

The background of the cover is a photograph of a forest fire. A large, intense fire is burning in the background, with bright orange and yellow flames reaching upwards. In the foreground, the dark silhouette of a tall evergreen tree stands against the fire. The overall mood is dramatic and urgent.

PROCEEDINGS

**MEETING GLOBAL WILDLAND
FIRE CHALLENGES**

**INTERNATIONAL
WILDLAND FIRE
CONFERENCE**

**THE PEOPLE,
THE LAND,
THE RESOURCES**

**Boston,
Massachusetts
July 23 - 26, 1989**

Publication Date:
June 1990



PROCEEDINGS

INTERNATIONAL WILDLAND FIRE CONFERENCE

Boston, Massachusetts

PURPOSE OF THE CONFERENCE:

**To bring together leaders
of public and private organizations
from around the world
to discuss issues, programs and strategies
to reduce serious wildfire losses and
to promote international cooperation.**



July 23 - 26, 1989

MEETING GLOBAL WILDLAND

FIRE CHALLENGES

The People,
The Land,
The Resources

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National Association of State Foresters



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Overview Comments from Allan J. West

Deputy Chief, United States Forest Service

During the decade of the 1980s, wildland fires caused major loss of life, property and natural resources in Africa, North and South America, China, the Mediterranean, Australia, and parts of Europe. Expanding populations in areas of high fire risk and the accelerating demand for natural resources to supply basic human needs added a critical emphasis to this fire problem. Recognizing that the global nature of this problem required international attention, the United States Department of Agriculture Forest Service, Forestry Canada, the United States Department of the Interior, the Mexican Secretaria de Agricultura y Recursos Hidráulicos, the National Association of State Foresters, the United States Agency for International Development, and the National Fire Protection Association organized and sponsored the "Meeting Global Wildland Fire Challenges" conference in Boston, Massachusetts, July 23-26, 1989.

The conference focused on worldwide wildland fire problems and steps that can be taken by the international community to reverse the upward trend of wildland fire losses. The conference assessed the worldwide natural resource situation, examined the physical, biological, social, political, and economic issues of wildland fire management decision making. Several examples of successful international cooperation were highlighted and the key elements of successful international programs were discussed.

Highlights of the conference include:

- An "International Survey of Fire Managers" identified problems throughout the world which limit or impede international cooperation in wildland fire management. Based on this information, a unique working lunch forum was developed, and each conference participant had an opportunity to help develop an "Action Plan," which would lead to enhanced international wildland fire cooperation.
- Almost 100 Educational Displays and Exhibits presented the latest in technologies and information necessary for successful establishment of basic fire management programs.
- More than 400 leaders of public and private organizations from around the world were brought together to discuss issues, programs, and strategies to reduce serious wildland fire losses and to promote international cooperation in the decade of the 1990s and beyond.
- The United Nations Disaster Relief Organization officially recognized the conference as a "Pre-Decade" activity. It is important that wildfire be recognized as one of the natural disasters to be addressed during the United Nations International Decade For Natural Disaster Reduction.

As we continue our wildland fire management responsibilities, let us be sensitive to the needs of our neighbors and seek ways to implement the opportunities identified at this conference.





Overview Comments from Robert W. Grant

President, National Fire Protection Association

Robert Grant acknowledged the unwavering commitment and expertise of each conference participant, saying, "You are the key to reducing the loss of life and property caused by wildland fire. I admire you and the important work you do."

He also noted the urgency of the problem. "Even as we meet this week, several dozen forest fires in Mexico's Yucatan Peninsula continue to ravage North America's largest tropical rain forest. In Manitoba, Canada, 14,500 people were evacuated last night because of several wildfires. And in the United States this month, more than 65 homes were lost in Boulder County, Colorado, to one wildfire."

Grant discussed the long held interest and commitment of the National Fire Protection Association (NFPA) to preventing and controlling wildland fires. "Several years ago the U.S. Forest Service approached NFPA to discuss this problem. The Wildland/Urban Interface Fire Protection Initiative was a result of that meeting." He added that he was proud that NFPA shares sponsorship of this conference.

He said the spirit of international cooperation was evident in the participants and added that, "We will all benefit from it. I am pleased that the United States Congress approved and President Bush signed legislation last spring that will allow the United States to reimburse foreign governments who provide assistance to our country in fire-fighting emergencies. This very positive step enhances the cooperation and sharing of information that is the focus of this conference.

"As president of the National Fire Protection Association, I feel particularly encouraged as you gather to exchange ideas, share your expertise and address the international wildfire problem... Because no matter what the language or how great the distance traveled, we share a common goal, and that is to reduce the devastation and loss of life and property caused by fire."



Keynote Speakers

Jean Claude Mercier

Deputy Minister
Forestry Canada



*We hope to initiate a
new era...marked by
cooperation and con-
sultation throughout the
global village.*

Overview of the Global Wildland Fire Problem

Before introducing the keynote speakers, Session Chairperson Jean Claude Mercier began his introductory remarks by stating his belief that years from now this conference may be perceived as a watershed in the history of global wildland fire management. "Over the past years we have seen increased evidence," he continued, "of the need for international participation to combat wildfire. By meeting here this week we hope to initiate a new era in the management of wildland fire around the world, an era marked by cooperation and consultation throughout the global village."

Mercier pointed out that no country has all the answers or all the technology. And no country is ever likely to solve its own fire problem. The truth is that wildland fire will be with us as long as we have oxygen, heat and fuels in the form of forests, shrublands and grasslands.

"As the world's civilizations evolve," said Mercier, "our concerns over fire become more complex. The old issues do not disappear. We simply add more issues to the agenda. Not only are new issues added, the old issues become even more urgent."

The loss of valuable fuelwood stands to forest fires in past times, he said, was a hardship. Today the loss is catastrophic. We have relied on our forests for fuelwood for millennia, but now we find ourselves faced with a global fuelwood energy crisis resulting in deforestation on a massive scale. Forests have been turned into deserts and people have been displaced. The fuelwood crisis contributes to the cycle of poverty, poor nutrition and disease that affects many countries.

As a result, Mercier said, "effective means to combat wildfires in the forests used for fuelwood have become more urgent than at any time in the past."

Mercier added that for centuries people have relied on forests for raw materials. Now, even in some parts of Canada, there is a potential for a shortage of wood. The forest has been an important part of the Canadian national psyche, but he said that now Canadians must question whether their forests can supply their growing and diversifying needs in the years ahead. He said he could personally attest to the devastating impact of fire on the best laid plans of forestry experts.

