UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE

FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS

INTERNATIONAL FOREST FIRE NEWS

No. 10 – January 1994

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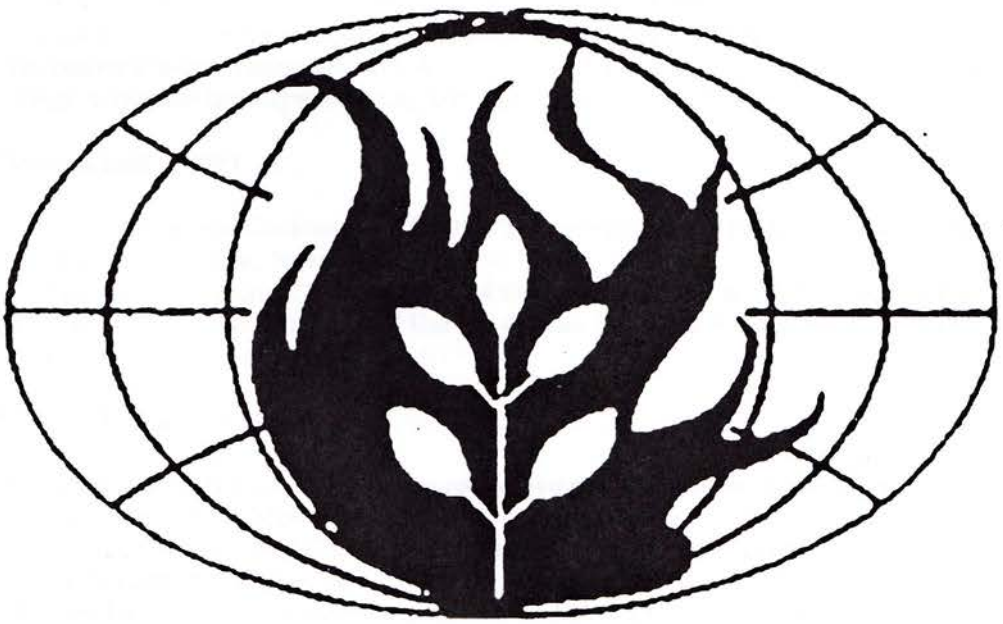

INTERNATIONAL FOREST FIRE NEWS

No. 10 – January 1994

Mailing address, telephone and fax numbers have changed once more (starting 10 October 1993)

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

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

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

The International Union of Forestry Research Organizations (IUFRO)
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Stand Replacement Fire Working Group

The International Association of Wildland Fire

EDITORIAL

The preparation of this issue of International Forest Fire News was more or less ready for printing when the news from the recent bushfires in Australia came in. In the first days of January the mass media reported the "worst fires since 200 years", and that "the forests would need more than 500 years to recover", and that "countless Koalas had been wiped out". I stopped to rush the newsletter for printing in Geneva. I thought that this exceptional event should be covered in this issue.

It took me a couple of days to remember that journalists and other mass media reporters tend to have a short memory and that many of them are not careful in investigating facts before releasing them to the public. After the first numbers were released about the fire damages (185 houses burned, 4 people killed, several hundred thousand hectares of forests "destroyed") I went back to some old fire reports from Australia. It is only 11 years ago when the last large fire struck Australia's suburbs -- the "Ash Wednesday Fires" of 1983. The 1983 fire statistics reveal that at that time 76 people were killed, 2539 houses were burned, and nearly 300,000 sheep and cattle killed. Were the 1994 fires the worst since 200 years?

David Packham from Australia regularly provided updated information on the New South Wales (NSW) fires of January 1994. Soon it became clear that fire intensity and losses were moderate. He said that the NSW fires moved at an average speed of 3 km/h compared with 10-12 km/h in the Ash Wednesday Fires. Fuel per hectare was only half that of the 1993 fires, and thus the intensity of the NSW fires was only one-sixth to a quarter of the Ash Wednesday Fires. According to the investigations by Frank Campbell, published on 21 January 1994, the monetary losses were ca. $200 million (Australian dollars) as compared to the $700 million (at 1994 values) for the 1983 fires.

While CNN TV led with the Sydney fire story for more than 24 hours, the BBC World Service led with it for days every hour on the hour, guaranteeing -- as Frank Campbell comments the "hysterical coverage" -- that Madras, Kenya, and Jamaica would emphasise with the overwhelming tragedy, disaster, holocaust and catastrophe of "burning Sydney". Campbell: "Of course nothing is more photogenic or audiogenic than 30-metre flames roaring towards an international city, but the foreign media took the fire at face value: they relied on the Australian media's assessment of the fire's threat. The result was excruciatingly misleading. The wave of international sympathy was quite inappropriate in a world of daily real "catastrophes". The Sydney fires have become an international embarrassment." As David Packham said in an e-mail to my desk, on 9 January: "The result of the media reporting has been that they have almost completely destroyed the last fifteen years of excellent public education".

The real disaster happened about one week after the Sydney fires were extinguished. On 21 January 1994 a tragic accident happened in Argentina, Chubut Province. In a high-intensity wildfire in Patagonian shrub vegetation 25 unexperienced, young firefighters were trapped and killed (see report on page 38). There were no CNN or BBC to cover that story.

Freiburg, January 1994 — Johann G. Goldammer

In the next issue (July 1994) the reader will find information about new aerial fire suppression technologies (from Canada, the Russian Federation, and the Ukraine). Furthermore the role of NATO (the North Atlantic Treaty Organization) in developing interdisciplinary research and cooperation in science will be explained. The most recent views of fires from space will be presented (December 1993 and February 1994 Space Shuttle missions).

COUNTRY NOTES

ARGENTINA

Fire in the Caldenal Region (Central Argentina)

The **Caldenal** region, located mainly in the Province of La Pampa in Central Argentina, occupies an area of approximately 60,000 km^2. Before the European colonizers reached this area during the last decades of the past century the vegetation was characterized by an open woodland dominated by **caldén** (*Prosopis caldenia*) with an understorey of bunchgrasses such as *Stipa clarazii, Koleria permollis, Briza subaristata*, and *Poa ligularis*. The caldén is a tree with a slow growth rate which can reach a height of 8-10 m. The aspect of the landscape resembles that of a savanna. With the arrival of the European pioneers and the following generations the caldenal ecosystem was intensively exploited and changed by deforestation, agriculture and sheep and cattle grazing systems.

Fire has always been present as a natural component in this ecosystem with a fire frequency which has been estimated to be 7-10 years. These fires were low intensity due to the fact that the fine material was provided by grasses which had little or no effect upon the trees. Grasses in the Caldenal region as well as in most of Argentina have evolved under low herbivore pressure. The introduction of domestic cattle generated a disturbance which resulted in a replacement of palatable species by less preferred species first and by non-palatable species later. The germination of caldén seed depends on the fact that it needs to go first through the digestive tract of an animal. Cattle and sheep consume caldén fruits and have helped to disseminate viable seeds promoting an increase in the density of caldén and changing its spatial pattern. It also helped to increase the number of individuals due to the fact that the rate of natural fires dropped drastically because the fine material to carry the fires had been consumed by the domestic animals.

The disturbance contributed also to the invasion of several shrubs coming from the **monte** region which is West of the Caldenal. Due to economic considerations in the 1960s sheep were entirely replaced by cattle, and this led to an increase in shrub density and expansion of unpalatable grasses generally called **pajas**. In the following decade this change of vegetation structure led to more frequent large-scale wildfires which, instead of being of low intensity, became high-intensity fires because of the shrub component together with a higher density of trees (Tab.1).

The Caldenal region has an average rainfall of 450 mm in the West and 600 mm in the East. Most of the grasses grow during fall and spring, while the shrubs and grasses grow during spring and summer time. Cow-calf production is the principal activity in the region. The average ranch sizes are about 600 ha in the East and 5,000 ha in the West. Meat production has dropped because of a decrease in forage production, and ranchers try to solve this by setting fire in order to be able to have cattle grazing on the paja's early regrowth. Unfortunately, ranchers have not been successful in improving range conditions and have caused, through fires, important damage to the tree component. Today's scene shows a degraded ecosystem with a tree compartment which is at risk due to shrub encroachment and a grass component constituted to almost 85% of unpalatable species.

In 1988 the **Estación Experimental Agropecuaria** that belongs to INTA (National Institute of Agricultural and Livestock Technology) at Anguil (Province of La Pampa) began prescribed fire research. Since then three experimental fires were conducted during the month of March in the years 1991-93. In each fire 150 ha were burnt, and data were collected on the effect of prescribed fire on soil organic matter, soil total nitrogen, and cover and density of grasses and shrubs. Subsequently weather conditions and the use by cattle were monitored. Most interesting are the following observations on the burned plots:

- Fire did not affect organic matter and total nitrogen in the soil
- Increase in cover and density of desirable grass species
- Increase in the stocking rate at least during the two first years
- Decrease in undesirable grass species cover, but no effect on its density
- Very low impact on old caldén trees
- Very low mortality of shrubs

Although the results of prescribed fires in the Caldenal region are encouraging more research must be done before the use of fire by prescription can be applied more widely. Different cattle management techniques after fire should be tested and vegetation response to fire at different seasons still needs to be evaluated. Nevertheless, prescribed fire seems to be a very valuable tool for increasing forage productivity without affecting the tree component and, overall, improving range condition.

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Tab.1. Fire statistics for the La Pampa Province, Argentina, 1976-93
(source: Ministry of Agriculture, La Pampa)

Wildfire Damage in the Province of La Pampa, Argentina (1976-1993)			
Year	Burned Area (ha)	Burned Fences (m)	Burned Animals (cattle, sheep, horses)
1976	1,200,000	2,700,000	32,620
1977	79,039	no data	no data
1978	116,670	5,600	402
1979	163,580	120,720	90
1980	240,310	117,800	248
1981	160,899	80,200	118
1982	149,715	79,400	40
1983	87,940	84,306	275
1984	100,400	2,000	63
1985	499,300	341,000	489
1986	302,224	397,550	1,330
1987	66,310	2,000	27
1988	558,449	1,131,397	1,419
1989	650,150	894,825	811
1990	110,000	3,000	---
1991	no data	no data	no data
1992	160,000	no data	no data
1993	410,000	no data	no data
Total	5,063,986	5,959,798	37,932
Average	297,882	425,700	2,918

Prescribed Fire Research in the Chaco Region - Northwestern Argentina

Almost one third of Argentina is included in the Chaco region of South America. Climate features shift from humid in the East to arid toward the West, with rainfall mainly during the summer months. Winter is dry and cold, with frosts sometimes reaching -15°C. The topography is gentle: only some 'sierras' break the landscape in the southwestern Chaco. In the center of the region, where the Santiago del Estero Experiment Station is located, soils belong to the Aridisol and Mollisol orders.

Vegetation of the Chaco region is a mixture of savannas, thorn shrublands and hardwood forests alternating in belts and patches. Species present belong to the following genera: *Schinopsis, Aspidosperma, Prosopis* (trees); *Celtis, Atamisquea, Larrea* (shrubs); *Elionorus, Setaria, Trichloris, Heteropogon, Botriochloa, Digitaria* (grasses); *Wissadulla* and *Justicia* (broadleaves). Evidence suggests that fire has been a natural component of the Chaco ecosystem for thousands of years. Indians used fire for warfare and hunting; in fact, "Chaco" means "a site for hunting" in the Quichua language. Fire swept across the savannas and shrublands and on some occasions hit the hardwood forest that burned with high intensity. Tolerance of species to fire is mixed. The fire cycle is estimated to be around 3-5 years in savannas.

Although ranches existed in the region since the very beginning of the Spanish settlement (XVI Century), extensive cow-calf and timber operations began in the mid XIX century largely due to European immigration. The practice of setting fires -- without too much concern about the consequences, as everywhere in the world -- is traditionally used by rangers to promote new growth in early spring, or to 'clean' native ranges. Coupled with overstocking, it led to savanna encroachment by *Acacia, Celtis, Schinus* and other shrubby/spiny species. Severely logged hardwood forest sites have been also invaded by early succession species and kept at this stage by overgrazing.

Nowadays, fires in this region are originated mainly by rangers' and farmers' activities. The 1993 winter (June to September) was a specially remarkable fire season: almost 100,000 ha were burned in the southwestern Chaco region. In the southern tip, almost 50,000 ha of mid-altitudinal palm savannas also burned. An extremely dry and cold winter was the main cause of these large fires.

In 1991, the Santiago del Estero Experiment Station, belonging to the INTA (National Institute for Agriculture and Livestock Technology) network, started research in fire ecology and prescribed fire. Due to the fact that the regional ecosystem has evolved with fire, the main working hypothesis is that prescribed fire in savannas, together with other range management practices, may benefit the livestock industry.

Field research is conducted at two levels or 'scales': basic work is conducted at the 7,000 ha Experimental Ranch; and adaptive research at private ranches. Objectives of the first approach are to develop prescriptions to control *Acacia aroma* and other shrubs with fire, and also to understand some basic facts about fire effects on grasses and broadleaf species, and on the nitrogen cycle through the study of the soil microbiology. A year of research (1993) is already completed, and data about fire intensity, fire spread, etc. are being processed. Three more seasons of work are already planned ahead. On the other hand, adaptive prescribed burning has been conducted since 1991 in several private ranches in cooperation with Extension Agencies depending on the Research Station. Almost 2,000 ha of native and exotic pastures have been burned, using Wright and Bailey's (1982) prescriptions as reference.

Results so far suggest that prescribed burning could be an effective management tool for native rangers. However, more research should be conducted in order to integrate some features of prescribed burning into the ranching operations on a yearly basis.

