UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

INTERNATIONAL FOREST FIRE NEWS

No. 17 – July 1997

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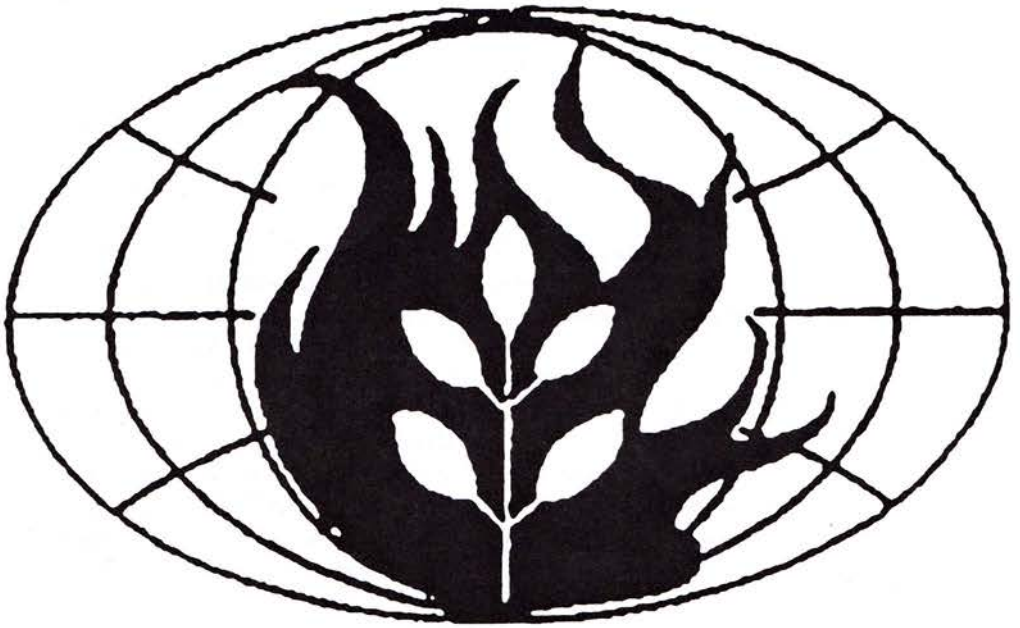

INTERNATIONAL FOREST FIRE NEWS

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Timber Section, UN-ECE Trade Division
Palais des Nations
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Fax: ++41-22-917-0041 e-mail: info.timber@unece.org

The publication is edited and prepared by Johann Georg Goldammer, Leader of the FAO/ECE/ILO Team of Specialists on Forest Fire, at the Max Planck Institute for Chemistry, Germany (address: see next page). The preparation of this issue was supported by Soo Ing and Georg Buchholz (both Max Planck Institute for Chemistry).

Mailing address, telephone and fax numbers of the editor:

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 and photographs should be submitted by mail.

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

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The International Association of Wildland Fire

EDITORIAL

In my last editorial I announced update information on fire science in Central and Northern Europe. Some recent developments encouraged me to postpone the publication to the January 1998 issue of International Forest Fire News. First, a surprisingly rapid change of paradigms takes place these days in Europe's nature conservation community, with peaks of activities in 1997. Between the Nordkapp and the Alps new initiatives are coming up which aim to restore the traditional use of fire in the management of forests, open landscapes, both under regular land-use management and in nature reserves.

On the other side, research institutes and administrations are seeking for new ways to improve their capabilities in fire management, ranging from the introduction of early warning systems, the use of remote sensing for alerting fire brigades, to the introduction of new fire suppression technologies.

I have invited representatives of fire research and management in the region of the Baltic Basin - these are all countries bordering the Baltic Sea (the Baltic States Estonia, Latvia, Lithuania), the Nordic countries (Denmark, Finland, Norway, Sweden), and Russia, Poland and Germany - to contribute to the next issue of IFFN. This activity is closely linked to the "First Baltic Conference on Forest Fire" in 1998, a Central-Northern European Fire Forum which is being formed these days.

*

After the UN FAO/ECE/ILO Seminar on Forest, Fire and Global Change" (Russia, 1996) the international wildland fire community - scientists, managers, and policy makers - met once again on a global forum. The 2nd International Wildland Fire Conference took place in Vancouver and provided an excellent opportunity to share views and to express a common spirit by underwriting recommendations which are directed to the UN system.

Finally, the 11th World Forestry Congress will take place in October 1997. The host country Turkey welcomes guests from all over the world and is prepared to give insights into its forest and forest management, a country full of traditions and rich in nature. This was one of the reasons to invite Ertugrul Bilgili, Karadeniz Technical University, Faculty of Forestry (Trabzon), to write a contribution to this issue in which he will familiarize the international fire specialists with the situation in Turkey: see pp. 15-21 of this volume.

Freiburg (Germany), July 1997 — Johann G. Goldammer

The 2nd International Wildland Fire Conference was a held in Vancouver, British Columbia, Canada from May 25 to May 30, 1997. The conference report and the principles, needs, visions and recommendations elaborated by the conference participants are given on pp. 46-48 in this volume.

COUNTRY NOTES

PEOPLE'S REPUBLIC OF CHINA

The Construction of Firebreaks with Retardant Species in China

Being the great enemy to forests, forest fire destroys all kinds of forest resources, damages forest ecosystems, jeopardizes the safety of human life and property in forest areas, impairs the social stability of forest areas and pollutes the air. All of which lead to the continuous deterioration of ecological environments and seriously threatens the human living environment. Forest fire has become a major problem in global forest development. It has been an issue of global concern to prevent forest fires and reduce the losses of forest resources.

General Situation of Forest Fire in China

China suffers from frequent forest fires. From the founding of New China till the year 1987, an average of 15,800 forest fires damaged a total forest area of 940,000 ha per year. During this period, the average **Annual Occurrence Rate** or **Fire Frequency** (=number of fires on 100,000 ha of forest land) of forest fire was 13.9 and the **Damage Rate** (=burned forest area compared to the total forest area of China) is 0.85%. During the recent ten years, however, forest fire has been greatly reduced. There has been a decrease of 52.7% in the frequency of forest fires and a decrease of 94.3% in damaged forest area compared to 1987. The average annual occurrence rate of forest fires is 6.3, and the **Damage Rate** is below 0.1%.

For many years a great deal of labour, material resources and funds have been put into China's fire control work, and construction in every aspect has been obviously improved. However, along with the development of forestry, more and more people are involved in activities within forest areas increasing the potential trouble. In addition, the great expansion of forest plantation areas achieved through the recent development of the afforestation movement has made the forest fire control task more arduous. The ecological environment issue has become increasingly severe leading to the necessity of strengthening forest fire control work. The task of forest fire control has yet a long way to go.

Fig.1. Forest fire brigade is getting ready for combating wildfires in the Daxinganling mountain region, Heilongjiang Province, North-East China. Photo: J.G.Goldammer.

Fig.2. Map of the large forest fire in the Daxinganling mountain region, Heilongjiang Province, which occurred in May 1987. At that time a total land area of 1.3 million hectares was affected by fire (grey shaded area). Source: Archive of the Fire Ecology Research Group, Max Planck Institute for Chemistry.

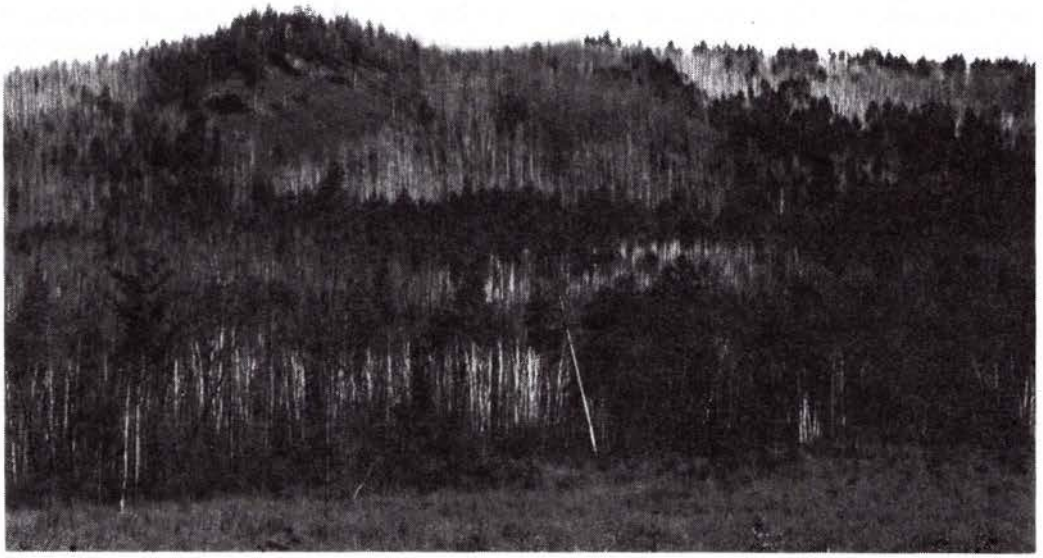


Fig.3. The consequences of large wildfires can be seen everywhere in the mountain boreal forest of Daxinganling. The light colour of trees indicate fire scars caused by high-intensity stand replacement fires; the dark trees are partially or non-damaged coniferous species. Photo: J.G.Goldammer.

General Situation of the Construction of Firebreaks with Retardant Species in China

"Retardant Species Firebreaks" belong to biological retardant engineering which is part of the forest fire retardant network. For the establishment of the firebreak, we will take into consideration the difference in combustibility and fire resistance between plant (arbor or shrub) individuals and colonies and the difference in mutual influence and mutual action between plants and environment. The fire resistibility of the plant itself is brought into full play, and those species with better fire resistibility are used in proper proportion to form the forest belt in order to improve the ability of fire resistance for the forest itself, prevent fire spread and reduce fire losses accordingly. The fire retardant effect achieved by the above-mentioned firebreak can be divided into two types. One is to use those species with better fire resistibility to prevent fire from expanding. For example, in South China, species like *Schima superba, Michelia macclurei, Myrica rubra* and *Camellia oleifera* are used, and in North China, *Fraxinus mandshurica, Populus* spp. and *Eleutherococcus senticosus* are used to build firebreaks. The other type is to plant *Larix gmelinii* of high density in the forest areas of Northeast China. The result is a change to the fire environment with little sunshine, low temperatures and relative high humidity inside the forest which will therefore separate the fire.

There are several advantages to the construction of retardant species firebreaks. First, it closely combines forest fire control together with afforestation, so that forest fire control work is brought into the whole procedure of afforestation. In this way, passive defence has been turned into early prevention, which reflects in a real way the policy of stressing prevention during fire control. Second, it closely combines present work together with long-term targets. The establishment of a retardant species firebreak will result in long-term benefits and is a radical measure taken for the permanent control of fire. The third advantage is that it closely combines social benefits, ecological benefits and economic benefits together. The establishment of the firebreak will effectively prevent the spread of forest fire, contribute to the improvement of forest species and stand, prevent the expansion of forest insects and disease, while at the same time increasing certain economic income. The construction of a retardant species firebreak in China was started by the end of the 1950s in some forest areas of South China where certain species with fire resistibility such as *Schima superba* and *Camellia oleifera* are used to build firebreaks. This activity was gradually promoted during the 1960s and 1970s in forest areas of both North and South China, and many good experiences have been achieved all over China, such as in the provinces of Fujian, Guangdong, Guangxi, Jiangxi, Zhejiang and Hunan in the south, and Heilongjiang, Jilin, Liaoning and Inner Mongolia in the north. Great development has been achieved in the construction of retardant species firebreaks along with the strengthening of basic facilities construction of forest fire control in China. At present, the retardant species firebreak with a total length of 339,000 kilometres has already been built in China, of which 170,000 kilometres of the firebreak has already been brought into full play in preventing forest fires.

Main Measures for the Construction of Retardant Species Firebreaks in China

Being one of the forest fire retardant engineering projects, the construction of retardant species firebreak is an effective method to prevent fire spread and has a very important position and role in the construction of basic facilities of forest fire control in China. To further promote the work, an on-site meeting on "Engineering Construction of National Retardant Species Firebreaks" was held by the Ministry of Forestry of China in July 1995. As a result, plans had been made in line with local conditions; funds had been raised in a wide range; input had been increased; and scientific research had been enhanced, so that the firebreak would be built in a more scientific and standard way. Currently, based on the principle of overall optimization, it has been initially planned that within the next 15 years, a total length of one million-kilometres firebreaks will be built. Therefore, together with another isolation strip, the length of an isolation strip per ha will reach 30 metres by the year 2010 in China. The efforts after 10 years, 20 years or an even longer period, will create a **Green Great Wall** of fire control within the 130 million ha of forest area in China. By then, the ability to control forest fires, especially big fires will be greatly improved.

Guang Chengxiang
Deputy Director, Forest Fire Control Office
Ministry of Forestry
No.18 Hepingli Dongije
Beijing 100714
People's Republic of China

Fax: ++86-10-6421-8153
Tel: ++86-10-6421-3058
Telex: 22237 CFEC CN

ITALY ***Forest Fires in Italy in 1995 and 1996***

Moderate weather conditions and unusual heavy summer rains in the southern regions of Italy, in two consecutive years, were partly responsible for relatively good wildfire seasons in 1995 and 1996. After the "annus horribilis" in 1993, when the country experienced dramatic fire events, surely the worst within the last 25 years, with more than 15,000 fires and 116,000 hectares burned, the number of fires and burnt surface dropped below average figures starting from 1994, apparently stopping the increasing trend (Fig.1a,1b). In any case, the number of reported fires has significantly decreased in the modern period, while the approximate timing of improved fire-fighting technology corresponds with this decrease. The decreasing turn continues showing a decrease in the number of fires and burnt surfaces in the past few years resulted in comparison with previous years' means (1970-1982 and 1970/92).

The distribution pattern of fires on the national territory exhibits a strong concentration of events in the southern and insular regions: though accounting only for 30.4% of the forested area of the whole country, in the past years they had more than 60% of fires and 70% of surfaces burned.

Years with a reduced number of fires are actually characterized by a moderate number of events in these areas, where figures can drop below the previous mean. Table 1 shows a trend of the concentration of fires in the three groups of regions (northern, central, southern and islands). The total budget is strongly influenced by southern regions, with a typical Mediterranean climate and a sharp summer distribution of fires.

Another feature of the phenomenon always observed in Italy, to such an extent as to be considered something of a postulate, is the high number of fires and surfaces burned in regions where forestry rates (percentage of total surface covered by forests) are strongly below national averages; the most severe situations are found in the islands of Sicilia and Sardegna, where fire is a traditional tool of rangeland management, dating from prehistoric ages. Table 2 shows fire data distribution within the regions for the past few years.

It can be observed that regions with reduced surface cover, normally accounting for the most severe budgets of events, correspond to the same southern regions and islands as mentioned above: the small group of regions (Puglia, Calabria, Campania, Sicilia, Sardegna) where summer fires are mainly voluntary and where forests can be considered marginal lands.

Fires are present, to a considerable degree, even in some central and northern regions (Lazio, Toscana and Liguria), far from marginal conditions. As a matter of fact, in these regions abandoned agricultural lands are quite often occupied by shepherds, emigrating with their flocks from Sardegna, where a shortage of rangelands is becoming a serious problem in relation to the increasing number of sheep, which still represent one of the pillars of local economy.

Fires in the northern regions of Italy are, on the contrary, without the character of severity of the southern group; in this case fires, often winter fires, are mainly non-voluntary, often related to dry winters and large amounts of cured fuels, and though their number can be considerable, surfaces are normally rather reduced.

To conclude, the moderate budget of fires in the last two years has been interpreted, by some state agencies, as the result of the increased airplane fleet which now consists of 14 airplanes (11 of which are Canadairs) and 32 helicopters managed by the national Civil Defence Service. A reduced number of airplanes and helicopters is also used by the Regions. The airplanes are used on the basis of *action on demand* for every fire, with a screening procedure which forcedly always gives priority to actions in the southern regions with a Mediterranean climatic pattern, where the number of events is very high. The airplanes are operation-based from two airports in central Italy (Roma and Pisa) with the exception of some Canadairs which are seasonally attached in Sardegna and Calabria.

A considerable distance between airports and places of action therefore often results in long, wasted periods of time while on the move to the fire site, thereby obviously reducing the efficiency of water or fire-bombing, made long after the fires have begun.

Tab.1. Number of fires and burned surfaces in Italy as percentage of national total (1961-1996)

Groups of Regions	Forested Area		Number of Fires									
	ha	%	1961-74	1978-87	1981	1986	1991	1992	1993	1994	1995	1996
Northern	3,004,137	44.4	32.84	23.53	27.27	24.74	19.77	16.97	14.33	19.24	32.32	16.71
Central	1,696,057	25.1	25.82	12.73	10.56	8.62	15.65	13.19	19.42	20.86	17.22	13.41
Southern & Islands	2,059,900	30.5	41.34	63.74	62.17	64.64	64.88	69.84	66.25	59.88	50.46	69.86
			Forest Surfaces Burned									
			1961-74	1978-87	1981	1986	1991	1992	1993	1994	1995	1996
Northern			38.11	29.33	50.25	40.92	7.89	27.36	10.66	8.10	52.06	11.30
Central			27.09	14.48	13.55	7.89	8.44	13.92	13.42	10.67	8.96	12.86
Southern & Islands			50.70	56.19	44.40	51.19	83.67	58.72	75.92	81.23	38.96	75.83

Tab.2. Number of wildfires and area burned in Italy

Region	Number of Fires		Forested Area									
			Forest Area (IFN 1985)	Area burned (ha)			Area burned as % of total area			Area burned in % of total forested area: period and yearly average		Forestry Ratio
	1982-95	1996		1994	1995	1996	1994	1995	1996	1982-94	$\bar{x}$	
Piemonte	5.139	223	743.400	667	2.768	284	0.08	0.37	0,03	6.87	0.52	29.3
Valle d'Aosta	326	16	84.600	44	92	4	0.05	0.10	0,004	1.65	0.12	25.9
Lombardia	4.746	127	598.500	431	1.495	331	0.07	0.24	0,055	6.01	0.46	25.1
Trentino Alto Adige	1.420	104	675.000	22	499	203	0.003	0.07	0,030	0.83	0.06	49.6
Veneto	1.440	83	351.000	95	511	240	0.02	0.14	0,068	3.11	0.23	19.1
Friuli Venezia Giulia	2.621	169	289.800	19	0	218	0.006	0.00	0.072	4.32	0.33	36.9
Liguria	12.444	631	374.400	1.433	2.910	941	0.38	0.77	0,25	21.48	1.65	69.1
Emilia Romagna	2.380	167	454.400	154	493	76	0.03	0.10	0,016	1.16	0.09	20.5
Toscana	9.771	556	982.800	1.963	461	1035	0.19	0.04	0,10	4.63	0.35	42.7
Umbria	1.897	87	336.600	511	52	95	0.15	0.01	0,02	3.10	0.24	39.8
Marche	1.731	84	224.100	621	28	63	0.27	0.01	0,028	3.05	0.23	23.1
Lazio	8.108	493	466.200	1.502	969	1.421	0.32	0.20	0,30	10.13	0.77	27.1
Abruzzo	1.573	66	322.200	810	208	193	0.25	0.06	0,05	3.00	0.23	29.8
Molise	1.148	222	129.600	73	32	90	0.05	0.02	0,06	4.36	0.33	29.2
Campania	17.316	1.579	378.900	687	560	3.396	0.18	0.14	0,89	16.95	1.30	27.9
Puglia	5.106	800	149.400	1.612	765	3.509	1.07	0.51	2,34	17.74	1.36	7.7
Basilicata	4.491	553	294.300	529	730	1.689	0.17	0.24	0,57	7.80	0.60	29.5
Calabria	14.365	982	576.900	4.156	1.384	3.608	0.72	0.23	0,62	16.75	1.28	38.3
Sicilia	3.578	470	266.400	6.112	2.022	2.559	2.29	0.75	0,96	22.30	1.71	10.4
Sardegna	34.422	1.681	976.500	15.341	860	369	1.57	0.08	0,03	14.51	1.12	40.5
Total Italy	134,022	9,093	8,675,100	36,782	16,839	20,324	0.42	0.19	0.23	8.53	0.66	28.8