Forestry has become a high-tech industry, he also noted. We have developed faster growing species, promoted silviculture techniques, and developed new and advanced uses for forest products. Indeed, we have learned many lessons on ways to protect, preserve and nurture our forests. But, he said, "As world demand for forest products continues to grow in the next century, increased investment must be made in our silviculture, our harvesting processes and our ability to add value to forest products."

Past investment, said Mercier, has placed us in a position similar to that of the family who has made additions and renovations to their home. They have increased the value of their home substantially, and the wise family will protect that investment by increasing the amount of insurance against loss by fire.

He described how this insurance for the forests must take the form of prevention, surveillance, presuppression and suppression. The insurance must also

take the form of new ways of cooperating, of sharing experiences and expertise, so that no one who faces the danger of wildfire must fight alone, without the resources, the investment and the training required.

On our fragile globe, observed Mercier, we understand more than ever before that forests are vital not only for the activities of the human inhabitants of earth, but for the very health of the planet itself.

"Today, during an industrial age in which, more than ever, we need forests to serve as the earth's lungs," he said, "the destruction of the forests by fire has important consequences. In managing the carbon dioxide cycle that is so closely linked to the greenhouse effect, a healthy forest contributes to the solution. A burning forest contributes to the problem. And as the planet warms as a result of the increasing levels of greenhouse gases, the fire hazard rises further into the danger zone. Today we understand that we protect forests from fire not just to preserve a resource for our use. We protect an environment for the benefit of all living things."

This conference was called to enable representatives from around the world to discuss ways to care for those resources, said Mercier, who discussed a number of objectives for the conference:

- We wish to propose measures to prevent, control and reduce the effects of wildfires.
- We wish to share fire prevention, fire management techniques and suppression strategies.
- We will encourage international communication and increase mutual cooperation among nations in the realm of wildland fire management.

Mercier reminded the audience that fires do not recognize international boundaries, political ideology or race. They destroy property and take lives in the developed world and the developing world alike. They draw upon the financial resources of the planet as surely as they suck the oxygen from an area that has been set ablaze. Their effects are as devastating in the Mediterranean as in the Americas, in Australia as in Africa, in Europe as in Asia.

"The wildfire problem has reached such crisis proportions," Mercier continued, "that international attention is now more essential than ever. We cannot stand idly by watching the resources of our neighbors burn. Our economies, our ecologies and our concern as individuals have become intimately linked across this global village. The crisis that hits any one of us now has an impact on us all."

Mercier described encouraging examples of international cooperation, calling this a unique era where we can substitute cooperation for confrontation and assistance for animosity. He said there will be differences of opinion and approach, but we cannot allow our differences to overcome our efforts. He referred to differences as a richness of diversity.

"The task of focusing the efforts of the fire fighting community around the world on a common goal," he said, "may appear overwhelming today. We have many challenges, and this has not been done before. But it is no longer a matter of choice, but rather of necessity."

We protect
an environment
for the benefit
of all living things.

Forest Resources of the World

Jean-Paul Lanly
Director
Forest Resources Division
Food and Agriculture
Organization



Lanly began his presentation by describing the geographical distribution of forests and "other wooded areas" and defined a forest as any plant formation where at least 10-20% of the surface area is covered by tree crowns. In 1980 these forest areas covered about 3,600 million hectares (36 million square kilometers) or about 27.6% of the earth's land area.

The Food and Agriculture Organization (FAO) characterizes "other wooded areas" as plant formations where tree crowns cover less than 10-20% of surface area and consist mainly of shrubs or shrubby trees and thickets of woody plants between 0.5 and 7 meters in height. These areas include chaparral, shrub savannas and tropical thickets, which cover about 13% of the earth's land area. "Thus more than 40% of the earth's land surface is covered by woody vegetation." (Table 1)

Table 1. Land Area Covered by Forests and Other Wooded Areas, by Region. (1980)

Continent (and adjacent islands)	Forests %	Other wooded areas %	Total %
Africa	23.9	21.3	45.2
America	36.9	15.2	52.1
Asia	18.4	6.6	25.0
Europe/USSR	32.5	8.6	41.1
Pacific Region	10.8	7.9	18.7
WORLD	27.6	13.0	40.6

This does not include the areas of agricultural land where trees and shrubs serve as hedge rows, windbreaks or barriers or plantations of non-forest trees and shrubs such as orchards, coffee, cacao, rubber and palm oil.

Table 2. Distribution of Tropical and Non-tropical Forest and Wooded Areas by Region (1,000 hectares).

Continent (and adjacent islands)	Total Land Area	Forested Area		Other Wooded Areas		Total Forest & Wooded Area
		Tropical	Non-tropical	Tropical	Non-tropical	
Africa	2954.6	701.2	8.1	623.4	6.6	1339.3
America	3892.7	889.8	546.0	322.0	269.1	2026.9
Asia	2677.3	303.4	188.4	111.2	66.0	339.0
Europe/USSR	2700.0	0	876.5	0	231.4	1107.9
Pacific Region	842.9	42.6	48.7	2.4	64.3	158.0
WORLD	13,077.5	1,937.0	1,667.7	1,059.0	637.4	5,301.1

Evolution of Forest Areas: Deforestation and Reforestation

The area covered by forests and other wooded areas is subject to change, Lanly warned. These areas are being decreased in certain regions because of land clearing with the forest giving way to other types of land utilization, such as agriculture and

Table 3. Population Distribution by Region (Millions)

Continent (and adjacent islands)	Tropical	Non-tropical	Total
Africa	359.9	119.6	479.5
America	318.9	294.4	613.3
Asia	1,267.1	1,316.2	2,583.3
Europe/USSR		749.8	749.8
Pacific Region	17.9	5.0	22.9
WORLD	1,963.8	2,485.0	4,448.8

grazing. In other regions, the forest area is being increased by afforestation or natural regeneration. Continuous over-exploitation of the land may cause a permanent reduction in forest areas, making it impossible for any type of woody vegetation to recolonize.

"This is the case particularly in the tropics," said Lanly. Excessively short cycles of itinerant vegetation lead to the formation of grassy savannas. In dry tropical Africa, over-exploitation of firewood and prolonged over-grazing complete the destruction of the forests and other wooded areas.

Lanly reported that forest areas are generally being reduced in the developing countries, particularly in the tropics. However, forests are being lightly but regularly increased in the industrialized countries, through plantations and forest regeneration of lands abandoned by agriculture and grazing. At the same time, urbanization results in the loss of forested areas.

