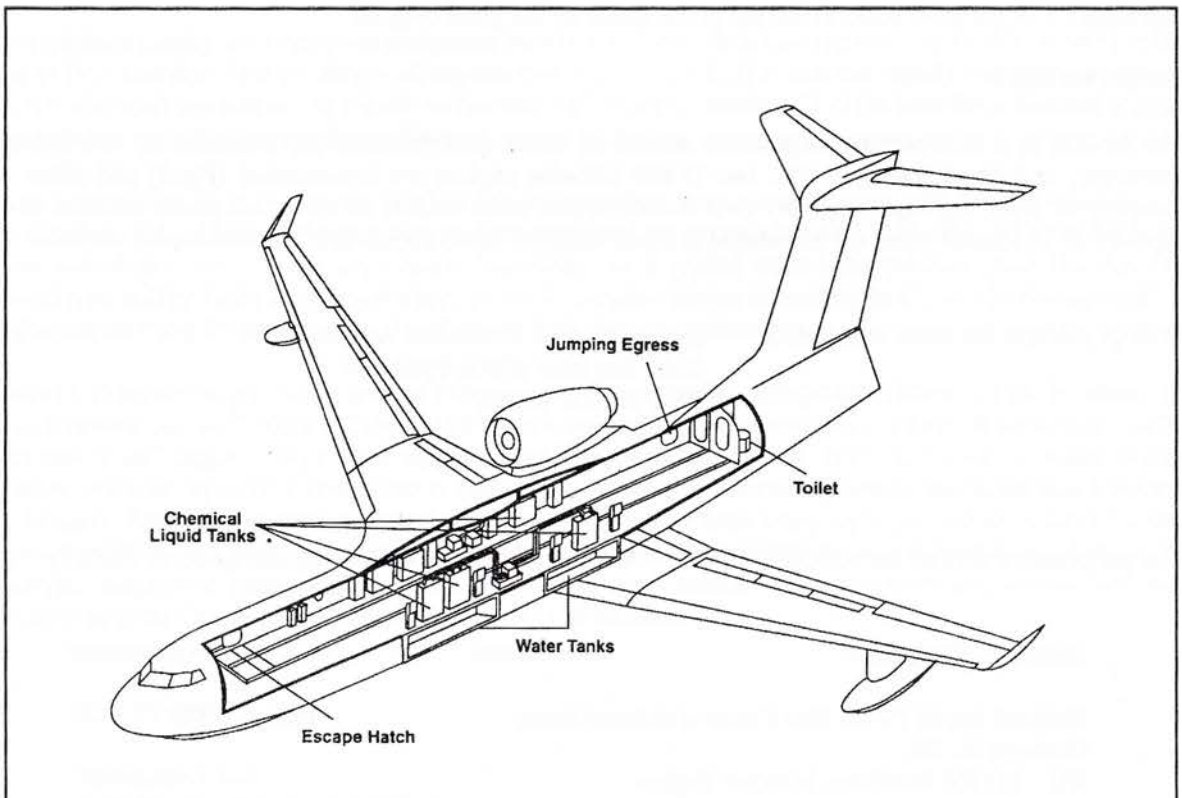

Fig.2. Construction plan of the Berijev BE-200 amphibious fire fighting plane

UKRAINE

Antonov AN-32 P

The AN 32-P "Firekiller" is designed as a multi-purpose fire missions aircraft (Fig.1):

- Combating fires by dropping retardant or water loads from external delivery units (2 x 4 t)
- Precise delivery of up to 30 fully equipped smokejumpers, with the aid of an advanced navigation system
- Cloud seeding (artificial rain) with the MP-26 meteo cartridges fired from the fuselage tail section
- Easy load and transport of heavy cargoes, vehicles and fire fighting equipment (ramp, loading device)

Contact Address for more information:

Kiev Airplane Production Association
100/1 Pobeda Prospekt
252062 Kiev
UKRAINE

Fax: + +7-44-442-6213 or 4385

Fig.3. Antonov AN-32 P during drop tests in 1993

Tab.1. Performance data of fire fighting aircraft produced in the Russian Federation (AN-2 P, AN-26 P, Be-12 P, Be-200, IL-76TD) and Ukraine (AN-32 P).

	AN-2 P	AN-26 P	AN-32 P	Be-12 P	Be-200 P	IL-76TD
Maximum takeoff weight (kg)	5,250	20,000	29,700	36,000	43,000 (on water)	190,000
Fire retardant weight (kg)	1,200	4,000	8,000	6,000	12,000	44,000
Cruising speed (km/h)	180	420	420-500	470	600	850
Minimum speed for retardant dropping (km/h)	150	230-250	220-230	230		
Take-off distance (m)	200	1,800	1,800	1,800	900 (land) 1000(water)	2,000
Maximum flight range (km)	1,200	1,600		3,000	4,500	7,000 (empty) 3,000 (w/water)
Number of smokejumpers fully equipped	6-8	30	27-30	30	30	50

Airborne Fire Disaster Control by the Russian Civil Defense Organization

Forest fires inflict serious damage on the national wealth of all countries. Fighting of fires demands much human effort and considerable economic resources. All of us have either taken part in or witnessed these events. As for our own experience, the most mobile means to suppress disaster-type forest fires is the use of aircraft. Many countries are also paying increasing attention to the development of these facilities.

The Russian Federation, which has a great amount of forest resources, suffers from heavy losses caused by forest fires. Due to this kind of disaster we lose as much timber as we use for the needs of the economy. The priority mission is to improve this situation. The Ministry of Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM of Russia) considers the use of heavy fire-fighting aircraft units as one of the decisive means to combat fires.

At present the introduction of a version of the Iliushin IL-76TP aircraft (maximum take-off weight: up to 190 tons), is in process. A standard aircraft IL-76MD is equipped with two detachable tanks for 44 tons of fire-extinguishing liquid. According to aircraft engineers a IL-76 may carry even three tanks with a total capacity of 66 tons. However, this option is still to be investigated.

The performance characteristics of the aircraft are as follows. After approaching a wildfire site the plane is flying at an altitude of 40 meters or more. The fire-extinguishing mixture is being discharged over the fire front within 3 - 5 seconds. The area covered by simultaneous discharge of the whole load is 550 x 100m. When a successive discharge is used the area covered by extinguishants will be 600 x 80 m. The water or retardant coverage exceeds 2 or more l/m^2. Time needed for filling the tanks by pumps is 35 minutes. Fuel endurance of a filled and equipped plane is 5000 kilometres. The aircraft can be based on airfields with a take-off runway of 3000 m and must withstand the pressure of 7,5 kg/cm^2.

Comprehensive tests of the plan were carried out in the years 1989-92. They included its application in real action. The valuable results gained in these tests are laid down in the further development of this fire-fighting project.

In August 1992 the plane made 22 flights to extinguish forest fires in the Moscow region. Thus, its efficiency was proved in fighting crown fires. The suppression of surface fires demands more accurate manoeuvring of the plane at the drop site and more frequent flights or use of several aircraft.

The plane was also engaged two times with a total of 9 flights in extinguishing fires of man-made structures. These operations proved its efficiency in mountainous regions and when fighting fires at the Army ammunition depots in the vicinity of Yerevan (Armenia) and in Vladivostok region (Russia). The use of a fire-fighting aircraft was the only way to deal with a disaster of this kind. Frequent explosions of the burning ammunition did not allow the ground fire brigades to approach the fire front. Discharging water from the plane promoted cooling of the object and impeded the spread of the disaster.

The tests and combat application of the aircraft showed its basic tactical and economic features. It is important to note that the costs of aerial fire fighting by using the IL-76 per 1 hectare at a distance to the fire site of more than 300 km proved to be twice or even more times less than other available aerial systems.

In September 1992 EMERCOM of Russia ordered from the industry a series of 5 water bombing units and 2 filling devices. This equipment is placed in reinforcement for the State Central Airmobile Rescue Team (TSENTROSPAS) of the EMERCOM. The water-bombing unit can be installed in any standard IL-76MD aircraft within 2-3 hours. The filling device provides the option to prepare and fill special fire-extinguishing solutions and to speed up the filling. The use of "Putidoil" solution provides the application of the plane for response to environmental disasters such as oil spills on sea. As for forest fire-fighting, water only is used in Russia in order to avoid negative impacts on the environment. Nevertheless the tanks could be charged with any other mixture.

Dimitri Lobanov

Ministry of Russian Federation for Civil Defence,
Emergencies and Elimination of Consequences
of Natural Disasters (EMERCOM of Russia)
Teatrainy proezd, 3
RU - 103012 Moscow

Fax: ++7-095-924-8410
Phone: ++7-095-926-3691

NEW SPACEBORNE FIRE RECONNAISSANCE SYSTEMS

Russian Aerospace Experiment *NOMOS* on Forest Fire Radiation Investigations

Russia is faced with more complicated problems in forest fire management than any other country due to the large size of forest cover with relatively small population density, especially in Siberia and in the Far East. At present aerial reconnaissance of forest fires is possible on up to 50-60% of the Russian territory. However, the need for increasing the airborne fire detection capabilities is clearly recognized. Since similar problems exist in countries like Argentina, Brazil, Australia, China and Canada it is timely to create a global spaceborne system for operational systems for early warning, detecting and monitoring of forest fires. Since boreal forests practically cannot be observed from geostationary orbits it is required to install a system with return intervals of satellites of less than one hour.

Several Russian firms headed by *Saliut* Designing Bureau (Khrunichev State Space Centre) are working now on the *Nomos* project which is devised to create and put into action by 1998-1999 a new low-orbit space system for forest fire monitoring and early warning.

The expected specification of this space system are:

- minimum detection size of forest fire: no more than 0.01 ha (under cloud conditions: 0.1-0.3 ha)

- mean return interval of observing fires (for Russia): 1 hour

- accuracy of locating fire coordinates: 0.3-0.5 km

- possibility of early fire danger warning

The system will include 6 to 8 satellites on low orbits (900 km), each satellite being equipped with Earth-observing sensors operating in visible, middle infrared (3.5-4 μm) and microwave (8mm) spectral ranges and communication links for transmitting fire warning messages to ground-based, user-friendly stations for receiving and processing satellite data.

The *Nomos* space system will also be capable to detect and monitor other types of disasters and emergency situations, e.g. floods, earthquakes, hurricanes, industrial fires, oceanic water contaminations, etc. and monitor the consequences of disasters.