Fig. 1 Number of reported fires (1961-1996)

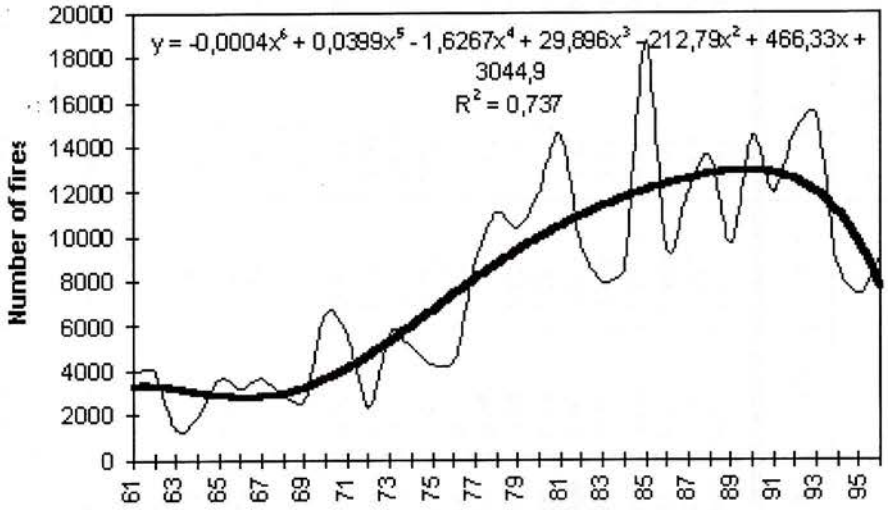
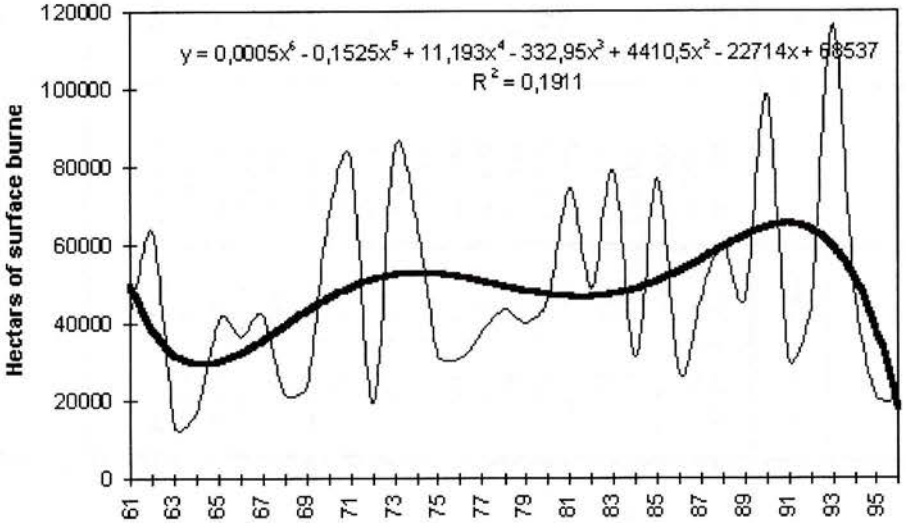


Fig. 2 Surfaces burned (1961-1996)



It is true that two years with a scarce presence of fires is likely related to weather fluctuations, but were misinterpreted in terms of the efficiency of a defence system which is still strongly based on stand-by seasonal crews; the most serious problem is that this period of unusual and unexpected calm has not been exploited to reinforce the defence apparatus in order to cope with the problem, if and when it will resume the usual size, after the odd fluctuations of the past years.

Vittorio Leone
Facoltà di Agraria, Università della Basilicata
I - 85100 Potenza

Fax: ++39-971-474269
Tel: ++39-971-474168
e-mail: Leone@unibas.it

MÉXICO *National Forest Fire Report*

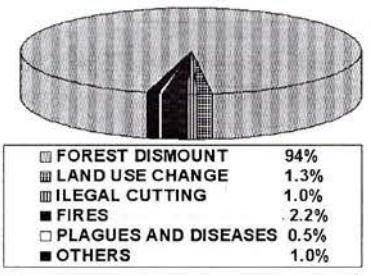
In this contribution the actions that México is carrying out to develop its Forest Fire Prevention and Control Programme and the results of the last 10 years are presented.

Biogeography of México: The Mexican Republic is located between the United States of America in the North and Guatemala and Belize in the South and Southwest, between the parallels 15° and 32°N. Three main vegetation types are distinguished:

Temperate-Cold Forest: Formed mainly by the coniferous species *Pinus* spp. and *Abies* spp. and by the broadleaved species *Quercus* spp. and *Alnus* spp. This forest region occupies an estimated area about 30 million hectares.

Tropical Forest: This forest zone is characterized by great species diversity among which the most important representatives are *Cedrela, Swietenya, Achras, Brosimum, Cordia, Metopium, Dialium*, and others. This forest region covers an area of 26 million hectares.

Arid Zone: The vegetation is represented by species of *Opuntia, Acacias, Agaves*, and others. This ecoregion occupies an estimated area about 58 million hectares.



Causes of deterioration of the ecosystems: It is estimated that 600,000 hectares of forest are destroyed annually. The main cause (90%) is attributed to deforestation (forest conversion) for agricultural purposes. Forest fires barely contribute to ca. 2.2% of the total destruction (Fig.1).

Fire Causes: In México the rural communities use fire for their agricultural activities. It is considered that the main share (60%) of wildfires is caused by grassland burning and the practice of shifting cultivation in the tropical zone (Tab.1).

Tab.1. Causes of wildfires in México

Fire Cause	Occurrence (%)
Agricultural Activities	60.0 %
Intentional	11.8 %
Smokers	10.1 %
Camp Fires	8.4 %
Other (illegal land occupation, power lines, lightning)	6.1 %
Forest Operations	1.9 %
Roads and Railroads	1,0 %
Other land-use Activities	0.7 %

Types of Fires: It is considered that 90% of the total fires are surface fires, and only 10% are crown and ground fires. Surface fires mainly affect the herbaceous vegetation layer and the natural regeneration of the forest, and are relatively easy to control.

Organization of Fire Control: The Federal Government, through the Secretary of Environment, Natural Resources and Fisheries (SEMARNAP), is responsible for the control of forest fires. At the administrational and operational levels the Subsecretary of Natural Resources acts through 32 Delegations in all the States of the Republic. Its authorization and action is based mainly on the Forest Law, the Law of Ecological Balance and Protection to the Environment, and on the Mexican Official Standard about the use of fire.

Resources: The resources for fire management provided by SEMARNAP are given in Table 2.

Tab.2. Fire management resources in México

Camps	99
Look out towers	64
Vehicles	240
Firefighter Crews	150
Firefighters	2000
Radios	715

Aerial Equipment: Recently SEMARNAP acquired one Bell 212 helicopter, one Bell 206, and two light fixed-wing airplanes (Cessna T-310). These are used for fire detection and the transport of firefighters. At the critical time of fires (March-May) SEMARNAP rents helicopters from private companies.

Coordination with other Agencies: A key element in the fire programme is the efficient coordination with other government agencies, such as the Secretary of the National Defense (Army), the Secretary of Marine, the Secretary of Government, the State Governments, as well as the owners of forests and volunteers. In 1996, for instance, the army supported control efforts in 287 forest fires with 13,555 soldiers and contributed substantially to reduce the risk of large fire situations.

The National Fire Programme

The National Fire Programme consists of three major elements, the prevention, the detection and combat of wildfires.

Prevention: The prevention element comprises all those actions that are dedicated to avoiding the presence of fires in the forests and to increase the awareness of the population about the importance of forests and forest protection. The prevention programme includes the involvement of mass media (TV, radio, press, etc.), the use of flyers, the organization of conferences and other direct actions with the inhabitants of the rural areas.

The prevention programme includes the use of prescribed burning and the establishment of control/buffer lines in zones of high risk in order to diminish the probability of occurrence and spread of wildfires.

The prevention programme also includes training and the provision of equipment. In the last fire season the prevention programme carried out 21,912 prescribed burns and established 6,292 kilometres of control/buffer lines.

Detection: An early and opportune detection which leads to the fast response and rapid control of the fire assures the reduction of large fires which are economically expensive and environmentally destructive. Means of detection utilize the full terrestrial and aerial support of the organization (e.g., fire towers, airplanes), commercial airlines, and the general public. A national telephone number has been established to which the public could call to report fires without cost.

In the last fire season a total of 40,227 terrestrial patrols, 64 operating lookout towers and 136 hours of aerial detection were involved in the programme.

Fire Control: The fire control programme includes all infrastructures, equipment and operations required to suppress wildfires. The available resources are listed above. In the fire season of 1997 more than 98,000 firefighters from all agencies were involved in fire control operations.

Fire Statistics

Fire statistics at the national level for the past ten years (1987-96) are compiled in Table 3. As of 10 July 1997 (date of writing this report) a total of 5,105 fires were counted, affecting 107,237 hectares. Out of this area burned, 70% are grasslands and brushlands which usually recover in the following rainy season/vegetation period. 30% of the land area affected by fire is forested, with varying degrees of damages. Comparing the data of 1997 with 1996 it can be seen that the number of fires was reduced by 45% and the area burned by 56% (Tab.4).

The fire season normally includes the months of January to August, the most critical being March, April, and May (Fig.2 and 3).

Tab.3. Wildland fire statistics of México for the decade 1987-96.

Year	Number of Fires	Area burned (ha)	Area/fire (ha)
1987	9,263	287,347	31.02
1988	10,942	518,265	47.36
1989	9,946	507,471	51.02
1990	3,443	80,400	23.35
1991	8,261	269,266	31.23
1992	2,829	44,401	15.69
1993	10,251	235,020	22.93
1994	7,830	141,502	18.07
1995	7,860	309,087	39.32
1996	9,256	248,765	26.88
Total	**80,241**	**2,641,524**	**32.92**
Average	**8,024**	**264,152**	**32.92**

Tab.4. Comparison of wildland fire data for the years 1996 and 1997

Year	Number of Fires	Area Burned (ha)	National Average (ha/fire)
1997	5,105	107,237	21.01
1996	9,216	244,318	26.51
Difference	-4,111	-137,081	-5.50
Percentage difference	**-45%**	**-56%**	**-21%**

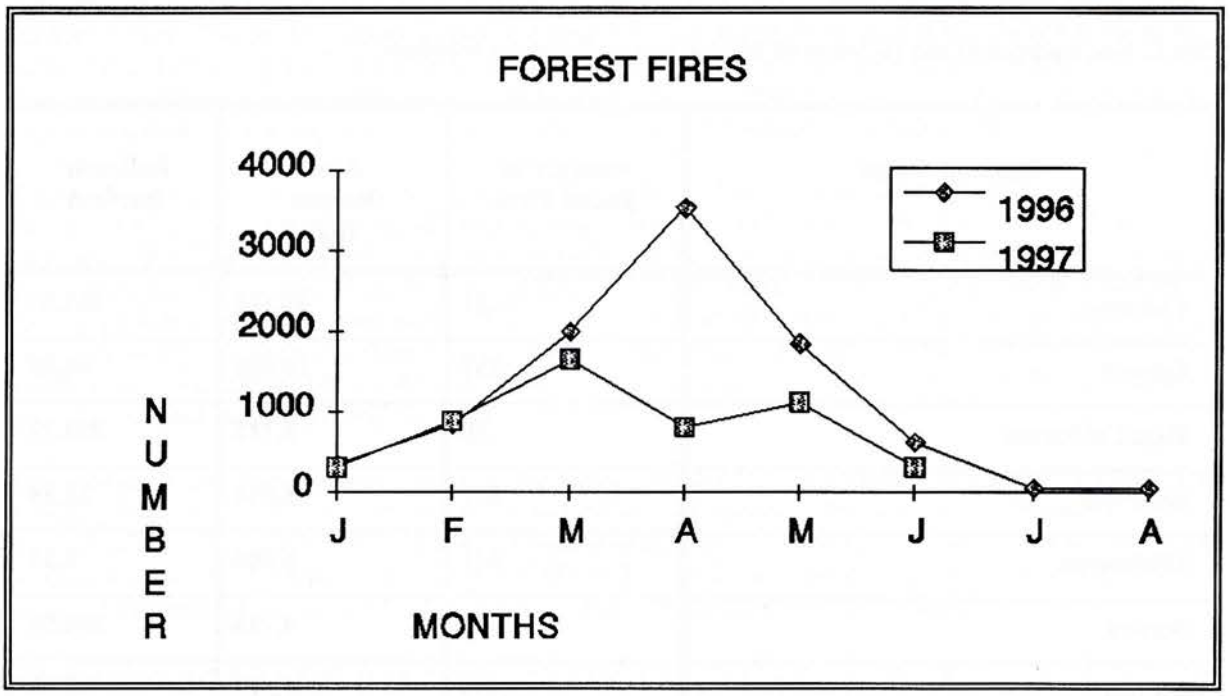


Fig.2. Average distribution of fire occurrence in México between January and August.

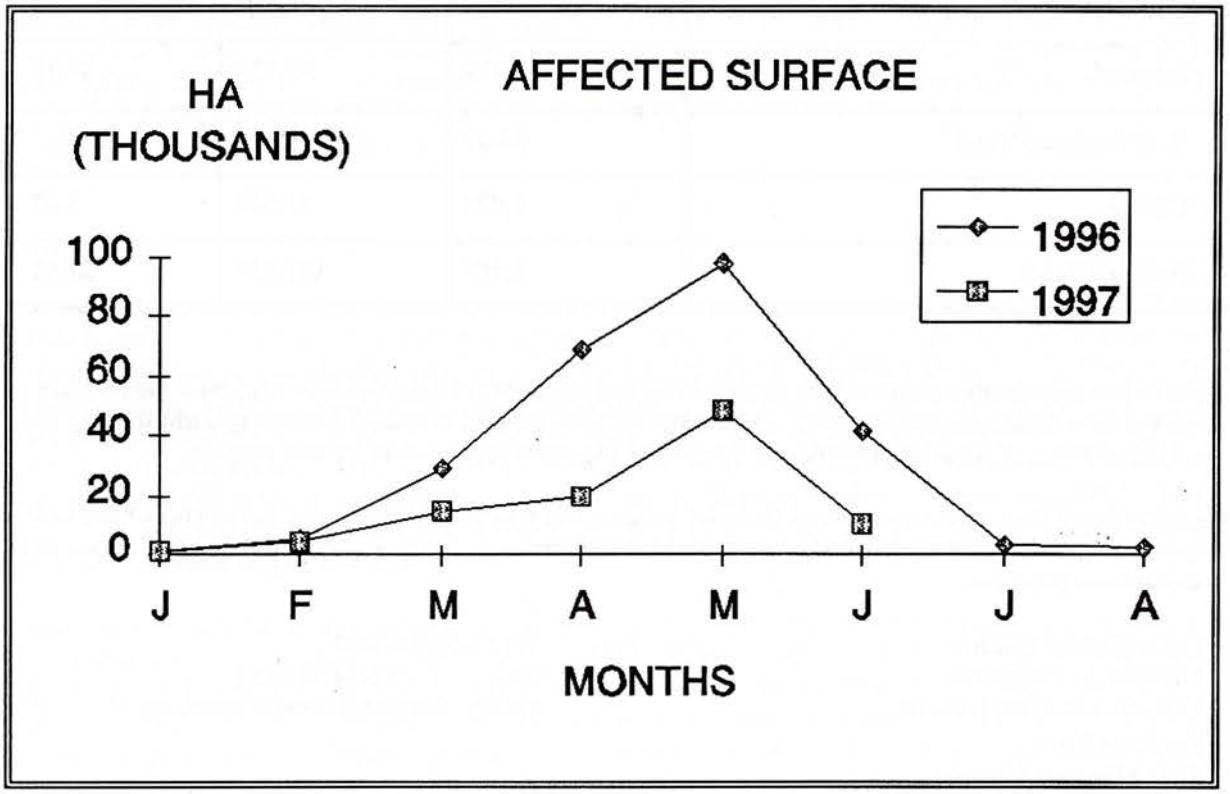


Fig.3. Average distribution of area burned by wildland fires in México between January and August.

The ten states with highest fire occurrence contributed to 62.27% of the total area affected by fires in the 1997 season (Tab.5).

Tab.5. Fire statistics of the 10 States of México most affected by wildfires

Mexican States	Number of Forest Fires	Area Burned (ha)	Indicator (ha/fire)
Chiapas	181	48,114	265.82
Oaxaca	237	10,629	44.85
Baja California	38	9,112	239.79
Guerrero	241	5,636	23.39
Michoacan	611	5,604	9.17
Sonora	23	4,713	204.91
México	1,496	4,517	3.02
Chihuahua	237	2,930	12.36
Nayarit	56	2,420	43.21
Colima	59	2,254	38.20
Subtotal	3,179	95,929	30.18
% of National Total	62.27	89.46	
Others	1,926	11,308	5.87
National Total	5,105	107,237	21.01

México has considerably improved the preparedness and management capabilities to cope with the problem of wildland fires during the past ten years. México has received support in special fire management training from the United States of America, Canada and Spain, and expresses appreciation for this support.

Fighting forest fires requires enormous financial budgets, but it is without doubt that the combat of fire is less expensive when it is either prevented or controlled before it becomes too large. Therefore fire prevention must receive more attention.

Oscar Cedeño Sanchez
Director de Protección
Dirección General Forestál
Progreso No.5
Col el Carmen Coyacán
C.P.04110
México, D.F.

Fax: ++52-5-554-7097
Tel: ++52-5-658-7452
e-mail: inforest@servidor.unam.mx

TURKEY *Forests and Forest Fires in Turkey*

Turkey is a country with a land mass of 77.079 million hectares, of which 20.199 million hectares is forested, representing about 26 per cent of the country's total land area. Figure 1 shows the vegetation types found in Turkish forests. The Mediterranean climate is predominant in the southern and western Anatolia where most of the forest fires occur every year. A continental climate with hot and dry summers accompanied by rain in the spring and fall and snow in the winter prevails in central parts. The Black Sea region has a distinct climate type with mild temperatures and precipitation almost uniformly distributed throughout the year.

Forest fires are a recurring phenomenon in, and has always had a pervasive influence on Turkish forests. In the period 1937-1996, a total of 60,434 fires burned a total of 1,464,928 hectares of forest land (Fig.2). This represents 1007 fires on 24,414 hectares annually with an average area burned of 24 hectares per fire. In recent years, there has been a gradual increase in the number of fires, but due to the increased and effective use of technology in transportation, communication and fire suppression, the area burned has been cut in half and kept at a range of 12,000-14,000 ha (Mol and Kucukosmanoglu 1997) on average (Tab.1). The distribution of fires to different regions are as follows: 41% of the fires occur in Aegean; 24% in Mediterranean; 22% in Marmara; and 13% in other regions (Anonymus 1989).

In the Mediterranean and Aegean regions, every place has a unique fire regime or pattern of fire activity resulting from the interaction of many natural and cultural influences. In the past, one of the major causes of forest fires was the use of fire to clear land for agricultural purposes. Although very little effort has been made to determine the fire regime (e.g., Neyisci 1985) in Turkish forests, many areas that are now covered by maquis formation (of mainly shrub species) were created by repeated fires set by people.