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National Wildland Fire Statistics Update

In the last issue of IFFN (July 1993) a table with Argentina's fire statistics for the years 1985-1990 was published. The update to 1992 is now available. The compilation of fire data is now one of the tasks of the Ministry of Agriculture (Ministerio de Economia y Obras y Servicios Publicos, Secretaria de Agricultura, Ganaderia y Pesca, Subsecretaria de Producción Agropecuaria y Mercados, Dirección Nacional de Producción Agropecuaria, Dirección de Producción Forestal) which formerly was under the responsibility of the National Forestry Institute (IFONA) which was dissolved in 1992. The statistics update was carried out by Nilda Irigoin. She belongs to the staff of Omar Tesolin who is the responsible coordinator of fire issues. Table 1 gives the summary table of the extensive fire statistics report.

Tab.1. Summary of land areas affected by wildfires in Argentina, 1985-1992

Year	Vegetation Type Affected by Fire (in Hectares)			
	Chaparral Grazing Lands	Natural Forests	Reforestation Plantations	Total
1985	1,106,144	891	2,698	1,109,733
1986	2,140,269	1,880	6,176	2,148,326
1987	793,244	26,216	1,370	820,830
1988	1,545,682	216,932	6,587	1,769,201
1989	724,448	3,149	4,054	731,651
1990	89,725	4,388	570	94,682
1991	66,400	3,262	1	69,663
1992	189,450	17,500	-	206,950
Total	6,655,362	274,218	21,456	6,951,036

Source: Ministry of Agriculture, Argentina

BHUTAN *Seasonality of Forest Fires in Bhutan*

Background

Bhutan is a mountainous country which lies between 26°45' and 28°30'N and 88°45' and 92°10'E. The total geographical area of the country is 46,500 km^2 out of which 26,338 km^2 (i.e. 56.6%) area is covered by forest. Further break-down of vegetation types and coverage by these types are given in Table 1. The climatic variations from region to region are considerable; summers being hot and humid with temperatures soaring to 30 to 35°C in the South, but cool and pleasing in the Western, Central and Eastern regions of the country with average temperatures of 19 to 22°C. The freezing dry winters in Western and some parts of the Central and Eastern territory contrast with mild pleasant temperatures in the South. The changes in climate occur within a short distance. Therefore we can say that there is a great diversity of climate, possibly greater than any other area of similar size in the world.

> *"The forests are the most important natural wealth of the country. The future economy of the people and the country is very much dependent on its protection, conservation and scientific management."* (The Bhutan Forest Act, 1969)

Tab.1. Distribution of forest vegetation types in Bhutan by percentage of land cover.

Vegetation Type	Area in %
Fir	7.72
Blue pine	2.47
Chir pine	1.97
Mixed Conifer	7.61
Broad-leaved with Conifers	5.16
Temperate Broad-leaved	12.86
Tropical & Subtropical Hardwoods	13.03
Plantations	0.08
Degraded Forests	5.74
Total Forest Area	56.64

Tab.2. Causes of fire starts in Bhutan.

Cause	%
Debris burning (i.e. escaping from field)	40
Cattle grazing (burning for new grass)	30
Uncontrolled camp fire, cooking fire, warming fire and road maintenance	25
Smokers	5
Human-made fires	100

The south-west monsoon starting in June and lasting for four months, accounts for 86 to 97% of annual precipitation. Precipitation varies with the valleys' exposure to the rain bearing monsoon winds. Parts of the valleys located in the rain shadow are dry. On the higher mountains the little precipitation during winter comes mainly in the form of snow, beginning at the end of November. Occasionally snow reaches down to 2250m amsl but it does not last more than two days. Whereas at the altitudes of 2500 to 3000m amsl it remains on the ground only in sheltered places. Beyond 3000m amsl it can last much longer from mid-December to early March especially under shelter and on North facing slopes.

Forest Fire Situation

Forest fire is one of the biggest threats to our forest resources. Blue pine, chir pine, mixed conifer, broadleaf with conifer, plantations and degraded forests, which cover approximately 40% of the total forest area, are most susceptible to frequent forest fires. Repeated forest fire, combined with heavy grazing pressure, can completely degrade vegetation cover. Proper attention should be given to prevent forest fires causing further degradation of remaining forests. Once the forest is degraded, it is difficult to restock it in the original shape by means of reforestation.

In Bhutan, forest fire incidence is normally high during the dry winter months. Freezing temperatures and lack of rainfall are responsible for drying of perennial grasses, and increasing wind velocity quickens the drying process thereby making the grass covered area inflammable. In the freezing winter, it becomes difficult to live without warming fire. Further land preparation for agricultural, horticultural and shifting cultivation purposes is done during or at the end of the winter months. Fire is used as the cheapest tool for cleaning such land by the villagers and shifting cultivators. As a result, uncontrolled use of fire in or adjacent to the forest occurs frequently. Often such fires escape to the forest accidentally. In some cases, fires are set wilfully by the cattle grazers to obtain new flush of good grasses. So far there is no report on forest fire incidence caused by lightning. Our analysis reveals that in our country 100% forest fire incidence are human-caused, wilfully or accidentally (Tab.2).

Every year 20 to 75 (average 50) forest fires are reported in our country. Most forest fires are caused by escaped fires from agricultural land and orchards. The number of escaped fires can be reduced by adapting appropriate controlled burning techniques in agricultural land and orchards. Uncontrolled use of fire as a tool to improve pasture land should not be considered in any part of the country. If it is a necessity for the survival of livestock, appropriate techniques for burning of pasture land should be developed so as to insure the protection of surrounding vegetation. Similarly, the number of fires escaping from camp fires, cooking fires etc. can be reduced by adopting more restrictions through rules and regulations. Appropriate prevention modules for different types of target groups, such as agriculturists, orchard owners, herders etc. should be designed. Various target groups should be made aware of the value of the forests. Only then would we be going in the right direction towards achieving good-will of the people. Prevention is better than cure. Therefore every effort should be made to prevent forest fires. If there is honour with our people in preventing forest fires, then the fire incidence could be avoided.

Some years like 1979, 1981, 1982, 1983 and 1989 were comparatively dry years and in most parts of the country pre-monsoon rains were delayed and very much limited. As a result the number of fire cases increased.

On the other hand, nowadays more land is brought under utilization for various purposes. As such there is every likelihood of increasing the numbers of escaped fires. Therefore, it is time to consider prevention approaches through various media and the enrollment of villagers in forestry programmes (social, community and agroforestry) which play a vital role in educating people on the importance of forests and developing good will to minimize destruction of the forest.

Rainfall Distribution Pattern and Fire Risk Zones

Most parts of our country in the Western and Eastern region receive no rain or very little (only up to 10 mm) during the months from November to April. In some parts of this region total rainfall for seven months (October to April) is only 150 mm. Based on the local rainfall regimes the country has been divided into three zones of fire risk (Tab.3).

High Fire Risk Zone

The areas with less than 1000 mm annual rainfall can be considered the high fire risk zone. Kurijampa, Tashigang, Tangmachu, Rongtung in the East and Thimphu, Paro, Haa and Wangdi in the West and some rain shadow areas of the Central region fall in this zone. Because of little rainfall, high day-time temperatures and afternoon winds, the forest floor dries out very quickly, leading to a high risk of fire. Chir pine growing areas are also included in this zone because these are occurring mostly in drier sites. If precipitation is more than 1000 mm, it is lost very soon by run-off and evaporation due to lack of sufficient ground cover like undergrowth, humus etc.

Tab.3. Zones of wildfire risk in Bhutan.

	High Risk (p < 1000 mm)		Medium Risk (p=1000-2000 mm)	Low Risk (p > 2000 mm)
	East	West	Central	South
Forest Fire Season	Jan - Jun	Nov - May	Nov - May	Feb - Apr
Peak Forest Fire Season	Feb - Mar	Jan - May	Jan - Mar	March
Peak Forest Fire Month	March	January	February	March

p = Total annual precipitation
Forest fire season: percentage of incidence higher than 5
Peak forest fire season: percentage of incidence 14 and above
Peak forest fire month: percentage of highest incidence

Medium Fire Risk Zone

The areas which receive rainfall of between 1000 mm to 2000 mm per year fall in this zone: Punakha, Hurchi, Langthal, Tongsa, Lame Gompa, Dungkhar, Thrimshing, Khengkhar, Daga Dzong, Dubani, Mangdechu, Dagapela, Shemgang, Chhuka, Tashithang, Yabilabsa and Damphu. The floor of the broadleaved forest in this zone is slightly moist, and as such forest fires are not frequent. However, the zone of chir pine forest remains quite dry, and therefore fires may occur frequently.

Low Fire Risk Zone

Areas with more than 2000 mm annual rainfall are considered as low fire risk zone. All Southern parts of the country like Sarbhang, Samchi, Phuntsholing, Sibsoo, Decheling, Daifam, Samdrupjonkhar, Surey, Deothang,

Dungmain and Dorokha fall in this zone. The floor of the evergreen forest is covered throughout the year by green grasses but the floor of deciduous forests is covered with dry fallen leaves and is prone to catch fire during long drought periods.

Concluding Remarks

In order to know the overall forest fire situation in the country 393 cases of forest fire were investigated, and the result is shown in Figure 1. It shows that forest fire incidence in the country was observed between October and July, but the risk of forest fire incidence during October - November and June - July is less than 5 %. As such this period cannot be considered as part of the forest fire season.

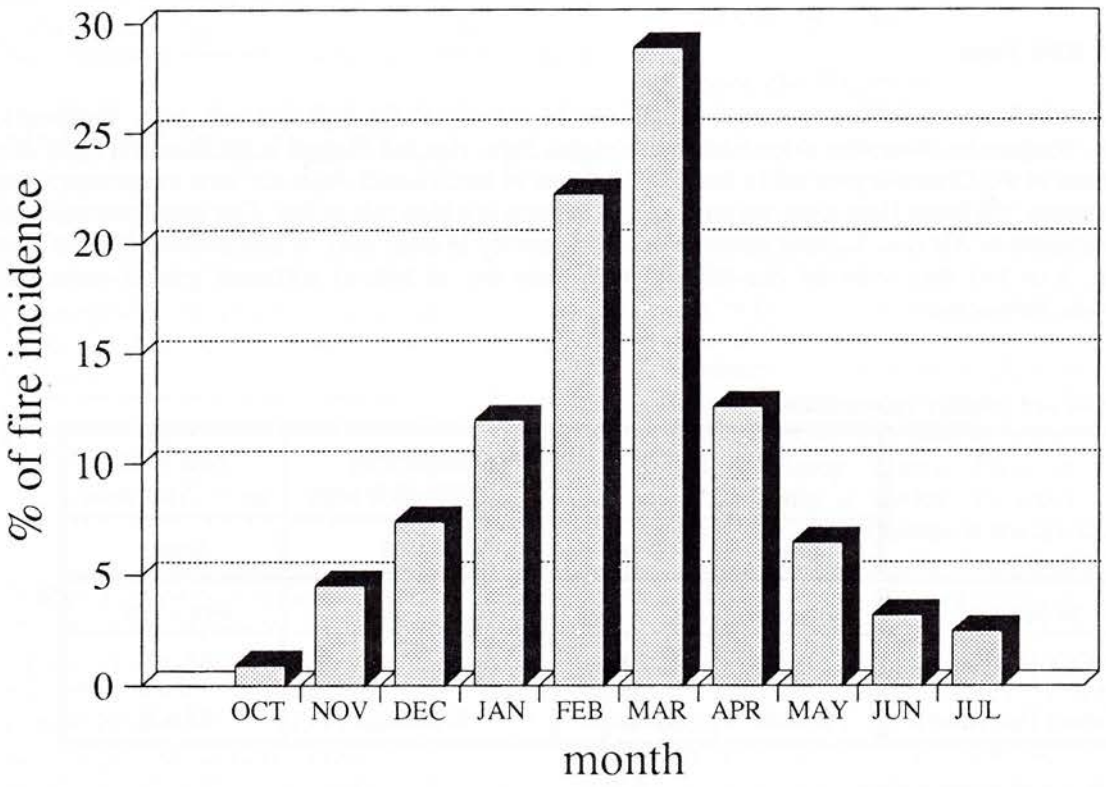

Fig.1. Monthly distribution of forest fire incidents (%) throughout the year in Bhutan

The period from December to May has more than 5 % the risk of fire incidence. Therefore, countrywide the forest fire season con be considered to be from the first week of December till the end of May, or six month's duration. During February and March the risk of forest fire incidence is more than 15 % and this is considered as the peak forest fire season.

Temperature, pressure, wind speed, wind direction, humidity, visibility, clouds and precipitation are important weather factors. These are always changing, as such weather also changes. It is therefore important to understand and interpret weather variations. These weather factors directly affect the behaviour of a fire. Strong wind and very low relative humidity are two main causes of escaping and accidental fires. The incidence of forest fires is caused mainly by escaped and accidental fires in our country.

Past weather and fire incidence data are manipulated to forecast rainfall and forest fire danger regionally. If weather conditions are indicating some danger, we can regulate the unfavourable forest conditions through management i.e. controlled burning, establishment or cleaning of a fire line, patrolling etc. or by creating awareness among people to prevent damage from fire. The forest fire season and the peak fire season of the Eastern, Western, Central and Southern regions are now known and utmost care to prevent fire during the fire season is expected.

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BHUTAN

Bhutan Fire Statistics

The following statistics cover the years 1981-85 and were made available to the editor of International Forest Fire News in 1986.

Tab.1. Forest fire statistics of Bhutan for the period 1981-1985 (Source: Royal Government of Bhutan)

Year	Number of Fires	Area Burned (ha)	Damage Nugultrun (1 US$= 12 NU)
1981-82	74	12,843	111,104,400
1982-83	64	5,487	54,531,700
1983-84	47	7,243	42,337,000
1984-85	47	3,943	22,041,000

DENMARK

Fire drill and nature preservation combined

Background. In the summer of 1989 a fire burned a large area of a protected moor near the tip of Jutland, Denmark. As this turned out to benefit the moorland vegetation, especially the heather, the county office in charge of landscape management decided to burn off another area in the spring of 1993. The prescribed fire would also serve as fire drill in connection with a general fire contingency plan for moors and plantations.

