FIRESCHEME

Fire Information Systems Research in the Socio-Culture, History, and Ecology of the Mediterranean Environment

Initial Thoughts to the Development of a Pan-Mediterranean Fire Research Project

Compiled by

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Content

1. What is FIRESCHEME?

Fire **I**nformation Systems **RE**search in the **S**ocio-**C**ulture, **H**istory, and **E**cology of the **M**editerranean **E**nvironment (FIRESCHEME) is an international multi- and interdisciplinary project, which aims to illuminate the human impact on fire regimes in the Mediterranean Basin. The objective is to develop Vegetation Fire Information Systems (VFIS), which include

- History and prehistory of land use
- Development and treatment of Mediterranean vegetation and potential natural vegetation
- Socio-economic, cultural, historical, and political background of fires
- Present state of vegetation as related to e.g., wildfire hazard, consequences of fire
- Contribution of Mediterranean wildland fires to regional atmospheric chemistry during the fire season
- Management prächtiges

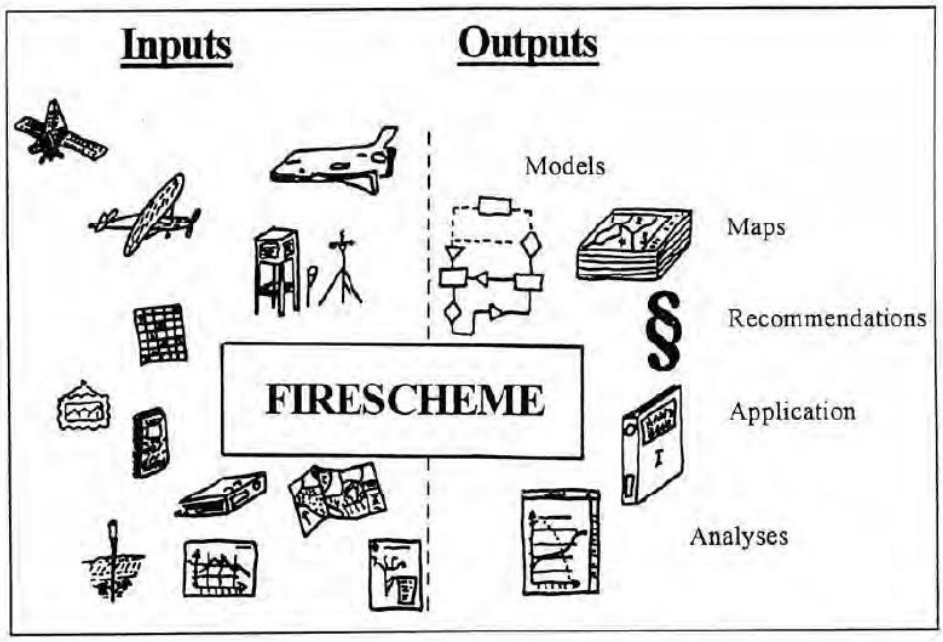

Fig. 1: Input and output factors of FIRESCHEME.

The systems shall not only show the complexity and diversity of natural and anthropogenic fire regimes and fire impacts, but also contribute to the

- Development of a new valuation of Mediterranean fire
- Delivery of data to a Global Cultural and Historical Fire Model
- Development of a Global Vegetation Fire Information System (GVFIS)
- Delivery of data to regional and global atmosphere and climate models
- Operational fire management decision support systems

The research must be supported and integrated by advanced methods and technologies used by the scientific disciplines involved, such as remote sensing and Geographic Information Systems. "We still need to develop more sophisticated answers to meet the needs in the coming decades.

This may require rethinking some of our approaches, redesigning some of our methods, and reconstructing our research. Answers must become more realistic and nondeterministic; approaches more integrative and holistic" (Martin 1990, Round Table 1-4).

FIRESCHEME will be a research activity coordinated with ongoing and planned regional fire research programmes under the umbrella of IGBP/IGAC[1], GCTE (Global Change and Terrestrial Ecosystems), IUFRO, and IBFRA. Until further decisions will be made by the FIRESCHEME Science Team, J.M. Pereira (Portugal) will be available as technical coordinator and liaison to IGBP/GCTE, and J.G. Goldammer (Germany) as liaison to the ongoing regional and global fire research campaigns under the programmes of IGBP/IGAC/BIBEX, and IBFRA.

2. The Human Impact on Fire Regimes in the Mediterranean Basin

The Mediterranean Basin can look upon a very long history of human settlements and land use. From the first hints of hunters (300,000 years ago) to our days many different cultures and civilizations (Persian, Egyptian, Hellenic, Roman, Byzantine, Islamic, Capitalism, and international tourism) have established their typical land-use systems and therefore changed natural ecosystems completely. The evidence of anthropogenic ecosystem modification can be found up to the most peripheral sites of the region. "Europeans burned woods as well as heath and moor to improve pasture and range. … They burned agricultural fields and gardens. Until very recently, agriculture, after all, was rotational, because either it moved the farm through the landscape or because, in effect, it moved the landscape through the farm; both forms demanded fire. Europeans adapted slash-and-burn farming into slash-and-burn forestry. And so it goes" (Pyne 1994, 897).

Fire has been identified as a natural process in dry and semi-dry landscapes, which keeps vegetation forms in a dynamic equilibrium, guaranteeing the maintenance of biodiversity, the release of nutrients, and elimination of dead or otherwise not usable plant material. Since hominids and humans learned how to handle fire, they have used it in different ways: "Humans purposefully set fires to increase food choice, to facilitate the gathering of edible plants, and to attract and hunt games" (Perles 1977, cited after Trabaud et al. 1993, 278). The domestication of animals and agricultural expansion promoted ignition in order to clear and fertilize wide areas. At the same time, biomass fuel was collected for heating and cooking. "The development of all human cultures was dependent on the free burning of vegetation and on the use of plant biomass to provide energy" (Goldammer 1993, 3).

The introduction of exotic plant species and plantations, excessive wood cutting (deforestation) and increasing grazing pressure changed the natural fire regimes entirely. "Humans are a principal force that shape the size, frequency, and severity of fire on Earth. They directly impact the biota by accelerating, modifying, or excluding fire from ecosystems" (Kauffman et al. 1993, 375). The cultivated and densely populated landscape ecosystems of the Mediterranean Basin have been in an equilibrium, which was based on human activities. Two recent tendencies, which have started at almost the same time, have changed deeply the existing "Total Human Ecosystem" (Naveh & Lieberman 1994) and modified the artificial but well-balanced fire regime:

[1] For acronyms see Figure 1 in the Annex

- The shift from burning wood to fossil fuel combustion
- Urbanization.

As has been stated by Kauffman et al. (1993, 375) "the shift from burning wood to fossil-fuel combustion has dramatically changed human society, the biota on Earth, and the chemical composition of the atmosphere". The accumulation of fuel material in Mediterranean shrub and forest lands that was previously used for heating and cooking has increased the fire risk and the intensity of wildland fires. The abandonment of forests and fields as a result of the ongoing migration process from peripheral regions into cities has also led to an increase of fuel material and to an expansion of fire-prone areas. Afforestations with highly flammable pine and eucalyptus forests on former agricultural and pasture lands have also increased fire hazard. Recently recreation activities, the development of urban sites in woodlands (tourism and residential housing), and the misuse of fire-setting as a political device have raised the probability of ignition.

The contemporary fire regimes of the Mediterranean Basin are entirely human-made. This is why "the protection against forest fires needs to recognize two facts:

(i) Fire is an integral factor of the Mediterranean ecosystems, because of the climatic and demographic conditions of this region.

(ii) The worsening of the situation has a socio-economic origin" (Vélez 1993, 20).

Therefore, it is mostly astonishing that the eco-subsystem "society" is still treated marginally in both fire prevention policy and fire ecology research.

3. Research Needs

In the last decades, many efforts have been made in the Mediterranean to collect data regarding ecosystem response to wildfires as well as fire behavior. Danger-rating systems have been installed; models for simulating fire behavior and for detecting fire-prone areas (e.g., BEHAVE, CARDIN) have been elaborated. At the same time firefighting techniques have improved, the amount of well-trained personnel has increased, detection and monitoring networks have expanded, and aircraft, helicopters, and modern fire patrol vehicles have been made available. But "in spite of the efforts and expenditures on fire suppression, wildfires in the Mediterranean are becoming more frequent and devastating" (Naveh 1990, 1).

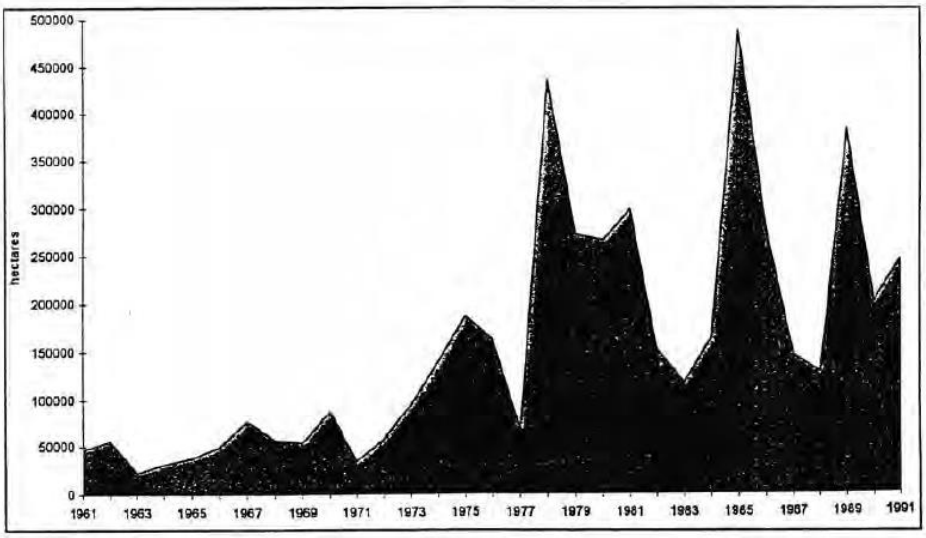

Fig. 2: Land area affected by wildfires in Spain 1961-1991 (Sources: ICONA 1981, ECE/FAO 1984, FAO 1992).