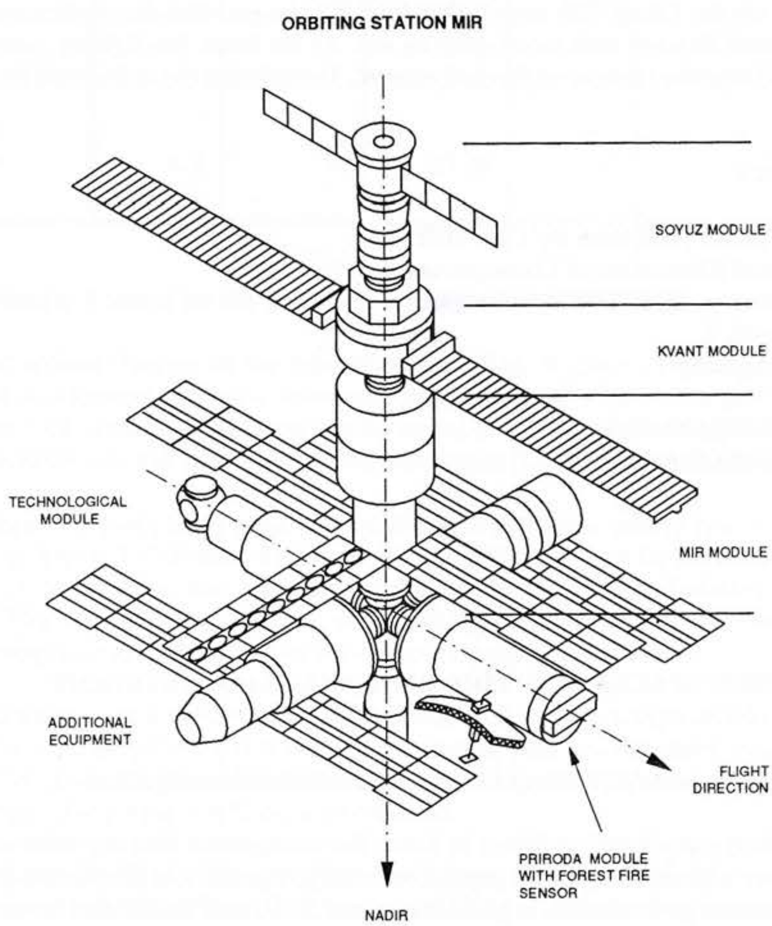

Fig.1. Orbiting station Mir with Priroda Modeule for Forest Fire detection and monitoring in the Nomos project

Tab.1. Characteristics of instruments on *Priroda* Module to be used in *ASE Nomos*

	Instrument	Wave Length	Field of View Width	Fluctuations Sensitivity (K)	Resolution at Altitude 400 km	Band of View at Altitude 400 km	Orbit-to-Earth Data Transmission Rate (Kbit/sec)
1	Scanning Radiometer Block Delta -2П						
	P-30	0.3 cm	1°	1.5	5 km	400 km	8
	P-80	0.8 cm	1.5°	0.5	8 km	400 km	
	P-135	1.35 cm	2°	0.4	15 km	400 km	
	P-400	4.0 cm	5-7°	0.15	50 km	400 km	
2	Infrared Spectrometric System Istok-1	3.6-16 μm	12 x 48 ang.min.	0.2	1 x 6 km	6 km	0.8
3	Scanner MSU-SK	0.5-12.5 μm (6 spectral ranges)		0.5	120-280 m	350 km	1150
4	Scanner MSU-E	0.5-0.9 μm (3 spectral ranges)		0.5	25 m	54 km	1150

FIRES: A Fire Reconnaissance System for Small Satellites

Introduction

Up to now the AVHRR (Advanced Very High Resolution Radiometer) on NOAA satellites is the main satellite sensor used for detection of active wildfires. Because NOAA AVHRR was not devised for fire detection it has serious drawbacks. The main disadvantages are

- saturation of the IR channels (the 3-5μm channel saturates already at 50°C) and
- the low repetitive coverage of the same area

Planned future remote sensing systems, such as MODIS-N on EOS, only partly overcome these disadvantages. But these drawbacks can easily be overcome with dedicated specialized systems on small satellites operating on optimized orbits. For instance, with an adequate exposure control (via integration time or aperture) of the main sensor, saturation can be avoided. And a special satellite system consisting of 4 to 6 satellites could provide a good spatial and time coverage for forest fire detection. In the following the concept of a pre-operational satellite system will be described, which demonstrates the feasibility and usefulness of an operational system for vegetation fire reconnaissance. This pre-operational mission should be included in the remote sensing activities of the IGBP/IGAC/BIBEX programs.

The devised multi-sensor system as the main payload of a small satellite specialized for fire detection shall be equipped with a substantial computing power (on-board intelligence) in order to carry out an important part of the data processing. The system user should obtain the information he wants very fast (i.e. within a few minutes after the detection) and in highly compressed, user-friendly form. This means that the system must have the ability to reduce the data substantially by means of autonomous decision making and control. To guarantee this, a new smart sensor system, consisting of a fore field sensor for area of interest definition, a controllable main sensor for (precise) IR radiation measurements in the areas of interest , and a sensor "brain" for autonomous decision making and control, fire parameter estimation and fire classification, is proposed.

Mission Objectives

To demonstrate the feasibility and usefulness of a future operational small satellite system for fire reconnaissance, the proposed pre-operational FIRES satellite (Fire Reconnaissance System for Small Satellites) is not only devised for the pure detection of fire events in large areas, but also for its (more or less) precise location, the assessment of its extent (in space and time) and type, and the timeliness of providing this information to local authorities.

Fires to be detected are mainly forest and other vegetation fires, but also fires in industrial and power plants, including nuclear power plants (especially in remote areas or if kept secret), and fires of oil wells, platforms, pipelines, tankers and so on. Heat emitting forms of volcanic activity (smoke plumes, glowing avalanches, lava outflows, lava lakes) can be detected too. Furthermore, the sensor system can contribute to other remote sensing tasks related to heat emission.

Secondary objectives of FIRES are the estimation of vegetation damage and atmospheric pollution due to fire and the assessment of the regrowth of vegetation on burned areas.

In order to fulfil the main objectives of the system one needs on-board:

- thematic data reduction and generation of thematic maps,
- orbit determination and attitude measurements,
- geo-coding of fire parameters and thematic maps.

These challenging objectives are not solved up to now.

The Principal Structure of the Multi-Sensor System

The proposed smart sensor system consists mainly of three parts:

I. Fore Field Sensor: a forward looking sensor with
- large swath width
- low geometric resolution
- few spectral channels
  (mainly in the 3-5m and 8-12m atmospheric windows)

Its main task is the definition of areas of interest by hot spot detection and the coarse estimation of fire parameters within the areas of interest.

II. Main Sensor: a multi sensor with
- low swath width
- medium to high geometric resolution
- several channels from VIS to TIR
- a controllable line of sight (in order to get directed to the areas of interest)

Its main task is the investigation of the areas of interest in order to determine fire and smoke plume parameters and to produce corrected image data (thematic maps) of fire regions. Further tasks of the main sensor are related to the secondary and other objectives of FIRES.

III. Sensor Brain:
The sensor brain as the component of sensor intelligence uses modern computer architecture for the
- Real-time processing of the Fore Field Sensor signals for defining the areas of interest and coarse fire parameter estimation
- Real-time determination of the control information for the Main Sensor for
  * directing the line of sight to the areas of interest
  * exposure control to avoid saturation of the Main Sensor
- Near real-time processing of the Main Sensor signals for
  * determination of fire and smoke plume parameters
  * fire type classification
- (Geometric) correction of area of interest images
- Evaluation of data from position and attitude measuring systems for geo-coding of the data products.

Feasibility of Fire Reconnaissance from Space

First estimations (for a sun-synchronous orbit of 888km height) of signals to be detected by two IR sensors at $3.7\mu m$ and $8.5\mu m$ (for the parameters see chapter 5) show that small (sub-pixel) fires can be discriminated from the background, demonstrating the feasibility of forest fire detection with a moderate technological effort.

Tab.1.: Estimated minimum resolvable fire size in dependence on the temperature (for $D^* = 10^{10} cm\sqrt{Hz}/W$)

Infrared Channel	Estimated minimum resolvable fire diameter at the fire temperature T =			
	230°C	800°C	230°C	800°C
$3.7\mu m$	14m	2m	10m	1.5m
$8.5\mu m$	14m	5m	10m	3m
	for the fore field sensor, ground pixel size = 1420m		for the main sensor, ground pixel size = 265m	