Preparations. The area which was burned is private. Under restrictions of a conservation act it has to be preserved as a moor. However, pine trees have invaded the site, and the heather became overmature, i.e. thin on top and with a woody growth. Before the fire the pine trees had been felled and piled in rows. To reduce damage to the wildlife the burning was done before April. The fire was started in late afternoon, so that the firefighters would get experience of working in the dark. The fire crew consisted of members of the civil

defence, the local fire brigades, and the nearby air base, plus tractor drivers from the National Forest and Nature Agency. Several forest districts of Northern and Western Jutland, which in dry summers are often affected by fires, sent observers.

The Burning. On the day of the fire a strong western wind meant that in spite of a clear sky there were some difficulties getting the fire going. Furthermore, the ground and vegetation were rather wet. Towards evening the wind calmed, and the fire gained -- so much so that in one place it nearly escaped the planned boundary.

The fire was controlled by fire beaters, tractors, and fire hoses, the latter being also used to wet the ground around the burning area. In the days after the main fire the remains of the pine trees were pushed together and burnt.

Experience gained. Generally, the result of the fire was considered satisfactory. The communication and cooperation between the various organizations involved went well. The experience showed that fire fighters along the side of the fire needed smoke masks, and that having traffic across the fire area did not work.

The future development of the area is to be monitored by botanists. The overall impression of the event was so positive, that another fire drill will probably be held next year.

Source: I. Salomon, 1993. Brandovelse komineret med naturpleje. Skoven 6-7: 274-275.-- Summarized by:

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FINLAND

Automatic Forest Fire Management Workstation for NOAA AVHRR Data

Prototype software for a forest fire workstation has been developed for automatic detection and monitoring of forest fires. Data from the AVHRR (Advanced Very High Resolution Radiometer) sensor of the NOAA satellites are utilized as the primary input.

The NOAA images are transferred from a receiving station to the workstation via a data transfer network. The images are checked for missing or erroneous lines due to reception errors. Image data are geo-coded using orbital data of the satellite. The geo-coded image data are searched for fire pixels. Detection of fire pixels is based on threshold of AVHRR channel 3 (middle infrared, central wavelength 3.5 μm). Contiguous areas of fire pixels are grouped into fire patches. For each fire patch, an alert message is generated and transmitted to a recipient via electronic mail. In the box below an example of such a message is given:

```
From: VTINSX::palokuva "Metsapalokuva" 26-OCT-1993 11:02:15.69
To: rauste
CC:
Subj: FIRE_Alert

A possible forest fire has been detected in data set: n119308121446
(Acquired on 1993-08-12 at 14:46)
Channel-3 minimum: 98,    8 pixels
Co-ordinates: Northing:       4377.8,     Easting:       119.0
(line:       865.9,     column:      242.1)

Best regards:
Forest-fire workstation (at 93-10-26 11:03)
```

The automatic forest-fire monitoring system was tested during the summer season 1993. In Finland, summer 1993 was more rainy than e.g. summer 1992. The test area covered southern Finland, Estonia, Latvia, Lithuania, and parts of Russia. NOAA image data from 1 June to 20 August (with some breaks of a few days) were obtained from the Finnish Meteorological Institute. The system reported 66 NOAA images as containing a possible fire. These 66 images were inspected individually. In four cases, the reported fire was considered to be real fire. Two of the fires could not be verified with fire authorities because the fires were located outside the Finnish territory. One of the fires, which was verified with fire authorities, covered an area of 30 ha. The system has also been tested over the territory of Greece.

Most of the cases where fire was reported by the automatic monitoring system were (specular) reflections from clouds or water. In future development, when the imaging geometry is taken into account in search of fires, the number of false alarms can be reduced significantly.

In forest fire monitoring for fire-fighting activities, it is essential that data in the 3.5 μm band (e.g. NOAA AVHRR channel 3) are available. This spectral band enables the day-time detection of relatively small forest fires. Most forest fires tend to start in the day time. If forest fires are only monitored using visible-wavelength data acquired during the hours of darkness, the fires have a long time to spread before they get detected. This makes the extinguishing of the fires more difficult. In high-latitude boreal forests, the acquisition of night-time images is difficult around mid-summer due to short nights.

The development project of the forest fire workstation was ordered by the Rescue Department of the Finnish Ministry of the Interior.

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GREECE

The 1993 Forest Fire Season in Greece

Last year was a record year in the forest fire history of Greece: during the fire season from May to October, 2417 fires ravaged Greek forests, marking an all-time record in the fire statistics of Greece since the national average does not exceed 1100 fires per year. Approximately 47,000 ha of forest land were burned by these fires during 1993.

This dramatic increase in the number of forest fires can be primarily attributed to the following reasons:

- A new law that legalised unlawful, arbitrary private structures in public forest lands that were previously burned, gave rise to a "wave" of arson in public forests. The prospect of subsequent arbitrary construction on the burned sites that would be rendered legal by taking advantage of the new law, during a year of national elections like 1993, was very tempting!

- Equally important, a wave of illegal immigrants from Albania crossed the border in Northern Greece and, through remote forest trails, crossed the mountainous regions in order to seek temporary employment at the urban centres of Thessaloniki and Athens. These people, having to spend nights in the open air inside the forests, have caused many forest fires by negligence (abandoned camping fires) or malice (animosity towards immigration authorities). Many of these fires burned in areas of low fire risk, such as the high elevation forests of fir, beech and black pine of Northern Greece.

- A third reason, independent of human acts, is the prolonged drought that has continued in Greece for four consecutive years and has left Southern Greece without a single drop of rain for 4.5 months!

At the same time, many extraordinary events marked the unique 1993 fire season in Greece:

- An arson fire on the island of Ikaria in the Northeast Aegean sea, cost the lives of 11 farmers who were burned in their efforts to escape from the fire or were suffocated by smoke inside their homes. A National day of mourning was declared, and the Prime Minister visited the fire-stricken island, promising increased fire protection measures for all Greece.

- Unlike other years, Northern Greece experienced many destructive fires, similar to those that traditionally occur in the drier and more flammable regions of Southern Greece which are covered by Mediterranean-type vegetation (maquis, garrigues). Thus, high-elevation forest of fir, beech and black pine, located in Northern Greece, that had never experienced fires since the Second World War due to existing climatic (cold, humid areas) and socio-economic conditions (lack of population pressure or grazing intensity), were destroyed by fires set by illegal immigrants who entered the country through them. The geographical regions of Epirus and Macedonia had a record-high of 400 and 600 fires, respectively, which burned over 20,000 ha of high forest. Thus, Northern Greece did not escape forest fires this year.

- The National Parks of "Valia Calda" in Epirus, covered with magnificent black pine forests, and "Olympus Mountain" in Macedonia, covered by fir forests, were burned. Thus, picturesque landscapes of amazing beauty and historical heritage were turned into ashes, leaving homeless the "12 Deities" of the Ancient Greek Pantheon!

- For the second time, German firefighting helicopters successfully helped in forest firefighting in Greece. The helicopters were sent "gratis" by the German Government to Greece. Ten helicopters hired from a Canadian company, were used in forest fire fighting, after the successful German example in Greece.

- A smokejumper unit was formed for the first time in Greece. It consists of former members of the "special forces" of the Greek Army who received special training. Bureaucracy and lack of funds delayed the unit's deployment until late in the fire season, and its effectiveness is therefore difficult to assess.

- Two huge forest fires, set for grazing land improvement at Peloponnese (Megalopoli Arkadias) and Crete (Lasithi), burned over 4,000 ha each and destroyed farms and other agricultural property, forcing the temporary evacuation of whole villages. Thus, the role of farmers in forest fire prevention and protection is under consideration, while the possibility of introducing prescribed burning in Greece is being reexamined.

In 1993 once again forest fires monopolized the headlines of news in the mass media, increasing public awareness and rendering forest fires the number one environmental problem of Greece over the last fifteen years.

Alexander P. Dimitrakopoulos (address on p.14)

Wildland Fire Science at Mediterranean Agronomic Institute of Chania (MAICH)

Introduction

The Mediterranean Agronomic Institute of Chania (MAICH) has established a modern Wildland Fire Science Laboratory as a part of major research facilities in 1993. The establishment was partly supported by EEC funds. The complexity of the wildland fire problem requires basic and applied research combined with education and training in modern methods and technologies from various scientific disciplines. The objectives of the Wildland Fire Science Laboratory at MAICH therefore are twofold:

- Promote basic and applied research on the principles, management and ecology of wildland fires.
- Provide post-graduate education and training with updated methods and modern technologies in wildland fire prevention, suppression and management in combination with ecological considerations.

Instrumentation

The instrumentation of the laboratory provides the most modern technological means in the field of fire and pyrolysis analysis:

- Automatic data loggers equipped with thermocouples for high temperature measurements
- A thermal analysis system for determining pyric properties and combustion processes of wildland fuels, consisting of (a) differential scanning calorimetry, and (b) thermogravimetric analyser
- Adiabatic bomb calorimeter for measuring the calorific value of different substances
- Gas chromatography
- Friction chamber for silica-ash determination
- Field instrumentation for fuel measurements and fire weather monitoring
- Instrumentation for prescribed burning documentation
- Complete collection of software packages on fire behaviour simulation, fire danger rating, fuel modeling and wildland fire management decision making

Research

The complete and updated instrumentation of the laboratory enables basic and applied research in various aspects of fire science:

- Fire behaviour principles
- Combustion processes
- Pyrolysis and thermochemical reactions
- Analysis of physical and chemical properties of fuels
- Inflammability and combustibility
- Pyric parameters
- Fire ecology
- Fire effects
- Fire management systems
- Fire suppression organisation operations research.

The Fire Science Laboratory of MAICH is engaged in the following research programs:

- Programme ENVIRONMENT: "Modelling of forest fires". The project aims at developing a wildland fire behaviour prediction model with managerial implications.
- Programme STRIDE: " Rehabilitation of burned areas and wildland fire prevention". The project seeks to create a system for forest fire risk assessment based on meteorological data and to provide training in fire prevention and control methods.
- Programme AIR: "Conservation and protection of low-elevation Mediterranean coniferous forests threatened by wildfires". The role of fires as an ecosystem process and evolutionary force in Mediterranean-type ecosystems is investigated.

Education

MAICH is one of the four agronomic institutes of the international Centre for Advanced Mediterranean Agronomic Studies (ICAMAS). It is an educational organisation which offers graduate study programs leading to the M.Sc. degree. The Department of Environmental and Renewable Resources offers in its curriculum courses on Wildland Fire Ecology and Management. Among them, an intensive course on "Ecology and Management of Wildland Fires in the Mediterranean Region" is attended by many international students who are exposed to modern laboratory technologies as part of their education. Visiting faculty members and researchers participate in the educational and research procedures at MAICH.

A number of competent graduate students is conducting research for their M.Sc. degrees in the discipline of Wildland Fire Science using the laboratory facilities.

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POLAND

Current Research on Forest Fire Management in Poland

Almost 20 % of wildfires recorded in Poland are forest fires (Fig.1). Surface fires contribute to 75% of all forest fires. The majority of these fires is not larger than 1 ha. However, an increase of large forest fires has been noted during the recent years. Figures 2 and 3 present data which show the increase of number of forest fires and burned areas in Poland. Especially dramatic was 1992 when 9,305 fires were recorded in Poland (three times more than in previous years); they affected 37,000 ha of forest (12 times more than in 1991). Long periods of drought and high air temperatures were the main reasons for such a great number of fires. Multiple environmental stresses and other influences are believed to create a new fire risk in Poland: impacts of the long-term droughts, forest decline due to air pollution, and high tourist traffic. The effects of forest decline lead to decay of trees, opening of the canopy, lush growth of grasses, hence large amount of available fuels).

In this situation, characterized by increasing fire risk and greater number of large fires, it is necessary to apply new techniques and technologies for fire prevention, e.g. remote sensing and GIS. There are three aspects of their application for fire management in Polish conditions:

- Fire risk forecast for the whole country and for particular regions
- Fire monitoring
- Inventory of fire damages, assessment of losses, and monitoring of regeneration

Since 1982 the Forest Research Institute (IBL) in Warsaw has applied panchromatic aerial photographs for evaluating the extent of fires. Aerial thermal imagery was used by the Remote Sensing and Spatial Information Centre (OPOLIS) of the Institute of Geodesy and Cartography in Warsaw for detecting underground fires. Thermograms recorded by AGA Thermoprofile THP-1 scanner and colour equidensity thermograms produced with the use of an electronic-analogue viewer allowed the distribution of soil temperature and hence fire

location to be determined. OPOLIS also has experience in utilizing colour-infrared aerial photographs for assessing the state of forest, especially for monitoring the long-term consequences of surface fires.

Research on the use of satellite imagery Research has been continuously followed for several years. In August 1992 the largest forest fire in Poland (9060 ha), located in the Upper Silesia region (Kuznia Raciborska) was observed on satellite images. The spread of this fire was exceptional in Polish conditions, and the increase of the burned area could be observed on NOAA AVHRR images. Smoke on these images was seen at a distance of 100 km. SPOT XS and XP images acquired in September 1992 and in May 1993, as well as ERS-1 images acquired in summer 1993, clearly present the extent of burns.

Both ERS-1 and SPOT images enable burnt area to be determined with the same accuracy. However, small clumps of trees which survived, could be better distinguished on the SPOT image, due to high near-infrared reflectance. Spectral characteristics for microwave images make discrimination of these clumps more difficult on ERS-1 images.