Fire ecology research still concentrates on the natural causes of wild fires (climate and weather conditions, vegetation composition and fuel development, topography), on fire behavior (simulation), and on fire impact on the ecosystem (monitoring of vegetation succession and soil characteristics, atmospheric deposition), whereas the social impact on the fire regime is treated marginally by researchers. This is not easily understandable in recognition of the fact that fire conditions in the Mediterranean Basin are primary anthropogenic (land use) and that ignition is estimated to be 95%-99% human-caused. One conclusion of a workshop of the European Parliament about forest fires in Southern Europe lapidarily states: "Le besoin se fait sentir d´intégrer également les phénomènes socio-économiques (dont utilisation des terres et comportement des populations) dans la recherche scientifique sur les feux de forêts" (Parlement Européen 1993, 92).

Investigation of fire behaviour and fire impacts on ecosystems is undoubtedly very important. But knowledge about the human impact on fire and fire regimes, about the correlation of land use and fire regimes, about arson in relation to political and economic situations, about cultural, ethnological and psychological factors of ignition, about the history, the present and the future trends of those anthropogenic factors that determine fire regimes is essential. For effective and long-term prevention against wild fires, research must fill this gap in present fire ecology studies. It has to be made clear what are the main determining human factors in producing high fire risk and uncontrollable fires.

Moreover, international exchange and cooperation of fire research groups seem to be very unsatisfactory. "*La coopération internationale à ce sujet (forest fires) est loin d´être satisfaisante. En dépit de l´ampleur de la tâche à remplir par la recherche sur les incendies, les efforts sont considérablement dispersés et les échanges, extrêmement réduits et hasardeux*" (Parlement Européen 1993, 93). "To address the complex and far-reaching issues related to anthropogenic impacts on fire regimes and ecosystem properties, formulation of a truly interdisciplinary approach is critically needed" (Kauffman et al. 1993, 387).

Efforts have to be made to investigate the impact of society on wildfires, to promote international cooperation and exchange of knowledge, to compare different fire regimes created within the same ecosystems but with different land-use systems, and to analyze future tendencies. FIRESCHEME shall be one step into this direction.

4. The Applicability of the Results – or: Why Research?

"*Il y a là un fait terrible: nous ne savons pas de façon officielle claire quelles sont les racines du problème» (of the fires). Or, pour pouvoir résoudre ce problème, nous devrions d´une certaine façon d´abord avoir une bonne approche, un bon diagnostic du phénomène, de ses ressorts, pour intervenir de façon ciblée et pour activer la prévention*" (Leone 1993, 48). "*La prévention des incendies restera vouée à l´échec tant qu´elle ne sera pas directement adaptée aux causes*" (Alexandrian & Gouiran 1990, 41). "En effet, en l´absence de toute étape de vulgarisation, on ne voit pas très bien ce qui peut transformer les résultats scientifiques de projets de recherche en indicateurs directement applicables pour les services opérationnels de prévention et de lutte" (Parlement Européen 1993, 93).

Politicians and managers ask for research that clarifies the reasons for the increase of wildfires and that is applicable and politically acceptable. They request background analyses and practical suggestions. Research results should lead to recommendations for application: Realistic recommendations for land-use systems have to be made. The way has to be shown by what political devices (e.g., laws, subsidies, education) the stated objective can be achieved. Key questions have to be asked and answered. By understanding the anthropogenic background of fires we will be able to think about solutions to the problem. This will enable managers and politicians to enact an effective prevention policy.

Fire ecological research will have to include economic, social, cultural, historical, ethnological, and psychological factors of the "Total Human Ecosystem" (Naveh & Lieberman 1994). All the parameters that influence and interfere with fire regimes have to be investigated and analyzed. High levels of interdisciplinary and international cooperation will be demanded - a challenge to the research community.

5. Content of FIRESCHEME

5.1 The System and the Model

In order to be able to predict fire regime tendencies, to detect fire-prone areas, to launch sound fire prevention measures, and to understand fire behavior, complex models are required. A lot of investigation has been executed within this scope, and many different models are available. Most of them concentrate on those subsystems of the ecosystem that include biological and geographical data. Meteorological values, vegetation and fuel factors, and the georelief deliver the main input parameters for the common models (e.g., BEHAVE). But remembering statements made, for example by R.Vélez (1994, 273) – "The forest fire problem has an essentially human origin component which has to be dealt by sociological approaches" - one can ask why so few models contain anthropogenic system parameters.

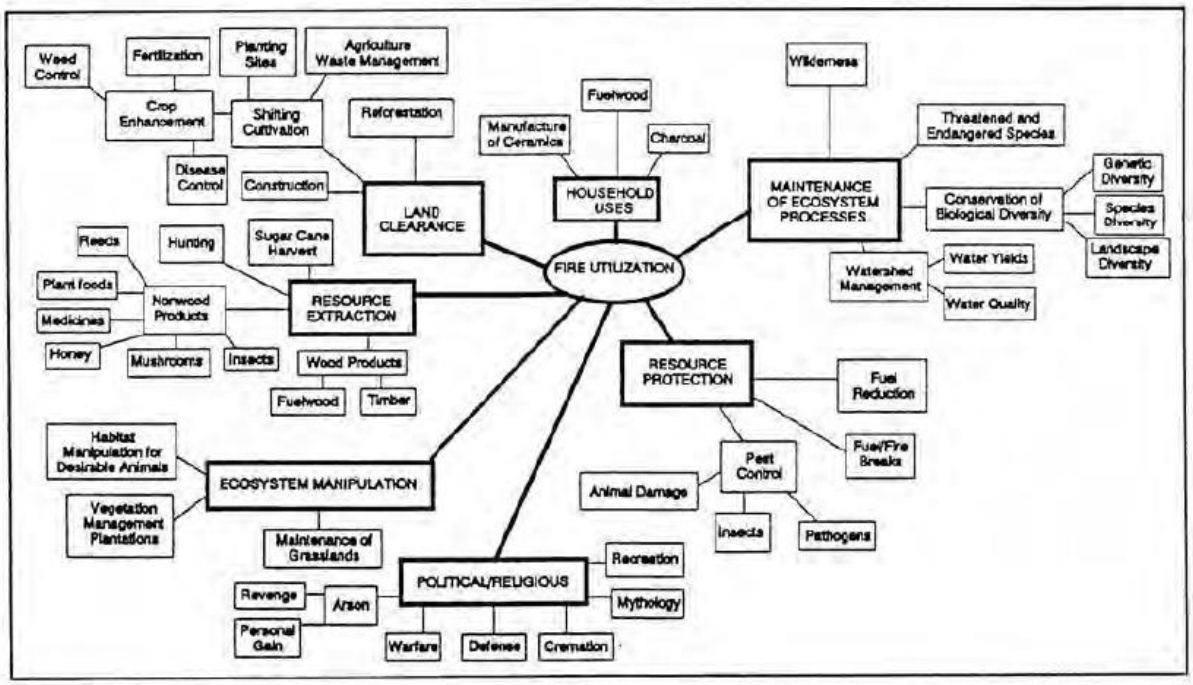

Fig. 3: The global uses of fire by humans (Kauffman et al. 1993)

One problem is the fictitious incompatibility of the type of data required by mathematical models and the type of data delivered by sociologists, historians, and ethnologists. Another problem is the reluctance for interdisciplinary cooperation within the research community. Researchers nowadays tend to restrict themselves to details within their scientific scope and to consider every possible aspect of each detail. But the more perfect the subsystem models are, the greater the risk that they cannot be integrated into a general/complete system. Moreover, the complete model has to reduce its level of quantitative characterization to the level of the least figured one (Leser 1991). One of the least figured systems in fire ecology is the human subsystem. Making other subsystems more perfect will not improve the complete model as long as anthropogenic factors remain neglected.

"A sizeable body of work on fire has concentrated on individual events and on the characteristics of the burning process itself; there is now a recognized need to produce assessments of the characteristics and effects of fire at hitherto unexplored scales. This calls for a better understanding of burning on regional and global scales, a better appreciation of historical changes that have affected the use of fire during various periods of human history, and, if possible, improved predictable capabilities to chart future trends and possible impacts" (Malingreau et al. 1993, 329). "...Research is needed to develop fire models that link spatial scales. These models must be developed with the capacity to account for the evolution of changing cultural, economic, atmospheric, and biological conditions. ...Trade-offs of ecological effects, altered fire regimes, and ecosystem properties between the use of fossil fuels and the traditional role of biomass burning must be described. These include costs and benefits of land-use practices on the atmosphere, biota and humans at local, regional, and global scales " (Kauffman et al. 1993, 388).

All these problems should not produce a hopeless feeling, but should be an encouragement to tackle the task. Anyway, before thinking of how to integrate anthropogenic data into a coherent and realistic operational system we should think of what parameters are needed in order to

understand the human impact on fire regimes. The input data are derived from research results (i.e., model development), and there is still an immense scientific backlog of demand. "The body of knowledge currently available to address the human role in the use of fire has been driven by a variety of land-use, scientific, and cultural objectives. As such, there has been no overall strategy for data collection.... identification and investigation of the critical gaps in our knowledge concerning the human role in shaping fire regimes, ecosystem properties and climate are particularly important" (Kauffman et al. 1993, 387).