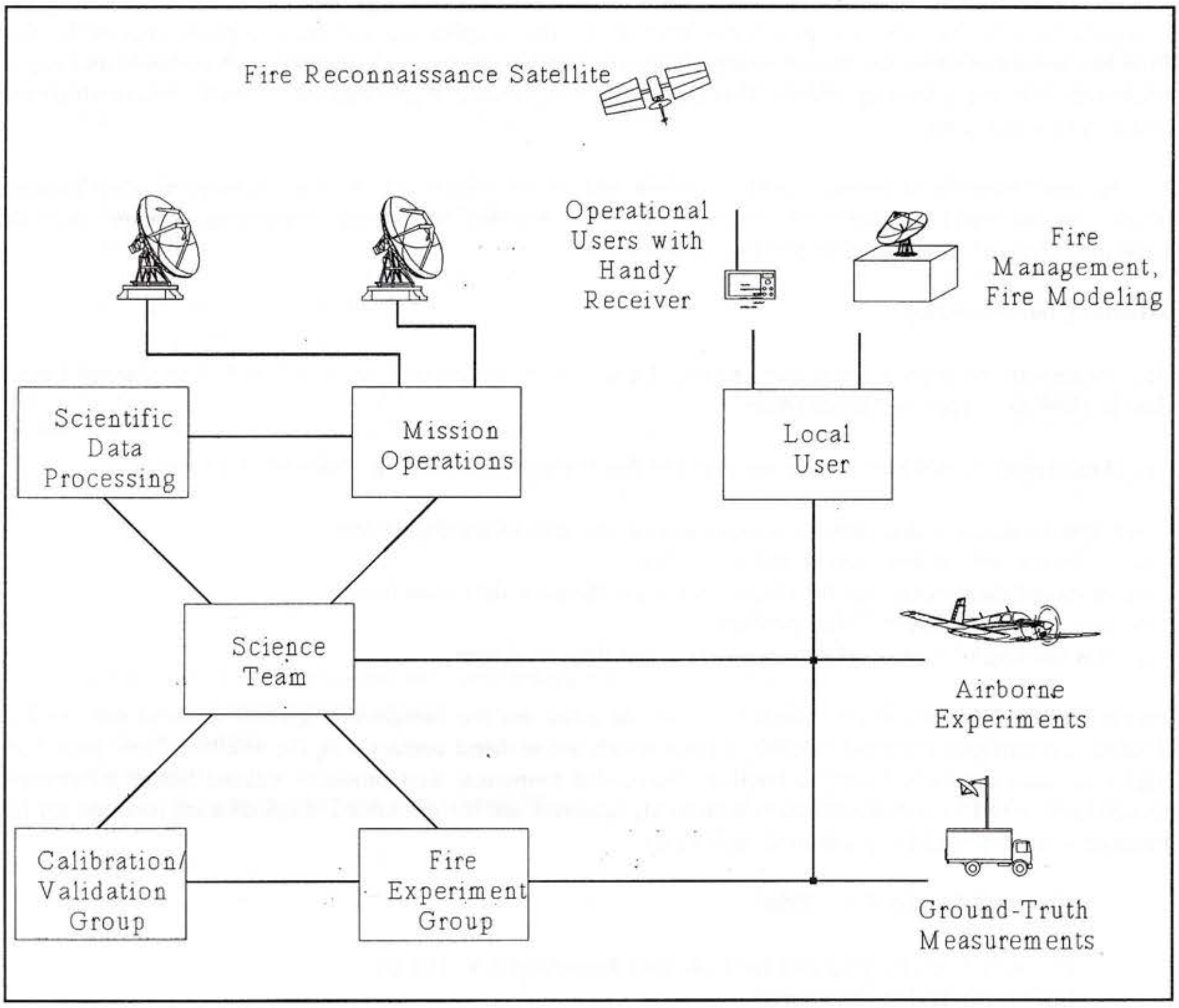

Fig. 2. Mission architecture of FIRES in relation to international local users with direct reception of high-level data products

Tab.2.: Preliminary orbit parameters and satellite characteristics

Orbit parameter		Satellite baseline characteristics	
Orbit type	sun-synchronous circular integer orbit	Stabilization	3-axis stabilized
		Spacecraft mass	<500kg
Altitude	888km	Payload mass	<100kg
Inclination	99.0°	Pointing Knowledge	±0.05° per axis
Orbital period	103min	Communication	X-band and UHF

The preliminary results presented in Table 1 show that the fire detection capability of the system is very good. Using the two IR channels, it is possible to estimate the fire temperature *and* the (sub-pixel) area of the fire. First investigations show that the necessary algorithms for this can be easily implemented on-board and can be made very fast (using look-up tables). This means that it is possible to generate user-friendly data products on-board in near real-time.

If it becomes possible to provide correct position data of the events (e.g. with a precision of some hundred meters) by on-board evaluation of the data from orbit position and attitude measuring systems, then the ambitious goals of FIRES can be fulfilled satisfactorily.

Mission Characteristics

The preliminary orbit parameters and satellite characteristics are pointed out in Table 2. The planned launch date is 1998 for a pre-operational phase.

The peculiarities of this mission are not only the fire detection but also the following features:

- first system which is dedicated to reconnaissance and remote sensing of fire,
- the on-board orbit determination and navigation,
- the on-board data processing for classification and thematic data reduction,
- the on-board geo-coding of data products,
- the transmitting of high-level data products to the final local user.

Figure 1 shows the mission architecture. It should point out the inexpensive ground segment dedicated to defined user groups of a small satellite mission which are in direct contact with the satellite. They should get high-level data products from the satellite. Geo-coded numerical data products without image information should be received by operational users with handy receivers and the geo-coded image data are foreseen for fire management, fire modelling and local authorities.

Herbert Jahn and Klaus Brieß

Deutsche Forschungsanstalt für Luft- und Raumfahrt e.V. (DLR)
Institut für Weltraumsensorik
Rudower Chaussee 5
D - 12489 Berlin

Fax: ++49-30-69545532

NEWS FROM FIRE RESEARCH

FIRESCHEME Foundation Meeting

Fire Information Systems Research in the Ecology, Socio-Culture and History of the Mediterranean Environment (FIRESCHEME) is the suggested working title of a proposed Pan-Mediterranean research project.

The outline of the proposed project was introduced in IFFN No.10 (January 1994). The founding meeting will be held *in tandem* with the 2nd International Coimbra Conference on Forest Fire Research, on 24 November 1994, in Coimbra (Portugal). Details on the conference are given on pp.40-41 of this issue.

TRIPARTITE AGREEMENT ON WILDLAND FIRE SCIENCE RESEARCH SIGNED

One of the resolutions arising from the 1988 Conference on Bushfire Modelling and Fire Danger Rating Systems[2], as proposed by B.J.Stocks of the Canadian Forest Service (CFS) (formerly Forestry Canada), involved the idea of an international Memorandum of Understanding (MOU) as follows:

> "That the time is opportune for the development of a Memorandum of Understanding between Australia, Canada and the United States on fire danger rating and fire behaviour modelling. Decreasing fire research resources in each country, coupled with the fact that the combining of empirical and physical modelling approaches is now seen as necessary, are strong reasons why an MOU that would facilitate co-operation and scientific exchange on a formal and consistent basis is necessary".

As the "wordsmith" of the original draft agreement, we are happy to report that this proposal has now become a reality. A complete copy of the agreement as signed by representatives of Australia, Canada and the United States is included here in the following three pages. The contributions of D.E. Dubé and B.J. Stocks of the CFS, M.A. Fosberg and W.T. Sommers of the USDA Forest Service, and N.P. Cheney of Australia's CSIRO Division of Forestry are hereby acknowledged.

W. Lachlan McCaw and Martin E. Alexander

Department of Conservation and Land Management
Science and Information Division
Research Centre
Brain Street
AUS - Manjimup, Western Australia 6258

Fax: ++61-97-712-955
Phone: ++61-97-711-988

Canadian Forest Service
Northwest Region
Northern Forestry Centre
5320 - 122 Street
CDN - Edmonton, Alberta T6H 3S5

Fax: ++1-403-435-7359
Phone: ++1-403-435-7346

ARRANGEMENT ON
COOPERATION IN WILDLAND FIRE SCIENCE RESEARCH
BETWEEN AUSTRALIA, CANADA AND THE UNITED STATES

CONDUCTED UNDER THE AUSPICES OF

The Memorandum of Understanding on Scientific and Technological
Cooperation in Agricultural Research and Development (1982)
between
The Department of Agriculture of the United States of America
and
The Commonwealth Scientific and Industrial Research Organization, Australia
and
The Memorandum of Understanding (1990)
between
The United States Department of Agriculture
and
Forestry Canada on Cooperation in the field of forestry-related programs

---

[2] Cheney, N.P.; Gill, A.M. (editors). 1991. Conference on Bushfire Modelling and Fire Danger Rating Systems Proceedings (11-12 July 1988, Canberra, Australia). CSIRO Division of Forestry, Yarralumla, ACT, Australia. [see notice in ***International Forest Fire News*** No. 6, pages 30-31]

Background

Cooperation between Australia, Canada and the United States in areas of wildland fire science research was initiated formally in July 1988 at the conference on Bushfire Modelling and Fire Danger Rating Systems held in Canberrra. Subsequent discussions took place between Canadian and United States representatives in Ottawa in 1989, and between representatives of all three parties in Missoula in 1991. As a result of these discussions, it was accepted that collaborative wildland fire research, conducted under the auspices of The Memorandum of Understanding on Scientific and Technological Cooperation in Agricultural Research and Development (1982) between the Department of Agriculture of the United States and The Commonwealth Scientific and Industrial Research Organization, Australia and the Memorandum of Understanding (1990) between the United States Department of Agriculture and Forestry Canada, would be beneficial.

There are sound reasons for seeking to maintain and expand research into wildland fire science. Knowledge gained through research is fundamental to an understanding of the role of fire in wildland ecosystem processes such as plant community response and nutrient dynamics. Objective information on fire characteristics is an important input into economic analyses of the costs and benefits of fire management programs. The success of community fire prevention programs may also be largely dependent on the adequacy of predictive models employed for fire danger rating, and on the accuracy of fire weather forecasts. Fire behaviour prediction systems and burning prescriptions are required by the agencies responsible for implementing wildland fire management programs.

In addition, a number of nations that lack an independent fire research capability have adopted fire danger rating and fire behaviour prediction systems developed in Australia, Canada or the United States. Successful application of these systems in practice depends upon initial selection of an appropriate system, provision of suitable data, and correct interpretation of outputs in the context of local conditions. Description of this collaborative research in this document will provide a forum to facilitate the consistent application of fire management support systems by other nations.

The fact that resources available for wildland fire research are tending to decline, together with the perceived advantages of combining the empirical and physical approaches to modelling, are strong arguments in favour of scientific cooperation and exchange on a formal, ongoing basis.

Objective of Project Area Description for Work on Wildland Fire Science

The objective of this document is to elucidate possible project developments for cooperation, scientific exchange and collaborative research into wildland fire science between Australia, Canada and the United States -- under the existing Memoranda of Understanding cited above.

Activities Within the Scope of Cooperation, Scientific Exchange, and Research

The following types of activities will be considered within the scope of cooperation, scientific exchange, and research in wildland fire science:

- exchange of personnel and equipment for participation in experimental programs, either field or laboratory based;
- exchange of data from field or laboratory studies;
- organization of workshops on issues of relevance to the participating countries;
- provision of support to visiting researchers;
- notification, in advance, of comprehensive or special fire experiments which international observers might wish to attend.

Benefit of Collaborative Work on Wildland Fire Science

Benefits resulting from collaborative work on wildland fire science include:

- opportunities to optimize the allocation of research resources in areas of common interest such as fundamental combustion processes, fire meteorology, smoke management, fire spread data for key fuel types (e.g., grassland, pine plantation), prescribed fire ignition patterns, relationships between fire characteristics and effects, and studies of suppression effectiveness in relation to fire behaviour;
- maintenance of consistent scientific standards for data collection, storage and communication;
- opportunities for more rapid adoption of new technology implementation of research findings in practice;
- provision of a formal basis to applications for funding support for collaborative projects.

Principles for Operation Under the Auspices of Existing Memoranda of Understanding

- Collaborative work on wildland fire science will be coordinated by designated representatives from each country, as nominated by the signatory organizations.

- Signatories are not necessarily obliged to support activities undertaken under the auspices of this project area description.

- Detailed letters of understanding will be drawn up to cover the operation of individual projects, including the exchange of data and formal publication of results.