Around 1980, the forests of the tropical countries, which represented about 90% of the forests of the developing countries, were being reduced by 11.4 million hectares a year, an annual rate of 0.6%. The forest plantations were being increased by 1.1 million hectares, for a net reduction of 10.3 million hectares. The 11.4 million hectares were made up as follows: 7.1 million hectares of dense wet tropical hardwood forests, 0.4 million hectares of coniferous forests, and 3.9 million hectares of mixed forest and grass formations of the dry tropics.

One recent cause of forest reduction in industrialized countries has been air pollution. In 1987, the proportion of trees severely affected or killed in Europe varied between 0.2% and 5%.

The Role of Fire in Forest Degradation

Lanly considers the decline of forests due to fire, in the industrialized countries, to be a phenomenon of disrupting plant succession rather than permanent reduction of forest areas.

In the wet tropical region, regeneration generally takes place very rapidly and he says it would be incorrect to consider that affected forest areas have disappeared. This question is particularly relevant to the very numerous forest fires that affected the Amazon forest of Brazil in 1987 and 1988. An important consideration is whether the fires indeed have a permanent effect.

"Fire in the tropical zones" Lanly said, "can be an essential element in the process of deforestation, when it is used as an instrument to clear the land for various forms of permanent or itinerant agriculture in the wet tropics."

In the dry tropics, fire is also used in the form of "bush fires" for grazing and hunting. These fires, often repeated every year, are generally a cause of degradation through reducing the number of species and their growth. However, continued degradation may result in a permanent disappearance of the trees and one is clearly dealing with true deforestation.

Forests and Forest Fires in the Major Ecological Regions of the World

"All forests and other wooded areas are not equally subject or equally sensitive to fire," stated Lanly. "The incidence, frequency and seriousness of forest fires

Forest areas are being reduced in the developing countries, and are being increased in the industrialized countries.

*These forest fires can
arise from the uncon-
trolled propagation
of deliberate fires
set to clear
agricultural land.*

depends on a large number of physical, climatic and socioeconomic factors and I will summarize the overall situation in four major ecological zones."

The Temperate and Boreal Regions. These comprise the greater part of North America, the Southern Zone of Latin America, Europe and the USSR, east Asia, New Zealand and part of Australia. This ecological zone is the one that includes the largest forest area (42% of the world's total). Prolonged summer and winter droughts and violent winds can create conditions for very large fires to develop. Lanly cited the extremely large fires in northern China and Southern Siberia during 1987 and the 1988 fires in Yellowstone National Park in the USA.

Mediterranean Climate Regions. This encompasses the Mediterranean basin (southern Europe, North Africa and the Middle East) and certain other zones of Mediterranean climate, particularly in the United States, Mexico and Chile. Among the major ecological zones this one is the least extensive and has the smallest areas of forests and other wooded areas. Long summer drought, sometimes aggravated by violent winds, such as the 'mistral' in France, create favorable conditions for forest fires to start and spread rapidly.

"In the Mediterranean region proper, the situation relative to forest fires is different in the north and the south," he explained. "In the north, the countries of southern Europe have their agriculture and animal husbandry limited to the more productive zones. The marginal agricultural lands are abandoned and extensive grazing and forest traffic are tending to disappear. Vegetation in the understory develops, making it easier for forest fires to start and spread. Additionally, tourism in the forest environment is another source of fire, because the tourists are unaware of the region's ecology or the risk of wildland fire.

"In the countries of the southern Mediterranean, the density of the indigenous rural population remains high, and they continue to practice extensive animal husbandry and movement through the forest. The risks that fires will break out and propagate are reduced by the clearing of the forest understory by grazing and the inhabitants' intimate knowledge of their natural environment." As a whole, forest fires are more numerous and wide spread in Europe than in North Africa.

Dry Tropical Regions. These cover the majority of tropical Africa, extensive areas in Brazil, Mexico and Peru, and less extensive areas in Colombia, Venezuela and the Caribbean, as well as in South and Southeast Asia. The dominant plant cover consists of deciduous forests and mixed forest-grass formations, the herbaceous layer constituting a natural fuel in the dry season.

"These formations are generally scoured every year, particularly in Africa, by 'bush fires' set by the population for different reasons," Lanly said. Among them are "to sanitize the region so that it will be cleared of the vectors of parasites and diseases (for example, the tsetse fly), to produce sprouting of vigorous woody or herbaceous species to feed grazing animals in the dry season, or to hunt wild animals. These forest fires can also arise from the uncontrolled propagation of deliberate fires set to clear agricultural land, or through negligence on the part of travelers (including tourists and hunters) who cross these areas in the dry season.

"Most of these formations are actually derived from sub-humid and dry dense forests through the action of repeated fires and they may be classified as 'pyroclimax' formations. Their woody component consists of species of hardwood resistant to fire, regenerating from the stump or from suckers, with a thick or corky bark, and characterized by slow growth.

"Each year bush fires cover considerable areas, as can easily be seen from satellite images. The gains that the local population realize from this ancestral practice are limited by the short and long-term losses." The uncontrolled fires lead to laterization and impoverishment of the soils, frequently devastate crops and homes, and are sometimes responsible for loss of human life. Attempts to set fires

at the beginning of the dry season have not passed beyond the pilot stage. Finally, the accumulations of carbon dioxide in the atmosphere, as a result of bush fires is becoming an important issue.

Wet Tropical Regions. More than half of these areas are found in tropical America, and particularly in the Amazon basin. The rest are located mainly in west and central Africa, South and Southeast Asia and Papua-New Guinea. Although it may seem paradoxical, forest fires have always existed in the wet tropics. Regular fires in the wet tropics would explain why pure conifer stands persist in the coastal areas. These pine savannas are plant cover formations derived from fire, which have replaced the wet dense forests.

Lanly pointed out that in recent years attention has been drawn to the very extensive forest fires in the humid tropics, particularly the one in Kalimantan (Indonesian Borneo) in 1982, which covered around 3 million hectares, those in Côte-d'Ivoire in 1983 and, more recently, those in the Brazilian Amazon in 1987 and 1988. With regard to the origin of these large forest fires, he said common factors are found in the humid tropics: 1) a relative dryness of the forest at the time of the fires; 2) forests that have been opened or cut down for crops, or forest exploitation; or 3) a combination of both.

Conclusions

Lanly asked, "Is it possible to foresee over the middle and long term how the frequency and seriousness of forest fires will evolve in the various regions of the world?" He answered his question by stating, "Certainly not with any precision, since the number of causative factors is so great and the evolution of each of them is so uncertain. Two significant questions are raised in particular: a) What is the overall correlation between socioeconomic development and forest fires; and b) What will the consequences be with respect to global warming and forest fires?"