5.2 Land Use and Vegetation

Land use is the general term for human activities on earth surface. It includes agriculture, silviculture, pasture, settlements, networks of communication, recreation areas, and so forth. Through using the landscape – extensively or intensively – mankind changes the land´s natural potential and with it also the natural fire regimes. The manner of land use is usually a combination of tradition and history, economic constraints, technical and financial possibilities, natural deliminations, cultural and psychological motivations, the means of land possession, and politics.

Of course, the changing of natural fire regimes is very obvious in **forestry**. By planting or cutting woods, by collecting fuel biomass, by fighting wildfires, and by setting woodland on fire both purposely and accidentally, the natural equilibrium of the forest ecosystems has been disturbed and has been replaced by entirely human-made ones.

In the Mediterranean Basin, **pastoralism** still plays an important role. Through setting fire to natural forest and brush humans gain pasturages, while repetitious grazing selects plant species and prevents maturation of vegetation. Overgrazing has been recognized as one of the most destructive processes to the Mediterranean environment. The importance of livestock for the ecosystem - "by converting the plant biomass into excreta and animal tissues, the decomposition of which is by far easier and faster" – has been shown for Greece by Liacos (1988, 169), for France by INRA (1990), and for Spain by Rodríguez (1985). Liacos concludes that "animal grazing of the understory vegetation, carried out in a rational way, constitutes a very efficient tool for eliminating fuel accumulation on the ground surface..." (Liacos 1988, 174).

The third area-wide land use in the Mediterranean is **agriculture**. By clearing surface cover in order to receive arable lands, farmers stopped natural burnings and replaced them for occasional prescribed burns. The migration of the rural population from peripheral regions into cities and the abandonment of traditional agriculture have made possible the reinstallation of brush and forest lands - and with them the return of fire risk.

Forestry, livestock farming, and agriculture – as area-wide activities – influence to a highest degree the actual fire regimes. These activities are dependent on social and economic factors. Determination and analysis of these factors should be a major task for the research community. In order to approach economic and political factors of land use and fire regimes, the following questions should be answered:

- How does the decision making process in land-use planning work?
- What laws are involved in this process?
- What are the institutions involved?
- How is the economic market (e.g., EU) exerting pressure on traditional and existing

land-use systems?

- What will be future tendencies?
- What kind of socially acceptable land-use practices would keep the biomass fuel at acceptable levels of low-fire hazard (e.g., prescribed burning, prescribed grazing)?

Fig. 4: Carefully planned utilization of phytomass by grazing and browsing animals (=prescribed grazing) and reduction of highly flammable fuel by controlled fire (= prescribed burning) contribute to the restoration of a stable equilibrium between biomass productivity and fire risk.

Inventories of the vegetation structure – received by remote sensing and field work – are very important devices in monitoring fire risk and fire behavior. In addition to completing those ongoing projects that concern vegetation data collection, importance should be attached to following questions:

- What is the social and economic interest in existing vegetation (structure and species)?
- What is the fire adaption of socially and economically desirable plant species?
- How did history and land use influence vegetation composition?
- What are the ethnic, cultural, and psychological motives behind the human creation of different vegetation formations?
- What could be socio-economically compatible alternatives of less flammable vegetation to the existing one?
- What kind of natural firebreaks are socially acceptable?
- What other interests besides the reduction of fire hazard could society have in vegetation pattern diversity (e.g., biodiversity, recreation activities, hunting)?

By answering these questions, we will be able to determine the human impact on plant composition and to give sound recommendations for a socially adapted but less fire-prone vegetation. The analysis of vegetation is also closely connected with the land use. As a result of investigation in the impact of land use on fire regimes, suggestions for less fire-favoring and more socially acceptable patterns of land use should be made. This could happen through both general and specific terms (e.g., national agriculture policy, land-use maps of a region), by consulting responsible institutions (e.g., the fire risk of different plantations), and by advising politicians (e.g., laws).

5.3 Population

Population and land use are correlated systems. Not only the quantity of human beings, but also their distribution and the quality of their action and interaction determine land use. Settlements and communication networks cover more and more of the earth´s surface. Metropolitan areas expand while at the same time rural homes are mostly constructed within woodlands. The wildland/residential interface shows an increasing disaster risk. Investigations have shown "a significant conformity" of burnt areas "with the areas where an important, demographical unbalance has penetrated and become accentuated" (Delgado 1990, A.11-1).

The expansion of recreational uses in the forest - mostly in times of high fire risk - leads to an increase of potential ignition sources. This new tendency of residential urbanization and tourism in "natural" woodlands has risen the peril of careless ignition. Additionally criminals have discovered in arson a means of reaching their aims (vengeance, delinquency, speculation). There is abundant evidence that social and political unrest leads to an increase of arson fires. Examples from Greece, Cyprus, and - recently - Algeria show that domestic political problems are well reflected by forest fires.

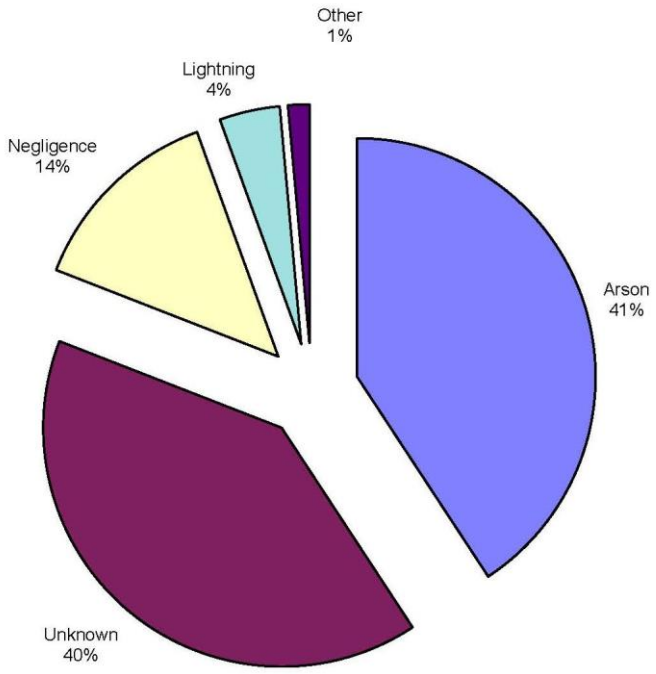

Fig. 5: Fire causes in Spain 1983-1992 (Source: ICONA 1994).

In order to effectively prevent wildland fires, the reasons why they exist and spread have to be clarified. "La prévention des incendies restera vouée à l´échec tant qu´elle ne sera pas directement adaptée aux causes" (Alexandrian & Gouiran 1990, 41). Demographical and political analyses, inquiries in behavior of individuals and societies, inventories of urbanization, and plans of development need to be carried out. This requires a broad cooperation of various social scientists and geographers. Moreover, the results of such a research should be prepared in forms not only suitable for integration into research models but also for teaching and public enlightenment.

5.4 Culture and History

"Wholesale anthropogenic modification of the biosphere did not begin with the industrial revolution or with the neolithic revolution but with the hominid revolution announced with promethean splendor by the capture of fire" (Pyne 1994, 889). Being conscious of the importance of human impact on fire regimes, it is hard to understand why Mediterranean fire ecology research has neglected the cultural and historical aspect of the topic for such a long time. "An understanding of fire history is necessary to ascertain future effects of anthropogenic fire on the environment and atmosphere. ... Such studies should include the cumulative influences of past burning practices and current fire regimes, and they should seek to establish trends that can be projected into future scenarios for societies and the ecosystems they inhabit" (Kauffman et al. 1993, 387).

The comparison of different eras and/or different cultures would help illuminating the human impact on fire. Questions should be asked and answered such as following:

- How did fire regimes change within key epochs (Roman Empire, Islamic expansion, end of pre-Columbian period, industrial period)?
- What is the cultural impact on wildfires?
- How do differing land-use systems affect fire regimes in naturally similar but culturally different landscapes (e.g., Southern Spain and Northern Africa).

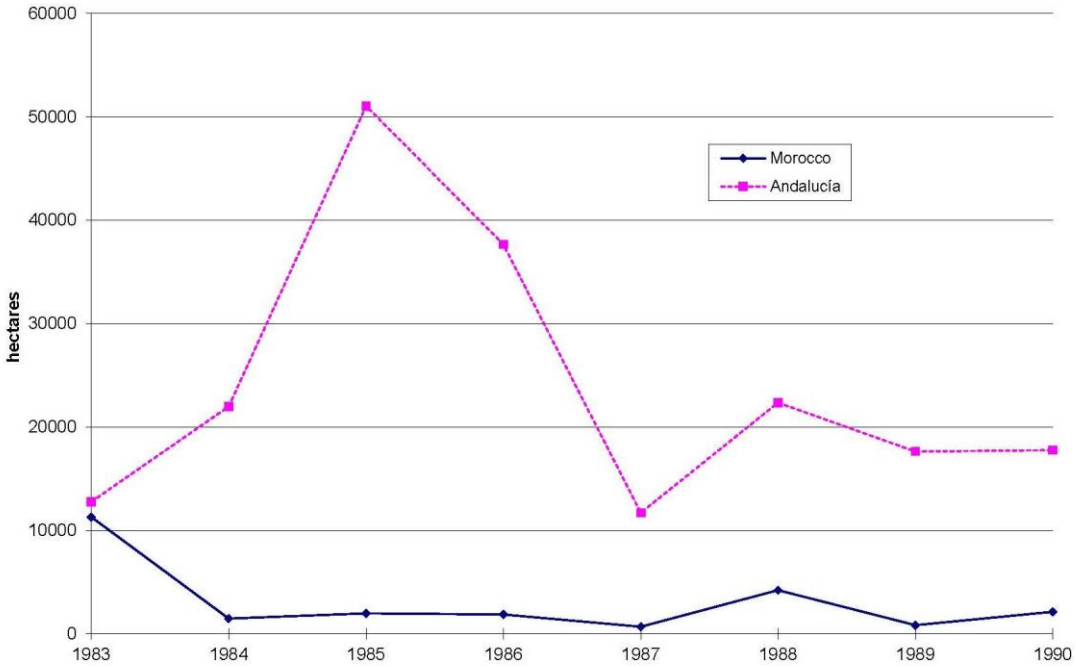

Fig. 6: Burned areas in Andalusia and Morocco (Source: FAO 1992, ICONA 1994).