Forecasting of forest fire risk is the next application of remote sensing for fire management. At present the fire risk is determined on a daily base during the fire season (ca. 200-240 days). This fire hazard assessment is based on the measurement of moisture content of forest litter in permanent observation stations, following a method developed by the Forest Research Institute in Warsaw.

Recent studies of NOAA-derived information reveal relationships between soil moisture, vegetation state and evapotranspiration. As a result of these studies it was decided to test the potential applicability of NOAA AVHRR imagery for evaluating fire risk in Polish forests. The research goal is based on the assumption that indices derived from NOAA images correlate with parameters which determine forest fire risk.

Research on modelling fire risk, its origins, development and consequences has been started recently. Spatial information systems are useful tools in creating these models. The main elements of the models are: types of stands, species composition for particular forest storeys, archived forest data, topographic data, relief, as well as climate conditions. The Forest Fire Database (FFD) provides the base of the information system. FFD stores 32 types of information about forest conditions of burnt stands, meteorological conditions during a fire, type and acreage of burnt area, fire characteristics and fire control information. These data are used for forest fire hazard analysis. Together with information derived from forest maps these data are the base of Geographic Information System (GIS) for fire management purposes.

In 1992 joint work on creating spatial information system for Kuznia Raciborska burnt area and for surrounding forests was started by OPOLIS, IBL and the Laboratory of Remote Sensing and Forest Management of the University of Gent (Belgium). The area of investigation is particularly important for highly industrialized and polluted Upper Silesia region. The information system will be used for monitoring fire effects. It will be based on several information layers derived from archive forest maps, soil-site maps, topographic maps, as well as from aerial and satellite images and digital terrain models. A relational database, additional to FFD, will contain archive taxation descriptions of stands and updated information, characterizing reclamation works and results of monitoring environmental changes.

Furthermore it is planned to develop operational GIS-based fire prevention systems, based on spatial information layers (containing forest maps, updated by remotely sensed data), other related databases (describing taxation features of particular stands), fire risk forecasts, and fire alarm procedures.

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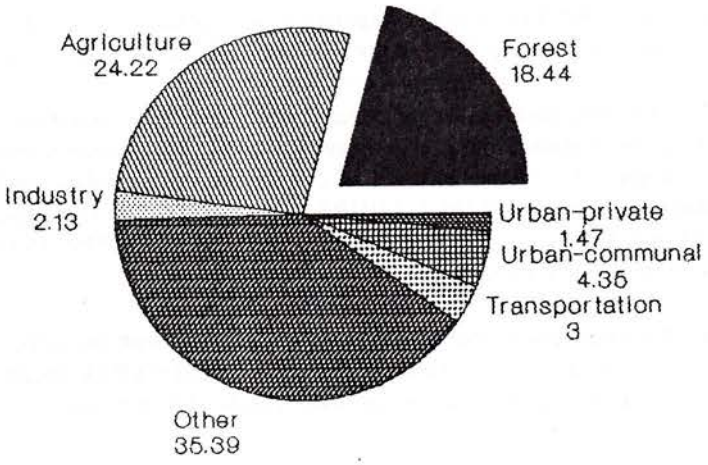

Fig.1. Structure of fire occurrences in Poland (all sectors)

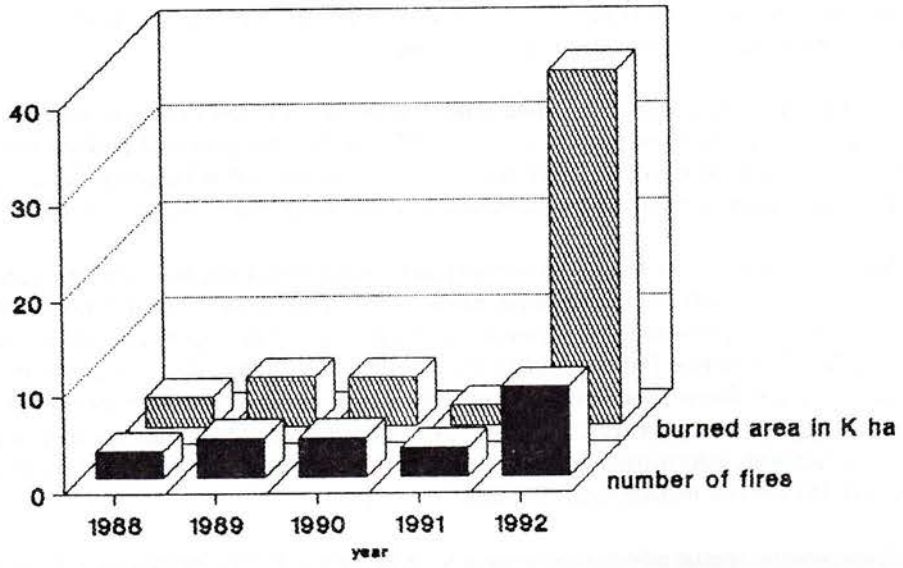

Fig.2. Number of forest fires and burned area in Poland, 1988-92

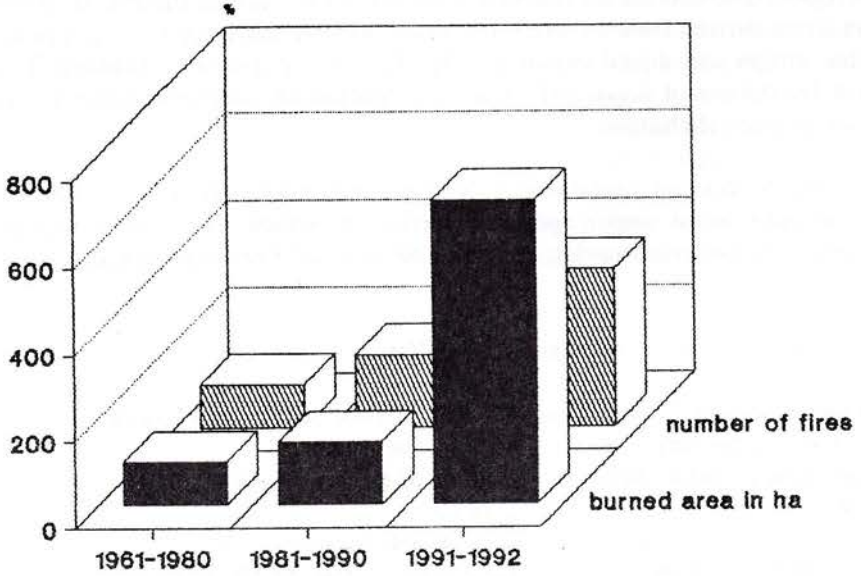

Fig.3. Increment of number of forest fires and burned area in Poland in the period 1961-92 (1961-80 = 100%)

RUSSIAN FEDERATION

This report on the recent developments (1992-93) in Russia's fire management sector covers a broad variety of issues, embracing:

- A short summary of fire statistics of the 1993 fire season and Russia's activities in international exchange of fire management personnel and technologies

- News from the forest fire situation in the radioactively contaminated regions

Additional information is given under **"News From Fire Research"** (Activities of the International Boreal Forest Research Association, Stand Replacement Fire Working Group, in conjunction with the international conference on "Fire in Ecosystems of Boreal Eurasia" and the **Fire Research Campaign Asia--North (FIRESCAN)**, and the **Taiga Aerospace Investigations using GIS Applications (TAIGA) Workshop)**.

The 1993 Forest Fire Season

The Russian Aerial Forest Fire Protection Association ***Avialesookhrana*** reports the following statistical data of the 1993 fire season. The numbers refer to fire-protected lands:

Number of Fires: 14,509
Area Burned: 719,400 ha

Exchange of Fire Research and Fire Management Personnel with the U.S.A.

In the last two years a series of activities in exchanging fire researchers and fire management personnel between the Russian Federation and the U.S.A. created new contacts within our community. As a response to the kind invitation of the first exploratory mission in the Russian Federation (see IFFN No.6, January 1992), Stephen J.Pyne, Arizona State University, Phoenix, hosted a delegation of Russian scientists and managers during the period 19 September to 6 October 1992. Visiting fire specialists were Valentin Furiaev (Russian Academy of Sciences), Eduard P.Davidenko and Nikolaij Liubutzen, and Alexander Beliaev (Avialesookhrana). Visiting points were the University of Arizona (Phoenix, Tucson), National Center for Advanced Technology (Marana, Arizona), Grand Canyon and Tonto National Forest, Riverside Forest Fire Laboratory, Sequoia Park, and various air tanker bases.

Another study tour was hosted by the Alaska Bureau of Land Management, 27 August - 10 September 1992. Visiting fire specialists from Avialesookhrana were Nikolai Andreev (Director), Eduard Davidenko, Boris Khobta (Magadan Fire Center), and Alexander Liubiakin (Khabarovsk Fire Center). This study tour was targeted to demonstrate the operations of fire management personnel, including air tankers and smoke jumpers.

Following an invitation by D.A.Amicarella, Director of Fire and Aviation Management, USDA Forest Service, and the response by N.Andreev, Director of Avialesookhrana, both countries agreed to exchange a total of four groups of fire management experts. The visits took place between May and August, 1993. The members of the Russian delegations were from Avialesookhrana and the Russian Forest Service: Yevgeny Shuktomov (Headquarters), Vadim Melkir (Perm), Alexei Shchedrin (Petrosavodsk), with the interpreter Nikolai Beliaev, and Victor Sergeienko (Russian Forest Service), Vladimir Schtetinsky (Headquarters), and Nikolai Kovaljov (Krasnoyarsk). The US delegations came from the National Forests: Stan Kunzman (Deschutes), Larry Swan (Payette), Jack Weingert (Quachita), Tom Goheen (Chugach), Deanne Schulman (Sequoia), and Dennis Hulbert (Tahoe).

On 28 November 1993 the Head of the Russian party of the Russian-American Forestry Commission, together with Nikolai A.Kovaljov (Avialesookhrana), travelled to Washington to sign the follow-up agreement for exchange of experts.

International Assistance and Mutual Agreements

In 1993 a contract was signed with **Mongolia**. According to this contract the Russian Federation will provide fire fighting equipment (parachutes, helicopter rappelling devices, small equipment). A mutual assistance scheme was agreed for large fire situations.

Croatia received the help of two Russian helicopters from Komi Region. The mission included aerial observers, instructors, and fire fighters, and was deployed in late summer of 1993.

Border-crossing rules with the **People's Republic of China** will be signed soon. The agreements will provide rules on simple communication, including radio frequencies.

These international agreements are not the first ones: Earlier Soviet activities in forest fire protection were in Cuba (1977-80) and in an FAO project in Mongolia (1989-90).

Spaceborne Detection of Forest Fires

Satellite-based fire detection technologies have been used in Russia for many years. Like in other countries, detection capabilities of conventional satellite sensors are limited, e.g. by cloud cover or by fire size. A contract with the Russian Association for research and Science of Space **Saljut** was signed to develop a sensor for (1) fire danger assessment, and (2) for detecting fires less than 0.01 ha in size and independent of cloud cover. Aircraft-borne sensors will be tested during the 1994 fire season. The sensors will then be mounted on the Priroda Platform (to be coupled to the Mir space station) and tested after launch in 1995. It is envisaged to carry out ground truth tests jointly with the IGBP/IBFRA activities.

The German Aeronautical and Space Research Institute (DLR), Institute for Space Sensor Technology (Berlin) recently proposed a research programme for the development of a sensor specially designed to detect, classify and follow-up a fire event. If realized, a joint German-Russian development project may develop. First bilateral talks took place in Russia and Germany (January 1994).

News from the Forest Fire Situation in the Radioactively Contaminated Regions

Following the disastrous effects of the Chernobyl Nuclear Power Plant accident in 1986 on forests, a meeting on "Forest Fires and the Areas Contaminated by Radionuclide" was held in Klintsi, Briansk Region, 18-19 May 1993. Scientists and administrators from the Russian Federation, Belarus and Ukraine reported about latest research in the contaminated areas and on technologies to detect and suppress fires in the contaminated regions. Among other, Sergeij Dusha-Gudym gave a report on the state of contamination (see first report published in IFFN No.7, August 1993). An updated map of the extent of contaminated lands in Russia, together with the information on forest fires occurring in 1992, was presented by S.Dusha-Gudym (Fig.1); the full investigation on fire in contaminated forests will be published in the volume "Fire in Ecosystems of Boreal Eurasia" [see FIRESCAN report]). The representatives of the Klintsi meeting concluded:

"In the forests polluted with a high concentration of radionuclides all forestry operations have been abandoned. As a consequence forest stands are in a critical condition, especially with an increased danger of fire. Uncontrolled wildfires may lead to a second contamination of nearby territories through radionuclides lifted with the smoke and ash. Therefore the Forest Service of Russia and the Ministries of Forestry of Belarus and Ukraine consider fire prevention and control as essential. For this purposed the technical base of the fire services must be strengthened and needs more inputs from relevant fire research. Preliminary results of the research conducted by the Research Institute for Forest Chemistry (Ivanteevka/Pushkino, Moscow Region) and the Forest Research Institute of Belarus reveal the difficulties to conduct research in such areas.

The participants of the conference recommend the development and strengthening of the fire protection service in the boundary region of the three countries, to be conducted as a cooperative effort. The following research priorities were defined: (1) modelling transmission of radionuclide during fire activity; (2) fuel inventory methodologies; (3) methods of protecting humans against the effects of radionuclide contamination. The

creation of an International Centre for Forest Fire Prevention and Control in Territories Contaminated by Radionuclides is being considered, on the base of the All-Russian Research Institute of Forest Chemistry (VNIIKhleskhoz)."