There are two major fire seasons in Turkey - short and long fire seasons (Canakcıoglu 1993). These seasons are characterized by the different climate and fuel conditions found in different regions. The short fire season prevails in the western Black Sea and Marmara regions. Depending on the local fuel, topography and fire weather conditions, the fire season may be two (July - August) or three (June - August) months long. The long fire season ranges from June through November in Mediterranean and Aegean Regions. Typically, there is very little winter activity, followed by an increase in May as the rain activity decreases and fuels start to dry up, a peak in the number of fire starts in August, followed by decreasing activity in the fall. Another but less recognized fire season is the spring/fall fire season. This type of fire season is seen in the spring and fall in broad-leaved forests in fire prone regions and in the eastern Black Sea region, one before leaf-out when the last years surface fuels are dried up before the new vegetation period starts and one in the fall after the vegetation period has ended and leaves fallen. Here, surface fuels are the only fuel component that become available for combustion, thus all fires spread as surface fires.

Fire Causes

The majority of forest fires in Turkey are caused by people. People-caused fires account for 98% of all fires, while lightning is responsible for the remaining 2%. Of the people-caused fires 23% was classified as arson, 27% as negligence and carelessness, and 50% as unknown (Mol and Kuçukosmanoglu 1997). "Unknown" fires are the fires for which no known cause could be determined. However, it is very likely that the shares of the first two categories of fire causes (i.e., arson, negligence and carelessness) in unknown causes are similar to that of the known causes. In this case, arson accounts for about 35% of all fires, which is a little over the average value (32 %) found in temperate forests of the northern hemisphere (Mol *et. al.*, 1997). This is definitely a very large proportion and is seriously taken into account in the process of fire prevention, presuppression and suppression planning.

Arson fires are set for several reasons. About 8.8 million people live in 17,445 villages in or near forests (Anonymus 1991). Socio-economic life standards of most of these people are well below the national average. People with low income and low life standards see the forests as an earning ground for their sustenance. So, people set fire in the forest to create jobs that will earn them some provision or manipulate vegetation to improve and produce useful plants for their animals to graze. Personal conflicts between people and forestry officials or between shepherds or different villagers have also been reported to have been a cause for fires.

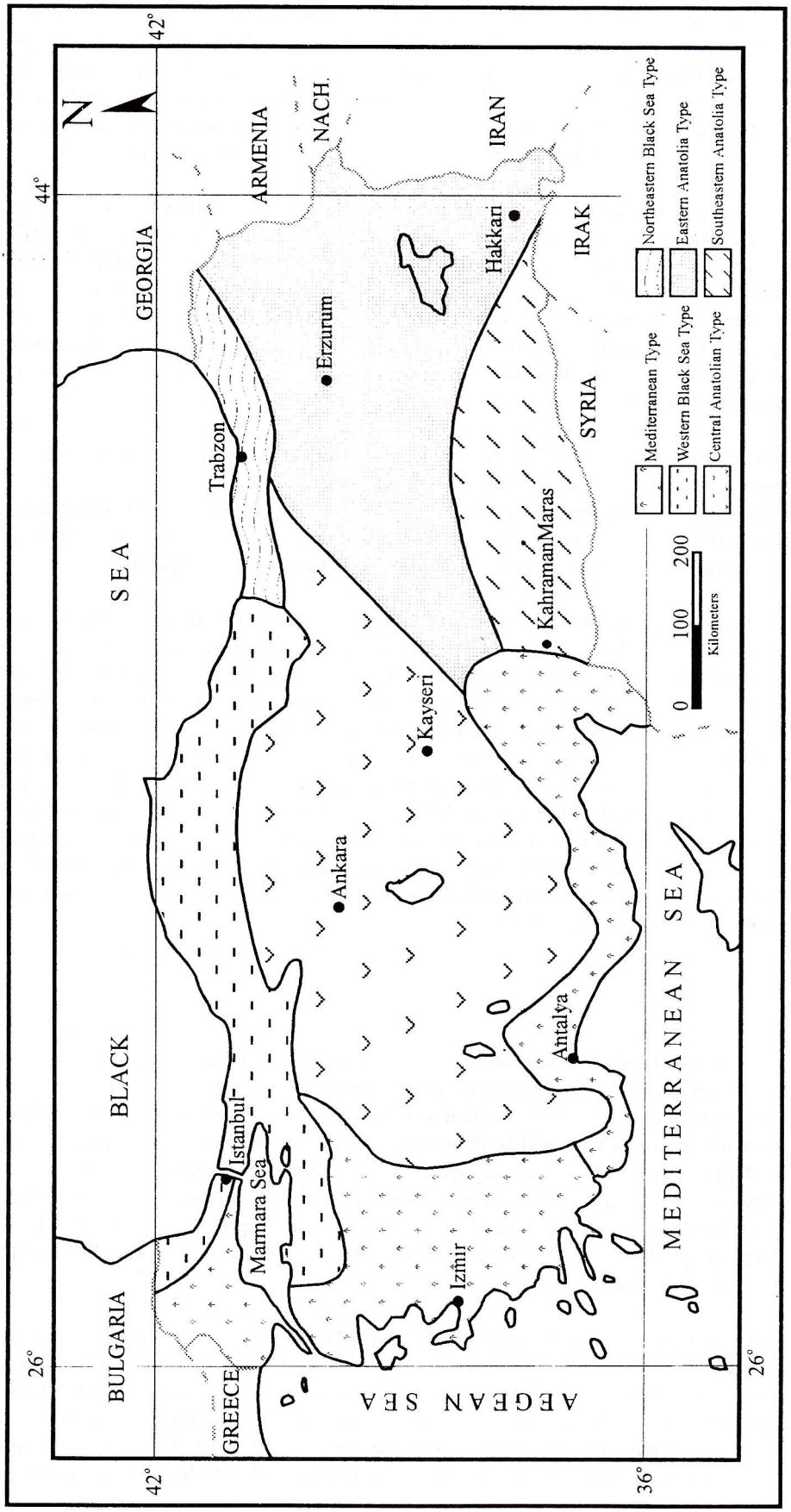


Fig. 1. Map showing vegetation types found in Turkey. Mediterranean, Aegean, Marmara and Western Black Sea regions are susceptible to forest fires (adopted from Davis et al. 1971).

Tab.1. Fire statistics for the years 1990 to 1996 in Turkey.

REGIONAL DIRECTORATES	1990		1991		1992		1993		1994		1995		1996	
	Number of fires	Area burned (ha)	No.of fires	Area burned (ha)	No.of fires	Area burned (ha)	No.of fires	Area burned (ha)	No.of fires	Area burned (ha)	No.of fires	Area burned (ha)	No.of fires	Area burned (ha)
ADANA	67	556.0	87	834.0	99	976.7	161	793.4	206	1590.0	84	223.5	94	1262.5
ADAPAZARI	57	553.3	12	60.0	44	356.8	98	1076.5	178	1449.0	40	156.4	29	186.1
AMASYA	12	35.4	14	81.4	13	107.3	19	84.7	105	374.0	23	42.2	35	47.6
ANKARA	36	108.7	61	283.0	33	49.3	76	217.0	100	124.0	39	29.4	45	49.0
ANTALYA	264	1131.3	241	1056.1	263	2342.7	187	1085.7	122	2246.0	98	319.6	105	309.3
ARTVIN	1	32.0	5	37.0			3	20.0	12	31.0	6	43.1	7	22.0
BALIKESIR	95	2462.5	72	273.5	102	681.2	111	311.7	163	245.0	122	165.7	95	203.7
BOLU	22	69.7	5	6.0	21	53.9	46	114.9	123	133.0	21	15.4	19	13.9
BURSA	56	525.4	32	105.3	68	664.3	114	703.9	110	346.0	51	86.3	51	57.9
CANAKKALE	68	1393.3	49	607.4	109	816.6	114	707.5	108	4342.0	56	364.5	65	815.0
DENIZLI	88	373.6	99	242.1	116	349.4	154	249.9	144	963.0	109	204.4	77	335.4
ELAZIG	11	121.2	16	308.8	4	108.1			3	3.0	5	3.0	9	489.5
ERZURUM	1	0.8			2	1.3	5	35.5	2	3.0	7	12.2	5	16.5
ESKISEHIR	55	102.1	54	68.5	23	157.0	61	138.4	59	339.0	33	60.4	38	56.8
GIRESUN	6	61.1	2	7.2	5	35.7	10	40.4	22	92.0	4	25.3	17	107.7
ISPARTA	21	29.4	35	301.6	57	271.0	57	161.9	76	160.0	70	77.3	44	205.0
ISTANBUL	61	539.5	60	179.8	131	693.2	219	2756.9	182	406.0	72	78.5	106	146.9
IZMIR	259	1244.1	182	490.7	259	1688.3	247	1552.8	335	5146.0	217	813.6	173	762.6
K.MARAS	84	428.0	82	1165.9	86	218.4	103	749.7	152	462.0	114	779.7	103	214.2
KASTAMONU	31	88.3	11	43.6	39	150.8	44	83.5	136	315.0	15	9.2	42	224.3
KONYA					10	37.4	13	36.3	30	138.0	25	14.0	20	105.7
KUTAHYA					69	80.6	103	159.4	133	106.0	75	84.4	57	96.3
MERSIN	103	530.3	54	251.7	91	427.4	159	886.6	123	112.0	99	274.7	73	61.6
MUGLA	304	2535.0	267	1171.3	395	1500.0	357	1464.3	388	1276.0	341	655.5	261	8966.0
SINOP					17	116.8	15	41.9	56	111.0	22	58.2	28	49.7
S.URFA					14	288.7	13	8.8	30	336.0				
TRABZON	1	0.4	2	9.0	5	105.0	5	50.2	18	10.0	14	192.5	12	83.0
ZONGULDAK	22	78.9	6	6.1	35	34.3	53	202.6	105	111.0	6	1.0	35	33.5
TOTAL	1725	13000.3	1448	7590.0	2110	12312.2	2547	13734.4	3221	20982.0	1768	4790.0	1645	14921.7

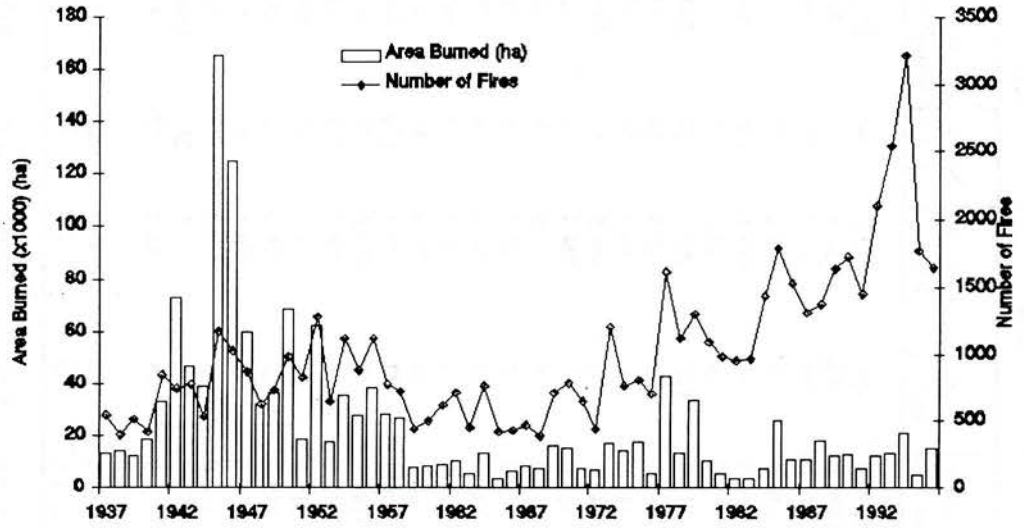


Fig.2. Forest fire statistics of Turkey for the period 1936-1996.

Borders separating public and private lands are not completely drawn in Turkey. Only in 30% of the country's total area are the ownership boundaries delineated. So, there are always ownership disputes and conflicts in and around forests and protected areas. People take advantage of this situation to increase their properties to the disadvantage of public forests.

Recently, forests have also received their share of terrorism. A number of fires have been reported to have been set by terrorist groups or individuals. A majority of fires, however, are often caused by people through sheer inadvertence or accident. These types of fires usually occur in and around recreation areas and camp sites or along major highways. In 1996, for example, the greater Marmaris forest fire which burned over 7000 hectares had its origin at a camp site near Marmaris (see Fig.3). Fires of this kind are usually caused by people who are unaware of the dangers of forest fires or by those with a low awareness of the value of forests.

Fig.3. The Greater Marmaris Fire of 1996 burned a total of 7079 ha. The photograph shows a yard where salvage-logged timber is stored temporarily and distributed. Photo: J.G.Goldammer.

Fire Management

Fire management in Turkey is a federal responsibility. Duties are carried out by state forest enterprises functioning under regional directorates. Fire control policies have developed around a strong emphasis on total fire control as a response to destructive fires. Regardless of the high costs involved, all required activities are planned and implemented immediately. However, the beneficial use and ecological role of fire has at no time been incorporated into the fire management planning process. Fire management therefore deals mainly with activities concerning prevention and control.

Fire prevention programmes deal with all activities concerned with minimizing the incidence of forest fires. In this regard, determining and analyzing the cause of fires (i.e., who is starting the fires, where and when they are started and, to the extent possible, why they are started) are considered to be the first steps to justifying and allocating the budget for prevention and presuppression. For this reason, the Fire Fighting and Forest Protection Branch of the General Directorate of Forestry has put more emphasis on the determination of fire causes and the inclusion of the findings in fire report files. A national database on forest fires is being created containing information on all aspects of forest fires. Information gathered on location along with the cause of fires are used to develop fire prevention techniques and prevention planning. In this regard, many techniques are being used to reduce people-caused fires which fall under two general categories, risk abatement and hazard reduction.

Risk is associated with ignition, and risk abatement involves raising the level of awareness of the general public and various accountable groups to the dangers of ignition and subsequent forest fires through education and enforcement. It is the opinion of the forestry service that a strongly favourable public opinion is a vital necessity in any effort to reduce the number of people-caused fires. All available communication avenues have increasingly been utilized for this purpose. These involve the utilization of mass media and local media outlets of radio, television, newspaper and magazines, education programs in the schools, military bases, service clubs, signs, and personal contacts. Also, fire law enforcement has been a potentially valuable technique for forest fire prevention since the laws have a potential to educate the public as well as to deter the negligent or malicious from destructive behaviour.

Given that a majority of fires are caused by sheer inadvertence and accident, no matter how good the education and enforcement activities may be, some fires will always be unpreventable. These causes can be reduced only through modifications of the ignition sources or the fuels that act as ignition receptors. Many forms of fuel modifications have been practice in all fire prone areas.

Despite the high cost of construction and maintenance, fire breaks (fire safety roads) and fuel brakes have been widely used to brake the continuity of forest fuels. It is interesting to note that when the planned fire brake network is completed, the forest area cleared to create fire brakes will amount to 5% of the total forest area (currently it is about 3%), and that the total area burned since 1937 is about 7% of the total forest area. This is also practice along and around the high risk areas such as camp grounds, disposal sites, settlements, major highways and railroads. Although very labour intensive, the practice of clearing and burning surface fuels along major highways within 15-20 m on each side of forest stands is a usual one.

As a general rule, fire breaks are constructed in plantation and naturally regenerated areas, and are supported by some fire resistant species (especially *Cupressus sempervirens* var. *pyramidalis*). These species are planted, with up to five rows, along the fire breaks. In areas close to settlements or critical areas, such species as stone pine (*Pinus pinea*) have been heavily utilized (planted) in place of other species. The local people look after these areas by pruning the trees and clearing underneath them and harvesting their cones. This practice not only helps to maintain an important fire resistant zone but it also provides an opportunity for the local people to make a living. One other activity worth mentioning concerns the fuel modifications is the charcoal production where some bush species that would not normally be harvested or utilized are used (Serez*et. al.* 1997; Fig.4-6). Those who produce charcoal purchase the wood they cut for a very low price (about 1/10 of what they sell charcoal for). Again, this benefits both forests and people.

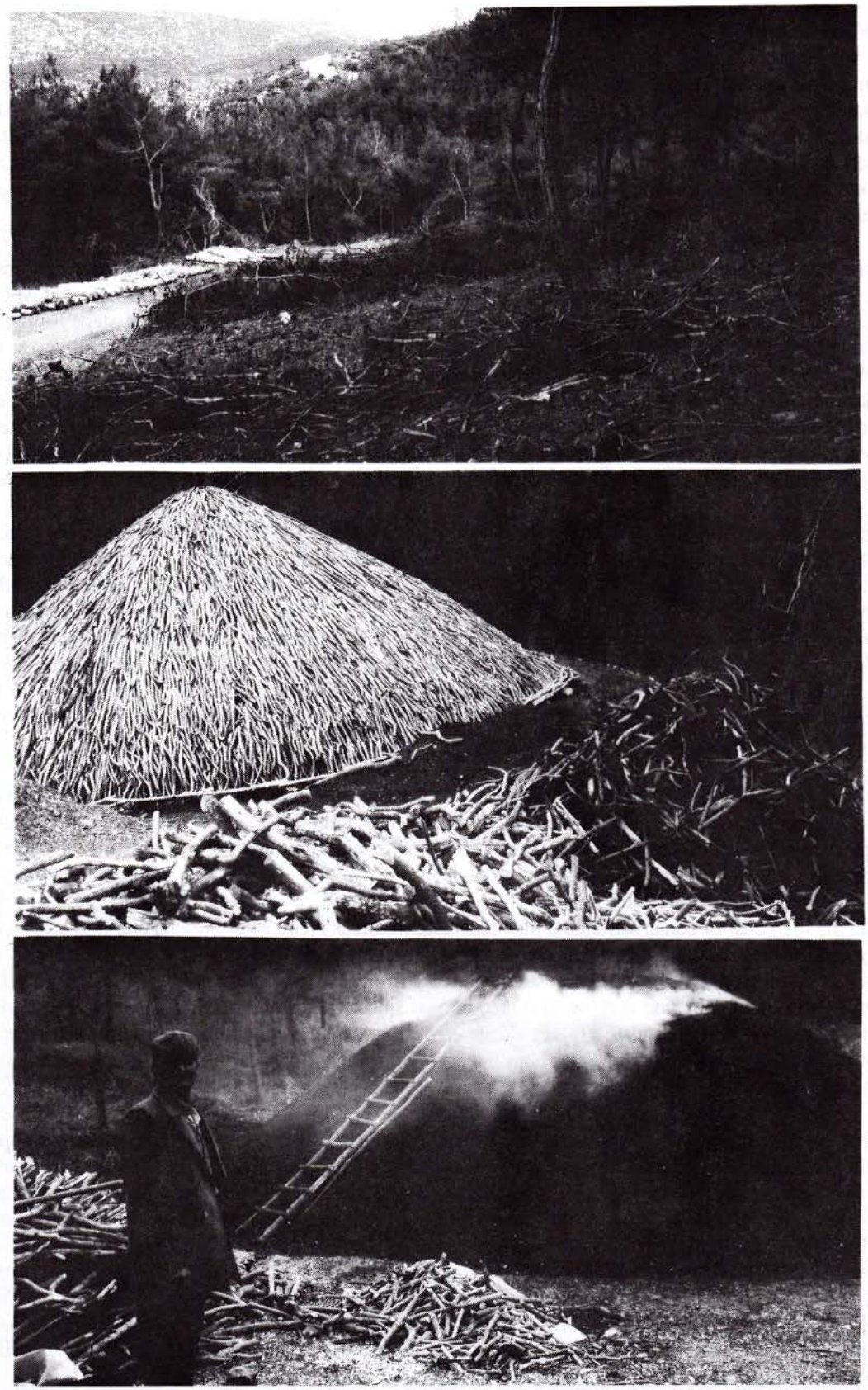


Fig.4-6. Charcoal making in Turkey is an integrated management measure. The construction of fuelbreaks alongside forest roads and highways involves clearing of small-size brush fuels which are suitable for charcoal production. Charcoal-making permits are issued to villagers and provide not only additional income: the participation and involvement of the rural population in the forest sector increases their active participation in forest fire prevention. Photos: J.G.Goldammer.