- Designated representatives will meet periodically to coordinate work plans covered under this project area description.

- This project area description will not affect the operation of any other arrangement entered into by the parties involved.

- This project area description may be amended, supplemented and extended to at any time, by mutual written concurrence of all parties.

- The intent for collaborative work in areas of wildland fire science between the United States, Australia, and Canada under the auspices of existing Memoranda of Understanding will enter in effect upon signature by the authorized representatives of all parties and will remain in effect unless terminated by any party upon 6 months written notice. In the event of termination, all parties will consult about completion of activities underway.

- In accordance with appropriate financial and budgetary processes, all parties will bear the costs of its participation and that of its personnel in cooperative activities unless the parties agree on other arrangements. Activities pursuant to project area description and intent for collaborative work in areas of wildland fire sciences are subject to the availability of appropriate funds and personnel.

Existing Understandings and Agreements

Nothing in this Project area Description will be interpreted to prejudice or modify existing understandings or agreements between the Parties.

The Tripartite Agreement was signed in Canberra, 1 October 1993, by G.A. Kile (Chief, CSIRO Division of Forestry), J.C.Mercier (Deputy Minister, Forestry Canada), and J.A. Sesco (Deputy Chief, Research, USDA Forest Service, for the United States Department of Agriculture)

IN MEMORIA OF N.P.KURBATSKY

Professor Nikolai Petrovich Kurbatsky, a well-known Russian forest fire scientist, Dr. Sci. Agr., a highly competent specialist in forestry and forest inventory, died on 18 February 1994.

In 1949 N.P.Kurbatsky established a Forest Fire Protection Department affiliated to the St.Petersburg Institute of Forestry. This was one of the earliest forest fire research institutions established in Russia. N.P.Kurbatsky's department became the leading scientific and technical centre focusing on the development of methods and equipment for forest fire control.

In 1959, N.P.Kurbatsky moved from St.Petersburg to Krasnoyarsk, Siberia, and founded a Forest Fire Research Laboratory in the V.N.Sukachev Institute of Forest, Siberian Branch, Russian Academy of Sciences. In time, the Laboratory grew to become a large and important scientific centre of forest fire investigations. N.P.Kurbatsky contributed much to forest fire science. He was the author of a theory of forest fire occurrence, spread and growth, including forest fire danger factors, and fire and forest fuel classifications; he systematized the main forest fire concepts and terms, developed the strategic line of forest fire protection progress in our country, and worked on many other problems. As to practical application of scientific findings, he was deeply engaged in developing fire-fighting techniques by water bombing and chemical retardants. He gave very valuable recommendations on how to contain fires using explosives and backfire or by distributing fire breaks over a forest area. Problems of fire fighting tactics never fell out of his area of interest. N.P.Kurbatsky's original ideas were based upon when developing "Recommendations on Forest Fire Detection and Fighting" (Gosleskhoz 1976), which still enjoy wide use in forest fire protection activities.

N.P.Kurbatsky summarized his experience of working on problems of forest fire protection in his monograph titled "Techniques and Tactics of Forest Fire Fighting"; the monograph is nowadays very popular among fire scientists. Soon after it has been finished, the monograph was translated and published abroad.

The results of his investigations in the field of forest fires allowed him to successfully defend his doctor's thesis on "Fires in the Taiga Forests. Patterns of Their Occurrence and Growth" in 1966. In 1968, N.P. Kurbatsky was conferred a Professor's degree. He is the author of more than 150 papers which made him widely recognized as a highly professional specialist, both in Russia and abroad. His life and activity show that he was a big scientist and the founder of forest pyrology.

N.P. Kurbatsky was a brilliant teacher. He was the leader of the school of Siberian forest fire scientists that includes three Doctors and many masters. He was not simply the supervisor of young specialists' work, but had a talent to deeply understand their problems and could find ways to cope with any difficulties, however big they were. Successes of his pupils always filled his heart with real happiness. Forest fire scientists of different generations currently working at the V.N.Sukachev Institute of Forest are N.P. Kurbatsky's followers. Up to the very last days of his life N.P.Kurbatsky continued to work on the problems of forest pyrology. Shortly before his death he had finished his last book dealing with the history of forest fire science in Russia, as well as with the policies of forest fire protection practised in this country.

All N.P. Kurbatsky's pupils and followers will always have the brightest memories of him in their hearts.

Valentin Furyaev and Peter Tzvetkov

Forest Fire Laboratory, Institute of Forest
Siberian Branch, Russian Academy of Sciences
RU - 660036 Krasnoyarsk

NEWS FROM ECE/FAO

ECE/FAO/ILO Team of Specialists on Forest Fire Reactivated

In early 1994 the Team of Specialists on Forest Fire Prevention and Control, of the Joint ECE/FAO/ILO Committee on Forest Technology Management and Training was reactivated. Mr.Johann G. Goldammer (Germany) was appointed as the new Team Leader. The first meeting of the reactivated team took place on the 20 and 21 April 1994 in the Palais des Nations in Geneva. Among others the following topics were on the agenda of the meeting:

- Review of past activities (seminars, International Forest Fire News)
- Possible role of the team in the follow-up activities to UNCED and the Helsinki Conference on the Protection of Forests in Europe
- UN Decade for Natural Hazard Reduction: The Role of the ECE/FAO/ILO Team of Specialists on Forest Fire, UNESCO and UNDRO
- Communication and collaboration with the CEC
- Next seminar (year, topic, host country)
- Update of the FAO glossary "Wildland Fire Management"

Starting with this issue of IFFN more detailed results will be given on the Team's activities. In this issue the first and immediate follow-up action of the Team, the active participation in the UN World Congress on Natural Disaster Reduction, is reported.

Jorge Najera

ECE/FAO Agriculture and Timber Division
Palais des Nations
CH - 1211 Genève 10

Fax: ++41-22-917-0041
Phone: ++41-22-917-3240

International Decade for Natural Disaster Reduction (IDNDR)

On 11 December 1987 at its 42nd session, the General Assembly of the United Nations designated the 1990's as the International Decade for Natural Disaster Reduction (IDNDR)(Resolution 44/236 of 22 December 1989). The concept of this international programme was an initiative of the US Academy of Sciences in 1984. The basic idea behind this proclamation of the Decade was and still remains to be the unacceptable and rising levels of losses which disasters continue to incur on the one hand, and the existence, on the other hand, of a wealth of scientific and engineering know-how which could be effectively used to reduce losses resulting from disasters.

Objectives of the Decade

The general objective of the Decade is

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

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

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

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

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

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

To date, 120 national IDNDR Committees and focal points have been established around the world in order to realize the Decade's objectives. In addition a group of 25 scientific and technical experts selected on the basis of their personal capacities and qualifications and with due to regard to the diversity of disaster mitigation issues and geographical representation constitute the membership of the Scientific and Technical Committee of the IDNDR[3]. Their functions include to develop programmes to be taken into account in bilateral and multilateral cooperation and to assess and evaluate the activities carried out in the Decade and to make recommendations on the overall programmes in an annual report to the Secretary General.

---

[3] One of the members of the International Ad Hoc Group of Experts was Phil Cheney, CSIRO Bushfire Research Unit, Canberra (Australia). He expressed his views in a publication on "Australia's role in the IDNDR" (Resource and Environmental Studies No.4, Centre for Resource and Environmental Studies, Australian National University, 1991).

Wildfires - "Natural Disasters" ?

In the past years there have been various successful examples of how national governments were prepared and the international community responded to disaster management support, e.g. after earthquakes, hurricanes, and floods.

What about wildfires? Are there or have there been any "wildfire disasters"? If so, has any of the goals indicated above been achieved in the sector of wildfire-caused disasters?

In the context of IDNDR, wildfires clearly have been defined as potential natural disasters. However, a global survey carried out by IDNDR shows an interesting picture. Among the 93 nations which responded to an enquiry by IDNDR a total of 49 nations considered wildfires to be an important "Prevailing Hazard" in their country. The remainder of 44 countries did not mention wildfires to be an important natural disaster threat (Tab.1).

From another survey on damages caused by significant natural disasters the evaluation of wildfire-related economic and human losses were not clearly to be identified. In the preface to that survey it was defined that a "significant disaster" must meet one of the following criteria:

Damage: $\geq$ 1% of total annual GNP
Number of affected people: $\geq$ 1% of the total population
Number of deaths: $\geq$ 100

It is clear that only a few wildfire disasters meet these criteria in order to be put into the category of "significant" disaster. However, a look to the forest fire statistics from the People's Republic of China show that throughout the last 40 years more than 100 people annually died in forest fires on an area affected by fire of nearly one million ha per year (Tab.2).

Wildfires at the UN World Conference on Natural Disaster Reduction

A World Conference on Natural Disaster Reduction, which forms a part of a mid-term review of Decade activities, was held in Yokohama (Japan) between 23-27 May 1994. The conference was the first of its kind to be held on a global level it was expected to provide a platform for the exchange of experiences between Decade partners at national, regional, and international levels.

During the UN World Conference some technical posters were exhibited, e.g. on new systems on remote sensing of fires (by Finland and Germany). The conference also provided the floor for the public presentation of the film "The Fire Experiment"[4].

The ECE/FAO Team of Specialists on Forest Fire brought the fire issue onto the table of policy makers by presenting a poster and discussing the fire issue in the Technical Committees.

---

[4] The film "The Fire Experiment" is a one-hour film originally produced for the German TV Channel Two (ZDF) and the French-German TV Channel "Arte" and broadcasted on 20 December 1993. The film covers the preparation and execution of a fire experiment in the frame of the Fire Research Campaign Asia-North (FIRESCAN), carried out in July 1993 (see IFFN No.10, p.25-26), a brilliant report on the start of fruitful cooperation in forest fire research between East and West. The background and systematics of fire research are well translated for the general public. The English version of this film which was sponsored by UNESCO and the Foreign Office, Federal Republic of Germany, can be obtained on request from the film producer Schubert Film Production, Leopoldstr.79, D-80802 München (GERMANY), Fax ++49-89-341908 (price for a single copy: DM 198.00; for research institutions, universities, etc. DM 148.00; please request a copy compatible with your TV system, e.g. PAL or NTSC).