Contact addresses for parties interested in cooperative in fire research on contaminated forest lands in Russia and Belarus are:

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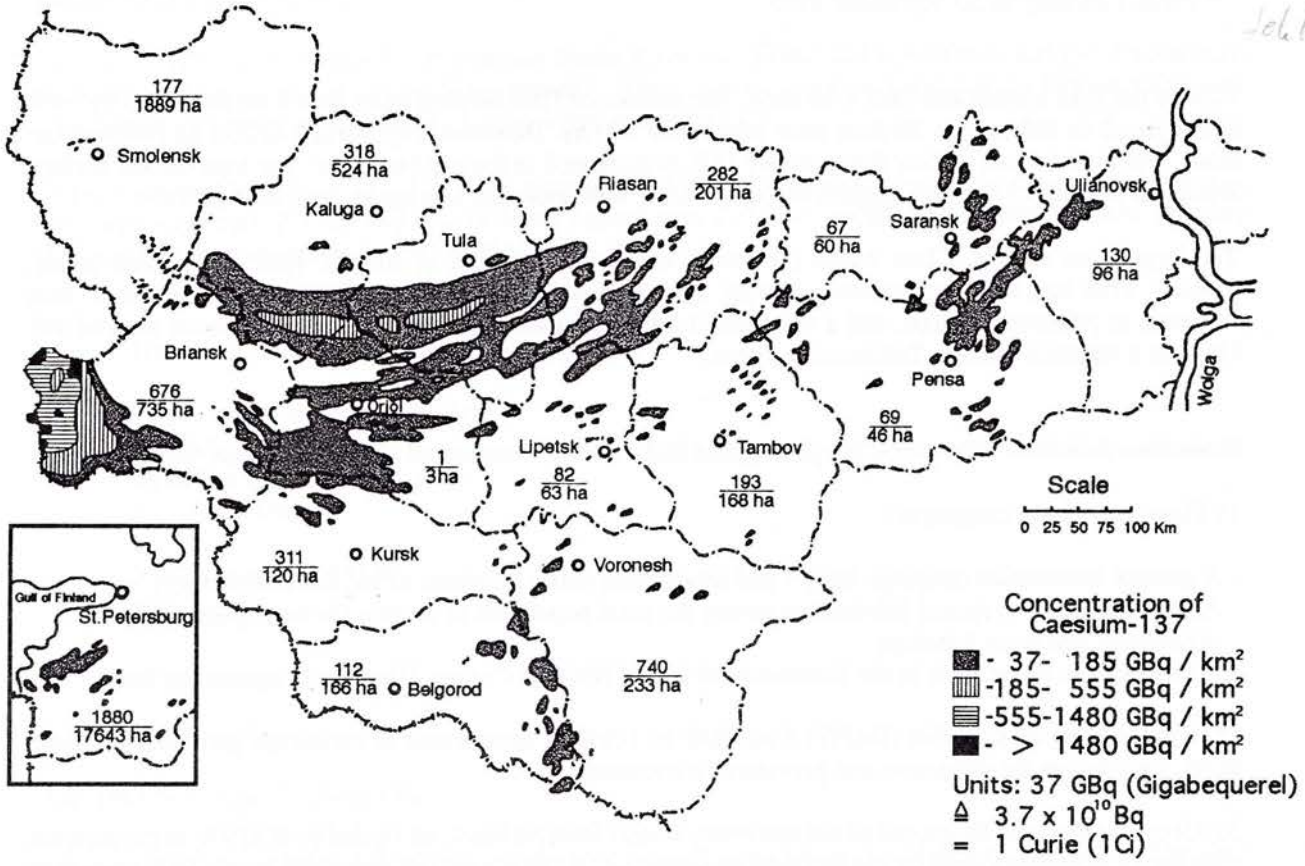

Tab.1. Land area in the Russian Federation contaminated by Caesium-137 (the main map shows the territory East of Chernobyl nuclear power plant). The numbers within the districts (Oblasts) give the number of forest fires and the total area affected by fire in 1992 (Dusha-Gudym 1994).

SPAIN

The 1993 Forest Fire Season

Fire Weather. After a very dry winter, rainfalls started in the spring covering the Northern and Western regions of the Iberian Peninsula. Permanent drought continued in the Southern and Eastern regions. Strong winds from the North in Catalonia (NE), from the west in Valencia (E), and from the North and the East in Andalusia (S) created many situations of Extreme Danger according the National Fire Danger Index. The months of August and September showed the highest number of days with Extreme Danger all along the Mediterranean coast. On the other hand the fire season was milder in the North and the West.

Damages. Figures for 1993 compared with those of the previous years were the following:

	1991	1992	1993 *
Number of Fires	13,011	15,895	12,119
Burned Forest Land (ha)	109,880	39,961	33,222
Burned Woodland and Grassland (ha)	134,826	64,631	55,840
Total Burned Surface (ha)	224,706	104,592	89,062

* From 1 January to 30 September 1993

70% of the fires burned less than 1 ha each. The number of fires burning more than 1 ha decreased by 34% as compared to 1992. Only 20 fires were larger than 500 ha. However, they burned 43.335 ha (49% of the total). The total burned surface decreased by 11% as compared to the previous year. The total burned surface amounted for the 0.3% of the Spanish woodland area, well under the average in the 1980s (0.9%).

The largest fire burned at Dos Aguas (Valencia) during the last week of August, with strong West winds, burning 7050 ha (1050 ha forested). During the suppression activities 3 casualties were registered: two crewmen in Alicante Province, and a volunteer at Soria Province. Furthermore five people were trapped and killed in a vacation cabin at Tarragona province.

Protection Activities. The protection plan against forest fires was developed in 1993 along the following lines:

1) Three prevention campaigns:

- A general information campaign by TV and newspapers (daily broadcast of the fire danger map)
- A rural campaign to spread information among the rural population to prevent the wrong use of fire in agricultural and grass burnings
- A campaign in the schools in the framework of the IX National Contest "Everybody against the fire"

2) A programme of subsidies (PAPIF) from 50% to 100% of investments of encourage patrolling of forest areas, cooperation by volunteers and preventive silviculture.

3) Air operations with 86 aircraft (fixed and rotary wings) from 50 bases, all funded by ICONA, in cooperation with the 79 helicopters hired by the Regional governments. ICONA's aircraft flew 7196 hours, 16% more than in 1992.

ICONA's fleet of turbo prop CL-215's was operated intensively, performing well near the coast and at the Northern regions. However, there were some difficulties for scooping operations in the Central regions because of the low water level in the hydroelectric and irrigation dams after the long previous droughts. A DC-6 aircraft and 10 water bomber helicopters (bambi bucket or belly tank) were hired to cover the areas where the CL-215's were not able to scoop water.

4) The special plan to prevent big fires entered its second year with the following activities:

- Special daily Extreme Fire Behaviour forecasts for every region
- A seminar on the Incident Command System (ICS) and the NIFMAS conducted by three U.S. experts.
- Implementation of four special reinforcement brigades (BRIF), according to the procedures tested in 1992 with only two brigades. These BRIF's were transported to provide assistance to the local crews in large fire situations. Every BRIF has 45 firefighters, trained by a mixed team of American and Spanish specialists during the month of June. The transport to the fires (sometimes 300 km from the base) was carried out by four helicopters MI-8, hired by ICONA from the Russian Army. The BRIF's were located in four bases, three in the West and one in the East, but because of the danger pattern in 1993, they had to be transported frequently to the Mediterranean regions. Their performance was really impressive.

They are becoming also a reference to improve the preparedness of the nearly 1000 initial attack crews distributed all over the country. The success of the BRIFs was mainly based on the special training they received and on the enthusiastic attitude of the people enrolled, all of them forest workers from the Cuenca, Huelva, Caceres and Leon provinces.

5) The Forest Fire Data Base attained its full operation with new hardware and software installed in 1992, providing detailed information of nearly 200,000 fires in the 1968-1992 period. Global Positioning Systems (GPS) equipment was extensively used to measure burned surface in order to give a fast appraisal of fire damages. Airborne video cameras were also used to transfer images to the Operation Centres in the Madrid, Valencia and Galicia regions.

6) A National Standardization Committee for Forest Fires was established by ICONA and the Autonomous Regions. Its first activities were on "Fire reports", "Operation rules and performances to hire aircraft", and "Physical requirements to hire people for the forest fire brigades".

7) The National Photo Key to Fuel Models, a work started in 1987, was completed after inventories in the last two regions covered. It is divided into 14 forest regions with 200 plates including five pictures each. This key is in use as a base for application of BEHAVE.

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U.S.A.

The 1993 Southern California Fires

Southern California suffered another disastrous series of fires in October and November, 1993. The fires started on 26 October under severe **Santa Ana Wind** conditions, some by arson and other accidentally. Preliminary data indicate that a total of 21 fires covered 197,225 acres (almost 84,000 ha) injuring 162 people

and killing three. The fires destroyed 1241 structures, and damage was preliminarily estimated to be $500 million, although that figure could rise as damage is further assessed and the aftermath of heavy rains, mudslides, and floods after the fires takes its toll.

The fires were in six southern California counties - Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura. Total acreage and structure loss by county is:

County	Number of Fires	Area Burned (ha)	Structures Destroyed
Los Angeles	3	9,996	562
Orange	2	7;034	368
Riverside	6	24,955	188
San Bernardino	2	1,914	5
San Diego	5	9,084	43
Ventura	3	26,832	75

Data from California Office of Emergency Services

Although the immediate causes of the losses were arson and accidental fire starts, we must look at the long-term need for fuels management to reduce California's fire losses. Our data clearly indicate the need to modify both structures and vegetation. Between 1920 and 1989, California lost about 3,500 structures to wildfires. In the first 4 years of the 1990s we have now lost almost 4,500 structures. Also, in the last 25 years we have seen the wildfire acreage just about double from ca.1 ha burned per 400 ha (ca.1,000 acres) protected to almost 2 ha. Loss of human lives has also increased dramatically.

A specific example of the need for structural and vegetation modification is the 1990 Santa Barbara "Paint" Fire. About 488 structures were lost and over 800 threatened. Analysis of 75 factors showed 21 to be statistically significant in whether or not a structure was lost. However, three factors were most significant. First, if any roofing other than wood shakes or shingles were on the structure, survival rose from 19% to 70%. Adding to this, if flammable vegetation were cleared beyond 30 feet (9 meters), structural survival rose from 15% to 90%, finally, both the other factors tend to make a structure more defensible, so that if anyone were present to defend the structure, the three factors then increased structure survival from 4% to 99%. This analysis is the subject of Ethan Foote's MS thesis, which should be completed in the near future.

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NEWS FROM FIRE RESEARCH

International Union of Forestry Research Organizations (IUFRO) - Subject Group S1.09-00 Forest Fire Research

Change of Officers

Robert (Bob) E. Martin who was Coordinator of S1-09 since the preparation of the 1986 IUFRO World Congress in Ljubljana has handed over this duty to Johann G. Goldammer (editor of this newsletter). Together with Brian J.Stocks (Canada) Bob will continue with the responsibility of being Deputy Coordinator of the group. The newly appointed chairman intends to stay in duty for an interim period until August 1995 (change of office scheduled at the occasion of the IUFRO World Congress). Andrea Koonce has taken over the responsibility of Coordinator of Working Party S1.09-01 (Prescribed Burning Research).

Updating of the FAO Multilingual Wildland Fire Management Glossary

The most urgently required activity of the Subject Group will be a revision and updating the FAO Multilingual Wildland Fire Management Glossary (FAO Forestry Paper 70, 1986). This will be a cooperative approach with with FAO, the Joint ECE/FAO/ILO Committee Team of Specialists on Forest Fire, FAO Silva Mediterranea and the organizations co-sponsoring International Forest Fire News (IBFRA, IGBP-IGAC-BIBEX, IAWF). The basic English Terminology will be revised by Robert E. Martin (University of California, Berkeley). New terms will be added, e.g. fire-related terminology from atmospheric sciences, climatology, remote sensing, etc. The language correspondents (French, German, Italian, Spanish, as well as Russian as the first language to be added) will update the corresponding terms and translations.

The project will be supported by the U.S.Forest Service, Forest Fire and Atmospheric Sciences Research, Washington. It is planned to continuously update the terminology and add more languages. More information about the publication will be given as soon as the first phase of the project is terminated.

The 1995 IUFRO World Congress - Call for Papers

The 20th IUFRO World Congress will take place in Tampere (Finland) from 7-12 August 1995. Two sessions on fire research will be held.

A two-hour session "Fire-Insect-Pathogen Interactions" will be chaired by Robert E. Martin. Those who wish to contribute to the session are kindly asked to contact the convenor of the session:

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An eight-hour session "Objectives and Design of Experimental Fires in Boreal Forest Ecosystems". This session will provide the floor for presentation of the results of the first phase of FIRESCAN/IBFRA, the Bor Forest Island Fire Experiment. The session will include the presentation of a 1-hour film on the experiment, and the presentation of the monograph "Fire in Ecosystems of Boreal Eurasia". Depending on the time required for presentation of the research papers, a limited number of additional oral presentations on the topic may be included. **Deadline for submitting an abstract to the convenor is 30 March 1994**. Convenor of the session is Johann G. Goldammer (address on page iv).

Reorganization of IUFRO: What Future for Subject Group S1-09 ?

The Executive Board of IUFRO, at its meeting in Burkina Faso in December 1993, accepted a recommendation from the Programme Committee to divide the current Divisions 1 and 2 into four Divisions of approximately equal size with effect from January 1996 (i.e. after the next IUFRO World Congress). This proposal was made because of the size of Divisions 1 and 2 and the excessive load of work and cost to the Coordinators. The four new Divisions would cover the same scientific subjects as the present two Divisions, though they would be arranged in different affinities and groupings.

Before discussing the arguments for and against the necessity of splitting the Divisions, those fire researchers who are organized in IUFRO should ask some very basic questions: What is the present role of IUFRO in fire research, and what do we anticipate from this organization? Has IUFRO had an impact on fire research during the past ten to twenty years? If so, what?