Fire Pre/suppression

Fire management relies on early detection, fast initial attack and powerful suppression. Each region has been provided with sufficient resources and man-power to combat forest fires. Available resources include 135 fire trucks, 12 helicopters, 11 airplanes, 882 fire look-out towers, 8472 radios, 650 initial attack crews (of 12-15 men), and 120 standby forces (of 40-50 men). New resources are being added as needed and new technologies adopted. These forces are allocated to each district based on fire danger levels and the area in question. Overall, 71% of fires are controlled at less than 5 hectares and account for only 8% of the area burned. In contrast, only 1% of fires exceed 200 hectares in size, but these fires account for 37% of the total area burned (Kucukosmanoglu 1986).

Fire Research

Fire is one of the areas that has received the least attention in Turkey. There have been no major studies concerning fire ecology or the role of fire in Turkish forest ecosystems. Recently, however, attempts have been made to establish a national fire danger rating system. Initial work has been completed and weather measurements will soon begin. The Turkish Fire Weather Index System will be developed based on the litter moisture and weather measurements in a standard fuel type (red pine, *Pinus brutia*). Fire behaviour experiments will be conducted later in the season. Results of the experiments will constitute the first steps towards achieving the goal of developing the fire behaviour prediction system. Also, the use of Geographical Information Systems in fire management is being increasingly utilized. These recent developments have been the result of a genuine cooperation between Karadeniz Technical University and the General Directorate of Forestry.

Conclusions

Forest fires have a major impact on the sustainability on Turkish forests. With its complex social, economical and environmental aspects, Turkish forestry presents great challenges to the society in general and the forest service and fire researchers in particular. Fire policies were formulated in such a way as to exclude fire on the assumption that it is always bad. Today, however, pressures brought about by certain realities of ecology and economics, and our increased demands for multiple resources require the development of new policies and attitudes towards fire. At the same time, increasing complexity and sustainable forestry will require a deeper understanding of fire and the development of more effective management systems. Effective management systems will not prove successful unless they include the demands and acknowledge the role of the society on forests.

Ertugrul Bilgili
Karadeniz Technical University
Faculty of Forestry
TR - 61080-Trabzon

Fax: ++90-462-325-7499
e-mail: bilgili@osf03.bim.ktu.edu.tr

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U.S.A. *Wildland Fire Exchange 97*

Wildland fire takes many forms and affects different landscapes throughout the world. A distinguished group of government officials and wildland fire experts examined several aspects of the wildland fire management and operation issues that affect the 270 million acres (109 million ha) under responsibility of the Bureau of Land Management (BLM) in the United States Department of the Interior.

The group included four officials from Russia, one each from the United Nations, Norway, Mexico and Canada, along with academic experts from Austria and South Africa. They visited the U.S. National Interagency Fire Center at Boise, Idaho, for a review of the operational procedures, then toured a rehabilitation area from a devastating 1996 wildland fire. They reviewed an area that has repeatedly burned, resulting in an invasion of more fire-dependent species which has a negative impact on a wild raptor area, and participated in discussions on the role of fire in respect to resource management.

New Mexico in the American southwest provided a different picture of wildfire issues for the group, with an emphasis on the use of planned fires in the desert setting to enhance proper vegetative management for livestock and wildlife forage. The program has been highly successful with joint participation on the part of federal, state and local officials, along with livestock lease operators and conservation groups.

Fig.1. Nicolay Andreev (l), Director of the Aerial Forest fire Center of Russia *Avialesookhrana*, and Les Rosenkrance (r), Director of US Bureau of Land Management Fire and Aviation share a laugh during conference discussions at Wildland Fire Exchange '97. Photo: BLM Fire & Aviation

From New Mexico, the group visited BLM lands in Alaska and the BLM Alaska Fire Service at Fairbanks. They travelled to a remote field office at Fort Yukon to review the wildland fire operational system at work. Officials in Alaska provided a comprehensive briefing regarding fire and resource management, and the capability of the U.S. system to respond to disasters of all types.

Each representative country provided a presentation on the unique fire and resource management issues faced. Discussions throughout the exchange provided a better understanding and insight into different approaches to the common problem of wildland fire.

There will be additional discussions among the participating countries represented regarding the major role of the BLM in U.S. wildland fire issues and response with the goal of finding appropriate avenues of sharing information, expertise and knowledge.

David F. Vickery
Bureau of Land Management Fire and Aviation
National Interagency Fire Center
3833 S. Development Blvd.
U.S.A. - Boise, Idaho 83705

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The Wildland Fire Exchange 97 resulted in signing of a letter of Common Understanding between the Bureau of Land Management and the Russian National Aerial Forest Fire Protection Service *Avialesookhrana*.

Letter of Common Understanding

Bureau of Land Management
National Office of Fire and Aviation
and
Russian National Aerial Forest Fire Protection Service
June 9, 1997

Russian and United States wildfire suppression managers have common goals of suppressing wild fire and protecting natural resources in the most efficient, safe, and cost-effective methods possible. Each country enjoys common problems of climate, geography, vegetation, and vast, roadless areas of land. It is desirable for both countries to learn of each others' methods and techniques of fire management. It is mutually agreed that managers and personnel of each organization should personally experience day-to-day operations in the respective countries. We agree it would be mutually beneficial to formulate procedures for:

1. Sharing information in the factors affecting fire management, such as weather prediction, fire behaviour, detection, and natural resource values;

2. Sharing managers to better understand the methods of each other of dealing with wildland fire fighting operations and management;

3. Sharing technicians and specialists whose primary responsibilities involve fire suppression activities, such as smokejumping and rappelling, aerial delivery systems, and other operational procedures;

4. Exploring the feasibility of future mutual aid agreements that would provide for the sharing of fire fighters and other resources during fire emergencies; and

5. Sharing training materials and instructors to teach new fire fighting methods and techniques and the use of new technology.

Lester K. Rosenkrance
National Director Fire and Aviation

Nikolai A. Andreev
Director,
National Aerial Forest Fire Protection Service

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A similar Letter of Intent was signed between the Department of the Interior, Bureau of Land Management National Office of Fire and Aviation, and the Secretaría de Medio Ambiente, Recursos Naturales y Pesca, Dirección General Forestál, México, on 9 June 1997. For Mexico's part this letter is in the process of being considered in the government.

NEWS FROM THE EUROPEAN UNION

Forest Fire in the European Union
A Community Scheme to Protect Forests Against Fires

Every day, somewhere in the European Union there is a fire in a forest. Every day, men and women protect forests and fight the fires. The spectacle and drama of major summer fires frequently overshadows the daily battle against them by the forestry and fire services. Their first duty is to do everything they can to prevent fires from starting. But, if they do start, they must stop them as quickly as possible. That is the underlying objective of the strategy for preventing and combatting forest fires in the Member States.

It is also the concern of the European Union whose specific scheme aims to contribute to the efforts of the Members States to prevent forest fires. This scheme has been recently extended for a new period of five years.

A Specific Scheme

The aim of the scheme, established in 1992 by the Council Regulation No.2158/92, is to contribute to the efforts of the Member States to prevent forest fires while at the same time ensuring that forestry measures financed by the Community in areas at risk from fire are consistent. The scheme also provides for the development of a close cooperation between the Member States and the Commission of the European Communities within the Standing Forestry Committee, and for the creation of a Community system of information on forest fires to permit a better evaluation of measures in protecting forests against fire. After five years, the results of the implementation of this measure are the following:

Areas at Fire Risk

The Commission has approved the lists of areas of high and medium risk submitted by Portugal, Spain, France, Italy, Greece and Germany, making a total of 60 million hectares at risk from fire (nearly one half of the Community's forests), of which 60% is privately owned and 40% publicly owned (Fig.1).

Forest Fire Protection Plans

The Commission has issued favourable opinions on 79 of the forest-fire protection plans submitted by the Member States. These plans, covering almost all the areas of high and medium risk, are particularly important tools, describing the measures taken by the Member States to protect their forests, thus giving improved guarantees of the success of forestry measures co-financed by the European Union.

Preventive Measures

For the period 1992-96, 480 projects submitted by the Member States were approved, involving a total of ECU 63 million. Table 1 gives information about the categories of measures approved over the period concerned.

Quantitative details on a number of measures funded are as follows:

* 254 information campaigns, 11,437 ha of fire-breaks, 13,534 ha of shrub-clearance, 12,005 km of tracks, 1152 water supply points, 8848 communication posts, 151 watch towers, 5226 persons trained;

* 97% of the assistance was granted in areas of high risk and 3% in areas of medium risk;

* 5% of the assistance was granted for publicly owned forests, 10% for privately owned forests and 85% in mixed areas (public/private).

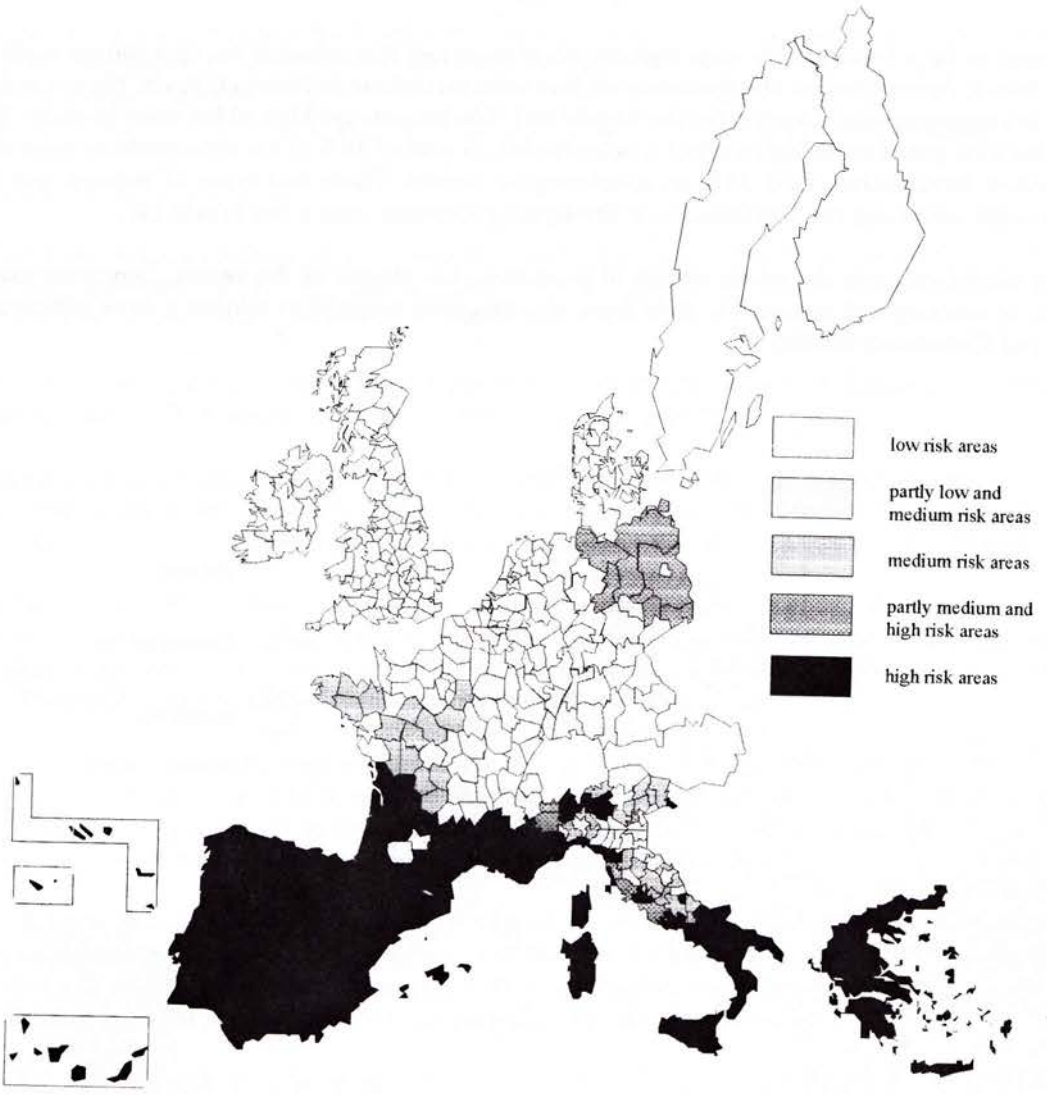

Fig.1. Classification of the territories of the Member states according to the degree of forest fire risk

Measures	Assistance granted (x million ECU)	%
Information campaigns and projects to combat causes	8.0	13.0
Prevention projects	30.3	48.0
Monitoring projects	18.6	30.0
Information-system projects, etc	6.0	9.0
Total	**62.9**	**100**

Tab.1. Categories of fire management measures approved for Member States of the European Union over the period 1992-96.

There seems to have been a fairly even regional distribution and this reflected the applications made by the Member States. Several studies into the causes of fires were carried out in Portugal, Spain, Greece and France (13% of the appropriations allocated for the Regulation). The projects are high added-value projects. The cost is small but their potential multiplier effect is considerable. A total of 48% of the appropriations were allocated to prevention infrastructures and 30% to monitoring operations. These two types of measure are of vital importance for increasing the effectiveness of fire-fighting measures once a fire breaks out.

In giving consideration to the whole system of protection, i.e. studies of the causes, improving preventive measures, monitoring and measures to fight fires, it is therefore essential to achieve a more effective use of national and Community funding.

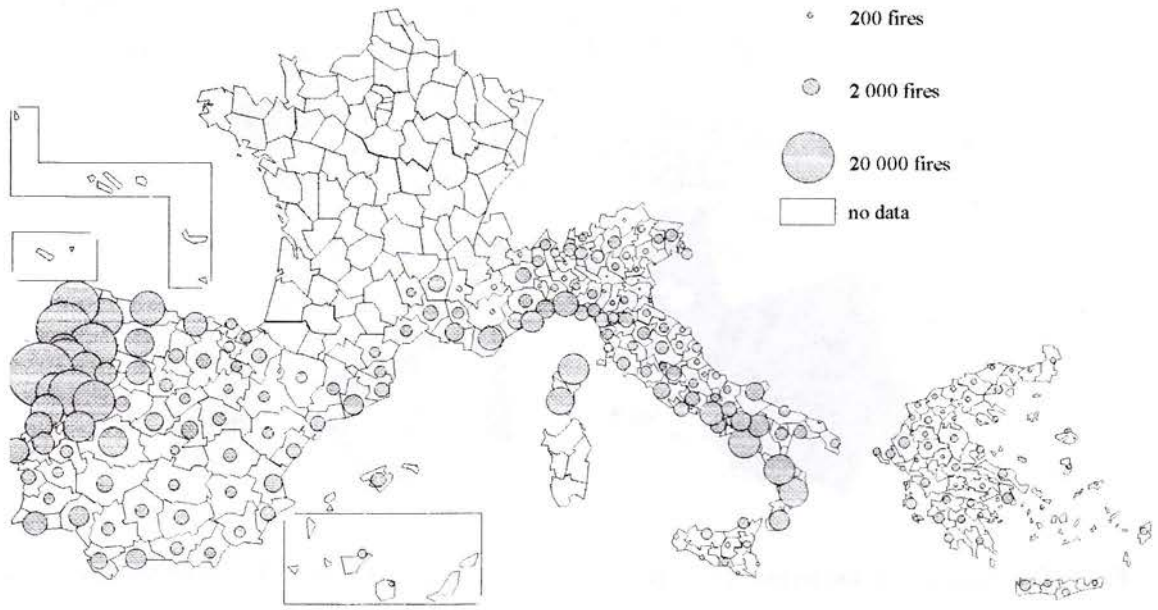

Fig.2. Total number of forest fires in the European Union during the period 1985-1995

The Community Information System on Forest Fires

Since 1990, the Commission and the Member States' experts on the Standing Forestry Committee wished to have an instrument at their disposal for ongoing monitoring and evaluation, comprising information on forest fires and allowing a contribution to be made to the greater effectiveness of national and Community protective measures. A **Community Information System on Forest Fires** has been therefore created on the basis of information collected on every fire in national databases.

The collection of data on forest fires (the common core) has become systematic with the adoption of a Commission Regulation in 1994. The Community Information System on Forest Fires currently covers 319 provinces/departments of Portugal, Spain, France, Italy, Germany and Greece. It contains information on 460 000 fires recorded between 1 January 1985 and 31 December 1995 involving a total of six million hectares.

The main results are clear:

* Forest fires are not a rarely occurring disaster but rather a daily problem against which the Member States must have appropriate protection strategies: in 11 years, no more than 44 days have passed without a fire; on some days, a fire breaks out every two minutes (Fig.2).

* The system can give useful clues to the types of Community and national measures to be developed in different regions, the situation obviously varying from one region to another:

  - In certain regions, for example, there are up to 4000 fires per year. Combatting the causes will be the priority there. These are practically always external to the forest; fires are indicators of tension in the management of rural areas; it is therefore necessary to look for the causes in connection with other policies.

  - In other regions, the number of fires may be small, but the average size of the fires may exceed 30 hectares. In those areas, certain specific prevention, surveillance and combatting measures should be strengthened. In general there are few major fires but these are responsible for the major part of the land burnt. The problem of controlling major fires is therefore a real one.

* Generally speaking, the summer is the period of highest fire risk (67% of fires and 79% of the area affected) when monitoring and fire-fighting systems must be at their most effective. However, in more than 10% of provinces, particularly in mountainous areas, fires mainly break out in winter, showing that specific causes are at work which must be addressed with specific measures (Fig.3).

* Over the past eleven years, there has been a steady improvement in the effectiveness of measures to combat fires implemented by the Member States and, therefore by the European Union. The area burned appears to be on a downward trend and the area affected by each fire has been sharply reduced. The time taken by fire-fighting teams to intervene has been shortened, as has the duration of fires.

Nevertheless, the marked increase in the number of fires is worrying and shows the need to strengthen measures to combat the cause of fires, particularly as still more than 53% of fires are of unknown origin.

An analysis of the information collected therefore shows that the exchange of information, the evaluation of protection measures and risk periods, and the development of protection strategies can be achieved by implementing the Community information system, especially when extended over a longer period of time.

The following strategies could be developed:

* identification of the kind of priority protection measures to be reinforced (controlling the causes, prevention, surveillance or fire fighting) on the basis of the characteristics of each region;

* strengthening inter-regional cooperation between geographically distant zones sharing the same forest fire characteristics;

* comparison of fire data with socio-economic information, such as rural out-migration, type of farming, tourism, etc., to make the analysis of the causes of fire more extensive;

* identification of periods of the year and hours of the day at which the risk of fire is at its greatest, allowing for a more effective use of surveillance and fire-fighting media, etc.

On an international level, the common core has also been used as the basis for the creation of a pan-European network of local databases, adopted at the 1990 ministerial conference in Strasbourg on the protection of forests in Europe. It also becomes a tool for international cooperation in the States of the Mediterranean basin.