"It appears that socioeconomic development is accompanied by an increase in the number of forest fires. In the temperate and Mediterranean zones the principal reasons are: the abandonment of countryside by the population that managed the rural areas and were conscious of the risk of forest fires; the significant migrations of city dwellers who are not familiar with the environment they are crossing or temporarily occupying; the planned expansion of wildlands; and the recolonization by woody vegetation of the areas abandoned by agriculture. In the majority of tropical countries where development is proceeding more or less rapidly, intensive management of the rural areas is still not very frequent; the rural population continues to grow and, with it, forest fires, since the peasants use fire for clearing, grazing and other vital activities.

"In addition, what may be the consequences of climate change on the frequency and significance of forest fires? Presuming that the current change will continue, an average temperature increase of 1.5 to 4.5 degrees Celsius, by 2030, which will be more marked in the higher latitudes, will occur. This warming and certain other consequences of the "greenhouse effect," dryer summers in the middle latitudes, increased variability of temperatures with more frequent droughts and more dry years in a row, combine to suggest future climatic conditions may be propitious to forest fires, with the possible exception of the wet tropical zones that will have more abundant rainfall.

"It therefore appears that both socioeconomic development and the climate change will create conditions more favorable to forest fires in the future. It thus appears essential to strengthen structures and increase research and development efforts at the national and international levels in all branches of prevention, detection and control. The FAO of the United Nations will serve, in so far as its means permit, as a forum and will contribute technical support to the member states in this area that is so important to human life, the protection of property, and the conservation of natural resources."

It therefore appears that both socioeconomic development and the evolution of the climate will create conditions more favorable to forest fires in the future.

Chuck Lankester

Principle Technical Advisor
United Nations Development
Program



*...global development
priorities—food security,
land degradation, bio-
diversity loss, global
warming, etc.—fall on
forestry's shoulders.*

The Economic Perspective of the Wildland Fire Problem

Chuck Lankester began by describing six critical environmental challenges for the 90s:

Desertification

Lankester noted that 17 million hectares per year are being reduced to non-productivity, and four or five million of those each year had been cultivated. "Africa has been the most critically affected region," he said, "and for those of you who have flown across the continent at night during the dry season will appreciate my words that fire is a terrible problem in this regard."

Lankester added that the issues are outreach, education and research to determine the most propitious schedules for burning to reduce soil damage, alternative cropping patterns that produce less waste biomass, favor ranching and eliminate pests.

Food security

This is related to desertification, Lankester said, and again Africa is the critical continent, with the chilling reminder from the FAO that by the year 2000 as many as 65 nations, heavily concentrated in Africa, may not be able to feed themselves. "Conservation of soil and water resources and agro-forestry are important weapons in this struggle," Lankester said, "and therefore forest protection is important."

Diminishing water availability

Lankester noted the 160 million hectares of severely degraded watersheds that need immediate attention. "Wildfires damaged many of these areas," he said, "usually deliberately set by illegal settlers and graziers, and controlling fires in these watersheds, especially those above irrigated plains with dense populations must receive top priority."

Lankester added, "when all the external economic benefit of watershed projects are calculated they may show economic rates of return that are significantly higher—say, up to two or three times higher—than for many industrial plantation projects. Of course conditions vary, but the emerging environmental agenda will force us to reconsider priorities."

Biodiversity loss

Lankester expressed concern over the extinction of species and the disappearance of genetic resources occurring today at rates unmatched in the last 65 million years. He said we don't even know how many other forms of life we share this planet with. "Losses are conservatively twenty-five species per day," he said, "perhaps as high as one hundred per day and, unlike the other issues I have mentioned, losses in this context means gone forever, extinct; clearly any deforestation, including destruction by wildfire, contributes to this economic loss."

Among the kind of questions forest managers will be increasingly required to address are how to minimize costs and maximize protection while also meeting multiple-use objectives such as maintaining biodiversity or tourism needs.

Population

Lankester noted that this was a critical issue but not appropriate for consideration here.

Climate change

This is the big issue, Lankester said. "Warming is occurring. Past actions have almost certainly committed us to rises of 2.5 to 3.0 degrees Celsius over the next thirty-five years. Carbon dioxide levels are already almost twenty-five percent higher than since the industrial revolution." He said that future trends are difficult to predict, "but a further increase of thirty percent in carbon dioxide concentrations over the next fifty years is seen as very likely."

Lankester did not know the effect such levels would have on future human societies but said the alarm signals are hoisted, adding, "Your work is implicated here, since the general consensus is that at least twenty percent of the total global release of carbon dioxide is due to deforestation. Much of the methane released to the atmosphere is also attributed to deforestation, and methane gas is increasingly implicated as a dangerous greenhouse gas."

The purpose of reciting such dire predictions, Lankester said, was to underline the point that unplanned, indiscriminate deforestation must be stopped. He emphasized that he meant stopped completely as soon as possible, not slowed down or brought under control. "It's strange," he said, "how squarely these global development priorities—food security, land degradation, biodiversity loss, global warming, etc.—fall on forestry's shoulders. Certainly the challenges foresters face today far exceed their expectations, and I submit few, if any of us, are adequately prepared."

What are some of the policy implications of this new urgency to control forest fires, or wildfires? Lankester described the need for hard facts and specific cost and benefit calculations for various alternative management options. He also said, "Environmental considerations will not have special relevance to decision-makers in planning and finance ministries unless and until environmental benefits are translated into comprehensible and defensible economic terms."

He listed some of the economic calculations that need to be completed:

- The economic value of resource use, including both enhancement and depletion. Lankester mentioned the debate over the failure of present national accounting methodology for calculating the economic health of a nation in Gross National Product terms to reflect the consequences of the depletion of natural resources. Average annual economic growth may have to be scaled back in countries with substantial and long-standing deforestation. He expressed concern over the possibility of fundamental economic planning decisions being made on what may be misleading and overstated economic indicators. He called for research and policy revision in this area.
- An assessment of the cost of utilizing forest resources and the lost income and benefits associated with not utilizing forest resources for reasons that would include watershed protection and the loss of the resource due to fire.
- Evaluation of the cost and benefits of environmental change associated with wildfire losses. In this area, Lankester includes soil degradation, disturbance of the hydrological cycle, loss of biomass, carbon dioxide and methane emissions.
- Measure costs and benefits of economic incentives, regulations, subsidies and tax credits on varying forms of land use when deforestation or reforestation is under consideration. Lankester referred interested persons to a work titled *Government Policies and Deforestation in the Amazon Region*, which makes brutally clear that ill-advised policies favoring livestock projects and allowing deforestation, combined with other erroneous approaches, have been significant contributing factors to deforestation in the region. This information contrasts, Lankester said, with the general perception that the slash-and-burn cultivator is both the instrument and

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*Prediction:
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the cause of thousands of fires there.