Tab.1. Extracts from the information provided in national reports to the IDNDR. One of the questions directed to the countries was on "Prevailing Hazards". In the questionnaire the countries had to state whether wildfires were considered to be a prevailing hazard or not. The total number of responses was 93. Extracted from: WCNDR Information Paper No.2 (April-94)

Countries considering wildfires to be a prevailing natural hazard	**Countries considering wildfires <u>not</u> to be a prevailing natural hazard**
Algeria	Austria
Armenia	Bolivia
Australia	Botswana
Azerbaijan	British Virgin Islands
Bangladesh	Cameroun
Bermuda	Chad
Bhutan	Columbia
Bulgaria	Cook Island
Burkina Faso	Costa Rica
Canada	Cuba
China, People's Republic of	Denmark
Dominican Republic	Ecuador
Egypt	Ethiopia
Finland	Fiji
Germany	Guatemala
Greece	Honduras
Guinée, Republic of	Iran
Haiti	Ireland
Hungary	Italy
Kazakhstan	Japan
Kenya	Korea, Republic of
Latvia	Kyrghyzstan
Malaysia	Mozambique
Maldives	Netherlands
Mauritius	New Zealand
Mexico	Nicaragua
Micronesia	Panama
Mongolia	Paraguay
Namibia	Solomon Islands
Nepal	South Africa
Nigeria	Spain
Norway	Sri Lanka
Oman	Sudan
Palau	Sweden
Papua New Guinea	Tajikistan
Peru	Tanzania
Philippines	Trinidad and Tobago
Poland	Turkmenistan
Portugal	Tuvalu
Romania	Ukraine
Russian Federation	United Kingdom
Switzerland	Vanuatu
Tunisia	Zaire
Turkey	
Union of Myanmar	
United States of America	
Uzbekistan	
Vietnam	
Western Samoa	

Tab.2. The forest fire statistics from the People's Republic of China for the years 1950-1990 reveal the high loss of human life due to severe wildfires (Source: Ministry of Forestry, Fire Prevention Office, Beijing).

Year	Number of Fires	Area Burned (x10,000 ha)	Human Lives Lost	Year	Number of Fires	Area Burned (x10,000 ha)	Human Lives Lost
1950	n.a.	114.50	n.a.	1973	10,143	100.88	65
1951	5,100	225.54	51	1974	16,268	53.88	92
1952	n.a.	58.35	22	1975	13,013	94.08	67
1953	10,784	72.69	37	1976	10,328	194.33	196
1954	25,692	140.02	89	1977	17,290	257.90	133
1955	57,153	248.34	301	1978	11,859	49.30	67
1956	30,704	279.82	203	1979	25,480	99.84	154
1957	25,171	91.14	120	1980	17,608	39.65	95
1958	9,278	33.59	33	1981	12,678	40.96	70
1959	8,113	81.13	62	1982	13,453	33.68	99
1960	11,593	100.43	208	1983	12,300	17.43	111
1961	33,879	152.93	196	1984	12,100	14.18	63
1962	43,321	186.77	187	1985	8,753	13.95	44
1963	32,846	107.11	173	1986	25,851	27.95	237
1964	6,433	19.22	11	1987	12,022	115.26	226
1965	10,913	54.60	78	1988	9,300	6.28	75
1966	5,189	57.85	41	1989	9,747	4.82	55
1967	4,487	30.23	59	1990	5,628	1.44	20
1968	2,338	18.46	12	**Long-Term Total and Average Data**			
1969	7,497	61.42	59	Total 1950-90	**606,152**	**3,712.06**	**4,137**
1970	6,569	76.15	79				
1971	8,860	83.01	55	Average per Year 1950-90	**15,951**	**90.53**	**104**
1972	16,411	184.64	187		(1953-90)	(1950-90)	(1951-90)

* 10,000 ha = 100 km^2
n.a. = data not available

A Possible Role of the UN System in Fire Research and Wildfire Disaster Management: A Proposal

Uncontrolled wildfires and prescribed fires occur in all vegetation zones of the world. It is estimated that fires annually affect up to

- o 10-15 million hectares of boreal and temperate forest and other lands
- o 20-40 million hectares of tropical rain forests due to forest conversion activities and escaped agricultural burnings
- o 500-1000 million hectares of tropical and subtropical savannas, woodlands, and open forests

Only a minor part of these fires is caused by nature (lightning). Most of today's fires are caused by human activities. Some burning practices still follow the traditional rules of rural populations, and many ecosystems are well adapted to fire. The majority of fires, however, is in conflict with land-use priorities and other considerations, leading to

- o Ecological problems (vegetation degradation, erosion, loss of biodiversity)
- o Socio-economic problems (loss of human lives, loss of values-at-risk, especially in the wildland/residential interface, economic losses)
- o Environmental phenomena (affecting air quality and the global carbon cycle, contribution to elevated concentration of trace gases and aerosols, with consequences on the regional and global climate)

Wildfire disasters sometimes occur as a consequence of other natural disasters (e.g. after earthquakes, volcano eruptions), and fires may lead to subsequent natural disasters (e.g. landslides, flooding after soil exposure).

On an international base no system is available to monitor the extent and the consequences of vegetation fires on a global scale. Most countries in the developing world do not have adequate infrastructures, experience and hardware to manage wildfire disasters. Although bilateral assistance agreements exist and a number of field projects in fire management are carried out through national and international organizations, there are no facilities and/or mechanisms available to provide the necessary disaster management assistance on an international level on a permanent and quick-response base. Besides the ECE/FAO Team of Specialists on Forest Fire which has a restricted mandate and a regionally restricted area of influence, or some ongoing and planned regional fire research campaigns under the IGBP scheme, neither the UN system nor any other organization is providing adequate structures and mechanisms with international (global) responsibilities in fire management.

In order to take the first necessary steps for clarifying the global importance of wildfires and for building international structures and mechanisms for mutual fire management support, it is recommended to entrust the ECE/FAO Team of Specialists on Forest Fire, in close cooperation with FAO, UNESCO, IDNDR, and UNDRO, to develop a plan for the establishment of a UN-sponsored Global Fire Research and Management Facility which includes a Global Vegetation Fire Information System and the capabilities to provide support on request to any nation in fire management and prevention and management of wildfire disasters.

Proposal to the Annex of the Yokohama Strategy for a Safer World, submitted by the ECE/FAO/ILO Team of Specialists on Forest Fire

Outcome of the Conference

The Yokohama conference clearly recognized the still existing gaps between its vision - as formulated in the begin of the Decade - and reality. This reality is that the goals and targets are far from being achieved as one would expect after half of the Decade has passed by: many of the delegates of the 147 nations represented at the conference commented that 95% of the Decade's work needs to be done in its second half.

The conference unanimously accepted the declaration of the "Yokohama Strategy". The 18-page document gives clear outlines and a plan of action although no specific disaster or action is mentioned in detail.

From the point of view of global cooperation in coping with wildfire-caused disasters, two of the recommended international activities, which were given in order to implement the IDNDR objectives, are of importance:

- recognition of the need of adequate coordination of international disaster reduction activities and strengthening of the mechanisms established for this purpose. International coordination should relate, in particular, to the formation of development projects which provide assistance for disaster reduction and their evaluation;

- effective coordination of international disaster management, in particular by the United Nations system, is paramount for an integrated approach to disaster reduction and should, therefore, be strengthened.

Detailed proposals of countries and organizations will be added to the strategy paper in the form of an Annex. As it had been decided at the Meeting of the ECE/FAO Team of Specialists on Forest Fire in Geneva, April 1993, a proposal was directed to the conference and will be part of the Conference Annex (see page 36).

With this proposal the ECE/FAO Team of Specialists on Forest Fire intends to open a forum for discussion and further suggestions.

Johann G. Goldammer
Leader, ECE/FAO Team of Specialists on Forest Fire
(Address on p.iv)

RECENT PUBLICATIONS: RESEARCH, STATISTICS AND POLICY REPORTS FROM EUROPE

Fire in Mediterranean Ecosystems

The International Workshop on the Role of Fire in Mediterranean Ecosystems was held in Banyuls-Sur-Mer, France, 21-25 September 1992. The workshop had been sponsored by the Centre d'Écologie Functionelle et Evolutive Louis Emberger, the Commission of the European Communities, and the Observatoire Océanologique de Banyuls, Laboratoire Araga. The proceedings, edited by Lois Trabaud and Roger Prodon, are now available. They cover a broad range of wildland fire disciplines, traditionally dominated by research on fire effects on vegetation (19 contributions) and soil (9 contributions). New insights into the fire-flora-fauna relationships are given in eight papers, including one from Australia. However, Louis Trabaud's introductory remarks entitled "From the cell to the atmosphere" go beyond the research objectives of the contributions.

The volume reflects the increased capabilities from Southern European research groups and institutions to cover the manifold aspects in wildland fire science and to provide the base for enlarging the scope of fire science toward a Pan-Mediterranean fire analysis, potentially to be expressed through its common fire culture and atmosphere. *J.G.*

Trabaud, L. and R. Prodon (eds.) 1993. Fire in Mediterranean ecosystems. Ecosystem Research Report Series of the Environmental Research Programme of the Commission of the European Communities 5, E.Guyot SA, Brussels, 441 p.(in English)

Forest Fires in Greece in the Year 1991

The forest fire analysis of Greece by S.Markalas and D.Pantelis, Aristotelion University of Thessaloniki, give detailed insights into the fire environment of Greece. The 1991 fire season is analyzed and compared with long-term developments of wildland fire in Greece. *J.G.*

> *Markalas, S. and D. Pantelis 1994. Forest fires in Greece in the year 1991. Aristotelion University of Thessaloniki, Laboratory of Forest Protection Publication No.1/1994, 20 Tab., 38 p. (in Greek, with English summary and table captions).*

Forest Fires in Southern Europe. Overview of EC actions: Towards an International Cooperation?

On 26 November 1993 a Workshop on Forest Fires was held in the European Parliament, Brussels, Scientific and Technological Options Assessment (STOA). The STOA programme is the official organ for the evaluation of scientific options of the European Parliament. It provides scientific and technical advice to the members and the commissions of the European Parliament. The project "Forest Fires in Europe" was devoted to closely investigate the fire problem of Southern Europe on a political level. Written and oral reports from representatives of the Southern European countries are published in a volume edited by the European Parliament, providing valuable analyses of national fire problems (including detailed fire statistics) and the individual ways Southern European nations go in solving the fire problem. Proposals to overcome the deficiencies of cooperation and coordination within and between the Mediterranean nations are abundant. Two main points raised by the representative of Greece, Mr.Paul N.Efthymiou, highlight the crucial weaknesses of Mediterranean fire protection. First there are the internal problems within the nations. They are largely caused by the splitting of responsibilities in wildfire prevention and control between a variety of agencies involved, resulting into weakening of the efficiency of national fire management capabilities. Second there is still a lack of joint, multinational efforts in sharing fire management resources. Europe is still separated by national boundaries and administrative competition. The process of European unity could be expressed better. *J.G.*

> *The European Parliament 1993. Forest fires in Southern Europe. Overview of the ECE actions: towards and international cooperation? STOA - Environment Programme, PE 177.697, 272 p. (French and English)*

MEETINGS HELD IN 1993-94

ARGENTINA

First Symposium on Fire Management and Fire Ecology in Patagonia

In December 1993, the first symposium on fire was held in Patagonia, Argentina. The symposium was attended by 41 specialists from various agencies and research institutions from all over Argentina. The subjects covered fire management and ecology not only in Patagonia but also in the central and northern regions of Argentina.