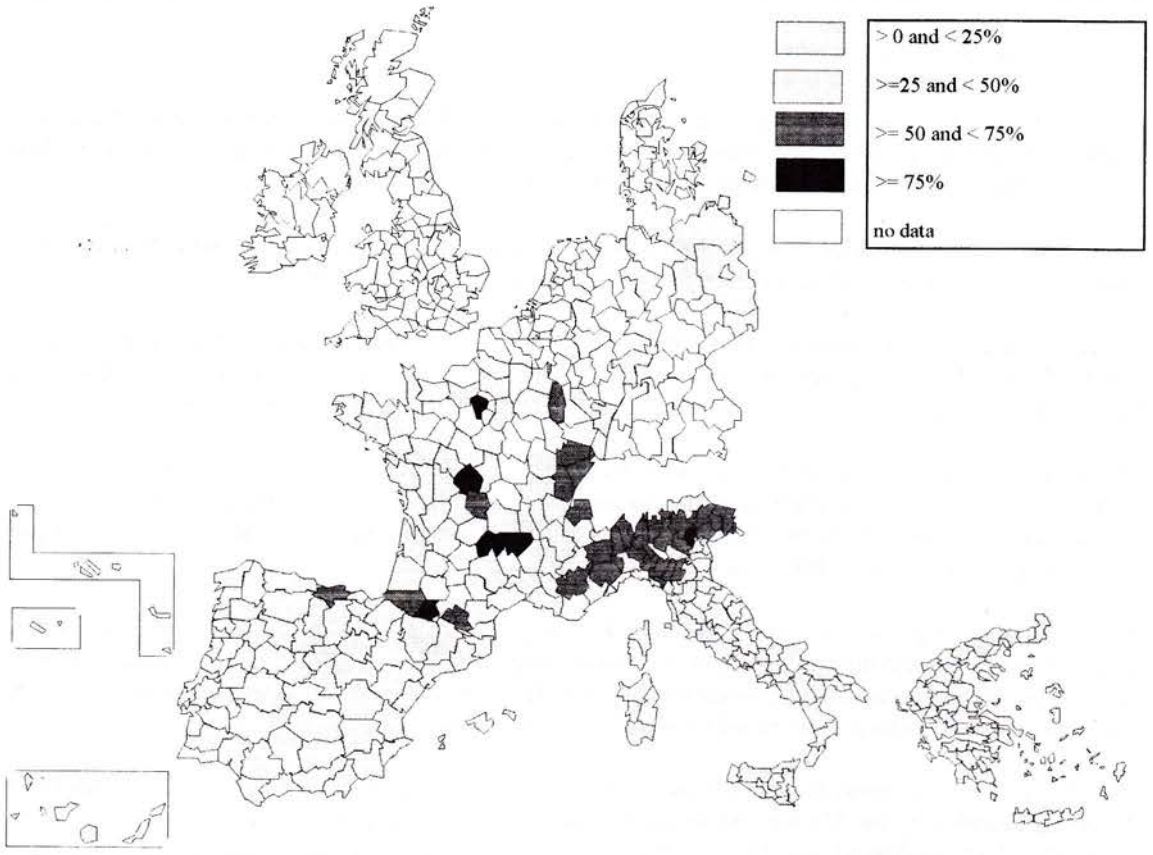

Fig.3. Number of forest fires in the European Union in the period 1985-1995 during the winter season (January, February, March) as a percentage of the total number of fires

Conclusions

The Community measures, complementing those of the Member States, have helped to improve measures to prevent forest fires and provide better guarantees and better direct Community funding for forest areas at risk from fire. At the end of the five years of application, nearly one half of Community forests have been classified as areas at risk from fires. The Member States concerned have submitted their forest-fire protection plans for the areas at risk. Assistance of ECU 63 million has been granted for more than 480 fire-prevention projects provided for in the protection plans. Community-wide cooperation has been established to analyse the causes of fires and to improve protection systems. The results of the Community system of information on forest fires show that this is an excellent tool for the evaluation of measures, which becomes also an interesting tool for international cooperation.

In February 1997, the Council has adopted the prolongation of this specific scheme for a new period of five years (1997-2001). Contact in the EU:

Michèle Lemasson
Administrator, VI.F.II.2 Specific Measures in Rural Space
Directorate-General VI Agriculture
rue de la Loi 130, 10/194
B - 1040 Bruxelles

Fax: ++32-2-296-6255
Tel: ++32-2-295-9512
e-mail: Michele.Lemasson@dg6.cec.be

NEWS FROM THE UNITED NATIONS

International Tropical Timber Organization (ITTO)

ITTO Guidelines on Fire Management in Tropical Forests

International action to save tropical forests was considered in a series of meetings and seminars, convened between May 1977 and December 1982, which had been called for by the United Nations Conference on Trade and Development (UNCTAD).

Subsequent meetings were held, during one of which it was agreed that the envisioned International Tropical Timber Organization (ITTO), when identifying and implementing its activities, should give due regard to ecological and other considerations for the effective conservation and development of tropical timber resources. At the plenary session of 18 November 1983, with 69 nations and the European Economic Community in attendance, the text of the ***"1983 International Tropical Timber Agreement"*** (ITTA) was adopted, entering into force provisionally on 1 April 1985.

To date twenty-six producing nations are members of the Agreement; they account for about 90% of the world's tropical forests and total net exports of tropical timber by volume. Another twenty-seven consuming nations are members, including the European Economic Community, and they account for about 85% of total net imports.

The ITTA covered only tropical timber, which was defined as non-coniferous tropical wood produced for industrial uses in countries situated in the tropic zone. Its objectives were an effective framework for cooperation and consultation between producing and consuming countries, and promotion of the expansion and diversification of international trade in tropical timber.

To provide the international structure for the achievement of its objectives, the ITTA established the ITTO, composed of the International Tropical Timber Council and three permanent committees; on ***Economic Information & Market Intelligence***; on ***Reforestation & Forest Management***; and on ***Forest Industry***. All three committees were also to be involved in research and development; evaluating project proposals; identifying financial resources; implementing pre-project activities; and making recommendations to the Council; in addition to implementing projects and publicizing their results.

In pursuing the provisions of the 1983 Agreement, the Council was active in policy development and in the establishment of standards. It adopted four sets of guidelines designed to promote sustainable management of tropical forests, and recommended them as reference standards to the international community. They are:

* Guidelines for the Sustainable Management of Natural Tropical Forests

* Guidelines for the Establishment and Management of Tropical Forest Plantations

* Criteria for the Measurement of Sustainable Tropical Forest Management; and

* Guidelines for Conservation of Biodiversity in Tropical Production Forests.

The ITTA of 1983 was the instrument by which the important work in protection of the tropical timber resource was begun; however, since the effort was entering a relatively new area, it was prudent to revisit the issues after some experience had been gained. Therefore, the United Nations Conference on Trade and Development convened a forum which developed the "International Tropical Timber Agreement, 1994". This document, influenced by almost ten years of actual experience, and recognizing the importance of several important facts of international life, could be said to "fine-tune" what was begun by the original ITTA of 1983.

For one thing, the ITTA of 1994 broadened the objectives from the original eight, to fourteen. Several of the objectives of the 1983 agreement were amplified to convey the idea of conservation rather than utilization. The words "sustain" and "conserve" are prominent in the objectives, indicating that the members are serious about long-term protection of the tropical resources.

The guidelines previously published by ITTO had focused directly on specific management practices relating to tropical forests, but these practices rely on continued protection of the forests if they are to be successful. For instance, it does little good to establish extensive plantations of genetically improved tree seedlings if these plantations are highly susceptible to wildfire. Similarly, funds spent to enact stand improvement programs will be totally wasted if the stands are severely damaged or destroyed by wildfire.

Losses due to uncontrolled wildfire range across a wide spectrum of categories. In many parts of the tropical world, forest industries are the principal source of income. Many tropical soils are extremely vulnerable to erosion, and fire quickly exposes them to raindrops. These are the obvious losses due to wildfire in tropical forests; we are only beginning to understand some others, such as loss of biodiversity and global warming.

With forest managers in producer nations adopting the suggestions in the first ITTO guidelines, it was readily apparent that considerable investments in time, money, and other resources were now at risk, especially from wildfire on the lands being managed. So, in 1993, work began on development of **Guidelines for Protection of Tropical Forests Against Fire**. A working draft was prepared, and in 1995 a panel of fire experts from producer and consumer nations met in Jakarta, Indonesia, to refine the paper into workable guidelines.

Early in the deliberations of this diverse group it became apparent that even the name of the working paper needed modification. **Protection of Tropical Timber Against Fire** was too limiting in that it suggested the need for total exclusion of fire from the tropical ecosystem. Not only is such a goal unattainable, but it is also undesirable, because of the need for prescribed fire in certain circumstances. Therefore, the title was changed to **Guidelines on Fire Management in Tropical Forests**. This allowed the panel to incorporate a much broader scope of techniques into the document.

Following the format used by previous ITTO panels, the drafters of these Guidelines first enumerated a series of principles known to relate to fire management issues in the tropics. These twenty-nine principles were then grouped into seven broad categories which suggested ways to address the ideas proposed by the principles.

A brief synopsis of the main sections of the Guidelines follows.

Policy and Legislation: This section contains two principles which lay out the basis for what follows in the rest of the Guidelines, in that they emphasize the need for broad-based support from all sectors of society, as well as formal backing by appropriate legislation. The actions proposed to respond to these principles include the identification of citizen groups and organizations capable of, and interested in forging partnerships with government authorities to implement fire management programs; formation of a national fire policy; establishment of an adequately funded agency to establish and implement that policy; and the enactment of laws & regulations with appropriate incentives and sanctions to ensure that they will be observed.

Strategies: The second major section contains six principles which go to the roots of the issue. The first of these principles acknowledges that Fire Management Planning provides the foundation for a sound program, and suggests three actions which provide for adequate resources at different levels of fire activity; identifies the requirements of complete fire management plans; and recommends a wide range of participation from government, industry, and citizen groups.

Within fire management planning resides the need for consideration of options, and the Guidelines provide a list of these which must be considered, along with actions to address them. Fire detection and early warning systems are discussed.

Some people who read the Guidelines may be surprised to find that Fire Suppression is addressed in only two principles. However, it should be remembered that suppression actions will vary substantially throughout the tropics, depending on fuels, weather, topography, soils, and other variables too complex to be covered in a general guideline. Therefore, the way was left open for each country to develop strategies applicable to its unique situation, with advice from others.

These Guidelines may be unique among this type of booklet in their recognition of the importance of community involvement. A positive relationship between the forest fire manager and the rural community was

highlighted as of paramount importance. Several ways of promoting this relationship were suggested, including the integration of agriculture and grazing into the fuel break system through incentive programs such as cost-free leases in these fuel breaks. Other incentives were offered which could stimulate interest in fire prevention in villages.

Monitoring and Research: The portion of the earth encompassed within the tropics includes many nations, which vary in their ability to deal with forest fire. The panel members who wrote the Guidelines recognized this fact, and attempted to address only those nations which had not already developed the means to deal with the forest fire problem. This is especially evident in this section which recognizes that a workable fire management program must be built on a solid base of information, including past and present conditions such as fire history, risk mapping, fuel inventory, fire behavior, and a host of other factors which in large measure rely on technological tools. This base of information can only be attained through monitoring and research.

Institutional Framework and Capacity Development: The Guidelines emphasize the importance of an institutional framework to insure the implementation of the national fire policy. In addition to identifying many of the agencies and non-governmental organizations which may be called upon to assist, the Guidelines suggest that fire and smoke problems often have transboundary implications, and that assistance can be forthcoming from international bodies.

Indeed, when dealing with the issue of funding, the Guidelines point out that in addition to internal damage, there are worldwide effects from fire, including destroyed resources, smoke-degraded air, and possible global warming. This raises the issue of monetary assistance from nations which may not otherwise feel the need to become involved in fire management efforts in another country. The Guidelines provide a list of international agencies and organizations to identify potential sources of funding.

Socio-Economic Considerations: The economic implications are many, and involve virtually every segment of the society, because fire negatively affects the environment as well as jobs, and therefore the quality of life and the means of obtaining a livelihood for everyone.

Much that is included in the Guidelines centers on the fact that tropical forests are affected by the ages-old practice of swidden agriculture. Because these practices are based on ancient traditions and in some instances on religious beliefs, the Guidelines recognize that proposed solutions must be carefully designed and presented to the people who live on the land. For example, the promotion of improved agricultural systems, with model demonstration areas, could provide alternatives to shifting cultivation. Also, incentives could reward individuals and communities for adopting approved techniques.

The absolute importance of the role of community life, and the competition with outside interests, are recognized throughout the Guidelines, as is the fact that centuries of experience with fire in a locale has endowed the residents with many fire management skills. This wealth of background should be consulted and used. This section of the Guidelines also points out the fact that several international organizations, such as ITTO, are available to help.

The role of women as family and community leaders cannot be ignored without serious consequences. Beyond the fact that women play an important role in defining family and community policy, it is also pointed out in the Guidelines that women are often the ones who are most aware of the fire-related factors in the area around the community. This is because they are often the ones who herd the animals, gather the fuelwood, etc. They also are the first teachers of the young, and therefore establish attitudes and values. Their input into fire management is absolutely essential.

Land Resources Management and Utilization: It is within this section that the Guidelines demonstrate the recognition that the ITTA serves both producer and consumer nations. Fire management techniques suggested to producer nations would be relatively simple to put in force if the laws of economics and their effects on consumer nations could be ignored. However, every fire management activity which is implemented by producers must be evaluated in light of its effect on the cost of timber to the consumer. Recognizing this the panel suggested forest management and silvicultural techniques which could minimize negative fire effects without unnecessarily increasing production costs.

The special management problems related to grassland and savannas adjacent to forests were also dealt with in the Guidelines.

The fact that concession holders, timber companies, and contractors employ many of the people who are most likely to pose a fire threat to the forests, because of their daily work, led to recommendations that strict work rules be enacted, and that employees receive regular training to minimize fire hazards at the job site.

All forests provide benefits in addition to the wood and fiber usually associated with them. This is true of tropical forests, especially from the perspective of the local residents. This places increased need for forest managers and forest industry to recognize that local people need to collect medicinal plants, foods, and other non-timber products of the forests. To ignore this need is to invite devastating arson fires, set in retaliation by residents.

The Guidelines strongly suggest that local leaders should be included in any forest-related planning in order to avoid unnecessary and costly mistakes.

Training and Public Education: Finally, the Guidelines recognize the very important need to formally train several groups of people in order to successfully implement a fire management program.

Forest managers must be trained in the best techniques of fire management, and in ways to develop community support for those efforts. The residents of the area must be convinced that what is being carried out in the fire management plan is what is best for them.

The citizens of the entire nation should be so well informed of what is going on, and convinced that it is the correct path, that they will support that action and protect it from attack.

It was recognized by the members of the panel that not all principles discussed in the Guidelines were equally important to all ITTO member nations; and even when several countries shared an identical situation, the recommended actions may not experience similar success from nation to nation. Indeed, it was felt that what might be such an obvious and simple solution in one locale could be absolutely impossible to implement in another country. For this reason, users of the Guidelines are advised to look closely at their specific problems, and to put into action only those solutions which not only have a chance of working, but which can be implemented with the funding and other resources available.

The panel of experts which was convened by ITTO in 1995 represented eight nations, and was equally divided between producer and consumer nations (Brazil, Côte d'Ivoire, Indonesia, Malaysia; Australia, Germany, Japan, U.S.A.). Most of these people had never met before, but they worked together in the spirit of needing to address a serious problem of world-wide importance. The basic report submitted to ITTO and the panel was jointly elaborated by J.Goldammer (Germany) and S.Manan (Indonesia). The panel was chaired by J.Sorenson (U.S.A.) whose report delivered at the 2nd Wildland Fire Conference, Vancouver, May 1997 (see conference report in this issue of IFFN) was used for this contribution.

All ITTO publications are produced in three editions, in English, French, and Spanish. Copies of the **Guidelines on Fire Management in Tropical Forests** are available from the ITTO Secretariat:

International Tropical Timber Organization
International Organizations Center
Pacifico Yokohama, 1-1-1, Minato-Mirai, Nishi-Ku
J - 220 Yokohama
JAPAN

Fax: + +81-45-223-1111
Tel: + +81-45-223-1110

ITTO

NEWS FROM FIRE RESEARCH

Global to Regional Fire Weather Forecasts

Weather forecasts at short to extended time ranges and global to regional space scales could be more effectively utilized for wildland fire management. An experimental modeling system, developed at NCEP for making short-range global to regional weather forecasts, is currently being used to make and disseminate experimental global to regional, fire weather forecasts focused on Southern California. This fire weather forecasting system could be easily transported anywhere else in the world. A description of current and planned products is provided below.

Background

Improved fire weather forecasts are needed at a variety of time and space scales. At large space and time scales, accurate fire weather forecasts have potential for the long range planning of allocation of scarce resources. At smaller time and space scales accurate fire weather forecasts have potential use in alerting, staging and planning the deployment of fire crews and equipment. At the smallest time and space scales, accurate fire weather forecasts can be helpful in fighting fires as well as determining optimal periods for setting prescribed silvicultural fires (Fosberg and Fujioka 1987).

Current U.S. fire weather forecasts are prepared from short-range weather forecasts (1-2 days) by the National Center's for Environmental Prediction (NCEP's) Eta model, model output statistics, and human judgment. These fire weather forecasts include information about precipitation, wind, humidity, and temperature. At weekly to monthly time scales, only forecasts for mean precipitation and surface temperature are available from the Climate Prediction Center at NCEP (see Epstein 1988, Wagner 1989). Basically, NCEP's global medium range forecast (MRF) model forecasts are combined with persistent, statistical, and human forecasts to make an extended forecast of the 700 mb height. "Perfect Prog" statistical models developed by Klein (1985) and Klein and Bloom (1987), which assume the 700 mb as perfectly prognosticated, are then used to predict surface temperature and precipitation. Klein and Whistler (1991) further extended these kinds of forecasts by finding statistical relationships between the monthly averaged 700 mb height and monthly mean temperature, dewpoint, wind speed, and precipitation frequency.

Global to Regional Fire Weather Forecasts

Juang and Kanamitsu's (1994) experimental modelling system, developed at NCEP for making short-range global to regional weather forecasts, is being used to make longer-range experimental global to regional, fire weather forecasts. At the largest space and time scales, the modeling system uses NCEP's MRF or GSM (global spectral model). A high resolution regional spectral model (RSM), is nested within the global model by first integrating the GSM, which provides initial and low spatial resolution model parameters as well as lateral boundary conditions for the RSM. The RSM then predicts regional variations influenced more by the higher resolution orography and other land distributions within a limited but high resolution domain. Both models use the same 28 terrain following sigma layers, the same comprehensive set of physical parameterization modular packages, and the same diagnostic packages, which include land surface parametres (e.g. soil wetness, soil temperature, etc.), sensible and latent heat fluxes, radiation fluxes, cloudiness, various three dimensional heating and moisture distributions, and max/min temperatures, etc. (Kalnay et al. 1996). Global to regional forecasts of the fire weather index (Appendix) and precipitation are currently displayed on our Experimental Climate Prediction Center's world-wide web site for several regions (Global, U.S., California, S. California, Hawaii) and several forecast times up to 72 hours after the initial date. The entire globe is shown at 100 km resolution; the entire U.S., including Alaska, is shown at 50 km resolution; California is shown at 25 km resolution; Hawaii is shown at 10 km resolution. As shown in Figure 1, separate forecasts are displayed as entries in a table. Each row of each table is a separate forecast and the initial date and initial hour are indicated in the leftmost column; validation times are indicated by the column headings. As shown in Figures 2 and 3, these times are repeated as the title of each individual forecast. All times are in UTC times; local time depends upon location. Also available are combinations of all the latest forecasts in a self-animated GIF files, which effectively summarize daily activities of each forecast. Note that a high fire weather index is represented by dark colours. For California (Fig.3), the speed and direction of the surface (10 meter) wind is also indicated, as is the surface elevation.