Lankester further offered some thoughts on just a few of the types of research and managerial decisions needed as a result of the changing environment we have created:

- Acidification. Acid rain is not only killing off many temperate-zone forests, but also the microorganisms which under preindustrial conditions efficiently reduced hazardous buildup of forest litter to humus and recycleable nutrients.
- Suppressing natural fires. Atmospheric pollution is now such a threat that any action which increases carbon dioxide and methane concentrations absolutely must be assessed. "Just where that leaves controlled burning as a silvicultural tool, I'm not too certain," said Lankester.

The people of Boston, Lankester observed, consume 150 times as much paper as the average developing country. But what happens when the developing countries grow? Lankester said eighty percent of the population growth over the next fifty years is going to take place in developing countries. "The global demand for wood, both industrial wood and fuel wood," he said, "will likely continue growing at roughly four percent per annum, with higher levels in the developing nations as they strive to advance their own economic development."

Forest plantations are one answer. Thorough and totally effective fire protection will be necessary. Lankester said forest plantations are going to represent major capital investments and will be sited on productive land as close as possible to populations for processing, research and development.

"In theory one would assume that these intensive plantation programs will serve to relieve pressure on the remaining national forests and thereby your responsibilities to the hinterland will decline," Lankester continued. "In practice this may not be the case. Rural populations will concurrently be rising, the pressure from the forest—the only remaining land bank—will be intense, and fire will remain the convenient tool of choice for forest destruction by shifting agriculturists and would-be settlers... swift, anonymous and effectively clearing land and releasing nutrients for agriculture."

The choice of species will be of major significance in controlling fires in these plantations, he said. "I'm not sure if anyone has ever tried to correlate the fuel risk of certain species with their rate of growth. I'll just offer the suspicion that the faster growing species that may be favored in plantation schemes seem to burn particularly well."

Returning to the global warming and carbon dioxide buildup in the atmosphere, Lankester noted that the United States is responsible for twenty-six percent of global carbon dioxide emissions and that automobile manufacturers are trying to relax or delay clean air proposals. He said that shows that the indulgence of the west is not going to be easily slowed in favor of tomorrow.

"As carbon dioxide levels continue to rise," he said, "and the adverse impacts in terms of global warming—with consequent ocean levels rising and climatic disruption—receive the attention they deserve, then using the photosynthetic process as a deliberate policy for 'sinking carbon' is bound to gain more favor." He described one fifteen-year global reforestation effort of one hundred and seventy million hectares that would reduce carbon dioxide levels by about twelve percent. "The point is that as fixing carbon dioxide becomes an urgent global priority, so reforestation schemes will be viewed more favorably by the planners and economists."

Similar grand efforts will not easily be accomplished, but the possibility remains that just such a global emergency may be needed. Lankester ventured the opinion that within five years, "there will be a global reforestation push, with atmospheric carbon dioxide being the single most important objective." Reforest or fry, he asked. "Is there really any choice?"

Turning to international cooperation, Lankester indicated that where the United Nations may help is "by ensuring that managers are giving sufficient

attention to protection and by investing in human resources, facilitating both the transfer of technology and technical cooperation among countries. It is already within FAO's mandate to continue the important work of collecting, collating and analyzing statistical information on fires worldwide. Data are scarce and a greater effort to collect information is required from almost all countries."

Lankester concluded by urging everyone to work with a renewed sense of purpose, determination, optimism and professionalism. He noted that while the signals from politicians, financiers and the general public are decidedly greener, the task before the forestry profession remains daunting.

"As professionals," he said, "we now have to get our act together; the technical basis of our actions must be further improved; we must improve our outreach; greatly improve our economic analysis skills; and we must go on and remain on the offensive. Forestry management including forest fire management, has come off the back burner and is bubbling nicely on the front. Let us resolve to never let it be displaced again and to regain our credibility as spokesmen for the preservation and responsible management of the forests that still cover nearly one-third of our planet's landmass."

*Let us resolve...
to regain our credibility
as spokesmen for the
preservation and
responsible management of the forests*

Philippe L. Boullé

United Nations
Disaster Relief Organization



The toll on human life and property can be significantly reduced by improved risk assessment and early warning systems and by increasing public awareness of disasters.

Confronting Natural Disasters: The International Decade for Natural Disaster Reduction

Philippe L. Boullé began his presentation by describing the United Nations Disaster Relief Organization (UNDRO) as the specialized office of the Secretary-General of the United Nations for all emergency-related matters. It carries out two broad series of activities:

- It assists governments of countries affected by natural disasters in mobilizing, directing and coordinating international disaster relief assistance. This means helping the government concerned to organize itself for dealing operationally with the emergency, including making an immediate assessment of damage in precise quantifiable terms, as well as providing a detailed description of relief needs, such as temporary shelter, medical supplies, and basic equipment and supplies for search-and-rescue teams. UNDRO immediately advises the affected countries and the international donor community of these needs, in order to avoid duplication of relief contributions. UNDRO also has a central warehouse for relief supplies in Pisa, Italy, from where the most needed items can be airlifted in a very short period of time. All of this is done in close cooperation with sister organizations in the United Nations System.
- UNDRO is also largely involved in prevention and preparedness activities for the mitigation of disasters. For the past seventeen years the world has witnessed the loss of millions of lives, as well as massive property damage and economic destruction resulting from earthquakes, floods, wildfires and other calamities. Because UNDRO has seen so much recurrent human misery and economic damage, it firmly believes in the value and importance of mitigation. The toll on human life and property can be significantly reduced by improved risk assessment and early warning systems and by increasing public awareness of disasters. In a large number of countries UNDRO assists the governments in activities such as hazard mapping, monitoring of seismic and volcanic activity, devising early warning and evacuation plans, and creating awareness in the population for the impending disaster.

Boullé said UNDRO welcomed two years ago the efforts of the U.S. Academy of Sciences, under the leadership of its chairman, Dr. Frank Press, to obtain agreement among all nations of the world through the United Nations for a concerted effort to reduce the impact of natural hazards. In 1987 the Academy produced a very important document, *Confronting Natural Disasters*. And at the end of 1987 the General Assembly of the United Nations adopted by consensus a resolution declaring the 1990s as an International Decade for Natural Disaster Reduction. A small interim secretariat was established within UNDRO and preparatory work began. Dr. Press presided over a group of 25 experts designated by the U.N. Secretary-General.