In the first part of the seminar technicians as well as brigade chiefs and those from the Forest Fire Services who are responsible for operational command met in the city of El Bolsón, Rio Negro Province. Papers were given and intensively discussed on the following subjects:

Basics of Fire Ecology in Argentina's Vegetation: From Local to Global Scale

At the beginning of the seminar the role of fire in the ecology of various vegetation types of Argentina was highlighted. Historical and modern fire records show that fire has been omnipresent since humans began to occupy the region. Ongoing research between various institutions in Argentina and the Max Planck Institute for Chemistry, Fire Ecology Research Group, shows that fire plays an important role in shaping ecosystems and has considerable influence on the regional and global atmosphere and climate.

Experience in the Use of Prescribed Fire in Argentina

In Argentina the use of fire as a land management tool has a long tradition. The controversial issues, e.g. questions of benefits vs. destructiveness of fire in various vegetation types, were discussed.

Pasture areas in Santiago del Estero Province

In this region, which belongs to the Grand Chaco Woodlands, fire is widely used for converting native vegetation to rangelands and to stimulate regrowth on these pastures. At present activities are developed to provide guidelines to use fire on a scientific basis so as to prevent or minimize system damages (see contribution in IFFN No.10, p.4).

The woodland region in La Pampa Province

This vast area corresponds to the Xerophytic Scrub Region in the central part of Argentina. Cattle raising is extensively developed on former woodlands which have been and still are constantly being converted into pasture. Fire management methodologies for those pastures are being studied at present to enhance grass productivity, at the same time to reduce deterioration of the soil and tree component (see contribution in IFFN No.10, p.2).

Andino-Patagonian forest region

The most important natural and man-made forests are concentrated in the southern part of the country. They are subjected to high wildfire hazard. The vegetational and climatic characteristics result in fuel accumulation, regularly leading to high-intensity and unmanageable forest fires. Prescribed fire is one of the tools proposed as a management technique in order to avoid excessive fuel accumulation in man-made forests, particularly in *Pinus ponderosa*. Safe techniques for prescribed burning are being developed at present.

Wildfire behaviour in mountainous forests

Forest fires in mountainous regions have a distinct behaviour. The behaviour of large fires which occurred during the last ten years in the Andino-Patagonian Region was analyzed and discussed.

The second part of the seminar took place in the Andino-Patagonian Center for Forest Research and Extension (Centro de Investigación y Extensión Forestal Andino Patagonico [CIEFAP]) in Esquel, Chubut Province, and consisted of a seminar on "Environmental Alterations Caused by Forest and Grassland Fires". During this part of the seminar more detailed presentations were given and discussions were held on fire research activities in Patagonia, Santiago del Estero, La Pampa and other regions. Finally, a visit was made to fire-affected areas, not only of native forests, which mainly consists of Ciprés de la Cordillera (*Austrocedrus chilensis*), but also to exotic conifer plantations. Studies on forest species regeneration and post-fire successions were presented.

The seminar was organized through CIEFAP and its supporting institutions, the German Agency for Technical Cooperation (GTZ), in collaboration with the Max Planck Institute for Chemistry (Germany).

Paul Cwielong

Centro de Investigación y Extensión Forestal
Andino Patagonico (CIEFAP)
C.C. 238
RA - 9200 Esquel, Chubut

Fax/Phone: ++54-945-3948

MEETINGS PLANNED FOR 1995-95

CANADA

Fire Management in the Wildland/Urban Interface: Sharing Solutions.
2-5 October 1994, Kananaskis, Alberta, Canada.

This international symposium is sponsored by the Partners in Protection Association, a multi-agency group that has banded together to address the issue of fire management in interface areas in the province of Alberta. In September 1992 the Partners conducted an introductory seminar attempting to create awareness of the situation in Alberta and other parts of Canada. The intent of this upcoming symposium is to focus on SOLUTIONS to fire management issues in wildland/urban interface areas. Experts from Canada, the United States, and Australia will discuss public education, fire operations, cross-training, and land-use planning and development. Examples of actual programmes that have been successful and informative research results will be presented in an interactive poster session. Delegates will also participate in a more in-depth analysis of potential solutions through concurrent, hands-on workshops.

The location for this symposium is in Kananaskis, Alberta, which is located in the Canadian Rockies and borders on Banff National Park. The area has seen tremendous development and use over the last 10-20 years and is an ideal location to view both interface problem areas and some potential solutions. Further information on the symposium can be obtained from:

The Partners in Protection
P.O. Box 7541
CDN - Edmonton, Alberta T5E 6K1

Phone: ++1-403-427-6807

PORTUGAL

2nd International Coimbra Conference on Forest Fire Research
21-24 November 1994, Coimbra

Objectives

Following the First International Coimbra Conference on Forest Fire Research that took place in November 1990, a second conference shall be held in Coimbra, 21-24 November 1994. The scope of this conference is to bring together scientists from Europe and other parts of the world working on various aspects of wildland fires, and encourage the presentation of results of scientific research, discussion of methodologies and the increase of international cooperation.

Due to the large number of papers submitted for presentation, there will be four days dedicated to formal sessions. These sessions will include eight keynote lectures on the main topics of fire research given by invited speakers, presentation of papers (ca.100) and posters (ca.30).

Main topics of the conference are: Human and institutional aspects, fire prevention (fire risk, fire weather), fire behaviour (fire modelling), and fire effects (ecological effects, physical aspects).

Short Course

A short course on Wildland Fire Behaviour Modelling, directed by Frank Albini (U.S.A.) will be held *in tandem*, on 25-26 November, immediately after the conference.

FIRESCHEME Founding Meeting

It is planned to convene the founding meeting for the proposed Pan-Mediterranean research project **Fire Information Systems Research in the Ecology, Socio-Culture and History of the Mediterranean Environment (FIRESCHEME)** (see page 26). The founding meeting to which all interested parties are invited will be held at the end of the conference, on 24 November.

For "last minute registration" please contact the Chairman of the Organizing committee:

Domingos Xavier Viegas
Grupo de Mecânica dos Fluidos
Departamento de Engenharia Mecânica
Faculdade de Ciências e Tecnologia
Universidade de Coimbra
P - 3000 Coimbra

Fax: ++351-39-22268
Phone: ++351-39-34339

U.S.A.

Environmental Regulation and Prescribed Fire: Legal and Social Challenges.
15-17 March 1995, Tampa, Florida

Environmental regulators and prescribed fire practitioners are seemingly at odds. Environmental regulators and lawmakers may see prescribed fire as a significant source of smoke pollution which should be limited to protect air and water quality. Prescribed fire managers see the use of fire as essential for ecosystem health, endangered species preservation, and hazardous fuel reduction. In the larger picture, however, environmental regulators and prescribed burn practitioners have a common goal: protection of a healthy environment. This national conference will serve as a forum for prescribed fire users and environmental regulators to discuss their respective roles, and to identify strategies that address the legal and social challenges to the continued use of prescribed fire as a management tool while protecting air and water quality.

Conference Topics

Legal Issues - Federal, state and local laws and regulations governing or affecting the following:
- Air quality
- Water quality
- Wildlife management
- Wilderness management
- Ecosystem management
- Private initiatives (conservation easements, deed restrictions)
- Participation in the regulatory process

Liability Issues - Liability and prescribed fire
- Prescribed fire vs. wildfire
- Practitioner health and safety
- Insurance for prescribed fire practitioners

Social Issues
- Public education
- Media relations
- Public health

Who Should Attend? Individuals from agencies and organizations involved with the use of prescribed fire, and those charged with regulating impacts of this management practice at the federal, state or local level. These include air quality regulators, environmentalists, lawmakers, land managers, private industry representatives, conservationists, and others interested in these topics.

Conference Information: The conference will include three days of paper and panel sessions, poster presentations, and a round table discussion. The conference will begin with a social on 14 March 1995 at 6:00 pm at the Tampa Hilton Metro Center, which is one mile from the Tampa International Airport. Field trips will be conducted Saturday, 18 March 1995.

Call for Abstracts! We welcome abstracts for consideration that elaborate on the subjects listed above, or provide specific case examples related to the topics. Most will be interactive poster presentations, but a few will be selected for oral delivery. Please submit by 31 August 1994. Abstracts should be one page or less in length, and include the author's name, address, phone and fax numbers. All presentations will be published in a conference proceedings. Authors of papers or posters accepted for presentation will be notified by 7 October 1994.

What are your Concerns? At the round table, a panel of conference participants representing different viewpoints will discuss the problems facing prescribed burners and environmental regulators, and develop possible solutions. To ensure that round table participants address the issues of greatest concern to you, please provide your input now. List your major concerns relating to fire and the environment, and mail or fax to the address indicated. The responses will be used to shape the focus of the table discussion.

Diane Ots
Environmental Regulation and Prescribed Fire Conference
Florida State University
Center for Professional Development & Public Service
USA - Tallahassee, Florida 32306-2027

Fax: ++1-904-644-2589
Phone: ++1-904-644-7545

Chapman Conference on Biomass Burning and Global Change
Williamsburg, Virginia, 13-17 March 1995

The aim of the conference is to asses the role and importance of biomass burning as a process for global change. The conference will consider the impact of gaseous and particulate emissions from biomass burning on atmospheric chemistry, on the bio-geo-chemical cycling of elements, and on climate. The conference will be held in Williamsburg, Virginia. Convenor of the conference is Joel S. Levine, Atmospheric Sciences Division, NASA Langley Research Center, Hampton, Virginia.