The criticism by the IUFRO Division 1 leader on the Fire Working Parties is rather harsh but faced reality. The Subject Group's main task, i.e. to promote discussion and cooperative approaches within wildland fire science and at the interface with other research areas, has been taken over by problem- or task-oriented international and interdisciplinary research programmes. Those programmes reported in the pages of IFFN, particularly in this issue, are examples of highly collaborative efforts. Both the IGBP-IGAC-BIBEX and the IBFRA activities are demonstrating the willingness and the capabilities of the community to jointly address a problem.

Many colleagues made the criticism that during the past years the activities of the group were restricted to "co-sponsoring" several fire conferences. There are doubts whether the act of "co-sponsoring" a conference is really a meaningful task for a IUFRO Subject Group.

I suggest that it is timely to reconsider the way how the fire research community organizes itself. There are many options that are functioning at present, e.g. improving mutual information through this newsletter and the International Association of Wildland Fire, speeding communication through the e-mail based FIRENET (see more details in the latest issue of HotSheet), or promoting active collaboration through task-oriented programmes such as IGBP/IGAC/BIBEX or IBFRA. Is there any role left for IUFRO's Subject Group? Even conferences are being organized through other mechanisms, such as the Tall Timbers Fire Ecology Conferences, NATO Advanced Research Workshops (there are three ARW's in 1994 which are fire- and carbon-related), the Dahlem Konferenzen, the Chapman Conferences, and the many workshops and conferences organized by universities and government agencies.

If there is really no useful role left for the Subject Group it may not be necessary to keep it alive. Hierarchical structures and posts for coordinators who don't have to coordinate anything are a burden for the small budgets of the responsible officers. Let me suggest we think jointly about the future of IUFRO S1-09. Those who are interested in participating in this discussion should use the form attached at the end of this newsletter to express their opinion. For those who are not familiar with the present structure of S1-09 the organizational scheme is given below:

Division Level (1 of 6 at present):	**Division 1**	**Forest Environment and Silviculture**
Subject Group Level (1 of 8 within Division 1):	**S1-09-00**	**Forest Fire Research**
Working Party Level (4 of 55 within Division 1):	**WP S1.09-01**	**Prescribed Burning Research**
	WP S1.09-02	**Fire Prevention Research**
	WP S1.09-03	**Fire Fighting Methods and Equipment Research**
	WP S1.09-04	**International Fire Glossary**

I am looking forward to receiving your comments through the reply form (page 39) or through a letter.

Johann Georg Goldammer (address on page iv)

International Geosphere-Biosphere Programme (IGBP-IGAC-BIBEX)

A series of regional fire research projects with inputs of components as e.g. fire ecology, atmospheric chemistry, and climatology have been launched or are being prepared at the present stage. Figure 1 (p.29) provides a schematic geography of the regional projects. In the following a brief description of the state of the regional projects will be given (Source: J.G.Goldammer, Fire Ecology Research Group, Max Planck Institute for Chemistry, Biogeochemistry Department, c/o University of Freiburg, Germany; address on page iv).

SAFARI

As reported in previous issues of IFFN (No.7 [p.22-24]; No.8 [p.22-23]) the **Southern Africa Fire-Atmosphere Research Initiative (SAFARI)**, a subcomponent of the **Southern Tropical Atlantic Regional Experiment (STARE)**, in conjunction with **Transport and Atmospheric Chemistry near the Equator--Atlantic (TRACE-A)** was operational in the field during the Southern Hemisphere fire season of 1992. The evaluation of the field campaign data has been accompanied by several data workshops (Stellenbosch, South Africa, May 1993; San Francisco, December 1993). First results of the campaign were reported by M.O.Andreae (Max Planck Institute for Chemistry, Mainz) at the first IGAC Conference in Israel (April 1993). A special SAFARI session was held at the Annual Fall Meeting of the American Geophysical Union (AGU) in San Francisco (December 1993). The session had been prepared by Joel S. Levine (NASA, Langley). A special issue of the Journal of Geophysical Research (JGR) will be devoted to publishing the whole set of research papers of SAFARI. Guest editor of the JGR Special Issue will be Janette Lindesay (Australian National University, Canberra). Subsequently a book monograph will integrate the findings of SAFARI. The book will be edited by the SAFARI Steering Committee (M.O.Andreae, J.G.Goldammer, J.Lindesay, B.van Wilgen) and published by the University of the Witwatersrand Press.

The aerial research phase of 1994 will primarily concentrate on investigating the Southern African background atmosphere not affected by fire, i.e. during the non-fire season of March-April 1994. This research is aimed at consolidating the conclusions derived from the 1992 fire studies. These studies clearly showed the impact of pyrogenic emissions from Southern African wildland fires on tropospheric air quality over the South Atlantic, particularly the formation and transport of aerosols and ozone. The ground studies in 1994 will move toward East Africa (Kenya).

FIRESCAN

The Fire Research Campaign Asia--North (FIRESCAN) is an effort of institutions and individual scientists jointly working under the umbrella of IGAC-BIBEX and the International Boreal Forest Research Association (IBFRA). The activities of FIRESCAN were opened by the International Conference on "Fire in Ecosystems of Boreal Eurasia" which was held at the Forest Fire Laboratory of the Sukachev Institute of Forest and Wood, Russian Academy of Sciences, Siberian Branch, Krasnoyarsk (Russian Federation). The conference was aimed at producing a synthesis of the state of knowledge on fire in boreal Eurasia. The monograph will contain contributions from 35 authors, edited by J.G.Goldammer and V.Furiaev (details on publication will follow).

The field phase, a large fire experiment (**The Bor Forest Island Fire Experiment**), was conducted in the North of Krasnoyarsk Region (details on Krasnoyarsk Region: see IFFN No.7, August 1992). The aim of the experiment was to investigate a high-intensity stand replacement fire in a boreal coniferous forest, using research methodologies developed in the East and in the West. The experiment took place in July 1993. Research institutions from all boreal countries were represented in the experiment:

- Russian Federation:	V.Furiaev, G.Ivanova (fire ecology), E.Valendik (fire behaviour) and staff, all from the Krasnoyarsk Institute; Nikolay S. Bufetov, Novosibirsk Institute of Chemical Kinetics and Combustion
- Canada:	Brian J.Stocks, Gary Hartley, Bruce Lawson, Canadian Forest Service (fire behaviour); Ross W. Wein, University of Alberta (fire ecology)

- United States of America:	Jim Clark, Duke University (sediment record of fires); Wesley R. Cofer, Loyd Overby, Edward L. Winstead, NASA (atmospheric chemistry); Susan G. Conard, USDA Forest Service (ecology); Thomas W. and Suzanne Swetnam, Christopher Baisan, University of Arizona (tree ring climatology and fire history)
- Finland:	Eino Mälkönen, The Finnish Forest Research Institute (soil sciences)
- Norway:	Stein Manö, c/o Max Planck Institute for Chemistry, Germany (biogeo-chemistry)
- Sweden:	Per Angelstam, Swedish University of Agricultural Sciences (landscape ecology); Anders Granström, Swedish University of Agricultural Sciences (ecology)
- People's Republic of China:	Xueying Di, Northeast Forestry University, Harbin (fire history)

Researchers from non-boreal countries were Hartmut Gossow, University of Vienna (Austria), a wildlife biology specialist, and Johann G. Goldammer, Max Planck Institute for Chemistry (Germany), ecologist and convenor of the conference and the experiment.

A summary of the first findings of this first international and interdisciplinary fire experiment will be published in the Journal of World Resource Review (in press). A special session with the final results of the experiment will be held at the 1995 IUFRO World Congress.

FIRESCHEME: Call for Participation in a Regional Mediterranean Fire Research Project

Fire Information Systems Research in the Ecology, Socio-Culture and History of the Mediterranean Environment (FIRESCHEME) is the suggested working title of a proposed Pan-Mediterranean research project. The project proposal was first discussed at the International Conference on Satellite Technology and GIS for Mediterranean Forest Mapping and Fire Management, 4-6 November 1993, Aristotelion University, Thessaloniki, Greece (see report further below).

The aim of the regional project is to develop Fire Information Systems which include the:

- History, prehistory of fire ecology in the Mediterranean Basin
- History of Mediterranean vegetation and vegetation treatment; potential natural vegetation
- Socio-economical, cultural historical and political background of fires
- Present state of vegetation as related to e.g. wildfire hazard, consequences of fire (e.g. stabilizing and destabilizing effects)

This research should provide basic information for:

- Recognition of the complexity and diversity of natural and anthropogenic fire regimes and fire impacts
- Development of a new valuation of Mediterranean fire
- Incorporation of this Pan-Mediterranean Fire Culture into a Global Cultural and Historical Fire Model
- Contribution to the development of a Global Vegetation Fire Information System (Dahlem Proposal)
- Development of Fire Information Systems as bases for operational fire management decision support systems

The Research is a cooperative multi- and interdisciplinary concept in which, among others, the following disciplines will be involved:

- Ecology, botany, biogeography
- Environmental, social, and cultural history
- Geography, demography
- Atmospheric chemistry, biogeochemistry, climatology

The research must be supported and integrated by advanced methods and technologies, e.g.:

- Remote sensing of the extent, composition and state of Mediterranean vegetation, related to land-use and fire
- Geographic Information Systems (GIS) in which the multitude of historic and present information on vegetation, human impacts and fire will be integrated

FIRESCHEME will be a research activity coordinated with ongoing and planned regional fire research programmes under the umbrella of IGBP/IGAC, GCTE (Global Change and Terrestrial Ecosystems), IUFRO, and IBFRA. IGBP-IGAC-BIBEX Coordinator for FIRESCHEME is Johann G. Goldammer (address on cover page). FIRESCHEME Coordinator is J. M. Pereira (Portugal).

It is planned to convene a strategic planning meeting in the near future. In this planning meeting the draft objectives of FIRESCHEME will be revised and research and cooperation procedures elaborated.

Research institutions and individual scientists are invited to collaborate. Please contact the FIRESCHEME Coordinator:

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South East Asia Fire Experiment (SEAFIRE)

In the second half of the 1990's BIBEX research activities will gradually move East from Africa and South from boreal Eurasia into tropical continental and insular South East Asia. Large-scale forest fire activities in SE Asia first became visible during the extreme drought period of 1982-83 which was related to the El Niño-Southern Oscillation (ENSO) event. The interactions of interannual climate variability and the escalating human pressure on South East Asia's tropical forest resources led to an unprecedented amount of wildfires which severely damaged several million ha of primary and secondary tropical forest throughout the region. Again in 1987 and 1991 smoke emitted from forest conversion fires in Kalimantan (Borneo island) raised international concern about the negative impacts of wildland fire emissions on human health and safety and on atmosphere and climate.

Regularly occurring smog layers over insular and mainland South East Asia consist of a rich bouquet of emissions deriving from a variety of vegetation types:

- Slash-and-burn agriculture: Traditional but expanding small-scale clearing of primary forest and secondary vegetation in the perhumid rain forest zone

- Other forest conversion fires: Large-scale clearcuts of primary and secondary rain forest vegetation and subsequent slash burning for conversion into other land-use types (e.g. exploitation of mineral, coal and oil resources; conversion of natural vegetation into agricultural plantations and man-made forests)

- Regularly occurring fires in seasonally dry deciduous and semideciduous forests (monsoon forests, "savanna" forests) in mainland South Asia

- Regularly occurring fires in the submontane and montane coniferous (pine) forests of insular and mainland South Asia

- Agricultural residue burning, mainly rice straw, throughout the whole region

The use of fuelwood for domestic energy supply is another source of emissions originating from plant biomass burning.

For the second half of the 1990s (ca.1995-1998) the **South East Asia Fire Experiment (SEAFIRE)** will be designed to investigate this highly complex and diverse fire theatre. The aim of the long-term set of experiments will be to identify the magnitude, patterns, quality and impacts of fire on the local terrestrial and regional atmospheric ecology. Unlike the conceptual design of STARE, the SEAFIRE campaign will not entirely be conducted as a set of short-term conducted and directly linked experiments. Infrastructure constraints of observations to be carried out in a variety of countries (Myanmar, Thailand, Cambodia, Laos, Viet Nam, Malaysia, China, the Philippines, Indonesia) will require a multi-year approach. However, it is aimed to concentrate research on a large-scale smog situation over the region. This will require a set of well prepared stand-by instrumentation and personnel.

Scientists from the countries mentioned and representing such disciplines as fire ecology, atmospheric chemistry, climatology, rural sociology, cultural history, etc. are called to send a letter expressing their interest to the coordinator of the campaign:

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

The International Boreal Forest Research Association (IBFRA) was established in 1991 to promote and coordinate research to increase the understanding of: (1) the role of circumpolar boreal forests in the global environment, and (2) the influence of resource management and environmental change on that role. Three priorities are recognized: ecosystem inventory, monitoring and classification; ecosystem function, anthropogenic impacts and global change; and forest management and biodiversity. Coordination of research activities is accomplished through working groups within the priority areas.

Current membership in the Association consists of forestry research organizations in Canada, Finland, Norway, Russia, Sweden and the United States. Research organizations and groups from non-member countries participate at the Working Group level.