Global

init.\valid.	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v
0602 06i	...	...	...	00f	06f	12f	18f	24f	30f	36f	42f	48f	54f	...	...	...
0602 00i	...	...	00f	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f	72f	
0601 18i	...	00f	06f	12f	18f	24f	30f	36f	42f	48f	54f	...	...	...		
0601 12i	00f	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f	72f			

(97060206 fcst animation ~ 264Kb)

U.S.

init.\valid.	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v
0601 06i	...	...	...	00f	06f	12f	18f	24f	30f	36f	42f	48f
0601 00i	...	...	00f	06f	12f	18f	24f	30f	36f	42f	48f	
0601 18i	...	00f	06f	12f	18f	24f	30f	36f	42f	48f		
0601 12i	00f	06f	12f	18f	24f	30f	36f	42f	48f			

(97060106 fcst animation ~ 272Kb)

California

init.\valid.	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v
0602 00i	...	...	...	...	...	...	...	...	...	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f
0601 00i	...	...	...	...	...	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f	72f			
0531 00i	...	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f	72f							

(97060200 fcst animation ~ 312Kb)

S._California

init.\valid.	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v
0602 00i	...	...	...	...	...	...	...	...	...	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f
0601 00i	...	...	...	...	...	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f	72f			
0531 00i	...	06f	12f	18f	24f	30f	36f	42f	48f	54f	60f	66f	72f							

(97060200 fcst animation ~ 264Kb)

Hawaii

init.\valid.	00v	06v	12v	18v	00v	06v	12v	18v	00v	06v	12v	18v	00v
0601 00i	...	...	...	...	00f	06f	12f	18f	24f	30f	36f	42f	48f
0531 00i	...	...	00f	06f	12f	18f	24f	30f	36f	42f	48f		
0531 12i	00f	06f	12f	18f	24f	30f	36f	42f	48f				

(97060100 fcst animation ~ 240Kb)

Fig.1. Fire weather forecast products available at http://meteora.ucsd.edu/ecpc/ecpc.html/. Individual tables correspond to individual regions, including the globe, U.S., California, Southern California, Hawaii. Each row of each table is a separate forecast and the initial date and initial hour are indicated in the leftmost column. Validation times are indicated by the column headings. Validation times are appended with a v; initial times are appended with an i; forecast times are appended with an f. Opening up each frame provides the forecast. Animated GIF image movies for the latest forecast are available at the bottom of each table.

These forecasts are made in a variety of places. For example, NCEP makes global, U.S. and Hawaii forecasts. We transfer a small number of products from these forecasts to provide the FWI and precipitation at our site. Due to bandwidth limitations of the Internet, only the complete initial and 72-hour forecasts 4 times daily (00, 06, 12, 18 UTC) for the global model are transferred. From these global initial and boundary conditions, regional forecasts at 25 km resolution, focused on the California-Nevada region, are then made and also displayed. We chose to initialize and force the RSM from the NCEP global forecast instead of initializing the RSM from the 50 km RSM forecasts, in order to retain the ability to forecast anywhere in the globe. In the future, only the global initial conditions will be transferred as we will soon be making global to regional forecasts at longer time periods than are available from NCEP.

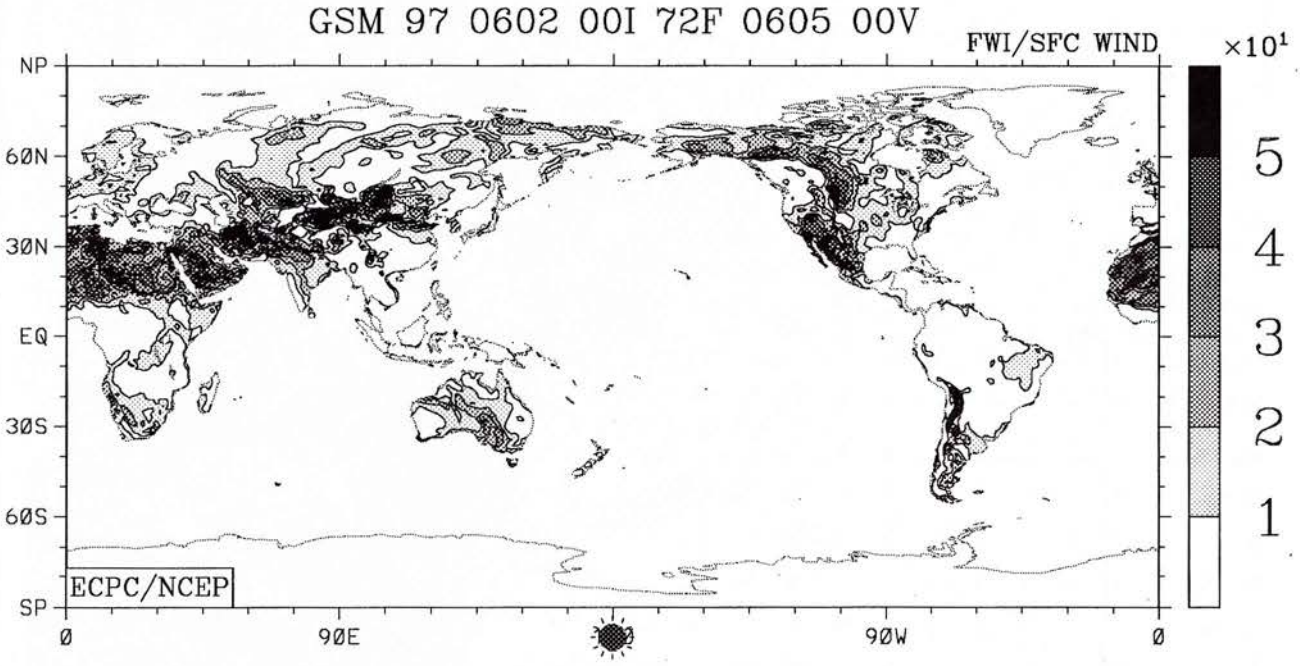

Fig.2. 72-hour global fire weather forecast initialized 00 UTC, 2 June 1997 and valid at 00 UTC, 5 June 1997. The location of solar noon is marked by the sun at 180. The fire weather index scale is on the right.

Future Work

New features are under development. Besides beginning development of longer-range monthly global to regional forecasts, we are also beginning extensive validation of our fire weather forecasting methodology using recently developed monthly diurnal climatologies, which will be used to assess the accuracy of anomaly forecasts. We are experimenting with the transportability of our global to regional modeling system by making experimental forecasts for Central America, Africa, and Taiwan. At smaller scales, an experimental non-hydrostatic mesoscale model at 2 km resolution, that is an integral part of the global to regional forecast system, is under development. Provision of additional output of corresponding land surface variables such as snow, soil and vegetation moisture are now being extracted and may soon be provided as part of the forecasts; these additional variables are needed to transform fire weather indices into fire danger indices, which include vegetation stresses.

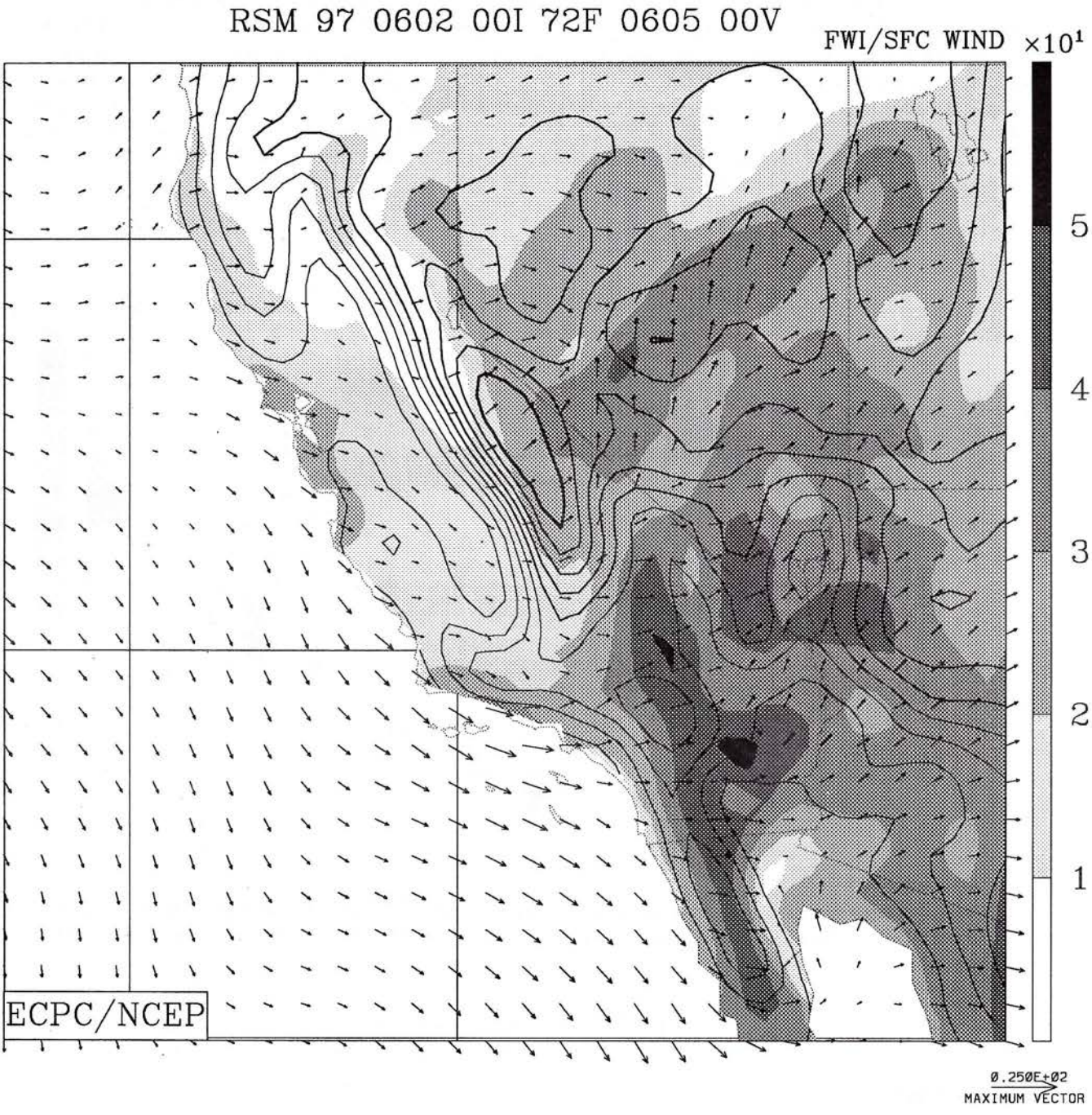

Fig.3. 72-hour Southern California fireweather forecast initialized 00 UTC 2 June 1997 and valid at 00 UTC, 5 June 1997. The fire weather index scale is on the right. The 10 meter surface wind speed and direction are indicated by the arrows. Topography is shown by the contour lines every 250 m.

Appendix: Fire Weather Index

The physical aspects of wildland fire can be quantified in a variety of ways, e.g. rate of spread, rate of thermal energy production, fireline intensity, etc. Similarly, fire danger can be described by a variety of measures. In the United States, the most common measures are those of the U.S. National Fire Danger Rating System (NFDRS; Deeming et al. 1977). By assuming constant fuel (vegetation) characteristics, Fosberg (1978; see also

Fujioka and Tsou 1985) derived a simpler fire weather index (FWI) based upon equilibrium moisture content (a function of virtual temperature and relative humidity) and wind speed. Haines et al. (1983) later showed that the FWI was highly correlated with fire occurrence in the U.S. Northeast. Anecdotal evidence suggests that the FWI is a good indicator of fire activity in the U.S. Southwest; for example, major fires of the past decade have been associated with anomalously high occurrences of FWI. The FWI is calculated from:

$$FWI=(1+W^2)^{1/2}(1-2a+1.5a^2-.5a^3)/.3002,$$

where

a = m/30
m = 0.03229+0.281073R -0.000578RT R<10%
m = 2.22749+0.160107R -0.014784T 10%<R<50%
m = 21.0606+0.005565R2 -0.00035RT-0.483199R 50%<R.

a is the ratio of equilibrium moisture content to a moisture of extinction of 30. The second quantity in parentheses is called the moisture damping coefficient. The normalized equilibrium moisture content, ***a***, is determined from dry-bulb temperature, ***T*** (degrees Fahrenheit), relative humidity, ***R*** (percent). ***W*** is the wind speed (statute mph). Roads et al. (1991) showed that the temperature dependence of the FWI was almost negligible. For increased temperature, the FWI increases only slightly. Much stronger variations in the FWI occur due to relative humidity and wind speed variations. As might be expected the FWI increases strongly for increased wind speed and decreased relative humidity. Basically, times of potential fire danger (as described by the above simplified FWI) are during windy, relatively dry, and to a lesser extent, warm conditions. The needed meteorological data for the FWI come from NCEP's GSM/RSM experimental forecasts of 10 m winds and 2 m T and RH, which are assumed to be similar to observed values. Incorporating characteristics of the fuel (vegetation) are needed to further develop this index into a true fire danger index.

John O. Roads and S.-C. Chen
Experimental Climate Prediction Center
UCSD, 0224
U.S.A. - La Jolla, CA 92093

Francis M. Fujioka
USDA Forest Service
U.S.A. - Riverside, CA 92507

H. Juang and M. Kanamitsu
Climate Prediction Center, W/NP51, Rm 604
National Centers for Environmental Prediction
5200 Auth Road
U.S.A. - Camp Springs, MD 20233

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TECHNOLOGY NEWS

Firebird 2001 Fire Fighting Management Support System

Every year, forest fires bring destruction, injury, and even death. The ability of forest fire incident managers to control fires quickly, thereby limiting the damage, is to a great extent dependent on their ability to gather information, to deploy resources, and to perform emergency evacuations efficiently.

The MALAT Division of Israel Aircraft Industries, using mature Remotely Operated Air Vehicle (ROA) (or Unmanned Air Vehicle [UAV]) technology, has developed the application described herein, which provides real-time information to fire management, greatly enhancing the ability to manage resources. The application also provide fire fighters alerts, emergency communications relay, and other features beneficial for improvement of cost effective and safe fire suppression.

Needs

Fire management decisions rely primarily on fire scenario information. Several factors serve to limit the ability of the incident manager to gain relevant information:

* Smoke over the fire area interferes with the ability to obtain comprehensive fire intelligence.
* The incident commander, in many cases, must personally fly over the fire area, thus leaving his management post.
* Using manned aircraft for flights over the fire area has certain limitations. Night flights are undesired for safety reasons, flight time is limited, and in-smoke flights are hazardous. Due to the consequent lack of information decisions are sometimes based on outdated information.
* Serious situations on the fire line often develop rapidly with very little prior notice. This makes it difficult to mobilize current intelligence gathering technology to assist the manager in making the necessary decisions in a timely manner.
* The quality of radio communications with fire fighting forces is sometimes very poor, especially in mountainous areas.

Furthermore, the safety and well being of all fire suppression resources on the fire line, as well as their ability to effectively battle the fire, depend on radio communications, contact with immediate supervisors, knowledge of their actual location on the fire line, and prediction of fire behaviour. Using the currently available resources, radio communications are sometimes of poor quality, the contact with supervisors is hindered, knowledge of location is sometimes outdated, and the means to accurately predict fire behaviour are limited.

Capabilities

The system which has been successfully demonstrated in Missoula, Montana, U.S.A., in October 1996, and is capable of the following:

* Continuous real-time TV and FLIR (forward-looking Infrared) imagery of fire scenario, down-linked to the fire control center (day or night)
* Fire front line and hot spots overlaid on either a digital map or a smoke free pre-prepared aerial or satellite photo map (ortho-photo) enabling the incident commander to see the forest, houses, roads, railroads, etc.
* Print out of the fire map issued in real time
* Location of fire fighting forces overlaid on the same map or ortho-photo. This capability includes the display of fire-fighter's emergency situation stress alarms (SOS) and their location coordinates.
* The display of direction and speed of wind (at the ROA/UAV flight level) and alarms about significant changes in wind direction and speed.
* The ability to identify (using the IR image) the location where retardants have been applied. By simply clicking his mouse on the digital map, the system automatically provides the next "drop" location coordinates.
* The ability to easily transfer (to any desired location) a full fire scenario image by modem.
* Spotting distance and burnt area calculations.
* Provide a map of fire intensity using different transparent color shades on the fire map.
* Computation and designation of the speed at which the fire front line is progressing in the various perimeter locations, including prediction of the front line location for various periods (30 minutes, 1 hour, etc.), and prediction of the time it will take to reach a particular location.
* Continuous monitoring of fire fighting resources and fire behaviour to provide alerts of dangerous blow-up conditions on the fire line and potential entrapment of fire fighters.
* Through integration of a terrain-passability software module, the fire manager can determine the optimal routes for the fire fighters and the time required for withdrawal of forces.
* Monitoring of two adjacent incidents by two ROA/UAVs simultaneously.
* Emergency airborne radio communications relay.
* In addition, the system includes the capability to function in a detection mode of operation, for early warning and suppression.

Fig.1. The Firebird 2001 during test flights in 1996

Prototype Capabilities and Features

The Civilian ROA/UAV System is structured to accept any of IAI/MALAT's airborne platforms. Nevertheless, the two platforms especially suitable for civil applications and budgets are:

* The Firebird 2001, a compact, low weight configuration, flight testing completed in October 1996, and
* The Heron, a long endurance, long range configuration capable of carrying a heavy payload with a demonstrated endurance of 52 straight flight hours.

Both configurations share the same avionics, briefly described below.

The FIREBIRD 2001 (Compact) configuration:

Engine	D.H. 290, 23.5 HP
Take Off Weight	140-150 kg
Pay load weight	15-25 kg
Fuel	19 kg
Loiter endurance	5 hours
Ceiling	15,000 ft
Cruise speed	60 kts

The Heron (Long-range, long-endurance, heavy payload) Configuration: 100 flight hours, 15 flights, including 52 continuous flight hours

Engine	Rotax 914, 100/115 HP
Take Off Weight	1100 kg
Payload weight	250 kg
Fuel	250 kg
Loiter endurance	40 hrs (with 250 kg fuel)
Ceiling	35,000 ft
Cruise speed	80 kts
Power (electric)	4 kW

Common to both systems, special redundancy and BIT (Built In Test) provisions will enable a reliable, safe and simple operation of the system. The avionics package developed for any particular platform configuration can very easily be implemented on another platform configuration. Consequently the descriptions herein focus on the avionics capabilities of the prototype demonstration system, rather than on any particular aspect of the platform.

Avionics Features

* Redundancy for all system components other than the engine
* System architecture ensures the safe return home after a sub-system malfunction. The system architecture has been designed so that a malfunction of any one sub-system does not result in malfunction of any other sub-system
* GPS autonomous navigation enables better navigation accuracy than VOR transportation air traffic
* Day and night operation of system platform and payload
* Battery-power redundancy
* Central double (redundant) computer for flight control and communication management
* "Pilot camera" for "internal pilot" control
* BIT (Built In Test) for autonomous flight decisions
* Continuous wind direction and velocity computation
* Continuous status computation, return home decision capability (bingo) and pre-bingo alarm
* Time for next way-point computation
* Location of ROA/UAV continuously displayed on GCS digitized map
* "Camera control" flight mode enables direction control of camera to Point Of Interest with fixed angles (relative to airframe) while UAV automatically keeps consequent required flight conditions.

* Simple and easy operation of system
* Continuous ground record of flight parametres and camera data

Some advantages of ROA/UAV use over other existing technologies

* Long endurance capability (Heron 52 continuous flight hours demonstrated)
* No risk to human life: Enables close approach to hazardous locations, such as:
  - Bad weather condition areas
  - Airspace with reduced visibility (heavy smoke)
  - Chemically polluted areas
  - Radioactively contaminated areas
* Long range capability (Heron - 700 miles to target, 20 Hour mission loiter, and return home)
* No human physiologic limitations
* Short runway requirements: 400 metre strip suitable for take-off and landings.

For more technical information contact:

Mr. Uzi Zurgil
Applications Manager
Civil UAV
MALAT Division
Ben Gurion International Airport
70100 Israel

Fax: ++972-3-9355222
Tel: ++972-3-9355970/7
e-mail: uzurgil@iai.co.il

RECENT PUBLICATIONS

Forest Fire Risk and Management

Proceedings of the European School of Climatology and Natural Hazards course advance study course held in Porto Carras, Halkidiki, Greece, in June 1992, have been recently published.