Conference Purpose

The conference will consist of 10 half-day oral sessions featuring tutorials, review talks, and contributed talks. Public lectures are also planned. Topics to be discussed are:

- Measurements of biomass burning from space
- The global geographical and temporal distribution of biomass burning
- The burning and combustion characteristics of diverse ecosystems: tropical, temperate, and boreal forests, grasslands and agricultural lands
- Gaseous and particulate emissions from biomass burning
- Impact of biomass burning on atmospheric chemistry and climate

- o Biomass burning as a source of chlorine and bromine in the stratosphere
- o The impact of biomass burning on the bio-geo-chemical cycling of gases
- o Modelling the impacts of biomass burning
- o History and future of biomass burning
- o Social, economic and political implications of biomass burning
- o Future biomass burning experiments

Publication of conference papers will be in a dedicated volume and/or in a special issue of an American Geophysical Union (AGU) journal.

Abstracts and Deadlines

A camera-ready original and two copies must be submitted in standard AGU abstract format by 23 November 1994, to the AGU at the address listed below. Those not submitting abstracts who wish to be placed on the mailing list, please contact:

AGU Meetings Department
Biomass Burning and Global Change
2000 Florida Avenue
USA - Washington, D.C. 20009

Fax: ++1-202-328-0566

RUSSIAN FEDERATION

International Conference on Forest Fire Modelling
24-28 July 1995, Tomsk, Russian Federation

An International Conference on Modelling of Forest Fires is being planned at present. The conference will be organized by Professor Grishin, Tomsk State University, in cooperation with the International Boreal Forest Research Association (IBFRA; contacts: Frank Albini, Michael Fosberg, Johann G.Goldammer, Brian J.Stocks) and co-sponsored by the International Association of Wildland Fire (IAWF).

In order to avoid conflicts with the time schedules of the IUFRO World Congress (7-11 August 1995) and the planned IBFRA fire experiments in Canada during the 1995 fire season (end of June until mid-July), the conference is now scheduled for the week 24-28 July 1995.

Those who are interested to attend, contribute or to sponsor the conference should directly contact

A.M.Grishin
Head, Department of Physical Mechanics

Tomsk State University
Lenin Avenue 36
RU - 634050 Tomsk

Phone: ++7-3822-232791
Fax: ++7-3822-445089
e-mail: sneg.tomsk.su!sneg@sneg.tomsk.su

FINLAND

20th IUFRO World Congress, 7-12 August 1995, Tampere

The 20th IUFRO World Congress will take place in Tampere (Finland) from 7-12 August 1995. Two sessions on fire research will be held. A two-hour session "Fire-Insect-Pathogen Interactions" will be chaired by Robert E. Martin. Those who wish to contribute to the session are kindly asked to contact the convenor of the session:

Robert E. Martin
University of California
College of Natural Resources
145 Mulford Hall
USA - Berkeley, CA 94720

Fax: ++1-510-643-5438
Phone: ++1-510-642-7931

Four two-hour session "Objectives and Design of Experimental Fires in Boreal Forest Ecosystems". This session will provide the floor for presentation of the results of the first phase of FIRESCAN/IBFRA, the Bor Forest Island Fire Experiment. The session will include the presentation of a 1-hour film "The Fire Experiment" (English), and the presentation of the monograph "Fire in Ecosystems of Boreal Eurasia". Depending on the time required for presentation of the research papers, a limited number of additional oral presentations on the topic may be included. **Because of the late distribution of the January 1994 issue of IFFN the deadline for submitting an abstract to the convenor has been postponed to 30 September 1994.** Convenor of the session is Johann G. Goldammer (address on page iv).

General Information about the IUFRO XX World Congress "Caring for the Forest: Research in a Changing World"

IUFRO News 1/1994 is devoted to the preparation of the 20th World Congress. For those interested in more information, please contact:

IUFRO-95 Congress Secretariat
Finnish Forest Research Institute
Unioninkatu 40 A
FIN - 00170 Helsinki

Fax: ++358-0-625 308
Phone: ++358-0-857 051
Telex: 121286 metla sf
E-mail: iufro@metla.fi

For those who are members of IUFRO and on the mailing list of IUFRO News: A registration package will be published in IUFRO News 4/1994.

SPAIN

Workshop on Remote Sensing and Geographic Information Systems Applications to Forest Fire
7-9 September, Alcalá de Henares (Madrid)

The objective of this Workshop sponsored by the European Association of Remote Sensing Laboratories (EARSel) is to discuss different applications of satellite remote sensing in forest fire research, with special emphasis on remote sensing and GIS integration. The preliminary program of the workshop is:

7 September: New sensors for fire monitoring from space

Fire detection from remote sensing systems. Special emphasis will be devoted to spaceborne sensors and global programs, but aerial sensors and local applications will also be covered

Remote sensing applications to burned land mapping and fire effects on vegetation recovery (mapping of burned areas, vegetation succession after fire)

8 September: Use of remote sensing data for fire danger estimation (estimation of vegetation stress, fuel moisture,. ignition risk)

Remote sensing and GIS integration for fire risk management

9 September: Field trip to Gredos area. This zone has been historically affected by forest fires.

The program still may undergo changes. Since it is planned to issue a deadline of submitting abstracts by 20 December 1994, this preliminary information is given already now. More information on the workshop may be obtained through the convenor of the workshop:

Emilio Chuvieco

Departamento de Geografía
Universidad de Alcalá
Cl.Colegios, 2
E - 28801 Alcalá de Henares (Madrid)

Fax: ++34-1-885-4400
Phone: ++34-1-885-4429

Global Vegetation Fire Inventory (GVFI)

Call for Cooperation and Support

Rationale

Assessments of past, present, and future atmospheric chemistry and the consequences of changes of atmospheric chemistry on the global climate rely in part on inventories of emissions of appropriate chemical substances (chemical "species") and aerosols constructed on appropriate spatial and temporal scales.

Global bio-geo-chemical cycles and the chemical properties of the atmosphere are highly influenced by emissions from combustion of fossil fuels and of plant biomass.

Whereas the investigation of fossil-fuel burning has been receiving most attention and meanwhile providing reliable information, the inventory of global emissions from free burning vegetation fires (wildfires, fires in land-use) and other plant biomass burning (burning of fuelwood and charcoal) is still inadequate.

The latest global estimates of emissions from plant biomass burning (Hao et al. 1990, Weiss 1990, Crutzen and Andreae 1990, Andreae and Goldammer 1992, Andreae 1993, Goldammer 1993) are still considered as uncertain due to the very weak databases (a summary table from Andreae and Goldammer [1992] is given in the Appendix).

The main reason for the weakness of basic statistical data is that in the most important regions and countries no statistical data are collected systematically on the spatial and temporal extent of free burning fires in

- forests (wildfires, prescribed fires, burning for planned forest conversion)
- tree, brush, and grass savannas (wildfires, prescribed fires)
- use of fire in agriculture (burning of harvest residuals)

The main reasons for the lack of reliable data is that the origins of vegetation fires are highly diverse (natural fires, a large variety of reasons of human-caused fires). Their spatial and temporal extent is not known in areas which lack infrastructure (remote sites with low human population densities, e.g. savanna and boreal forest lands). The use of spaceborne sensors for fire detection, classification and mapping has been used mainly for research purposes and case studies. On a permanent operational base the use of satellites is restricted to few locations (e.g. Brazil).

The systematic collection of fire data through administrations, e.g. forest services, is restricted. While forest fire statistics are systemically collected and published only within the ECE region (Economy Commission for Europe: Member countries are all European countries including the CIS, plus the U.S.A. and Canada; c.f. ECE/FAO 1993), most other statistical data are in the "grey literature" and practically not available for international interpretation. The FAO Global Wildland Fire Statistics (FAO 1992) was a first attempt to collect country reports and to summarize information on wildfires in forests. The findings for the decade 1981-1990 show that a large gap of information exists on reliable statistical coverage.

The existing estimates mentioned before have been reexamined recently and improved through the integration of the vegetation fire component into a High Resolution Biome Model (HRBM)(Mack 1994).

This model approach provides the temporal and spacial extent of vegetation fires and allows the modelling of all kinds of chemical species emitted by the fires. For instance, the model reveals a global gross flux of carbon emitted from vegetation fires to the atmosphere of 4.14 Pg (1 Pg = 1 billion tons) per year. This compares with the previous estimates as follows (bio-fuels and agricultural burnings are not included)[5]:

Hao et al. (1990):	2-2.5 Pg (tropics only)
Crutzen and Andreae (1990):	2.6-3.3 Pg
Andreae and Goldammer (1992), Andreae (1993):	2.74 Pg
Weiss (1990) and Goldammer (1993):	4.5 Pg ("upper limit of fire potential", tropics only)
HRBM Model (Mack 1994):	4.14 Pg

The obvious discrepancies between the various estimates and the model, and the inherent weaknesses of a model itself, clearly justify the necessity of a new comparative approach.

---

[5] **References:**

Andreae, M.O. 1993 The influence of tropical biomass burning on climate and on the atmospheric environment. In: Biogeochemistry of global change: Radiatively active trace gases (R.S.Oremland, ed.), 113-150. Chapman and Hall, News York.

Andreae, M.O. and J.G.Goldammer 1992. Tropical wildland fires and other biomass burning: Environmental impacts and implications for land use and fire management. In: Conservation of West and Central African Rainforests (K.Cleaver et al., eds.), 79-109. World Bank Environ. Paper 1. The World Bank, Washington, D.C.

Crutzen, P.J. and M.O. Andreae 1990. Biomass burning in the tropics: Impact on atmospheric chemistry and biogeochemical cycles. Science 250, 1669-1678.

P.J.Crutzen and J.G.Goldammer (eds.) 1993. Fire in the environment: The ecological, atmospheric, and climatic importance of vegetation fires. Dahlem Workshop Reports. Environmental Sciences Research Report 13. John Wiley & Sons, Chichester, 400 p.

ECE/FAO 1993. Forest fire statistics 1990-1992. ECE/TIM/70, United Nations, New York, 24 p.

FAO 1992. Global wildland fire statistics. FO: MISC/92/4. FAO, Rome, 48 p.

Goldammer, J.G. 1993. Feuer in Waldökosystemen der Tropen und Subtropen. Birkhäuser-Verlag, Basel-Boston, 251 p.

Hao, W.M., M.-H. Liu and P.J. Crutzen 1990. Estimates of annual and regional releases of CO_2 and other trace gases to the atmosphere from fires in the tropics, based on the FAO statistics for the period 1975-80. In: Fire in the tropical biota. Ecosystem processes and global challenges (J.G. Goldammer, ed.), 440-462. Ecological Studies 84, Springer-Verlag, Berlin-Heidelberg-New York, 497 p.

Mack, F. 1994. Zur Bedeutung von Vegetationsbränden für den globalen Kohlenstoffkreislauf. Doctoral Dissertation, University of Giessen, May 1994.