"You will surely be interested to learn," said Boullé, "that one of these 25 experts was Noel Philip Cheney, of the National Bush Fire Unit in Canberra, Australia. This clearly indicates that wildland fires are considered to be one of the important hazards for the 1990s, a hazard that can be reduced through mitigation,

according to the international community.”

He added that at the end of 1989 the 159 member states of the United Nations will make a final decision on the forum and contents of the International Decade. There is already broad agreement on most matters.

Further describing the Decade for Natural Disaster Reduction, Boullé said, “According to recent observations, the inevitable occurrence of natural hazards will increase as we approach the twenty-first century, as a result inter alia of increased urbanization and increased physical infrastructure constructed sometimes according to vulnerable technologies. In this context of a more hazardous world confronted by more windstorms, more volcanic eruptions, more earthquakes, more wildfires, the main objective of the International Decade is not to erase disasters from the face of the world—that would be an impossible goal—but rather ‘to reduce, through concerted international action, loss of life, property damage and social and economic disruption caused by disasters.’

“The definition of a disaster for the Decade is ‘any disruption of the human ecology that exceeds the capacity of the community to function normally.’ The essence of a natural disaster therefore is not only the hazard itself, i.e. the physical event, but also and principally the human, economic and social impact of that particular physical event. Seen through that angle of the vulnerability of a community to disasters, it seems indeed possible to talk about natural disaster reduction.”

According to Boullé there are five overall goals of the Decade:

- To improve the capacity of each country to mitigate the effects of natural disasters expeditiously and effectively.
- To devise appropriate guidelines and strategies for applying existing knowledge.
- To foster scientific and engineering endeavors aimed at closing critical gaps in knowledge.
- To disseminate information related to the assessment, prediction, prevention and mitigation of natural disasters.
- To develop through technical assistance and technology transfer measures for the assessment, prediction, prevention and mitigation of disasters.

Boullé said that there are two specific goals of the Decade which are in themselves mechanisms for action:

- All governments are called upon to establish national committees in their own countries to develop a strategy to attain the goals of the Decade.
- The United Nations is to become an international Center for the exchange of information, the storing of documents and the coordination of international efforts for the implementation of the Decade's goals. To fulfill these functions, the United Nations needs to work in close cooperation with all interested parties, including the nongovernmental organizations, scientific groups, universities, etc.

But how to achieve these goals and objectives, asked Boullé. This is discussed in a report of the Secretary-General of the United Nations, which includes the report of the international group of experts for the Decade. Boullé said UNDRO will be happy to make these reports available to the audience on request.

“The basic approach for mitigation activities during the Decade is one of flexibility,” Boullé assured the audience. “There will be no compulsory program of action for the Decade, nor a detailed list of projects to be implemented. There is recognition of the evolving nature of the exercise, of the need not to cast in stone a program for ten years that may need adjustment as the years go by. Most of the activities would be designed and implemented at national or regional levels by governments, by organizations of the United Nations System, or by scientific groups and private, voluntary organization (PVOs) following guidelines at the international level. This is indeed a wise approach for a decade which will cover all

The main objective of the International Decade is ... to reduce, through concerted international action, loss of life, property damage and social and economic disruption caused by disasters.

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participation of the
whole community.*

natural hazards, blend international, regional and national preoccupations and associate scientists, political leaders, United Nations organizations and PVOs.

"On the threshold of this International Decade, one cannot escape having the feeling that there is today enough scientific and technical knowledge to mitigate effectively the impact of most disasters. Yet there are difficulties in effectively applying this knowledge, as a result of constraints which I am going to enumerate. The intention is to address these constraints and overcome them during the Decade."

The constraints Boullé listed are:

1. The Decade is based on the premise that we need to change our attitude to disasters from one of emergency response to one of anticipation of the hazard. This is not easy to realize. A large part of local officials, of United Nations System officials, as well as the general public are programmed to respond to disasters, and it will take a lot of effort to change these perceptions. In order to realize a change in mentalities a large part of the Decade's activities will have to be devoted to public education and public awareness, especially at the local level in disaster-prone countries.

2. The will of the political world to give priority attention to disaster mitigation is not as strong as it should be. The economic and social benefits of disaster mitigation are not fully perceived. Resource allocations for disaster mitigation either in national budgets or in the programs of international organizations are clearly not enough at present.

3. There is need of a stronger link than at present between scientific research on the cases and manifestations of disaster and the actual response to them when they occur. It is not enough to predict accurately a volcanic eruption or to describe accurately how a wildfire will develop; it is as important to respond effectively when the catastrophe occurs. The link is not as easy to establish as one would think: by essence disaster mitigation is a field where high level technology can be used. By contrast, when a disaster strikes, immediate rescue efforts have to be undertaken by local individuals sometimes unfamiliar with technology and in a typically disorganized setup.

Boullé reminded the audience that these constraints will not be easy to overcome, but that is the essence of the need for international cooperation.

He also said that this conference precisely emphasizes the importance of international cooperation. He went on to suggest some links between the concepts of the Decade and wildfire management generally.

- Widespread international publicity will be of importance if the International Decade is to succeed, because no preventive or protective measures will be fully effective without the informed participation of the whole community. This is probably also true in the specific case of wildfire management. Both the teaching profession and the news media can contribute greatly to improving public understanding of natural hazards, including wildfires, and of what can be done to protect against them. Experience shows that alert, aware and informed communities can and do play a vital role in fire prevention, mitigation and preparedness. This applies particularly to the evacuation of communities in the face of fast-moving fire fronts.

- The importance of preparedness activities must be stressed. An essential thrust of the Decade is to promote counter-disaster action in places where disasters are likely to occur. To this effect, it is necessary to closely integrate the work of scientists and engineers with that of planners and managers to ensure that all those who conduct research are also able to communicate the results clearly and precisely for use by public safety officials, land use planners, architects, etc., whose duty is to provide the best possible protection from disasters to the community at large. If we are to utilize preparedness to its maximum effect, we must obviously be in a position of warning of disaster onset which, for wildfire as most other disasters, is not an easy task. It is true, however, that in developed countries there has been significant

progress in wildfire hazard assessment and associated warning methods. These advances need to be extended for the benefit of less-developed nations as well.

- Hazard assessment, risk management and land use are other key areas for attention during the Decade. Long-term risks can be reduced significantly by the appropriate choice of less-hazardous sites for the implantation of new settlements and industrial projects and by the application of prevention and mitigation measures. Controlled removal of the most easily combustible material in fire-prone areas, fire restrictions and, where necessary, severe legal penalties illustrate the recognition that prevention and mitigation have to be sensible and firmly applied. Yet in many countries the increasing encroachment of populations into fire-prone areas has increased not only the wildfire risk but also the difficulties of handling fire situations when they arise. If the Decade program can be developed in close cooperation with the wildfire community, international attitudes can be influenced toward safer land use and better prevention and mitigation measures.