The book provides a basic knowledge on **general aspects** of forest fires, in particular, historical evolution of forest fires in the Southern European Countries; socio-economic and legislative aspects of forest fires; **fire behaviour**, in particular, flammability and combustion of Mediterranean type ecosystems and modelling surface and spot fires; **fire management**, in particular, principles of fire prevention and fire suppression, methods for risk evaluation and decision aid, fire detection and remote sensing techniques, and fuel management through prescribed burning; and **fire effects**, in particular, fire effects on soils and vegetation, post-fire dynamics and landscape interactions in the Mediterranean ecosystems, and global scale implications of fire. Papers and an abstract of posters presented by the students who participated at the course are also included.

Forest Fire Risk and Management. EC publication EUR 16719 EN (ISBN 92-827-8486-X)

Copies of the report may be obtained (free of charge) from:

Mr.Panagiotis Balabanis
European Commission, DG XII/D-2
200, rue de la Loi
B - 1049 Brussels

Fax: ++32-2-2963024
e-mail: panagiotis.balabanis@dg12.cec.be

Sediment Records of Biomass Burning and Global Change

Fifty scientists from North America, Eurasia, and Australia gathered in Algarve, Portugal, 11-14 October 1994, for an assessment of the role of biomass burning during past changes in climate, vegetation, and land use. This interdisciplinary group of paleoecologists, environmental historians, fire ecologists and managers, atmospheric scientists, and organic chemists presented and debated three of the principle challenges to the interpretation of long-term burning from sediments. These challenges are a (i) characterization of combustion products embedded in organic sediment matrices, (ii) description of the production and transport of emissions, and (iii) synthesis of existing sediment records. Problems characterizing combustion emissions in sediments have not only made it difficult to document past burning, but also to estimate the amount of carbon that is sequestered in recalcitrant elemental forms. The relative merits of microscopy, chemical, and thermal assays were compared. Atmospheric scientists used recent developments in mesoscale transport and empirical evidence from controlled burns to argue that even relatively "large" particles might frequently be transported long distances. Paleoecologists presented evidence to suggest that these particles represent principally local sources and therefore can be used to interpret local fires. Numerous examples were presented where known fires have been well-documented by sediment combustion records at local scales. Regional syntheses showed a high degree of geographic coherency in the accumulation of combustion products. The results are now synthesized in a volume edited by the group of the workshop conveners under the lead of James S. Clark, Duke University, Department of Botany.

Clark, J.S., H. Cachier, J.G. Goldammer, and B.J. Stocks (eds.). 1997. Sediment records of biomass burning and global change. Springer-Verlag, Berlin-Heidelberg-New York, 489 pp. (ISBN 3-540-62434-1, DM 248.00)

Fire in Southern African savannas - Ecological and atmospheric perspectives

The Southern African Fire-Atmosphere Research Initiative (SAFARI) was an important component of the first international, intercontinental and interdisciplinary fire experiment ever. The field campaign of this initiative (SAFARI-92), was also a unique example of scientific cooperation that aimed to address an important environmental problem. Over 150 scientists from 14 nations came together during SAFARI-92 to collect data on the effects of African savanna fires on the atmosphere of the southern hemisphere.

Changes to the earth's atmosphere are among the most important environmental problems we face today. Such problems call for the formulation of rapid and effective solutions, solutions which must come from the best use of scientific understanding. Conventional approaches to science are reductionist by nature, while the global nature of environmental problems cry out for holistic solutions. The SAFARI campaign was an attempt to address this need. Some studies took place on sample sites on the ground as small as one square metre, and were complemented by various other studies that addressed questions at the scale of ecosystems (in large experimental burns), continents (through wide-ranging sampling of atmospheric gases and smoke from the ground and from aircraft), intercontinental comparisons (through sampling from aircraft and satellites in space), and global syntheses (through the use of modelling techniques). These approaches required the combined skills and insights of a range of scientists, including soil scientists, ecologists, meteorologists, and atmospheric chemists.

The chapters of this book are intended to provide the reader with an overview of the SAFARI campaign. Introductory chapters provide a context for the more detailed accounts on the ecology, climate and atmospheric chemistry of southern Africa that follow. Following chapters provide overviews of important components of SAFARI and the results that were obtained. A final chapter provides a synthesis of the results, and critically evaluates the extent to which the SAFARI campaign asked the right questions, whether it obtained the right answers, and whether it defined important gaps in our knowledge that remain.

van Wilgen, B., M.O. Andreae, J.G. Goldammer, and J. Lindesay (eds.) 1997. Fire in Southern African savannas. Ecological and atmospheric perspectives. The University of Witwatersrand Press, Johannesburg, South Africa, 256 pp. (ISBN 1-86814-304-X)

Cycle of Fire

Cycle of Fire is a new series within Weyerhaeuser Environmental Books, under the general editorship of William Cronon. Cycle of Fire will eventually comprise six books by Stephen J. Pyne - including both original publications and reprints - which collectively tell the story of fire's role in shaping the earth through the entire sweep of human history. The first two volumes are *World Fire* (first published in 1995) and *Fire in America* (first published in 1982). *Vestal Fire* will be available in November 1997. Stephen J. Pyne is professor of history at Arizona State University. The author of seven Books, including *Fire on the Rim: A Firefighter's Season at the Grand Canyon*, he has been the recipient of a MacArthur Fellowship and the 1995 los Angeles Times Robert Kirsch Award for his career contribution to American letters.

Vestal Fire
An environmental History, told through Fire, of Europe and Europe's Encounter with the World

"Vestal Fire is Stephen Pyne's masterpiece. In it, he offers nothing less than a retelling of all of European history from a vantage point no other historian has ever adopted so consistently before: that of the fire which in Pyne's view burns at the very heart of Western civilization." - *from the Foreword by William Cronon.*

Stephen Pyne has been described as having a consciousness "composed of equal parts historian, ecologist, philosopher, critic, poet, and sociologist." At this time in history when people are trying to understand their true relationship with the natural environment, this book offers a remarkable contribution - breathtaking in the scope of its research and exhilarating to read. Pyne takes the reader on a journey through time, exploring the terrain of Europe and the uses and abuses of its lands as well as, through migration and conquest, many parts of the rest of the world. Whether he is discussing the Mediterranean region, Russia, Scandinavia, the British Isles, central Europe, or colonized islands; whether he is considering the impact of agriculture, forestry, or Enlightenment thinking, the author brings an unmatched insight to his subject.

Vestal Fire takes its title from Vesta, Roman goddess of the hearth and keeper of the sacred fire on Mount Olympus. But the book's title also suggests the strengths and limitations of Europe's peculiar conception of fire, and through fire, of its relationship to nature. Between the untamed fire of the wilderness and the tended fire of the hearth lies a never ending dialectic in which human beings struggle to control natural forces and processes that in fact can sometimes be directed but never wholly dominated or contained.

Pyne, S.J. 1997. Vestal Fire. An environmental history, told through fire, of Europe and Europe's encounter with the World. University of Washington Press, 672 pp., 65 illus., maps, notes, glossary, bibliography, index, cloth (ISBN 0-2295-97596-2; $34.95).

World Fire
The Culture of Fire on Earth

World fire is the story of how fire and humans have coevolved. The two are inseparable, and together they have repeatedly remade the planet.

"Stephen J. Pyne writes about fire as if he were on fire, with searing, consuming heat and light. When he looks at fire he sees not biological catastrophe but social illumination and natural renewal... This book will change the way you view fire - and the way you see us routinely fighting it." - *Seattle Times*

"Pyne considers the evolution of fire in such diverse regions as Australia, Africa, Brazil, Sweden, Greece, Iberia, Russia, and India and than ponders Antarctica, the land without fire. As he examines changing techniques for and attitudes toward fire control, Pyne challenges our concepts of nature and wilderness and explains why the study and management of fire have tremendous environmental, cultural, and political implications." *Booklist*

Pyne, S.J. 1997. World fire. The culture of fire on earth. (First publ. in 1995.) University of Washington Press, 408 pp., illus., Paper (ISBN 0-295-97593-8, $19.95).

Fire in America
A Cultural History of Wildland and Rural Fire

From prehistory to the present-day conservation movement, Pyne explores the efforts of successive American cultures to master wildfire and to use it to shape the landscape.

"On rare occasions, the historical literature is enriches by the introduction of a broad new field for study, by a book that dramatically expands the boundaries of scholarly investigation. Stephen Pyne's Fire in America is such a book. It achieves the Promethean goal of bringing fire to history." *-Science*

"Stephen J. Pyne compels our admiration for his gargantuan ambition and richly informed intelligence. He tells us more than anyone else to date has about the role of fire in the landscape, tells us we have been wrong assuming a pristine state of nature before the white man's invasion, tell us what fire has meant to the rise of civilization and this nation. No one interested in the environmental history can afford to ignore this massive achievement." *-Journal of American History*

Pyne, S.J. 1997. Fire in America A cultural history of wildland and rural fire. (First publ. in 1982.) University of Washington Press, 680 pp. illus., Paper (ISBN 0-295-97592-X $24.95).

Biomass Burning and Global Change

The 1989 report of the U.S. National Research Council "Global Change and Our Common Future" states: "Our planet and global environment are witnessing the most profound changes in the brief history of the human species. Human activity is the major agent of those changes - depletion of stratospheric ozone, the threat of global warming, deforestation, acid precipitation, the extinction of species, and others that have not become apparent." One human activity that contributes to all of these global changes is the excessive burning of vegetation due to unprecedented land-use changes (forest conversion). The manifold interactions between human population growth, land use and fire, especially in the tropics and subtropics lead to the degradation of landscape potentials and desertification. The Chapman Conference on Biomass Burning and Global Change (Williamsburg, Virginia, 13-17 March 1995) aimed to assess the role and importance of biomass burning on ecosystems, the atmosphere, and climate. The papers presented at the conference are now published in the proceedings "Biomass Burning and Global Change". The two volumes represent the most updated compilation of the state-of-the-art in global fire science. There are also results of recent national and international fire experiments and campaigns, including the Southern African Fire-Atmosphere Research Initiative (SAFARI) and the Bor Forest Island Fir Experiment in Siberia, a part of the Fire Research Campaign Asia-North (FIRESCAN), and the U.S. Smoke, Clouds, and Radiation (SCAR) experiment. The two volumes of the Williamsburg conference are an essential source book for scientists working on aspects of regional and global fire.

Levine, J.S. (ed.) 1996. Biomass burning and global change. Vol.I+II. The MIT Press, Cambridge, MA, 902 pp. (ISBN Vol.I: 0-262-12201-4; Vol.II: 0-262-12202-2)

Mathematical Modeling of Forest Fires and New Methods of Fighting Them

The focus of this new book by Aanatoly M. Grishin, Tomsk University, Russia, is on theoretical and experimental investigations of forest fires and the development of new concepts and methods of fighting forest fires. The book is published in English, the result of a very valuable companion work between the author and the English language editor Frank Albini, Montana State University, U.S.A..

This book provides a general mathematical model of forest fires, the burning forest being represented as a porous disperse reactive medium. The model has been developed on the basis of mechanics concepts of multiphase reactive media, meteorology and biology. It results from the analysis of some well-known and new experimental data. Forest fire aerodynamics are examined with scientific care; mathematical theories of surface and crown forest fires are presented numerically and analytically. Mechanism and limiting conditions of forest fire propagation are identified and investigated. The interaction between shock waves, forest vegetation, and

forest fire has been investigated. A new concept and new fire fighting methods have been worked out. The book is designed primarily for experts in mechanics of reacting media, forest pyrology, combustion physics, applied mathematics and ecology. The book also serves as a companion text for both students and postgraduates of the corresponding higher educational institutions.

Partial Contents: Experimental investigation of forest fires. General mathematical model of forest fires. Thermophysical, optical and reactive properties of the medium in the forest fire zone. Two-dimensional and axisymmetric flows in the near-ground layer of the atmosphere during forest fires. Mathematical modelling of forest fires. Study of limiting conditions of forest fire spread and new methods of fighting forest fires.

Grishin, A.M. 1997. Mathematical Modeling of Forest Fires and New Methods of Fighting Them. English version edited by Frank Albini. Tomsk State University Press, Tomsk, Russia.

The price of the book is US$ 60.00 per copy, which includes the postage from Tomsk. Books will be mailed when transfer of funds is complete. Payment instructions can be received by the author:

Anatoly Mikhaiylovich Grishin
Centre of Education and Research
on Reactive Media Mechanics and Ecology
Tomsk State University, 36 Lenin Avenue
RUS - 634050, Tomsk

Fax: ++7-83822-226162
e-mail: fire@fire.tsu.tomsk.su

Effects of Fire on Madrean Province Ecosystems

In a basic paper of the symposium "Effects of Fire on Madrean Province Ecosystems" (Tucson, Arizona, 11-15 March 1996) Larry S. Allen in his basic paper on the ecological role of fire in the Madrean Province summarizes the history of fire in that border region of the U.S.A. and Mexico as follows:

"Landscapes of the Southwestern United States and Northern Mexico, including the Madrean Province, have historically been shaped by fire. The region is of high lightning occurrence with frequent wildfires in spring and early summer. Early humans are known to have used fire as a tool for hunting, warring, and manipulation of vegetation. With the advent of Europeans came modification of fuels by livestock grazing and other land management activities. This resulted in diminishing of the ability of fires to spread and affect large landscapes. As modern range management techniques, coupled with moderate stocking rates began to improve rangeland condition, several state and federal agencies initiated aggressive fire suppression. The result was virtual elimination of fire as a significant ecological force for almost a century .... Landowners and agencies are currently exploring ways to restore fire in its natural role in the ecosystem."

The conference had provided a forum in which resource specialists, managers, researchers, and other interested people could share their collective experiences, opinions and informational needs on the effects of fire on the resources in the Madrean Province ecosystems and on fire management. The results of the conference are now published as proceedings edited by the USDA Forest Service. The papers deal with the ecological role of fire in the region, with socio-political perspectives, the effects of fire, and implications on fire management.

Ffolliott,P.F., L.F.DeBano, M.B.Baker, G.J.Gottfried, G.Solis-Garza, C.B.Edminster, D.G.Neary, L.S.Allen, and R.H.Hamre (tech.coord.) 1996. Effects of Fire on Madrean Province Ecosystems - A symposium proceedings. 11-15 March 1996, Tucson, Arizona. General Technical Report RM-GTR-289. Fort Collins, Colorado: USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, 277pp.

Copies of this publication can be ordered by sending mailing information in label form to:

Publications Distribution
Rocky Mountain Forest and Range Experiment Station
3825 E. Mulberry Street
U.S.A. - Fort Collins, Colorado 80524

MEETINGS HELD IN 1996-97

CANADA

2nd International Wildland Fire Conference
Conference Report

The 2nd International Wildland Fire Conference was a held in Vancouver, British Columbia, Canada from May 25 to May 30, 1997. The Conference was a resounding success, with 565 delegates from 39 countries in attendance. The Wildland Fire Conference provided delegates with a forum to promote the theme of Wildland Fire Management and Sustainable Development including social, economic and environmental perspectives. The thirty-eight speakers representing fifteen countries presented a wide range of views and topics surrounding the theme of the Conference. The Conference sessions were complemented by various ancillary events including FireInfo 97 Exhibit and Poster Session and FireExpo.

FireInfo 97 provided an opportunity for delegates and exhibitors to exchange information on wildland fire issues. Twenty-two exhibitors, including government agencies, corporations and non-governmental organizations, presented research, product development and program initiatives at their information booths over the first two days of the Conference. In conjunction with the exhibits, a Poster Session featuring forty-one posters on topics ranging from fire behaviour, prescribed burning to fire ecological effects were on display for the delegates to examine and discuss.

FireExpo was the technical and interactive trade show portion of the 2nd International Wildland Fire Conference. Live demonstrations of rotary and fixed wing air tankers, fire trucks and fire equipment provided an ongoing array of activities for the delegates to take in. Over 125 manufacturers and suppliers of wildland fire products, services and technology were brought together in this international showcase. In addition, FireExpo received approximately 2,000 visitors during the three-day event including conference delegates, fire management experts, fireline specialists and the public.

The final day of the Conference added to the international theme of the Conference. WorldFire 97, sponsored by Forest Renewal British Columbia, provided a forum for discussions on the advancements and challenges facing wildland fire management programs throughout the world.

The Conference program was complemented by a series of social functions allowing the delegates to interact on a more informal level. The Conference's official opening, the Welcoming Reception, was held on the Vancouver waterfront where delegates were able to enjoy demonstrations from the city's fire boats and the impressive Martin Mars Water Bombers. At FireExpo, the Wildland Fire 97 Barbeque was held with a buffet-style dinner featuring Canadian West Coast favourites and an assortment of entertainment.

Delegates of the Conference were also able to take part in several Forestry Field Tours including the Canadair Amphibion Aircraft Demo, the British Columbia Institute of Technology Forest Fire Centre Simulator Tour and the Wildland Firefighting Operations Tour.

The Conference received excellent local Vancouver media coverage by the major daily newspapers, television and radio stations. In addition, there were freelance writers from both aviation and fire trade publications covering the events of the Conference and tradeshow.

The momentum from the Conference is still carrying on. The rapporteurs report from the Conference Program will soon be out to all the delegates with additional copies available to interested parties by contacting the conference chair (address below).

In addition, the Conference web site will continue to be maintained and will feature abstracts, the rapporteurs report, and a number of speakers' papers as well as other pertinent information. The address of the web site is:

http://142.36.185.86/Conference

In closing, the Organizing Committee of the 2nd International Wildland Fire Conference wishes to extend their appreciation to the North American Forestry Commission, Fire Management Study Group and the British Columbia Ministry of Forests, Protection Program, for sponsoring and hosting the Conference. A further acknowledgement must be extended to all of the co-sponsors and corporate sponsors; without whose generous support, we would not have been able to stage such a high calibre event. And a special thank you to all the delegates who attended this event. Their enthusiasm for fire management, their patience with conference organizing and their willingness to be active participants, made this Conference successful.

We are all looking forward to the 3rd International Wildland Fire Conference!

Rick Clevette
Chair, 2nd International Wildland Fire Conference
British Columbia Ministry of Forests
Protection Program
PO Box 9502 Stn Prov Govt
Victoria, BC
CANADA V8W 9C1

Fax: ++1-250-387-5685
Tel: ++1-250-387-8716
e-mail: rick.clevette@gems2.gov.bc.ca

2nd Wildland Fire Conference '97

Recommendations

Background: Wildland Fire '97 took place on May 25-30, 1997 in Vancouver, British Columbia, Canada. The conference was sponsored by the North American Forestry Commission, Fire Management Study Group as well as numerous government agencies and private companies. It was endorsed by the International Decade for Natural Disaster Reduction, the Food and Agricultural Organization, and the European Economic Commission. There were 565 delegates from 38 countries, representing a global cross-section of policy makers, managers, scientists, and private industry. The theme of the conference was wildland fire and sustainable development, including social, economic, and ecological perspectives.

Principles: Wildland Fire '97 delegates agree on several principles:

* Fire is a key element of sustainable development
* Fire is a component of ecological processes
* Fire is both a threat and a tool
* Fire and its effects are not constrained by geographic or political boundaries
* Fire is one of the few natural disturbances that can be forecasted and mitigated
* Fire may endanger people and communities
* Fire can disrupt local economies
* Fire can cause irreversible impacts
* Fire is an important element of most global ecosystems and atmospheric processes
* Fire's role in the global environment is not fully understood or appreciated

Vision: In recognizing these principles, delegates to Wildland Fire '97 envision:

* Increased awareness of fire's impacts on sustainability, including communities, ecosystems, and the environment.
* Increased understanding of fire's role and avoiding irreversible actions.
* Increased international cooperation in fire management, fire research, sharing information and implementing technology.