Weiss, K.F. 1990. Abschätzung der jährlichen Biomasseverbrennung und Kohlenstoffemissionen aus Wald- und Savannenbränden in den Tropen und Subtropen. Unpubl. Diploma Thesis, Fire Ecology Research Group, c/o Inst.Forest Zoology, Univ. Freiburg, 88p.

This proposed first step for a global fire inventory aims to collect a comprehensive set of data on vegetation fires. These are all free-burning fires occurring in all types of vegetation, including fire used in the agricultural sector.[6]

Objectives of the GVFI

With a global fire data set it will be possible to feed regional and global models, e.g. in atmospheric chemistry, carbon cycle, etc. Such a data set will be an important step to realize the Global Vegetation Fire Information System as proposed by the 1992 Dahlem Conference on "Fire in the Environment" (Crutzen and Goldammer 1993).

Phase I of the GVFI

The aim of establishing a Global Vegetation Fire Inventory (GVFI) is supported by various international research activities. Among various international activities the most actively involved research structures and programmes, which are supporting GVFI, are:

a. The International Global Atmospheric Chemistry Project (IGAC), a core project of the International Geosphere-Biosphere Programme (IGBP) with its operational projects BIBEX (Biomass Burning Experiment) and GEIA (Global Emissions Inventory Activity).
b. The International Boreal Forest Research Association (IBFRA)
c. The ECE/FAO Team of Specialists on Forest Fire
d. The International Decade for Natural Hazard Reduction (IDNDR), in cooperation with UNESCO and the Man and Biosphere (MAB) programme.

Methodology of Phase I

In Phase I of the Global Vegetation Fire Inventory it is attempted to collect experience in developing, applying and improving methodologies of data collection and a first set of "raw data". Through a network of Regional Correspondents the regions would be investigated. The correspondents would be responsible for collecting the data of all countries within their region of responsibility. With this call for cooperation the Regional Correspondents would be supported. In order to utilize the country- and biome-specific expertise of the regional correspondents it is suggested to proceed on a country-by-country base and vegetation type (→ fire regime type) respectively.

For Phase I a simplified approach is chosen in order to obtain a quick result for first discussion and further improvement of accuracy. The development of the outline and structure of the following Phase II will require a more thorough discussion, based on the results of Phase I.

The Vegetation Types to be Investigated

The vegetation types of which the fire data should be collected are given in a blank table (see Appendix).

---

[6] On a global scale the extent of the use of fuelwood and charcoal for cooking and heating is also not well known quantitatively. Because of a different research approach and a different target group involved, this survey will not investigate the extent of the use of fuelwood and the production and burning of charcoal, and other renewable biofuels (e.g. dung, biogas, etc).

Sources of Data

Potential sources for the compilation of data are different for each vegetation types:

Forest conversion fires:	Deforestation rates, e.g. from national or FAO statistics. Burned biomass data from relevant research (e.g. Brown and Lugo's publications)
Forest wildfires:	Statistics, satellite data.
Prescribed forest fires:	Statistics, research data.
Other wildlands (savannas):	Vegetation maps. Fire intervals and biomass loads from research.
Range management fires:	Agricultural statistics (yearbooks). Biomass estimates.
Agricultural residues burning:	Agricultural statistics, biomass estimates.

Reference Time

The data to be collected should refer to an annual average. In case of availability of statistical data or other regularly collected records (e.g. remotely sensed fire data) the average given should refer to a recent decade, preferably to the last ten years.

Time Frame: A Desirable Target

Since the goal of Phase I is to obtain a "quick look" at the global fire scene, it would be desirable and helpful to obtain the products by end of 1994 (November). This first product would be analyzed between December 1994 and February 1995. The results would be presented as a team paper at the upcoming AGU conference "Biomass Burning and Global Change" which will be held in Williamsburg, Virginia, 13-17 March 1995. Immediately after that conference a one-day session of GEIA will be held (18 March) (see pp.42-43).

In the following year more detailed investigations will take place for preparing a more comprehensive document for the ECE/FAO/ILO Conference on "Forest, Fire, and Global Change" which will be held in the Russian Federation, Summer 1996. One of the major objectives of that meeting in which government representatives and scientists will meet will be to create the ground for an international agreement on joint vegetation fire inventories (the draft agenda and objectives of that meeting are given in the Appendix).

Support of Regional Correspondents by Readers of this Newsletter: Country Contacts

In order to facilitate the collection of data within the regions it would be highly appreciated if Country Correspondents would support the Regional Correspondents. Interested individuals, research groups or agencies are requested to send their information, preferably summarized on the attached form, to the GVFI coordinator:

Johann G.Goldammer
Fire Ecology Research Group
c/o University of Freiburg
D-79085 Freiburg

Fax: ++49-761-808012

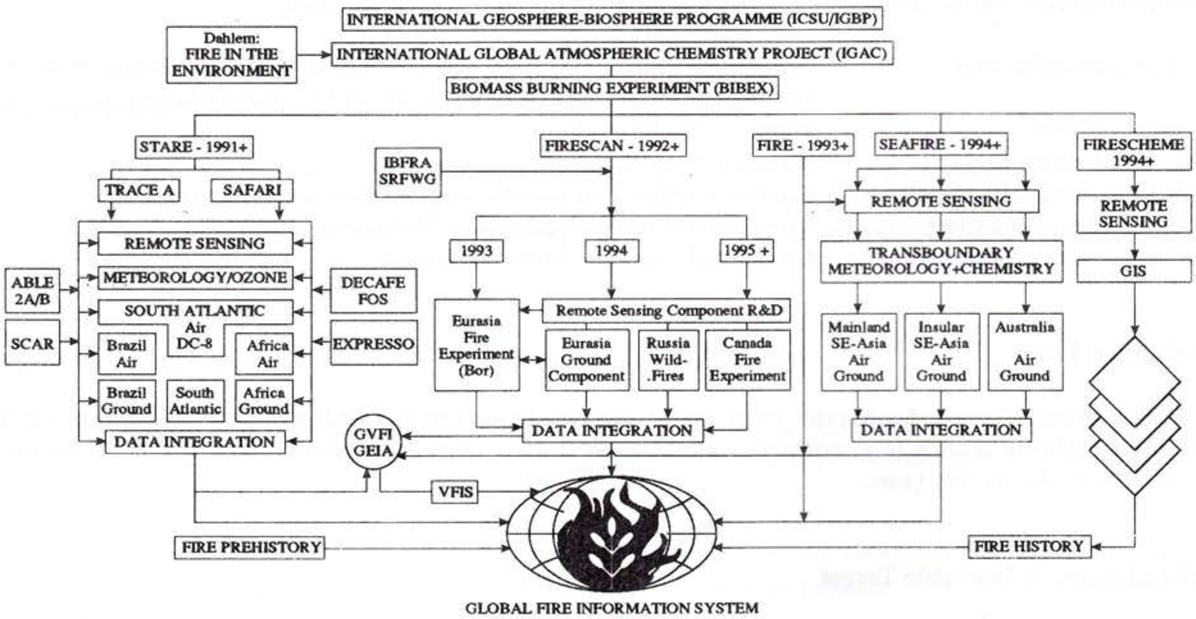

Fig.1. Organizational diagram of vegetation fire research activities which will be integrated into the development of a Global Fire Information System. Acronyms are explained below.

List of Acronyms of Regional and Global Fire Research Activities

ABLE	Amazon Boundary Layer Experiment (→ GTE)
BIBEX	Biomass Burning Experiment (→ IGAC)
EXPRESSO	Experiment for Regional Sources and Sinks of Oxidants
FIRE	Fire in Global Resource and Environmental Monitoring (CEC-JRC)
FIRESCAN	Fire Research Campaign Asia - North (→ IGAC)
FIRESCHEME	Fire Information Systems Research in the Ecology, Socio-Culture and History of the Mediterranean Environment
FOS/DECAFE	Fire of Savannas/Dynamique et Chimie Atmosphérique en Forêt Équatoriale
GEIA	Global Emissions Inventory Activity (→ IGAC)
GIS	Geographic Information System
GTE	Global Tropospheric Experiment
GVFI	Global Vegetation Fire Inventory (→ IGAC, BIBEX, GEIA, IBFRA)
IBFRA	International Boreal Forest Research Association
ICSU	International Council of Scientific Unions
IGAC	International Global Atmospheric Chemistry Project (→ IGBP)
IGBP	International Geosphere-Biosphere Programme (→ ICSU)
SAFARI	Southern African Fire-Atmosphere Research Initiative (→ IGAC)
SCAR	Smoke, Clouds, Aerosols, and Radiation Experiment
SEAFIRE	South East Asian Fire Experiment (→ IGAC)
STARE	Southern Tropical Atlantic Regional Experiment (→ IGAC)
SRFWG	Stand Replacement Fire Working Group (→ IBFRA)
TRACE-A	Transport and Atmospheric Chemistry Near the Equator - Atlantic
VFIS	Vegetation Fire Information System (→ Dahlem Konferenz Model)

REPLY FORM

From: ....

Address:..............................

....

....

Phone: ....

Fax: ....

E-mail: ....

To
Johann G. Goldammer
Fire Ecology Research Group
c/o Freiburg University
P.O.Box
D-79085 Freiburg

Fax: + +49-761-808012 .

Global Vegetation Fire Inventory (GVFI)

In the enclosure I am attaching

O a completed form for a first assessment of vegetation fires in

.... (name of the country)

O a note with suggestions for the follow-up Phase II of GVFI

O I declare that I (or my research group, administrative body, etc) desire to cooperate further in GVFI

Date: ____________ Signature: ________________________

enclosure: .... pages

Biome Type	Area Burned (ha/yr)	Average Fuel Burned (t/ha)*	Total Biomass Burned (t/yr)*	Fraction (%) Burned per Month (1 = January, 12 = December)												Source
				1	2	3	4	5	6	7	8	9	10	11	12	
Forest 1: Not intensively managed and protected																
Forest 2: Intensively managed and protected																
Savanna/ Shrubland 1: Not intensively managed and protected																
Savanna/ Shrubland 2: Intensively managed and protected																
Grassland/ Pastures (not in categories savanna 1/2) intensively managed																
Other agricultural lands (straw burning, e.g. corn, wheat, rice paddies, sugar cane)																
Other (explain)																
Name of COUNTRY:										**Years/Decade of Reference:**						

* Metric tons, dry weight

Printed at United Nations, Geneva
GE.94-23396—September 1994—1,100