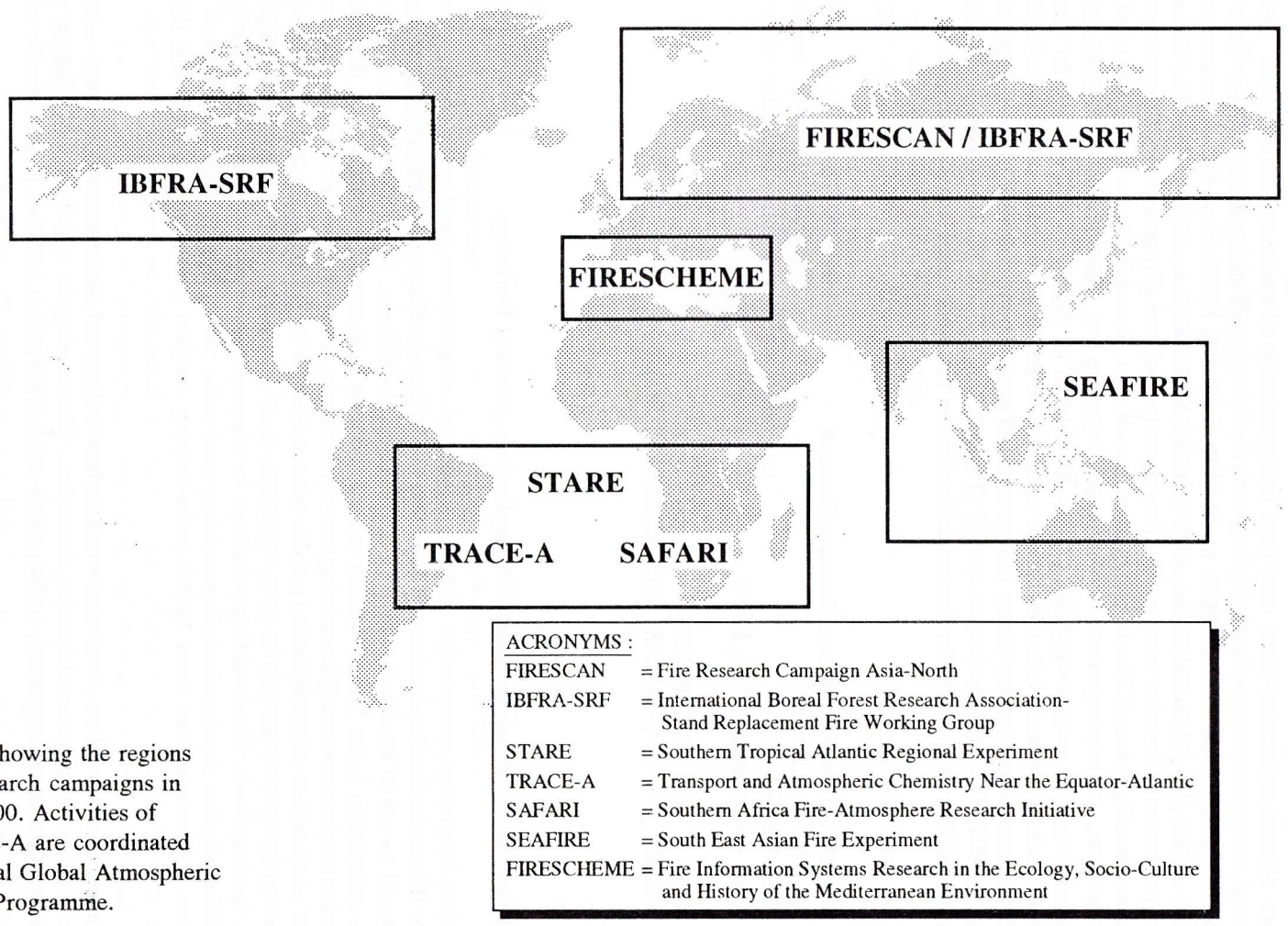

Fig.1. World map showing the regions covered by fire research campaigns in the decade 1990-2000. Activities of IBFRA and TRACE-A are coordinated with the International Global Atmospheric Chemistry (IGAC) Programme.

Source: Max Planck Institute for Chemistry

The Stand Replacement Fire Working Group met in Biri, Norway on 27-28 September 1993 to review accomplishments of the past two years, and to develop plans for 1994-1995. Major accomplishments for 1992-1993 were sponsorship of a workshop on Fire in Ecosystems of Northern Eurasia in Krasnoyarsk Russia, a field campaign to examine a stand replacement fire following the workshop (see report on FIRESCAN), and support for establishment of a satellite receiving station in Siberia to monitor fire (see TAIGA report below).

Plans for the next two years fall into five categories: remote sensing, ecology and biogeochemical cycles, replication of stand replacement fires, modelling, and sponsorship of workshops and symposia. Three activities are planned in remote sensing: (1) work jointly with the Inventory Working Group and the Carbon Working Group to map forest fuels; (2) participate in the NASA, Russian International Forest Institute workshop to produce a science plan for the utilization of the NOAA AVRR data that will be collected at the two Siberian downlink stations to be installed in early 1994 (see report below); and (3) develop a plan to evaluate large fires in the unmonitored portion of Siberia using remote sensed data. Research plots will be established to monitor forest succession, soil respiration and carbon budgets following fire. These plots will be coordinated with the large transects used in monitoring global change. Conduct of an experimental crown fire in Canada is also planned. Evaluation of a multi-index fire danger rating system for the circumpolar boreal forest is planned. The Stand Replacement Fire Working Group will sponsor and participate in a number of workshops and symposia including the IUFRO World Conference in 1993 (Tampere Finland), the NATO workshops on fire, a planned Dahlem Conference on fire, and the Russian conference on fire modelling (Tomsk, 1995).

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Taiga Aerospace Investigations using GIS Applications (TAIGA) Workshop

The TAIGA Workshop, sponsored by NASA's Office of Mission to Planet Earth and the International Forestry Institute (IFI) of the Russian Academy of Sciences, was held to develop a multi-national science plan for study of the boreal forests of Russia. A total of 49 scientists (32 from Russia, 15 from the United States, and 2 from Canada) participated in the 5-day workshop at the IFI offices in Moscow. The impetus for this workshop was the decision to place new satellite receiving stations in Siberia, a region of the world where previous satellite coverage was less than adequate, and to use this increased capability to intensively study the vast boreal forests of Russia to determine their role in global biogeochemical cycles. The first NASA HRPT (High Resolution Picture Transmission) station will be installed in Krasnoyarsk in south-central Siberia early in 1994. Cooperative projects developed at the workshop will make use of both AVHRR (Advanced Very High Resolution Radiometer) data from NOAA polar-orbiting satellites and existing ground and aircraft based datasets.

Three subgroups (Forest Fire, Productivity and Carbon Budget, and Mathematical Modelling) were created at the workshop for the purpose of focusing discussion. After meeting for two days each subgroup submitted a detailed list of proposed cooperative studies which will be finalized as a science plan before the end of 1993.

The Forest Fire Subgroup proposed the following studies, all of which require the extensive use of satellite imagery and Russian forest inventory and ground truth data:

1) Detection and mapping of active fires using AVHRR imagery.
2) Monitoring the spatial distribution of live fuel moisture using AVHRR imagery and ground truth data.

3) Determine the spatial and temporal distribution of ground layer fuel moisture, using satellite and ground station data, and integrate this information using a multi-index fire danger/behaviour system (the Canadian Forest Fire Danger Rating System will be evaluated in this study).
4) Evaluation of lightning risk using AVHRR imagery to track and assess thunderstorms.
5) Investigate the relationship between the atmospheric boundary layer and intense forest fire behavior.
6) Develop an annual inventory and assessment of the area burned by fires in all regions of boreal Russia.

Many of these collaborative Russian/Canadian/United States forest fire research initiatives complement or reinforce a number of studies already planned by the Stand Replacement Fire Working Group of the International Boreal Forest Research Association (IBFRA) and the Fire Research Campaign Asia--North (FIRESCAN) respectively.

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MEETINGS HELD IN 1993

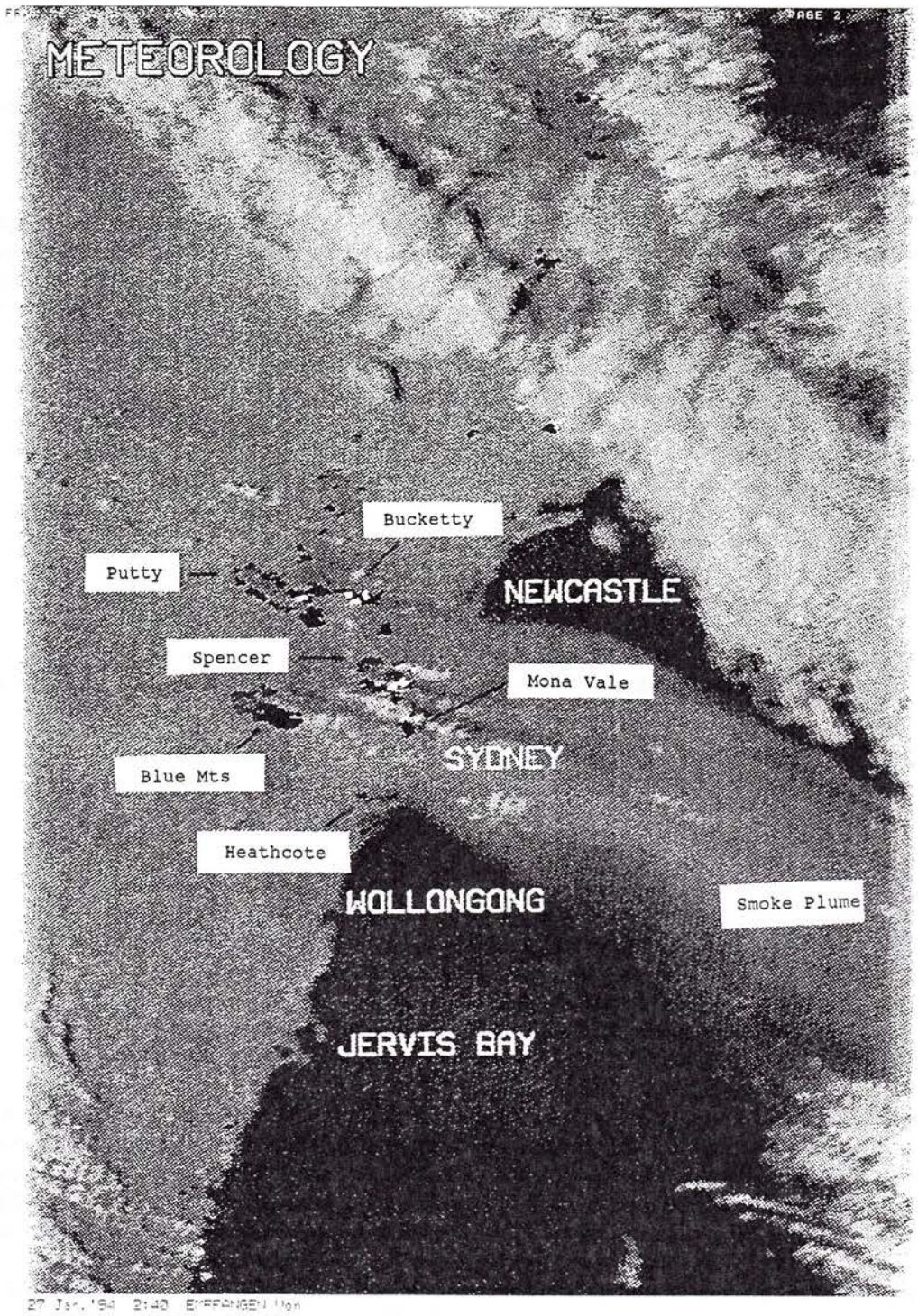
GREECE

International Conference on Satellite Technology and GIS for Mediterranean Forest Mapping and Fire Management 4-6 November 1993, Aristotelion University, Thessaloniki, Greece

This international event was jointly organized by the Department of Forestry and Environment, Aristotelion University (Thessaloniki, Greece), the Joint Research Centre (JRC) of the CEC (Ispra, Italy) and the European Association of Remote Sensing Laboratories (EARSeL; Paris, France). The topic of this conference clearly stimulated a wide interest throughout the scientific, public and political communities of Europe, with the result that there were almost 200 participants from all over Europe and from several institutes in America and Africa.

The large number of participants brought together a wide variety of papers, presented under the two main themes of forest fire management and forest mapping. A total of over 45 presentations adressed such issues as fuel type mapping in Mediterranean forest ecosystems, vegetation degradation, soil erosion and desertification. Within these applications the utility of high and low spatial resolution satellite data and GIS were discussed, together with the potential contribution of new instruments designed for specific forest applications. Other papers described various modelling approaches for fire risk, fire behavior and the impact of fire on the environment.

The final afternoon of the conference was devoted to two discussion sessions addressing the two main themes of the meeting. One of the major concerns of many participants was the need to recognize the complexity of the Mediterranean region. The diversity of species, the social customs regarding the use of fire and the historically varied and continuously growing needs of its population all contribute to the uniqueness of the



The New South Wales Fires of January 1994 as depicted by NOAA AVHRR. This composite image was derived from channels 2 and 3, showing the bushfires around Sydney, on 8 January 1994. The imagery was received at the Bureau of Meteorology (NOAA HRPT Receiving Station, Melbourne) and has been enhanced by computer processing to show the hot spots and associated smoke. The fires appear as black areas to the West and North of Sydney. The smoke plume drifting eastward out to sea appears grey.

Courtesy: John Beard, Satellite Section, Bureau of Meteorology, Melbourne, Australia

Mediterranean region. Proposals to address these difficulties stressed the need to establish better communication between countries, and to initiate joint projects in which experts and scientists from many different fields can work together (see project proposal FIRESCHEME, p.26).

The final discussion on forest mapping focused on the common requirement for creating a European forest ecosystem database. The Environmental Mapping and Modelling (EMAP) unit at the Joint Research Centre (Ispra, Italy) has addressed this requirement by launching a new project entitled FIRS (Forest Information from Remote Sensing). The central aim of this project is to create a forest information data base for the whole of Europe. Two critical issues which were identified as topics needing rapid consideration, were those concerning definition of the users and user requirements, and definition of a suitable nomenclature appropriate for describing forests on a European scale.