Research that seeks answers to such questions has to deal with a broad spectrum of scientific methods and strategies. Every data set – charcoal, fire scars, ethnographic accounts, forest stand structures, paintings, census statistics, literature, government reports, etc. – has to be taken into account. Sophisticated technologies and traditional concepts as well as the natural and social sciences should be complementary. One of the biggest problems of such an investigation may be the exchange and accession of dispersed data.

5.5 Socio-Economics and Policy

"Forest fires are not an autonomous phenomenon, but a symptom of socio-economic problems" (Vélez 1993, 20). Depopulation of rural areas, the relinquishing of traditional agriculture, pasture, and silviculture, recreational activities, urbanization, arson, and so forth are the results of the socio-economic situation that confronts the Mediterranean population, and these considerations must frame any policy of fire management. The governmental support of fossil energy, for example, has displaced traditional fuels, which now remain in the forests. The subsidy of intensive mass production gives way to the abandonment of peripheral and multifarious agriculture.

A political decision might influence fire regimes in a way that can scarcely be foreseen when released. Goldammer (1988) lists some legislation and regulations related to forest fires. It is amazing how multiple are the direct impacts of policy on fire regimes. How much more involved must be the indirect impact, usually through the device of economic regulations. There should be analyses pointing out the effect of political decisions on fire regimes. Moreover, the causes of incendiarism have to be clarified and the motives eliminated. Social, political, and psychological analyses are needed and such scientists should work together with the fire ecological research community toward common solutions.

5.6 Influence of Wildland Fires on the Mediterranean Atmospheric Environment

The emissions from combustion of plant biomass and the role of these emissions on biogeochemical cycles and the regional atmosphere must be clarified. However, compared to other regions of the world, the Mediterranean fires contribute only a small fraction to the globally emitted trace gases and aerosols from vegetation fires.

A quick calculation highlights the quantitative role of vegetation fire emissions. The annual average burning of ca. 600,000 ha of forests and other lands, providing ca. 15 metric tonnes (ovendry weight) of plant biomass per hectare available for combustion would result in a release of ca. 4.5 million tonnes of carbon, either in the form of various trace gases, aerosol, or ash residuals.

Emission studies of Mediterranean fires have not yet been undertaken. The basic emission factors are therefore largely unknown. Secondary processes, e.g., the pyrogenic smog formation with products of photochemistry (e.g., ozone), have not yet been quantified. The importance of particle emissions to Mediterranean haze, visibility problems, etc. are unexplored. Other factors of interest are related to the regional transport processes of pyrogenic emissions within the Mediterranean Basin and in interconnection with neighbouring regions.

Emissions from wildland fires in the Mediterranean region are traditional part of the atmosphere. Before the beginning of the industrial revolution, the free-burning vegetation fires and the use of biofuels were the exclusive source of combustion products. The atmospheric environment of the industrial age is different because of the predominant role of fossil fuel combustion and the release of human-made chemical constituents. The relationships between vegetation fire emissions and modern technogenic emissions need to be clarified.

6. Operational Steps: Definition of Objectives, Planning and Implementation

The objectives of FIRESCHEME are not yet defined in detail. The definition will depend on the inputs and implementation capabilities of the research groups interested in becoming involved. The FIRESCHEME founding convention in Coimbra is offering an opportunity to determine the first steps to be taken.

FIRESCHEME will be a large research endeavor in the concert of a series of attempts to determine the role of vegetation fires in regional, subcontinental, continental, and inter-continental scales.

The fire research campaigns, which are already being implemented or in the planning stage are briefly described in the annex. Figure 1 of the annex visualizes their geographical extent of the research programmes. Figure 2 of the annex shows the organizational diagram and the interconnections of the research campaigns.

The finance component is still open. FIRESCHEME could potentially be financed following the example of STARE/TRACE-A/SAFARI. That research campaign involves more than 150 scientists from numerous institutions of 14 participating nations. Each of the groups brought their own budget into the exercise and shared resources. The contributions varied considerably, ranging from multi-million Dollar spending of NASA for financing the DC-8-based flying laboratory, to several hundred K-Dollars spent by the Max Planck Institute of Chemistry for flying fixed-wing planes for subcontinental and local fire emission studies, or to small research groups working within the ground components (e.g., fire ecology) and being dependent mainly on small travel budgets to bring in their expertise and equipment. Many institutes had reoriented their ongoing work towards the scope of SAFARI, thus not needing any additional financial inputs at all. FIRESCAN and SEAFIRE are functioning accordingly.

The organizational umbrella of the International Geosphere-Biosphere Programme (IGBP) with its core projects, e.g., IGAC (International Global Atmospheric Chemistry Programme), GCTE (Global Change and Terrestrial Ecosystems), and PAGES (Past Global Changes), is offering structures and access for national funding.

In the case of FIRESCHEME, however, it is proposed to conduct the programme under the auspices of the European Forest Institute (EFI). An independent and non-governmental research body, EFI conducts problem-oriented and multidsciplinary forest research at the European level in order to serve the needs of policy-making and decision-making bodies in Europe. FIRESCHEME would include the North African and Near East regions because of their strong historic, cultural, and environmental links to the European part of the Mediterranean Basin. This should not discourage the fire research community to apply for sponsoring through a Europe-oriented research facility. A relevant proposal needs to be drafted and submitted to EFI. A feasibility study would provide appropriate answers to the many open question, which remain after the founding meeting of FIRESCHEME.

7. Call for Participation

Objectives and final achievements of FIRESCHEME highly depend on inputs and active participation of interested groups. In order to explain Mediterranean fire, FIRESCHEME requires a large variety of datasets, e.g., analyses of sea and lake sediments, alpine ice cores, pollen, charcoal, fire scars; anthropologic, ethnographic, socio-economic, and cultural accounts; historic and modern literature, paintings, and other artwork; reports from explorers; government reports, census statistics; historic and modern composition and distribution of vegetation; historic and contemporary land-use systems; regional climatology and atmospheric chemistry; etc.

With the use of modern technologies for describing the Mediterranean fire environment, such as remote sensing techniques, and advanced methods of processing large amounts of data and integrating information into systems like Geographical Information Systems (GIS), the research community will be able to create a highly interdisciplinary working platform.

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ANNEX

Brief description of regional and global vegetation fire research programmes or projects that are related to vegetation fires.

1

BIBEX-STARE: The First Intercontinental Fire Experiment

As indicated in Figure 1 the International Geosphere-Biosphere Program (IGBP) provides a base for interdisciplinary research programs. Within the International Global Atmospheric Chemistry (IGAC) Project, an IGBP Core Project, one of the activities of its foci (Focus 2: Natural Variability and Anthropogenic Perturbations of the Tropical Atmospheric Chemistry) is devoted to investigate the impact of biomass burning on the atmosphere and biosphere ("Biomass Burnig Experiment" [BIBEX]). The goals of the BIBEX research activities are summarized as follows:

- To characterize the production of chemically and radiatively important gases and aerosols species from biomass burning to the global atmosphere.

- To assess the consequences of biomass burning on regional and global atmospheric chemistry and climate.

- To determine the short- and long-term effects of fire on post-fire exchanges of trace gases between terrestrial ecosystems and the atmosphere.

- To understand the biogeochemical consequences of atmospheric deposition of products of biomass burning.

The first current BIBEX research activity is the Southern Tropical Atlantic Regional Experiment (STARE), an aircraft- and ground-based measurement program initiated in 1990. Its objective is to investigate the sources of trace gases, their atmospheric transport, and the chemical processes in the atmosphere which lead to elevated levels of ozone, CO, and other trace gases over the southern tropical Atlantic Ocean.

The STARE research activities of 1992 consisted of two major components, TRACE-A and SAFARI. The "Transport and Atmospheric Chemistry Near the Equator - Atlantic" (TRACE-A) program covers the western area of STARE-92. The main objective of TRACE-A is to investigate the chemical composition, transport and chemistry of the atmosphere over the southern tropical Atlantic Ocean and the adjacent South American continent. The research will focus on understanding the seasonal enhancement in tropospheric ozone that