- A critical issue is the use we can make of modern advances in science and technology. Wildfire management has been quick to use such advances as satellite information, infrared systems, retardant materials, and advanced research and development. It is hoped that as a result of the International Decade such benefits of science and technology shall be applied widely and effectively to combat disaster in developing countries around the world.

In closing, Boullé said, "Let me express the view that the International Decade for Natural Disaster Reduction gives us an immense opportunity to change man's historical fatalistic view of natural disasters. There are now alternatives...and if a firm commitment is made to apply them in the next ten years, there is hope that by the end of the Decade—and of the century—mankind will have gone far towards learning to live with natural hazards and not simply suffer from their violence."

MEETING GLOBAL WILDLAND FIRE CHALLENGES

*There is today enough
scientific and technical
knowledge to mitigate
effectively the impact of
most disasters.*

F. Dale Robertson

Chief
USDA Forest Service
Washington D.C.



*There is a time to
plan...and a time for
aggressive action. We
must be smart enough
to know the difference
and bold enough to do
something about it.*

The Global Challenge for Wildland Fire Management

To begin his presentation on international cooperation, Mr. Robertson described the tremendous challenge the U.S. Forest Service and others faced during the Yellowstone National Park fires of 1988 and the implications for international cooperation.

In addition to the million acres that burned in and around Yellowstone, he pointed out other fires were also burning throughout the western United States and Alaska at the same time. During a single day in early September, there were thirty-nine major fires burning in eleven western states.

"We had more days of extreme burning conditions last year," Robertson said, "than any other year in recorded history."

Fires were advancing five to 10 miles in a single day with spotting of new fires a mile and a half ahead of the fire fronts. Fire behavior baffled the experts and the record book was re-written with unprecedented fire intensities, rates of spread and burning indices. Fires often burned at night with as much severity or more than during daylight hours.

"There were days when over 100,000 acres burned," Robertson continued. "One day that I will always remember, September 6, 1988, nearly one-half million acres went up in smoke as major runs occurred on almost all of the fires. The Canyon Creek fire, in western Montana burned over 180,000 acres that day as 60 mile-per-hour winds pushed the fire out of the Bob Marshall Wilderness, forcing 127 firefighters into their protective shelters to save their lives. The fire burned across miles of private property, killing cattle, burning fences, outbuildings, crops and livestock forage. Fortunately, there was not a major population center in its path and there was no loss of life.

"I had the opportunity several times on live national television to explain the situation and why the fires were not being put out. We were doing all we could do under the circumstances. The Forest Service and other wildland fire management organizations in the United States had mobilized over 40,000 fire fighters and support personnel from throughout the country to combat the fires.

"This included, regular and reserve fire fighters from federal agencies, eight battalions of military personnel plus military aircraft and other support equipment, state and local firefighters from 39 states, plus hiring 4000 temporary emergency fire fighters.

"For weeks on end fire tools and other materials from our fire caches were dangerously low. All fire fighting aircraft were committed and we needed more in a crisis situation. And despite this largest mobilization of fire fighting forces in the United States ever, the television networks were still asking me over every few days so I could explain to the American public why we weren't getting the fires put out.

"The Congress of the United States also got involved and invited National Park Director Bill Mott and I over several times to answer a few questions that were difficult to answer. There was a lot of advice on what the Forest Service and National Park Service should be doing differently to get on top of the situation. President Reagan asked the Secretaries of Agriculture, Interior and Defense to

personally visit the fires and make recommendations to him. One outcome as a result of that visit was a national fire management policy review for wilderness areas and national parks."

Robertson explained that one of the problems he had during the Yellowstone fires was with international cooperation. "We had total commitment of U.S. fire fighting forces and were experiencing shortages of critical equipment and technically trained personnel. Yet we share a 3000-mile border with Canada which has one of the largest, best trained and equipped forest fire fighting organizations in the world.

"They were ready and willing to come help and had the trained personnel, aircraft, equipment and fire tools that we needed but I could not utilize them. I couldn't ask them for assistance because of a legal barrier here in the United States that did not permit us to reimburse Canada for their expenses. At the height of the crisis I'm glad to say we did get the Congress of the United States to give us temporary legal authority to reimburse Canada for their badly needed equipment, aircraft and trained personnel.

"But because we didn't have those authorities in place prior to the emergency, we lost crucial valuable time during a crisis situation."

If there is any distilled wisdom from all of this experience, Robertson explained, it is that there is a time to plan and a time for aggressive action and the planning better be complete before you have to go into action. "And, I'm happy to report that Congress passed the Foreign Fire Fighter Assistance Act in April of this year which makes the authority to cooperate with foreign nations permanent."

Robertson said that international cooperation and emergency assistance isn't something that is needed every year. Fortunately it is the exception not the rule. "But, we all have to be prepared for it when our time comes up."

He suggested that every nation develop adequate trained personnel, and have the equipment and support capabilities to deal with normal wildland fire problems. He added that developing and maintaining capability to deal with expected wildland fire situations is a part of our responsibilities.

Robertson described two important objectives for the conference:

- To develop and improve our own capabilities for handling wildland fire emergencies.
- To develop plans and procedures to assist neighbors or accept assistance during times of extreme emergencies.

International cooperation is an important part of achieving both of these objectives. "Together, we can do more" Robertson said, "in joint training, technology transfer, mutual research, equipment development and making trained fire fighters and equipment available between nations, especially in crisis situations such as the United States had in the Yellowstone fires. By working together to overcome physical, logistical, policy or political barriers to mutual cooperation, we can all improve our capabilities and programs at home as well as across borders.

"We don't need disasters to make these things happen. In fact the time for this type of information and technology exchange is before disasters happen. We should all take advantage of the opportunity this conference provides to talk to one another and make plans for expanding international cooperation. As I found out last year, you cannot afford to wait until the midst of a crisis to make cooperation work. Potential barriers must be anticipated and resolved ahead of time, for there will be little time to work on processes and procedures when wildfires are rapidly spreading and becoming more difficult and expensive to control.

"I believe there are many benefits to be gained from international cooperative efforts. Joint efforts between nations can offer cost efficient training programs. Especially among countries with common borders. It provides opportunities for people who may work together in an emergency situation to train together before

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the emergency.

"Short term exchange of personnel between countries provides an excellent means to broaden their experience and provide hands-on development of on the job training that may not be available at home.