In addition to the presentations, a number of companies from Europe and America provided exhibits and demonstrations of their current research or other activities in the fields of forest fire and forest mapping using remote sensing data and GIS. Ten companies, as well as some university departments provided material and on-line demonstrations of new software capabilities which complimented, and in some cases expanded on the information given in the oral presentations.

The proceedings of this conference will be prepared by the EMAP unit at the Joint Research Centre, Ispra. It is hoped to produce the proceedings by spring 1994. All participants will receive a copy, but if any one else is interested in receiving a copy, they are asked to contact one of the following co-organizers of the conference:

Sten Folving, Pam Kennedy (author of this report), and Niall McCormick

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U.S.A.

12th International Conference on Fire and Forest Meteorology
Jekyll Island, Georgia, 28-28 October 1993

The 12th International Conference on Fire and Forest Meteorology featured 39 oral presentations and 66 interactive poster presentations. Presentation topics generally covered wildland fire issues that included fire behavior modelling, fire ecology and ecosystem modelling, quantifying fuel characteristics, and meteorology related to weather forecasting and air quality. The conference was an international gathering with over 180 registered participants representing countries that included Australia, Canada, France, Germany, Hong Kong, Mexico, New Zealand, People's Republic of China, Portugal, Spain and the United States.

The conference was sponsored by:

Society of American Foresters
American Meteorology Society
International Association of Wildland Fire

With supporting participation by:

U.S. Department of Agriculture, Forest Service
U.S. Department of Interior, National Park Service
University of Georgia Extension Service

The conference proceedings will be published and should be available in March, 1994. All registered participants will receive a copy of the proceedings. Additional copies will be available through:

Society of American Foresters
5400 Grosvenor Lane
USA - Bethesda, Maryland 20814

The next (13th) International Conference on Fire and Forest Meteorology is currently scheduled for Melbourne (Lorne), Australia, in the spring of 1995. The principal Australian contact is David Packham in close cooperation with Maria Greenlee of the International Association of Wildland Fire. (Additional members of the conference planning committee are Francis Fujioka, Jack Cohen, Kevin Tolhurst, Mike Whelan, Noreen Krusel, and Lachlan McCaw.)

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and

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ZIMBABWE

Trace Gas Fluxes, Land Use and Climate Change in African Savannas
IGAC-Workshop at Victoria Falls, 2-5 June 1993

This joint IGBP Core Project Workshop was convened to bring together scientists involved in studying various aspects of the savannas of Africa. The objectives were to discuss mutual research interests and to outline a regional research agenda. The workshop focused on land-atmosphere interactions with particular emphasis on sources and sinks of trace gases. Sixty-five international delegates attended the meeting, including representatives from IGAC, GCTE, START, GAIM and IGBP-DIS.

Interests in African trace gas emissions has been boosted by the recent discovery of a seasonal maximum of tropospheric ozone over the southern tropical Atlantic. This anomaly has been linked to land use practices in African savannas resulting in the production and transport of O_3 and OH. Preliminary estimates suggest that biogenic (ruminants, soils and termites) and pyrogenic sources dominate the emissions. The development of a dynamic model of trace gas fluxes which is responsive to interannual variability as well as long term changes in climate is an important interdisciplinary goal for the research community. Such a model needs to take account of primary production, emission characteristics, fire behaviour, land use, herbivory and other aspects of savanna ecosystem function.

The workshop was opened by the Deputy Minister for Environment and Tourism for Zimbabwe, Mrs. O. Rushesha. Representatives from the organising committee then presented the background to the workshop and its objectives. Professor Rosswall outlined the relevance of regional START initiatives, and the activities of the Intergovernmental Panel on Climate Change (IPCC).

The first part of the Workshop consisted of a series of review presentations on the major processes and factors affecting regional emissions. In the second part, discussion groups examined the areas of major uncertainty (namely primary production and land use), focusing on key processes, available data, new data and experimental needs. Another group discussed the design and content of a data and information system for regional emissions.

Subsequent discussion groups addressed specific questions associated with land-atmosphere interactions, and identified key questions, hypotheses and associated experiments under four categories: pyrogenic emissions, biogenic emissions, herbivory and land use. In the final session of the meeting, presentations were made on START activities, and the major field experiments already planned for Africa in the area of land-atmosphere interactions. A proposed research strategy was then outlined based on known proposals and perceived needs.

The meeting was unanimous on the need for a regional effort to compile the existing data and results pertinent to African savannas. This information is currently scattered throughout the region in the grey literature and in national holdings, with additional relevant data collected by the international projects DECAFE (Dynamique et Chimie Atmosphérique en Forêt Equatoriale) and SAFARI (Southern African Fire-Atmosphere Research Initiative). Quantification of the distribution and timing of fires is now possible through the use of daily coarse-resolution satellite data. Our knowledge of the distribution and rates of land use change in Africa can also be much improved using the 20-year record of high resolution satellite data. The human dimensions of the research questions were identified, including the need to locate and compile up-to-date data on population, fuelwood consumption and charcoal production within the region.

The meeting promoted the necessary interdisciplinary dialogue between the atmospheric, ecological and social science communities, and between field researchers and modellers. It exposed individual research efforts to a broader community; in addition, several new experiments were proposed, and ways to strengthen planned studies were discussed. The meeting laid the foundation for a regional research programme that would also have national relevance, assisting in national assessments of greenhouse gas emissions for the IPCC.

The advantages of an African research initiative were apparent from the meeting, as was the need for the increased involvement of regional scientists at all levels within such a programme. There may be difficulties in obtaining funding for interdisciplinary and regional scale studies; nevertheless, the regional nature of the research questions, the requirement for regionally applicable methodologies and the limited human resources to conduct the research are very strong arguments for such an approach.

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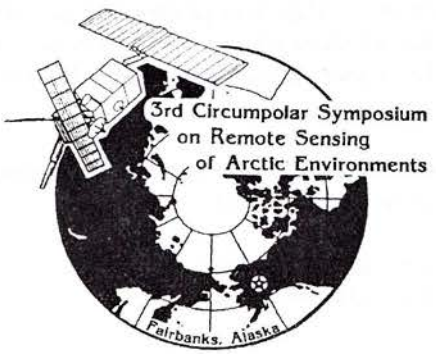
MEETINGS PLANNED FOR 1994-95

U.S.A.

The Third Circumpolar Symposium on Remote Sensing of Arctic Environments
16-20 May 1994, Fairbanks, Alaska



As one of the most remote portions of the earth, the Arctic is a land of extreme climatic cycles. These rigorous environmental conditions have helped to keep the Arctic pristine and sparsely populated with little industrial or agricultural development. However, changes in factors such as global climate, a growing global population, pollution and improved transportation systems are affecting the Arctic and Antarctic. Satellite and airborne remote sensing systems are valuable sources of data when used to study and to monitor the polar regions. More conventional data collection and analysis methods are often hindered by the environmental extremes, geographic vastness, and logistical expenses involved in polar research. Thus, remotely sensed data now are beginning to play a critical scientific and operational role in the Arctic and the Antarctic.

With this in mind, the Third Circumpolar Symposium on Remote Sensing of the Arctic Environments will be convened in Fairbanks, Alaska, 16-20 May 1994. Discussion topics (including Remote Sensing of Arctic, Subarctic and Antarctic Regions) will be:

- Atmosphere	(Ozone, Circulation, Chemistry, Dynamics)
- Biology	(Tundra, Boreal Forests, Vegetation)
- Ecology	(Wildlife Habitats, Herding)
- Frozen Ground	(Permafrost, Solifluction, Rock glaciers)
- Geology	(Landforms, Volcanoes, Lineaments)
- Hydrology	(Aufeis, Lakes, Rivers, Flooding)
- Nat. Resources	(Northern Shipping Routes, Timber, Coal, Mining)
- Oceanography	(SST, Circulation, Ocean Color, Fisheries)
- Pollution	(Arctic Haze, Radioactive Wastes, Oil Spills)
- Snow and Ice	(Glaciers, Sea Ice, Lake Ice, Ice Sheets, Ice Shelves, Icebergs)
- Social Sciences	(Polar Inhabitants, Policies, Geography)
- Technology	(Sensors, Algorithms)

Fore more information contact:

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Geophysical Institute	
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PORTUGAL **2nd International Coimbra Conference on Forest Fire Research**
21-24 November 1994, Coimbra

Objectives

Following the First International Coimbra Conference on Forest Fire Research that took place in November 1990, a Second Conference is announced for November 1994. The scope of this conference is to bring together scientists from Europe and other parts of the world working on various aspects of wildland fires, and encourage the presentation of results of scientific research, discussion of methodologies and the increase of international cooperation. The format of the conference will be basically that of its first edition, with two or three days of formal sessions and a guided tour. Formal sessions will include keynote lectures by invited speakers, round-tables and presentation of papers by the authors.

Subjects

Various areas of this multidisciplinary problem are covered in this conference. Papers or posters dealing with subjects related to forest fires on a scientific basis are welcome. Although there are not restrictions on the topics to be covered, the following are given as a guide line: Fire Behaviour, Fire Weather, Fire Effects, Human and Institutional Factors.

Deadline for submission of abstracts had been 31 December 1993 (see IFFN No. 9, July 1993). However, those interested to attend the conference or wishing to receive information should contact:

Grupo de Mecânica dos Fluidos	Phone: (++351) 39-34339
Departamento de Engenharia Mecânica	Fax: (++351) 39-22268
Faculdade de Ciências e Tecnologia	
Universidade de Coimbra	
P - 3000 Coimbra	

RUSSIAN FEDERATION

International Conference on Forest Fire Modelling
June 1995, Tomsk, Russian Federation

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

In order to avoid conflicts with the time schedules of the IUFRO World Congress and the planned IBFRA fire experiments in Canada during the 1995 fire season, the conference may be held in June 1995.

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

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

Detailed information on the session of Subject Group S1.09-00 Forest Fire Research is given under "News From Research" (page 23-24).

Call For Cooperation

Fire and Rare Plants: An Annotated Bibliography in Progress

The National Biological Survey, the National Wildlife Refuge System, and The Nature Conservancy are cooperating in the development of a bibliography on the effects of fire on rare plants, including those federally listed as endangered or threatened, or Category I candidates for listing. We would be interested in any information for such plants in the United States including Alaska and Hawaii, even if only anecdotal, that you can provide. Please respond to:

Susan Spackman

Colorado Natural Heritage Program
c/o University of Colorado Museum
Hunter 115
Campus Box 315
USA - Boulder, Colorado 80309-0315

Argentina: 25 Firefighters Killed in Blaze

A fire on a private property, 15 km W of Puerto Madryn (near Rawson, Province of Chubut) was first reported by the rural farm worker Vicente González, on Friday 21 January 1994, at 13:30 h. The fire was burning in the typical Patagonian brush vegetation. At the time of reporting the fire front had already reached a size of 5 km and had been running for more than 12 km. Flame lengths were up to 20 m, and the rate of spread was ca. 10 m/min. The wind was strong. No more meteorological details are known so far.

The investigations by the government are not terminated. According to inofficial information the voluntary fire brigade of Puerto Madryn was the first group to reach the fire scene. In a radio message they told the fire department that the wildfire was under control. The next radio message reported a wind shift, and the fire started a hot run. Obviously the volunteers were trapped by the fire when flame length reportedly developed up to 100 m. Windspeeds in gusts reached 100 km/h and caused multiple spotting fires. After the radio contact with the fire brigade center had been interrupted all available forces, including the Civil Defence and the use of heavy equipment, were sent to the scene to fight the fire. They were not able to evacuate the trapped fire brigade. On Saturday the burned corpses of 25 people were found. On saturday night the fire was extinguished by rain. The total area burned was 15,000 ha.

The voluntary fire brigade was completely killed. The tragedy is that the youngest victim was only 11 years old, the oldest 24 years, and 9 of the kids were below 16 years, including a girl. Most likely they were on their first hot wildland fire assignment, and they did not have the necessary experience.

Source: Report by P.Cwielong (CIEFAP, Esquel, Chubut) and
the daily newspaper "El Oeste" (Chubut) of 25 January 1994.

LAST NOT LEAST: FROM THE PRESS

German News Agency DPA Reports (11 January 1994): "Red" Adair Retired

Nobody else in the World has been so close to hell like Paul Neal "Red" Adair. For more than half a Century Red Adair had been fighting oil well fires by explosives, water, and the courage and great spirit of a firefighter. Several days ago the 78-year old fire specialist sold his company which he had taken over from Myron Kinley, another well known fire expert, in 1959. He received worldwide attention after he extinguished a burning oil well which ejected its inferno more then 135m high in the Sahara desert in 1962. After the Gulf War of 1992 Red Adair assisted the Government of Kuwait to extinguish the oil fires ignited in the final days of the war.

Reply form to be Used to Express your Opinion on Restructuring of IUFRO

To Johann G.Goldammer, Chairman, IUFRO Subject Group S1-09 Forest Fire Research, Fire Ecology Research Group, c/o University of Freiburg P.O.Box, D-79085 Freiburg GERMANY, Fax: + +49-761-808012

From: .....

Address: .....

.....

..... **Fax:** .....

In accordance with the proposed reorganization of IUFRO Division I my suggestions are the following (check and/or add suggestions):

O **S1-09 structure to be maintained as functioning at present Yes / No**

O **Following Working Party/Parties should be dissolved (see list on page 25):**

O .....

O **Following new Working Party should be proposed to IUFRO World Congress (Tampere, Finland, 1995)**

O .....

O .....

O **Tasks of S1-09 should be restricted to following subject areas:**

O .....

.....

O **If you think Subject Group S1-09 should be dissolved, give reasons and/or alternative suggestions (additional comments or suggestions on separate sheet):**

.....

.....

.....

Signature: .....

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