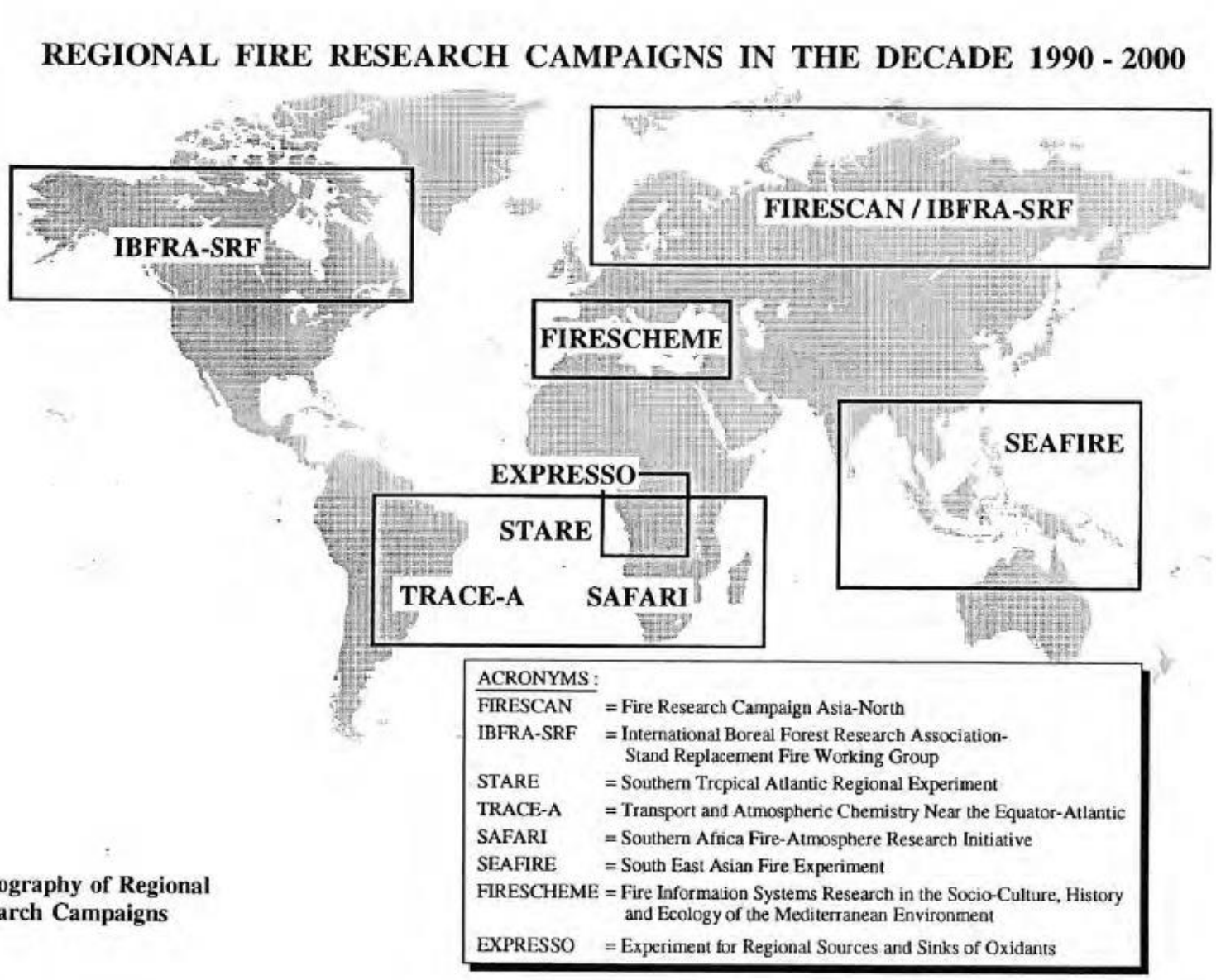
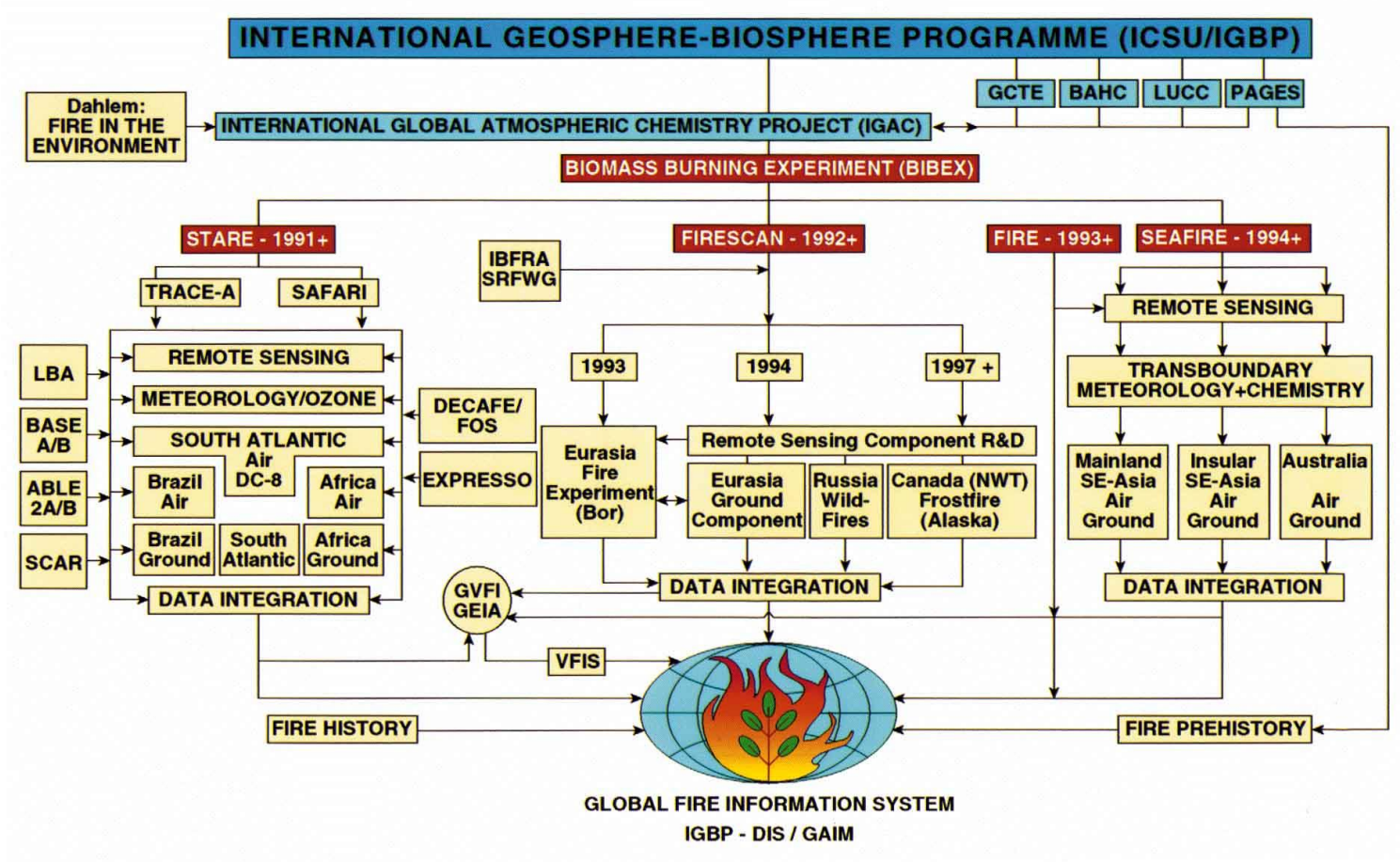


Fig.1. Geography of Regional Fire Research Campaigns


INTERNATIONAL GEOSPHERE-BIOSPHERE PROGRAMME (ICSU/IGBP)
GCTE
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Dahlem: FIRE IN THE ENVIRONMENT
INTERNATIONAL GLOBAL ATMOSPHERIC CHEMISTRY PROJECT (IGAC)
BIOMASS BURNING EXPERIMENT (BIBEX)
STARE - 1991+
FIRESCAN - 1992+
FIRE - 1993+
SEAFIRE - 1994+
IBFRA SRFWG
TRACE-A
SAFARI
REMOTE SENSING
TRANSBOUNDARY METEOROLOGY+CHEMISTRY
1993
1994
1997 +
LBA
BASE A/B
ABLE 2A/B
SCAR
REMOTE SENSING
METEOROLOGY/OZONE
SOUTH ATLANTIC
Air
DC-8
Brazil Air
Africa Air
Brazil Ground
South Atlantic
Africa Ground
DATA INTEGRATION
DECAFE/ FOS
EXPRESSO
Eurasia Fire Experiment (Bor)
Remote Sensing Component R&D
Eurasia Ground Component
Russia Wild-Fires
Canada (NWT) Frostfire (Alaska)
Mainland SE-Asia Air Ground
Insular SE-Asia Air Ground
Australia Air Ground
DATA INTEGRATION
DATA INTEGRATION
GVFI GEIA
VFIS
FIRE HISTORY
FIRE PREHISTORY
GLOBAL FIRE INFORMATION SYSTEM
IGBP - DIS / GAIM

Fehler! Textmarke nicht definiert.

List of Acronyms of Regional and Global Fire Research Activities

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

has been observed over the tropical Atlantic Ocean and that is caused most likely by widespread vegetation fires (forest conversion, savanna fires) in South America and Southern Africa. It will also investigate the potential contribution of land-use changes in both continents on the observed levels of other trace gases such as CH_4 and N_2O.

The TRACE-A activities involved chemical and meteorological measurements in Brazil (ground and aircraft component, jointly carried out by Brazilian and American research groups), ozone sonde launches in the Congo Republic, and an aircraft component (NASA DC-8) spanning the South Atlantic. This component was coordinated with the Brazilian and African Aircraft components.

The "Southern African Fire-Atmosphere Research Initiative" (SAFARI) is primarily the eastern component of STARE-92. The research objectives of SAFARI are similar to TRACE-A. SAFARI-92 involved ground and airborne chemical and meteorological measurements in the source or near-source regions of South Africa, which were carried out primarily as a cooperative international campaign. In addition, it included the investigation of the ecological role of fire in African savannas and the study of trace gas emissions from soils on fire-affected sites. Experience from previous experiments carried out in Brazil between 1979 and 1990 and in Côte d'Ivoire in 1991 facilitated the linking of ground-based emission measurements with airborne sampling.

In both components of STARE-92, remote sensing of fires (identification of active fires, quantification of fire-affected vegetated area) on both sides of the Atlantic concentrated on spaceborne sensors such as NOAA AVHRR, METEOSAT and LANDSAT.

The evaluation of data collected by individual scientists and research groups from 14 nations during the field phase in 1992 follows the conventional procedures of individual experiments. The concept of STARE, however, provides the mechanisms of synchronization of experiments in time and space. This made the realization of a crucial and important phase of the experiment possible, the integration and interpretation of the multitude of single observations into a coherent picture of fire-related processes on a regional scale. The results of STARE-92 will be published soon in (1) a special issue of the Journal of Geophysical Research and (2) a book volume to be published at the University of the Witwatersrand Press (1995).