Needs: Delegates to Wildland Fire '97 acknowledge the work of previous fire conferences and ongoing international initiatives in wildland fire, including the first international fire conference (USA, 1989), the Chapman Conference on Biomass Burning and Global Change (USA, 1995), the FAO/ECE Seminar on Forest Fire and Global Change (Russian Federation, 1996), and the ITTO Guidelines on Fire Management in Tropical Forests (1996). Building upon this dialogue, we agree that there is a compelling need to:

* increase awareness of the impact of fire on sustainable development
* incorporate wildland fire into land management policies
* compile international data on wildland fire
* expand our understanding of fire's role in global processes
* establish international partnerships and agreements
* coordinate international research
* continue international dialogue
* implement appropriate technology
* share information, knowledge, and experience
* evaluate international progress in wildland fire

Recommendations

1. That a group be formally established under the auspices of the United Nations to facilitate addressing global wildland fire needs.

2. That the global wildland fire community reconvene in five years to evaluate progress in resolving these needs. A consortium of international fire groups should meet to develop and promote a follow-up conference.

Endorsement of Recommendations of the Seminar on "Forest, Fire, and Global Change" Shushenskoe (Russian Federation, 1996)

The seminar on "Forest, Fire, and Global Change" was held in Shushenskoe, at the invitation of the Government of the Russian Federation from 4 to 9 August 1996. The conclusions and recommendations of the seminar were published in International Forest Fire News No.15 (p.40-47). The full official report has been prepared by the ECE/FAO/ILO Joint Committee on Forest Technology, management and Training (TIM/EFC/WP.1/SEM.44/2, 21 October 1996). At a satellite meeting during the 2nd Wildland Fire Conference (Vancouver, Canada, May 1997) the North American Forestry Commission, Fire Management Study Group, endorsed the recommendations made by the 1996 conference. The statement of endorsement was signed by the representatives of the three member countries of the Fire Management Study Group; the full text of this important endorsement is given below:

A Statement of Endorsement

The North American Forestry Commission, Fire Management Study Group is pleased to have sponsored Wildland Fire '97 - the latest of a series of international fire conferences during the past decade. Beginning with the 1989 international fire conference in Boston, the global fire community has collectively addressed

important international issues related to wildland fire. The Fire Management Study group endorses the following recommendations made by the 1996 conference, held in Shushenskoe, Russia.

The following are needed at a global scale:

* Quantitative information on the spatial and temporal distributions of vegetation fires.

* A satellite system to quantify the extent of and impact of wildland fire.

* A process to gather and share fire information on the World-Wide Web.

* Mechanisms to permit community self-reliance for mitigating wildfire damages and permitting rapid and effective resource sharing.

* A research, prevention, and control program for areas with unique threats to the health and safety of fire fighters and the public.

For the North American Forestry Commission, Fire Management Study Group

Mary Jo Lavin	Oscar Cedeño Sanchez	Albert Simard
United States	Mexico	Canada

Vancouver, Canada, 27 May 1997

SPAIN *ENRICH/START Toledo Workshop "Global Change and the Mediterranean Region"*

From 25 to 28 September 1996, the ENRICH (European Network for Research on Global Change) initiative of the European Commission jointly with the START Planning Committee for the Mediterranean Region (MEDCOM) and supported by the International START Secretariat, the Spanish IGBP Committee, MEDIAS-FRANCE and additional sponsors, convened a workshop on "Global Change and the Mediterranean Region" in Toledo, Spain, with the objective of bringing together scientists from the countries in and around the Mediterranean region, in order:

* to evaluate the role of the Mediterranean region for understanding the whole earth system functioning, either for its relevance for earth system processes as a model (*per se*, or as a part of a larger undertaking) to understand such processes on a global basis;
* to review on-going research and initiatives relevant to global change in the region;
* to determine what research is needed to evaluate the role and impact of global change in the region;
* to ascertain the needs in monitoring and surveillance for global change research in the region; and
* to identify the needs in training and capacity building to accomplish the former.

The Workshop, at which about 80 scientists from North African and Eastern Mediterranean countries, the European Union and the USA participated, addressed a wide range of topics through working groups. Working Group VII (Terrestrial Ecosystems) identified four research priorities in relation to pressing needs for prediction:

* Fire regimes and effects
* Feedbacks from the land to the atmosphere
* Water availability and quality
* Changes in ecological diversity

These research fields integrate issues relating to the three main types of global change drivers. Because they all have multifactorial controls, research needs to focus on analyzing net effects of different drivers. For each of these themes, existing projects need to be identified, including those already included in other programmes (in particular EU projects). The following statement on the research priority "Fire" was agreed upon:

"The prediction of future fire regimes and their effects have been identified as a main issue in the Mediterranean region. Mediterranean ecosystems have evolved in the presence of fire, yet recent land abandonment is thought to modify fire regimes, in particular with an increase in fire extent. Post-fire regeneration strongly depends on climatic conditions, therefore interactions with climate change need to be investigated. Finally, because the Mediterranean region is heavily anthropised, fire can represent a risk to populations and have large economical impacts (e.g. forest plantations). Mitigation will then be a necessity and procedures will have to be developed both for the prevention and restoration of large, heavily burned areas. "

Contact address for the ENRICH/START initiative:

Mr. José M.Moreno
Instituto Universitario de Ciencias Ambientales
Universidad Complutense
Bartolomé Cossio s/n
E - 28040 Madrid

Fax: ++34-1-394-4399
e-mail: jmmoreno@eucmax.sim.ucm.es

MEETINGS PLANNED FOR 1997-98

CANADA

Canada - U.S. Fire Safety Summit
30 September - 2 October 1997
Rossland, British Columbia

An innovative cross-cultural comparison of wildland fire safety attitudes and practices. The goal of this meeting is to provide a forum for honest discussion about the best and the worst in wildland fire safety from the many agencies involved in wildland firefighting in Canada and the U.S.. Fire professionals from all fields and levels are encouraged to attend and share their opinions. Both practical and philosophical discussions will be highlighted. For further information contact:

International Association of Wildland Fire - Safety Summit
103 E. Main, P.O.Box 328
USA - Fairfield, WA 99012

Fax: ++1-509-283-2264
Tel: ++1-509-283-2397
e-mail: greenlee@cet.com

CHILE

IX Silvotecna: Incendios Forestales
17-18 November 1997, Concepción

From 17-18 November 1997 the IX Silvotecna will be held in Concepción, Chile. The conference will focus on the current issues pertinent to forestry and fire. Four panels are planned for the conference:

Panel I **"The impact of forest fires"**
Objective: To know the real dimension of the forest fire problem
Topic 1: Environmental Impact
Topic 2: Economic Impact
Topic 3: Social Impact

Panel II **"Forest Fire Prevention"**
Objective: To propose fire preventive actions based on the real motives of them and to stimulate the punishment of arsonists
Topic 1: Risk Prevention
Topic 2: Danger Prevention
Topic 3: Fire Motives Determination
Topic 4: Arson and Punishment Adjudgement to the Responsible
Topic 5: The Legal Control and Fire Use Supervision

Panel III **"Organisation and Roles for the Protection against Fires"**
Objective: To know the roles and functions about different actors that should participate in the protection against fires
Topic 1: The Mutual Support between Entities that Possess Protection Systems
Topic 2: The Integrity of the Protection Systems
Topic 3: The Protection Against Fires of Owners without Protection Systems

Panel IV **"Technological News"**
Objective: To know the technological advances in the protection area against the fire
Topic 1: The Air Operations and Use of Chemical Products in Fire Fighting
Topic 2: Computational Tools of the Protection Support
Topic 3: The New Technologies for Forest Fire Detection

For further information / consultation or registration please contact:

CORMA, REGION DEL BIO-BIO
O'Higgins 536, 3° Piso Of. 3
Concepcion
CHILE
Fax: +56-41-236831

SPAIN

GCTE-LUCC Science Conference
14-18 March 1998, Barcelona

The Global Change and Terrestrial Ecosystems (GCTE) and Land Use/Cover Change (LUCC) core projects of the International Geosphere-Biosphere Programme (IGBP) will hold an open science conference in Barcelona, Spain from 14-18 March 1998. GCTE studies the effects of changes in climate, atmospheric composition (especially CO_2) and land use on terrestrial ecosystems, and the consequent feedbacks to the climate and atmosphere. LUCC aims to document and understand global land use and land-cover change, the forces that drive it, its relationship to climate and bio-geo chemistry, and the links between sustainability and land use.

Major Topics of the Conference include:

* Changes in ecosystem functioning, and the implications for the earth system
* Vegetation/land cover changes at local, landscape and global scales
* Global change impacts on agricultural production, forestry and biodiversity
* Land-use change and its ecological consequences, with a special session on Europe
* Special science-policy forum "Living with Global Change"

The GCTE-LUCC Science Conference will be the second open science conference for GCTE and the first for LUCC. The program for the conference will be:

Day 1: Overview of GCTE research
Day 2: Parallel sessions on each of the four GCTE Foci (Ecosystem Physiology; Ecosystem Structure; Agriculture, Forestry, Soils; Ecological Complexity)
Day 3: Cross-cutting themes within GCTE and between GCTE and LUCC
Day 4: GCTE-LUCC Symposium
Day 5: GCTE-LUCC Forum "Living with Global Change"

For more information please contact:

GCTE-LUCC Science Conference
GCTE Core Project Office
PO Box 84
Lyneham ACT 2602
AUSTRALIA

Fax: ++61-6-241-2362
e-mail: Rowena.Foster@dwe.csiro.au

Registration is also possible via the Conference Homepage at:

http://jasper.stanford.edu/GCTE/Barcelona98.html

U.S.A.

21st Tall Timbers Fire Ecology Conference
Fire and Forest Ecology: Innovative Silviculture and Vegetation Management
14-16 April 1998, Tallahassee, Florida

Purpose of the Conference: This three-day conference will bring together researchers and managers from across the land management spectrum who use fire to manipulate vegetation to achieve their organizations' goals. Land managers from groups with very different objectives, whether industrial commodity production or preservation-oriented, often use fire for remarkably similar reasons. Our goal is to provide a forum to discuss fire ecology, management and effects, both within and outside of the context of silvicultural treatments.

Organization: The conference will be divided into sections that address the effects of fire on the following topics (with confirmed plenary speakers and invited speakers [in brackets]):

* Tree and vegetation physiology and implications for growth - David Weise, USFS Pacific SW Forest and Range Experiment Station, Riverside
* Silvicultural impacts - David Van Lear, Clemson University
* Forest ecology and stand dynamics - James Vose, USFS Coweeta Hydrological Laboratory
* Soil productivity and structure - [Mike Weber, Canadian Forest Service, Northern Forestry Centre]
* Restoration ecology - [Wally Covington, Northern Arizona University]

* Vegetation control: fire vs. herbicides - [Elizabeth Cole, Oregon State University]
* Social/policy implications - [Bill Leenhouts, National Interagency Fire Center, Boise]
* Wildlife population dynamics and management
* Keynote Speaker - Johann G. Goldammer, Fire Ecology and Biomass Burning Research Group, Biogeochemistry Department, Max Planck Institute of Chemistry (Germany)
* Banquet Speaker - Robert Lee Izlar, Georgia Forestry Association, Norcross

There will be a poster session/social hour during the first evening and a banquet during the second evening. Post-conference excursions will highlight the uses of fire in the management of the many unique ecosystems in the greater Big Bend area of the southeastern Coastal Plain.

Questions to be Addressed

* What is the current status of prescribed fire across different ownership categories?
* Can we quantify the economic vs. ecological trade-offs of different methods of vegetation control?
* What are the similarities and differences in using fire to manage land for commodity outputs vs. non-economic goals?
* In restoration ecology, can some combination of fire and other methods quickly and efficiently return the landscape to a predisturbance state?
* What is the impact of prescribed fire upon commodity production and quality? How will this impact influence the choice of fire by an industrial vs. non-industrial landowner?
* Will current and pending air-quality regulations influence the use of fire as a silvicultural tool?
* Does fire as a site-preparation tool add to or ameliorate the impact of intensive management upon forest soils?
* How do the organization's goals influence the choice of fire vs. herbicides?
* Is the public more accepting of the use of prescribed fire as a vegetation management tool for non-commodity reasons vs. for commodity reasons?
* How do past fire management practices influence current and future silvicultural choices?
* What is the political future and management implications for prescribed burning in rapidly urbanizing areas? Are herbicides an option?
* Can fire assist active forest management in the presence of threatened and endangered species?

Proceedings: The conference presentations will be published in the Proceedings of the 21st Tall Timbers Fire Ecology Conference by Tall Timbers Research Station, Tallahassee, Florida. Complete manuscripts from both oral and poster presentations will be considered for publication. All papers will be peer-reviewed by independent referees and published in book chapter format.

This publication will be mailed to the participants and be available for purchase by other researchers and land managers interested in fire as a management tool.

Accommodations: Several full-service hotels are located within easy walking distance or short drive to the Ramada Inn Tallahassee on North Monroe Street. Information on reservations will be mailed to all conference participants in the registration packet.

For Further Information: For a symposium brochure, registration materials, or to submit an abstract, please contact:

W. Keith Moser
Ecological Forestry Scientist
Tall Timbers Research,Inc.
Route 1, Box 678
USA - Tallahassee, Florida 32312-9712

Fax: ++1-904-668-7781
Tel: ++1-904-893-4153 x 247
e-mail: 74673.3145@compuserve.com

GERMANY

International Conference on
Early Warning Systems for the Reduction of Natural Disasters
7-11 September, Potsdam

By resolution 44/236 of 22 December 1989 the UN General Assembly designated the 1990s as the **International Decade for Natural Disaster Reduction (IDNDR)**. According to the 1994 "Yokohama Strategy and Plan of Action" one of the key themes of the Decade is the realistic assessment of hazard, risk and vulnerability including early warning and response capabilities. Accordingly, the UN General Assembly with its resolution A/RES/49/22B of 23 January 1995 requests the Scientific and Technical Committee (STC) of IDNDR, the UN Secretary General, and governments respectively, to:

* continue work on early warning capabilities;
* examine new scientific and experimental concepts and methodologies aiming at accurate and timely short*notice forecasting of disasters, e.g. fire;
* facilitate an internationally concerted framework for improvements in early warning capacities;
* develop a concrete proposal for an effective international mechanism on early warning;
* undertake regular reviews of early warning requirements and capabilities at national and community levels; and
* promote the transfer of technologies related to early warning to developing countries along with the corresponding training.

To achieve these goals, to consolidate the accomplishments of the IDNDR, to plan for the 21st Century, and to implement the related UN Resolution IDNDR 51/185 it has been proposed by the STC for the IDNDR to hold, on the invitation of the Federal Minister of Foreign Affairs of the Federal Republic of Germany, an International Conference on "Early Warning Sytems for the Reduction of Natural Disasters" (EWC-98) in 1998 in Potsdam, Germany.

The conference invites high-level expert contributions in order to produce a synoptic interdisciplinary presentation and discussion of the use of EWS for the detection of and appropriate reaction to imminent potential threats related to geo-hazards, hydro-meteorological hazards, and other environmental hazards, such as wildfires.

Scientists and managers who are developing and working with methodologies, technologies, and systems related to the early warning of wildfire hazards should present their activities and the achievements of the fire community at the Potsdam conference. At the time of printing this IFFN issue the final First Announcement and a conference registration form were not yet available. More details will be given in the January-1998 issue of IFFN. Since the deadline for submission for first registration is already on 27 September 1997, it is recommended that those who wish to attend the conference or receive more detailed information write to:

GeoForschungsZentrum Potsdam (GFZ)
Secretariat of LOC-EWC98
Telegrafenberg A 17
D - 14473 Potsdam, GERMANY

Fax: ++49-331-288-1504
e-mail: course@gfz-potsdam.de

PORTUGAL

Third International Conference on Forest Fire Research
16-20 November 1998, Coimbra
in conjunction with the
14th Fire and Forest Meteorology Conference

The third edition of the International Conference on Forest Fire Research is planned together with the 14th Fire and Forest Meteorology Conference which is to take place in Coimbra from 16 to 20 November 1998.

The common scope of both conferences is to bring together scientists from various parts of the world working on different aspects of forest fires, to encourage the latest advances of research, to promote discussion of methodologies and results, and to increase international cooperation.

Although there are no restrictions on the areas to be covered, papers dealing with the physical and meteorological subjects are particularly encouraged. The following list of subjects is only to provide a guideline for the eventual organization of the sessions:

- Fire Weather
- Fire Behaviour
- Fire Ecology
- Fire Management
- Human and Institutional Factors

Authors willing to submit a paper, are requested to send an abstract written in English of no less than 300 words, but not exceeding three A4 pages including key figures and tables, before 31 December 1997. The authors will be informed of the acceptance of the papers by 30 April 1998. The full version of the papers accepted for oral presentation or for poster presentation, should be sent by 30 June 1998 in order to be included in the proceedings of the conference.

Overview of deadlines:

Presentation of Abstracts:	31 December 1997
Acceptance of Abstracts:	30 April 1998
Full version of papers or posters:	30 June 1998
Second Announcement:	31 July 1998
Registration:	31 May 1998
Hotel Reservation:	30 September 1998
Final Program:	31 October 1998

For more information please contact the Chairman of the Organising Committee of the Conference, Prof. Domingos Xavier Viegas at:

ADAI - Associacao para o Desenvolvimento da Aerodinamica Industrial
Apartado 3131
P - 3000 Coimbra

Fax: ++39-7000771
Tel: ++39-70007320
e-mail: dxvuc@gemini.ci.uc.pt

INTERNATIONAL FIRE COURSE 1997

Advanced Study Course on Wildfire Management
6-14 October 1997, Athens, Greece

Training and Education are important parts of the accompanying measures of the European Union Research Programmes. Advances study courses on selected relevant topics of the Environment and Climate RTD programme form an important part of training and education activities. They are solicited through a call of proposals launched annually and published in the Official Journal of the European Communities.

The main objectives of those courses are:

* to further advance the education on specific topics at the forefront of scientific and technological development in Europe,
* to exploit the wide-ranging teaching capacities of European institutions for transnational education, and
* to improve communication between students and scientists on a European level.

Following a call of proposals launched on 17 December 1996 (O.J. N° 96/C 381/21 of 17.12.96) an advanced course on Wildfire Management has been selected. The course will take place in Athens (Greece) from 6 to 14 October 1997. It will deal with

* Behaviour and Modelling
* Prevention Plan
* Suppression and Management
* Fire effects
* Management Technology

The course is addressed to graduating, graduate or post-graduate students already involved in research in the area. The course will be given in English. About 25 grants will be awarded to successful applicants from a European Union member state or associated state. The grants will cover participation in the course, living expenses, field trips and demonstrations. Travel costs will only be covered partially for a limited number of students, exceptionally selected on qualification and need. Attendance of all other students will be at their own expense or where possible under some other sponsorship.

The deadline for the submission of the application forms is 31 July 1997. Application forms and any questions concerning the course should be addressed:

ALGOSYSTEMS S.A.
Applied Research Department
Mr. G. Eftichidis
9, Mitidiotisis & 2, Fidiou str.
GR - 18533 Piraeus

Fax: ++30-1-4118736
Tel: ++30-1-4112802
http://rtd.algo.com.gr/algoeu/asc/index.htm

FROM THE PRESS

Radioactive Trees seen as Biomass Power Fuel

"Trees contaminated by radioactivity from the 1986 Chernobyl nuclear power plant disaster will be burned to produce electricity in a $1.6-million pilot plant financed by the US Department of Energy and the government of Belarus. The plant will be built in Belarus in a two-year project directed by scientists from Sandia National Laboratories, the Belarussian Institute for Power Engineering Problems and Wheelabrator Environmental Systems. About 25% of Belarus land, mainly in the heavily forested South-East, is contaminated by radioactive material from Chernobyl. A Sandia spokesman estimates 99.9% of radioactive material can be trapped as ash inside biomass plants, then disposed of as nuclear waste. Biomass power stations could decontaminate Belarus forests within 40 years, compared with centuries required for the radioactivity to decay naturally. This would also offset the chance of forest fires, which would release large quantities of radionuclides into the atmosphere with no cleanup at all. Forests would be replanted as they are harvested."

Source: Wood Technology, Vol 124 (May 1997), No.4, p.16

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