EXPRESSO

Tropical biomes are the most dynamic, yet most poorly understood on Earth. Tropical forests are being cleared at a rate of ~1% per year. Biomass burning, ubiquitous in African savanna, exerts a dominant influence on ecology and atmospheric chemistry. Biogenic fluxes of reactive or radiatively active trace gases are concentrated in tropical land areas and are strongly influenced by land use change and biomass burning. Future human population increase is projected to be higher in tropical areas than in any other region and will accelerate changes in land use. The interplay of global change, climate change, biogeochemical processes, population increases and resource limitations are likely to affect more people in the tropics than anywhere else.

Plans are being developed for an international "Experiment for Regional Sources and Sinks of Oxidants" (EXPRESSO), to investigate tropical biogeochemistry. EXPRESSO will take place in the Central African Republic (CAR) and the Congo with some aircraft missions extending over Southern Africa. The goals of EXPRESSO are:

1) to better quantify the exchange fluxes of reactive trace gases and aerosols between the biosphere and the atmosphere in the tropics;

2) to analyze chemical interactions between the savanna and the tropical forest;

3) to isolate the roles of photochemical and meteorological processes;

4) to characterize the effects of ecological processes on trace gas fluxes;

5) to assess the impact of these tropical processes and land use change on the global atmosphere.

Two field campaigns are planned for a 1996-1997 time frame. One is planned for the wet season of the CAR savanna region, and one for the fire season. Preparations to allow the future field campaigns to occur have already begun. These preparations include:

- Instrument development efforts;

- Laboratory studies to elucidate biological processes which control trace gas emissions from soils and vegetation; and

- Chemical mechanistic and kinetic studies to determine the fates of atmospheric constituents.

- The field campaign will include:

- Ground based field studies, in the savanna and tropical forest, to determine the fluxes of important carbon and nitrogen containing trace gases;

- Aircraft studies to define the chemical and meteorological climatology of the study region;

- Remote sensing studies to define the location and extent of biomass burning and to aid in vegetation characterization; and

- Modelling efforts for a hierarchy of models which operate on scales ranging from micro-scale processes which occur in soil and leaves, to coupled regional/global models of atmospheric chemistry and dynamics.

Resources will be necessary to facilitate the participation of U.S. Universities in 1995 and in the future.

The main station for ground operations will be in Bangui (CAR). The aerial investigations will be conducted by a French plane (lower altitudes flights) and the NCAR C-130 (high-altitude flights).

FIRESCAN

Despite the lack of accurate information on the overall global occurrence of vegetation fires it is obvious that most contemporary burning takes place in the tropics. Fires in other vegetation zones of the world, however, are of similar importance to local, regional and even global ecology. Until very recently only little was known in the West about the fire environment of boreal Eurasia although its forest belt covers the largest contiguous forest area of the globe (with more than 700 million ha in the Russian Federation alone). Lacking awareness of Eurasia's fire world by the Western fire science community was the result of isolated evolution of science during more than 70 years of political separation. And the language barrier is still a major impediment to understand eachother.

With the opening process of the former USSR and the political changes after 1991 the first post-Cold War contacts between fire researchers and managers of East and West were initiated. It became immediately evident that the enormous amount of burning taking place in Eurasia's taiga forests has considerable impact on ecosystem dynamics and biogeochemical processes.

The concept of the "Fire Research Campaign Asia--North" (FIRESCAN) was first designed in 1991 as a more or less bilateral initiative between Germany and the Soviet Union. It gradually developed into an "in tandem" exercise of a symposium with field campaign financed by the Volkswagen Foundation and co-sponsored by IGAC/BIBEX and the International Boreal Forest Research Association (IBFRA). In the first part of FIRESCAN the updated state of knowledge on the fire ecology of the Taiga was compiled and discussed in the international conference on "Fire in Ecosystems of Boreal Eurasia". On the base of the Russian contributions and the additional inputs from North America, Scandinavia and boreal China a boreal Eurasian fire synthesis, enriched by pan-boreal perspectives, is now under preparation (Goldammer and Furyaev [in prep.]).

The objective of the first phase of the field campaign is the investigation of a high-intensity stand-replacement forest fire by using methods developed in the East and the West. The fire experiment (The Bor Forest Island Fire) took place in the Northern Krasnoyarsk Region (6 July 1993). Besides the comparison of descriptive methods (e.g. vegetation classification, fuel quantification, fire behaviour, etc.) attempts were made to recover historical fire and climate data (tree ring and lake sediment analyses). In addition trace gases and aerosols emitted from the experimental fire were measured by NASA, Max Planck Institute for Chemistry and the Novosibirsk Institute, using sampling devices mounted on Russian airborne platforms. The first phase of FIRESCAN will be followed by long-term research (1994 onward). One of the goals of FIRESCAN is to provide the scientific base for development of integrated fire management systems for the Russian Federation, especially taking into account the consequences of projected climate change on wildfire occurrence and impacts.

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) and in the International Journal of Wildland Fire (in prep.) A special session with the final results of the experiment will be held at the 1995 World Congress of the *International Union of Forestry Research Organizations* (IUFRO). A conference on mathematical modelling of forest fires will be hel in Tomsk (Russian Federation) in July 1995. In June 1995, a high-intensity stand replacement fire experiment is planned in Canada.

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) a **South East Asia Fire Experiment (SEAFIRE)** is proposed to investigate this highly complex and diverse fire theatre of the region. 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.

The scientific objectives and the research procedures of SEAFIRE have not yet been planned. However, it seems likely that the campaign will not only be conducted as a set of short-term conducted and directly linked experiments. Infrastructural constraints of observations to be carried out in a variety of countries (Myanmar, Thailand, Kampuchea, Lao, Viet Nam, Malaysia, China, The Philippines, Indonesia) will require a multi-year approach. However, it is suggested 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.

Fire in Tropical Resource and Environmental Monitoring (FIRE)

The Fire in Tropical Resource and Environmental Monitoring (FIRE) project has been initiated under the premise that what is now commonly termed "Global Change" is more than climate change or global warming. The world is in its current state largely through the wide-reaching pressure of resource exploitation practices linked to population growth and economic development. Agricultural extension or intensification, rapid urbanisation and the overall changes in land use over large areas are the immediate forces, which are shaping the landscapes of the continents. These forces will increasingly determine the world of tomorrow. Vegetation fires and other burning of biomass, e.g. in households, are key elements of land use practice shaping large tracts of the tropical belt. Being closely associated with human activities, burning practices are considered good indicators of trends and changes in such practices.

Satellite data provide opportunities for combining various levels of observations on vegetation fire and its impacts. Current technologies and institutional arrangements are leading towards the production of relevant data at continental and global scales. The FIRE project is intended to represent a major effort by the European Community towards the study of this important environmental parameter. The project objectives are:

- Determine trends in fire activity associated with land cover and land use change over the 1982-1992 decade.

- Document current fire dynamics through the intertropical belt.

- Define if such trends may be used as indicators of deforestation.

- Determine the effects of vegetation fires on tropospheric chemistry and precipitation chemistry in equatorial regions.

- Investigate the nature of the interaction between vegetation fires and meso-scale climate.

- Contribute to the specification of dedicated fire monitoring remote sensing systems.

- Integrate the above into a Vegetation Information System (see also Fig.2)

The proposed timeframe of FIRE, to be coordinated by the Institute for Remote Sensing Applications, Monitoring of Tropical Vegetation (CEC Joint Research Centre), is 1994 to 1997. One of the research foci will be South China and Viet Nam where fire calendars will be established from archived NOAA AVHRR data. The results of this research (1994-95) will provide a valuable database for SEAFIRE (1996+).

In this context, it must be mentioned that the development of new spaceborne fire sensors must receive high priority. The conception of a "smart" multi-sensor system specifically designed for active fire and fire impact monitoring opens a promising approach toward more precise and economic use of remote sensing for fire research and fire management (see International Forest Fire News, July 1994).

Global Vegetation Fire Inventory (GVFI)

Assessments of past, present, and future atmospheric chemistry and the consequences of changes of atmospheric chemistry on the global climate rely in part on inventories of emissions of appropriate chemical substances (chemical "species") and aerosols constructed on appropriate spatial and temporal scales. Global biogeochemical cycles and the chemical properties of the atmosphere are highly influenced by emissions from combustion of fossil fuels and of plant biomass.

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

The latest global estimates of emissions from plant biomass burning are still considered as uncertain due to the very weak databases. The main reason for the weakness of basic statistical data is that in the most important regions and countries no statistical data are collected systematically on the spatial and temporal extent of free burning fires in

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

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

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

The existing estimates mentioned before have been reexamined recently and improved through the integration of the vegetation fire component into a High Resolution Biome Model (HRBM). This model approach provides the temporal and spacial extent of vegetation fires and allows the modeling of all kinds of chemical species emitted by the fires. For instance, the model reveals a global gross flux of carbon emitted from vegetation fires to the atmosphere of 4.14 Pg (1 Pg = 1 billion tons) per year. This compares with the previous estimates as follows (biofuels and agricultural burnings are not included):[1]

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

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

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This proposed first step for a global fire inventory aims to collect a comprehensive set of data on vegetation fires. These are all free-burning fires occurring in all types of vegetation, including fire used in the agricultural sector.[2]

Objectives of the GVFI

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

Phase I of the GVFI

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

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

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

Methodology of Phase I

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

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

The Vegetation Types to be Investigated

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

Sources of Data

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

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

Reference Time

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

Time Frame: A Desirable Target

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

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

Support of Regional Correspondents: Country Contacts

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

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:

José M.C.Pereira
Department of Forestry
I.S.Agronomia
Tapada da Ajuda 1399
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(extract from IFFN 1/1994)

אוניברסיטת חיפה
UNIVERSITY OF HAIFA
جامعة حيفا

DEPARTMENT OF GEOGRAPHY

LGE06513/149

November 29, 1993

Johann Georg Goldammer
Fire Ecology & Biomass Burning
Research Group
(Max Planck Institute of Chemistry)
c/o Freiburg University
Bertoldstr. 17
D-W-7800 Freiburg
GERMANY.

Fax: 49 761 203 3731

Dear Dr. Goldammer,

I would like to join the "FIRESCHEME" group. My research concentrates on fire effects on vegatation, nutrient cycling and runof-erosion relationships. Thus, the title "Present state of vegatation" fits my field of interest.

I am pleased that this co-ordinating initiative has proposed, and look forward to contributing to the effort.

Please let me know more about FIRESCHEME and future meetings.

Hope to hear from you soon.

Yours sincerely,

Pua.

Dr. Pua Kutiel.

Fax: 972-4-246814 (University of Haifa)
972-3-5351825 (Bar-Ilan University)

Dep. of Geography
Bar Ilan University
52900 Ramat-Gan
ISRAEL

Record of the FIRESCHEME-Session (24.11.1994)

2nd International Conference on Forest Fire Research Coimbra (Portugal)

As an introduction **J.G.Goldammer** (Fire Ecology Group of Max Planck Institute, Germany) presented the organization structures of regional and global vegetation fire research campaigns (see annex of FIRESCHEME-paper). He pointed out the main ideas of FIRESCHEME and gave way to the discussion.

Alex (?) found the project-paper an interseting proposal with which he very agreed. It showed the common problems of the fire ecology research community and it was then time for exchanging ideas and for planning future research activities in the Mediterranean Basin. The FIRESCHEME-session was a good opportunity for collecting ideas. He admitted that exchanges were taking place within the research community, but they lacked continuity. He saw the session as a starting point and the research community should then decide where to go.

Goldammer thanked for the supporting comment and remembered the workshop "Remote Sensing..." in Thessaloniki one year back. Many specialists with a lot of experience within the topic had been reunited then. The main problem pointed out by most participants had been the magnitude of information available, which needed to be digest for fire managers. The practicitioners and the politicians were complaining about the lack of useful products, such as Information Systems supporting decision making strategies. Policy people were looking for less theoretical but more practical devices.

A.Haim (University of Haifa) stated that one of the main problems in the Mediterranean was the missing funding for long-term research projects. The usual period where fire ecological investigations were funded did not exceed three years. Responsible scientists had to monitor for 20 or 25 years in order to understand the ecological impact of wildfires. He asked how a researcher had to go on after having collected data for four years and declared that an international Mediterranean organization was missing to support the research community.

K.D.Kalabokidis (?), who had been working in the United States, wondered about the amount of data existing in Europe. He pointed out that data was not knowledge and that it was knowledge that was missing. He was surprised to see that researchers and managers did not talk together. He stated that plans had to be made then as funding agencies did not ask for good results but for application of those results.

P.Kutiel (Bar-Ilan University) feared that the meeting could be another meeting with a lot of talking and no decisions. She had been working in fire ecology in Israel for 20 years then. In order to finance her recent research projects she had to be very fashionable and look for pleasing titles. With view to the Coimbra-Conference, which in general she considered to has been very poor, she asked herself if there was any progress in fire ecology research. A comparison of data was - due to the differing methods used - not possible. She wondered about the broad indifference against the project FIRESCHEME. She called upon the research community to bring itself together and to start with serious work. The Mediterranean was a good example for ecological research in general as it is very sensitive to desertification processes. She regreted that only one person from Tunis participated at the Coimbra-Conference as the people from Northern African countries were already confronted with desertification (i.g., Atlas-mountains). Everybody within the Mediterranean Basin seemed to work with her and his own methods and everybody was complaining about the lack of financial support. But from her point of view the EC spent a lot of money. She asked for an expertise in order to examine EC-funded fire ecological research projects. She called for the organization of existing knowledge and she proposed that researchers should be adviced by managers and business people.

Goldammer remarked that that was a very strong statement.

Bart-frz? (??) stated that people went where money was offered. He asked hisself if FIRESCHEME was necessary and answered the question by affirming that Information Systems were indispensable. So he looked for a kind of programme or institution that would bring up with such systems. He opined that tackling the task would be very difficult and that it had to end up with applicable results.

J.Greenlee (International Journal of Wildland Fire) was very interested to facilitate the FIRESCHEME work. He offered the Mediterranean research community to help them by pulling together European literature about the topic and addresses of persons involved in fire ecology. He attested the interest of the United States, he admitted that there would not be any funding available, and he asked the European research community for their help.

Goldammer gave an example of fire policy in Russia where fire fighting organs tried to put out every single wildfire with a lot of manpower and energy - although the boreal system was a naturally fire influenced ecosystem. He stated that one could observe - similar to the US fire management policy - a change within how to treat the problem. Future fire policy also of the Mediterranean Basin had to consider ecology and natural mechanisms. Researchers had the task to convince the funding agencies about this fact.

Haim confirmed that fire was a part of the natural mediterranean environment, but he feared that "let-burn-policy" would meet with rejection by politicians due to the fact that the Mediterranean Basin was densly populated and that wildfires threatened human lifes and blongings. He gave the example of the Mount Carmel fire where responsible persons had been thinking of evacuating Haifa University.

J.M.C.Pereira (University of Lisboa) wondered if there was an alternative to FIRESCHEME. He asked if the EC supported networks and promoted the desired exchange activities. He asked ?.Balabanis (Commission of the EC) if he had any ideas, if he thought such activities were useful, and what he thought of FIRESCHEME.

?.Balabanis admitted that he had no time for reading the FIRESCHEME-paper, but that after a brief examination he found the project not desired by the EC. He declared that the EC funded various activities within fire research, some of them related to climatic processes, others to ecological changes and desertification. He was surprised to see the same thing twice over. The EC had explicitly the task for taking over exactly the issues presented in the FIRESCHEME-paper. He regreted that the present research community were not interested in joining the EC-projects. He saw the initiative quite up in the air and could not see any linkages to other ongoing initiatives. He stated that there was a responsible office for the topic within the EC. He declared FIRESCHEME to be a bottom-up initiative and he claimed for top-down ones.

Goldammer answered that Balabanis mentioned a very important point. Goldammer contacted several times the EC offering advertising help. It was a sign for lacking organization that the EC never responded. He pointed out the many linkages to international organizations FIRESCHEME had to show and stated that the research community was looking for cooperation. He reported about the organization PAGES where many researchers participated which did not know how to find links to the fire ecology research community. Linkages were also missing between terrestrial ecologists and atmospheric chemists. He reported that such links had been established in other countries but until then not in the Mediterranean Basin. The opportunities and needs were well known but still no research application was to be seen and he wondered why.

Balabanis answered that there was no need for further exchange and that such activities were not foreseen.
(?stimmt das? Ich hatte ziemlich Mühe ihn zu verstehen!!)

Goldammer admitted that he himself had no experience with Mediterranean fire regimes. But he pointed out that he got the impression - recently from Algerian-Tunisian wildfires - that fire regimes of the Mediterranean were closely related to politics. He felt sorry about the rejection of his offers by the EC. He stated that there would would have to come up something more comprehensible.

Balabanis reported that the next programmes of the EC within fire ecology research would deal with fire behaviour and fire detection. There would also be investigations within the impact of wildfires on ecosystem dynamics as well as the role of fire within the desertification process. Only within those topics he saw a possibility of application whereas FIRESCHEME seemed to him not being appropriate for realization. He offered taking FIRESCHEME into account in future planning and he was ready for discussing the project for the coming 2 or 3 years.

Pereira said that it was then time for something more concrete. He felt the need of making the project easier and asked the research community if there was someone willing to check and offer his or her data for a comparative study. He asked for further proposals in order to not come into conflict with existing structures.

Goldammer mentioned that other comparable projects did not have any central funding, any institution, any buildings nor budgets. All groups involved brought in their own ressources. He further considered the European Forest Institute (EFI), which showed great interest in Mediterranean countries and which had a mandate, a appropriate organization for FIRESCHEME. He pointed out that the EC had to be convinced and that a priority list had to be drawn up. As the research community had in view long-term research he asked for patience as starting a good concept would need some time. He stated that present researchers were the bottom, the executing ones, who had the highest awarness of the real problems. The research community had to bring their message to the higher levels and therefore he felt glad that Balabanis from the EC was listening to their concerns. He encouraged the research community to looking for alternatives funding ressources. He reported about the .....which has been funded by Volkswagen. He pointed out that all possibilities had to be taken into account and that this would require a lot of energy from the responsible researchers willing to do so. He asked for some conclusions that could be drawn.

Haim proposed that for every Mediterranean country there should be a responsible person.

Goldammer pointed out that this would be an ideal situation which was probably not realizable.

Pereira asked for getting into contact with the EFI.

Goldammer agreed with the proposal as the EFI seemed to be more interested into long-term results and to be more flexible than the EC.

Balabanis offered to contact the Global Change Programme in order to give way to participation.

Goldammer asked for persons willing to to take over coordination of FIRESCHEME-activities. (As nobody was willing) he admitted that the beginning of such project would be very difficult but that there still remained the need for applicable results and that FIRESCHEME or similar projects would have to run one day. He closed the session.

Kai Schrader, 1.12.1994

Universität Bern

Botanische Institute
Systematisch-Geobotanisches
Institut und Botanischer Garten

6. Dezember 1994

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An
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Mitarbeit im Firescheme-Projekt

Geschätzte Kollegen

An der Konferenz in Coimbra wurde am 25. November das Projekt Firescheme vorgestellt. Das Konzept (Schrader, Goldammer & Pereira, 1994) zeigt klar auf, wie wichtig es ist, im Mittelmeerraum ein koordiniertes Projekt über die Wechselwirkungen zwischen Bränden, Geschichte, Kultur und Umwelt zu starten. Begeistert hat uns insbesondere die zeitliche Komponente des Projekts.

Das Mittelmeergebiet ist eines der ältesten Kulturgebiete der Erde. Unserer Meinung nach, können deshalb nur Untersuchungen, die gleichwertig Gegenwart und Vergangenheit betrachten, zu einem Verständnis der heutigen Brand-Situation im Mittelmeergebiet führen. Insbesondere gilt dies für die (langfristigen) Beziehungen zwischen Bränden, Klima, Vegetation und Landnutzung. Auch für die vorgesehene Modellierung (Global Cultural and Historical Fire Model, Global Atmosphere and Climate Models) liefern paläoökologische Daten wichtige Informationen zur Feuerökologie.

Nun kann niemand behaupten, die Schweiz sei ein Mittelmeerland. Trotzdem sind wir dank unserem südlichsten Kanton mit dem Mittelmeergebiet verbunden. Das Tessin weist von der Kultur, Sprache und Landnutzung, aber auch von der

Vegetation her, viele Gemeinsamkeiten mit Mittelmeerländern auf. Das Wallis nimmt eine Zwischenstellung ein. Geographisch und in seiner frühen kulturellen Prägung mit dem Mittelmeerraum verbunden, begegnen sich hier klimatisch und der Vegetation nach auf engem Raum submediterrane und boreale Elemente. Unser laufendes Projekt "Fire History in the Central and Southern Alps" hat zum Ziel im Tessin und Wallis die Beziehungen zwischen Feuer, Mensch, Vegetation und Klima mittels Sediment-, Pollen- und Holzkohleanalysen seit der letzten Eiszeit (und insbesondere im Holozän) zu ergründen.

Wir sind deshalb an einer Mitarbeit im Projekt Firescheme sehr interessiert. Können wir Sie bitten, uns nähere Informationen zukommen zu lassen, welche Möglichkeiten der Zusammenarbeit bestehen? Der Arbeit im Wallis wegen sind wir darüberhinaus sehr an Firescan interessiert und wären Ihnen dankbar, wenn Sie uns mitteilen könnten, ob eine Möglichkeit besteht, vom Stand der Forschungsarbeit in diesem Projekt unterrichtet zu werden.

In Zukunft könnte es (vielleicht dank Firescheme) möglich sein, in internationaler Zusammenarbeit ähnliche Projekte zur Feuer- und Vegetationsgeschichte auch im eigentlichen Mittelmeerraum durchzuführen. Lohnen würde es sich sicherlich, sind uns doch zur Feuergeschichte im Mittelmeerraum kaum Untersuchungen bekannt.

Mit der Hoffnung, dass das Firescheme-Projekt gelingen möge, grüssen wir Sie freundlich.

Prof. Dr.
Brigitta Ammann

Madlena Winter

Willy Tinner

THE MINISTRY OF SCIENCE AND THE ARTS, ISRAEL

BUNDESMINISTERIUM FUER BILDUNG, WISSENSCHAFT, FORSCHUNG UND TECHNOLOGIE (BMBF), GERMANY

Israeli-German Workshop

in

Environmental Research

MEDITERRANEAN FOREST ECOSYSTEM: THE MOUNT CARMEL CASE

Program and Abstracts

March 18-19, 1995

Hotel Beit Oren

Kibbutz Beit Oren

NCRD 95-2

ISRAELI-GERMAN WORKSHOP IN ENVIRONMENTAL RESEARCH:

MEDITERRANEAN FOREST ECOSYSTEM - THE MOUNT CARMEL CASE

March 18-21, 1995

Hotel Beit Oren, Kibbutz Beit Oren
(Tel: 04-222111-2-3; Fax 04-231443)

PROGRAM

Saturday, March 18

Arrival of the German participants at Ben-Gurion Airport

Drive to Beit Oren (near Haifa)

21:30 Informal Get-together

Sunday, March 19

09:30 Registration and Coffee

OPENING SESSION

10:00 Greetings

FIRST SESSION: CHAIRPERSON - K.F. Schreiber

10:30 D. Cohen, A. Shmida, Y. Heller, E. Tchernov, Y. Werner, The Hebrew University of Jerusalem
W. Schmidt, Goettingen University

"Ecological Research along an Aridity Macrogradiant" (DISUM 12)

11:15 H. Lavee, Bar-Ilan University, Ramat-Gan
Hans-Rudolf Bork, Center for Agricultural Landscape and Land Use Research (ZALF), Germany

"Dynamics of Eco-Geomorphological Processes along a Climatic Gradient" (DISUM 29A)

"Development of Soils and Landscapes along a Climatic Gradient from the Judean Mountains to the Dead Sea" (DISUM 29A)

J.C. Munch, A. Fliessbach, Inst. f. Boden-biologie, Braunschweig
Y. Steinberger, Bar-Ilan University, Ramat-Gan

"Nitrogen Dynamics in a Desert Soil Ecosystem" (DISUM 29B)

"Carbon and Nitrogen in a Desert Soil Ecosystem" (DISUM 29B)

Sunday, March 19 (Contd.)

12:30 Lunch

SECOND SESSION: CHAIRPERSON - K. Stahr

14:00 J. Garty, Tel-Aviv University
G. Schiller, Agricultural Research Organization (Volcani Center), Bet-Dagan
M. Broza, A. Haim, G. Ne'eman, I. Izhaki, Haifa University
H. Rennenberg, G. Heldmaier, Fraunhofer Institut fuer Atmosphaerische Umweltforschung

"Resilience via Succession of a Semi-arid Mediterranean Aleppo Pine Forest Ecosystem to Fire on Mt. Carmel, Israel" (DISUM 25)

15:00 K. Schrader, J.G. Goldammer and J.M.C. Pereira, Geographic Institute, Basel

"Fire Scheme - Fire Information Systems Research in the Socio-Culture, History, and Ecology of the Mediterranean Environment: Initial Thoughts to the Development of a Pan-Mediterranean Fire Research Project" (Guest Lecture)

15:30 A. Singer, Faculty of Agriculture, The Hebrew University of Jerusalem, Rehovot
E. Ganor, Israel Ministry of Environment, Tel-Aviv
H. Zoettl, Albert-Ludwig University

"Atmospheric Sulfur Deposition in a Natural Pine Forest on the Carmel" (DISUM 13)

16:15 Coffee Break

16:45 E. Frankenberg, Y. Cohen, Israel Nature Reserves Authority
R. Lenz, M. Sittard, P. Schall, ESRI, Kranzberg

"Using GIS for Planning the Carmel as a Biosphere Reserve" (Guest Lecture)

17:30 **OPEN DISCUSSION: MODERATORS - Y. Waisel, W. Schmidt**

Mediterranean Forest Ecosystem - The Mount Carmel Case

19:30 **FESTIVE DINNER**

Monday, March 20

08:30 PROFESSIONAL SIGHTSEEING

13:30 Lunch

THIRD SESSION: CHAIRPERSON - Z. Gerstl

15:00 U. Safriel, The Hebrew University of Jerusalem
A. Cahaner, Faculty of Agriculture, Hebrew University of Jerusalem, Rehovot
A. Novoplanski, Ben-Gurion University, Sde Boqer
G. Jetschke, F. Schiller University, Jena

"Biological Responses to Global Climate Change - Differences between Central and Peripheral Populations" (DISUM 35)

"Biological Responses to Global Climate Change... - Mathematical Modelling" (DISUM 35)

15:30 L. Blaustein, E. Nevo, Haifa University
B. Breckling, W. Windhorst, Kiel University

"Biodiversity Studies for Ecological Management in a Mediterranean Mountain Site: Mount Carmel, Israel" (DISUM 36)

16:00 N. Seligman, Z. Henkin, Agricultural Research Organization (Volcani Center), Bet-Dagan
U. Kafkafi, Faculty of Agriculture, Hebrew University of Jerusalem, Rehovot
D. Prinz, Institut fuer Wasserbau u. Kulturtechnik, Karlsruhe University

"Population Dynamics in a Typical Mediterranean Dwarf-shrub Community in Relation to Disturbance and Nutrient Status" (DISUM 37)

16:30 Close of Workshop Sessions

17:00 **Joint Advisory Committee Meeting**

Guest Lecture

FIRESCHEME - Fire Information Systems Research in the Socio-Culture, History, and Ecology of the Mediterranean Environment

Initial Thoughts to the Development of a Pan-Mediterranean Fire Research Project

K.Schrader, J.G.Goldammer & J.M.C.Pereira

Abstract

One result of the over 500'000 years of human activities in the Mediterranean Basin is that fire regimes are entirely human made. Recently the accumulation of fuel material in Mediterranean shrub and forest lands - a consequence of the shift from burning wood to fossil-fuel combustion, the abandonment of forests and fields and the fire-fighting policy - as well as the increase of ignition rates by recreation activities, the development of urban sites in woodlands, the creation of highly flammable afforestations and the misuse of fire-setting as a political device have changed the former well-balanced human-maintained equilibrium of fire regimes: Wildfires become more and more frequent and devastating. In order to enlighten the human (i.e. the social, cultural, economic, historical, and psychological) impact on the fire ecology of the Mediterranean environment an interdisciplinary and international fire information systems research is required that takes into account all kinds of datasets such as analyses of sea and lake sediments, alpine ice cores, pollen, charcoal, fire scars; anthropologic, ethnographic, socio-economic, and cultural accounts; government reports, census statistics; historic and modern literature, paintings and other artwork; reports from explorers; historic and modern composition and distribution of vegetation; historic and contemporary land-use systems; regional climatology and atmospheric chemistry. FIRESCHEME - Fire Information Systems Research in the Socio-Culture, History, and Ecology of the Mediterranean Environment - is a proposed first pan-Mediterranean fire research project which could receive its initiation and stimulation through joint Israeli-German research efforts and could be supported by various initiatives in Switzerland and Portugal.