"International cooperation provides for the exchange of fire fighting techniques and technology and sharing of research results. Joint programs between nations to better prepare us to work together in combating wildfires also prepares us to cooperate on an international basis to handle other disasters as well. I think this will be really important in supporting the goals of the United Nations in their Decade for the Reduction of Natural Disasters.

"I also strongly believe that cooperative joint programs between nations help build bonds of friendship that extend beyond the emergency or project, thus helping to foster better world understanding which is so important in our global environment.

Turning the spotlight again to the U.S. Forest Service, Robertson indicated it has long recognized the mutual benefits of international cooperation. "We have a strong international forestry program covering many aspects of forest management including fire management. In addition, the U.S. State Department, Agency for International Development and other agencies of the U.S. Government ask the Forest Service to participate and provide assistance in many international emergencies."

Robertson discussed some of the recent international wildland fire and emergency assistance projects the Forest Service has been involved in:

- Fire training for foresters in Indonesia.
- Participation in the Fourth International Fire Fighting Course hosted by Mexico with representatives from Spain and ten Latin American countries
- Development of a memorandum of understanding with Mexico, providing for joint fire suppression, training and use of equipment.
- Technical fire management study group exchanges with Australia and Israel
- Locust control in Africa.
- Technical assistance to Argentina for construction of an interagency fire dispatch center and development of a fire danger rating system.
- A fire protection and rehabilitation project with China providing technical assistance in damage evaluation, air operations and electronics research applications after the devastating fires there in 1987.
- Emergency assistance to Mexico after the devastating Mexico City earthquake in 1985.

Robertson described the conference as an excellent opportunity to start building the foundation of expanded international cooperation for confronting catastrophic wildfires and learn from our past experiences. It's always better, he said, to be wise by the misfortunes of others than by your own—and the United States can put the Yellowstone fires on the table as one misfortune that everyone can learn from.

He said the issues luncheon on Tuesday will be a chance for each participant to talk with representatives from neighboring countries and those from nations with fire protection problems similar to what they have at home. The results of those discussions and the international wildland fire survey many of the participants responded to will be published and available at the end of the conference. It will provide an excellent foundation for building expanded international cooperation.

"I'm sure there are going to be some great ideas brought forward this week, said Robertson, "and no one country has all the answers. But let me mention just a few ideas for improving and expanding international cooperation in wildland fire management."

- We need an increased effort for nations to overcome logistical, policy and

political barriers to increase our ability to deal with catastrophic wildfires and other natural disasters. Our situation with Canada is a good example which now has been resolved.

- Memorandums of understanding between nations with common borders can increase information exchange, training of personnel and use of equipment for ongoing programs as well as during disasters.
- We should increase the use of group study exchanges between nations to exchange technical information and foster professional and personal international relationships and world understanding.
- There needs to be an increase in international research cooperation to keep pushing the outer boundaries of mutual knowledge and expertise.
- The world population is projected to double in only 35 years. By the year 2025 the world population will be 10 billion. Much of this growth will take place in what are now forests and wildland areas. Fire prevention and protection of life and property in wildland interface areas is truly a "global" problem. Educational programs with citizens, government agencies and local officials and technologies for effective fire protection in the interface must be developed and shared.

"I'm sure all of you have many more ideas for recommended actions and solutions," continued Robertson, "and I look forward to hearing them. In 1988 the United States had a bull by the tail with the Yellowstone fires and the other wildland fires throughout the country. Over five and one half million acres were burned, destroying over 400 homes, killing eleven people and cost nearly three quarters of a billion dollars to fight.

"In 1983 some of our colleagues with us here from Australia had a problem with wildfires. The wildfire disaster that came to be known as Ash Wednesday claimed 77 lives, injured 3500 people, destroyed over 2500 homes, and killed 300,000 farm and ranch animals as wildland-bush fires burned over 840,000 acres of urban, forested and pastoral lands in Victoria and South Australia in a single day.

"In 1987 it was China's turn. In May of that year a huge fire burned about 2.5 million acres. The fires damaged three towns, 10,081 homes and resulted in 193 fatalities. All of these examples must shake us out of our complacency.

"Who is going to have problems with wildfires this year or in 1990 or the year after that or the year after that? There is no way to predict when it will be your turn to have a problem with wildfires and we have very little control over the development of the extreme conditions that set the stage for catastrophic wildfires to develop.

"What we do have control over is how prepared we are to handle disaster when it strikes. How capable are our organizations to offer assistance or accept assistance when situations get beyond a single nation's ability to deal with them?

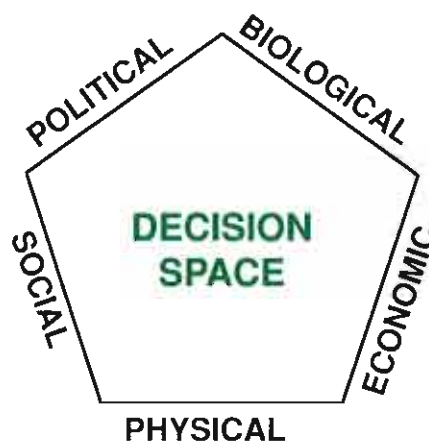
"There is a time to plan and work out details, and a time for aggressive action. We must be smart enough to know the difference, and bold enough to do something about it in advance.

"Philosopher Tyron Edwards said that 'hell is truth seen too late.' Let's face the truth head on at this meeting and do something about it."

*We should increase
the use of
group study exchanges
between nations
to exchange
technical information*



Five Issues of Decision-Making



The manager's job is somewhat different from other professionals in land management. The researchers and resource specialists make recommendations in their respective areas of expertise. The decision-maker then must blend these recommendations with other variables into an acceptable and workable decision and course of action. Compromise is often necessary.

The land manager's decision space is normally bounded by five variables: biological, physical, social, political, and economic. Any decision to be workable should be within acceptable limits of all of the variables.

(Note: The Decision Space example was adapted from a presentation made by O.L. Daniels and L.D. Mason at the Symposium and Workshop on Wilderness Fire in Missoula, Montana, November 15-18, 1983.)

Five Issues of Decision-Making

Jesús B. Cardeña Rodríguez served as session chairperson for the regional presentations and gave an overview of the social, political, economic, biological, and physical consequences of global fire regimes.

■ The Social component:

"The level of development of each country," Cardeña began, "the quantity and degree of endowment with natural resources and the consequent contribution to the well-being of the population determine to a great extent the concern and attention which society in general pays to the problems that affect forest resources.

It is the will and decisions of society which encourage or limit actions to promote the protection of each country's forest resources."

■ The Political component:

This important aspect, represented by various levels of authority, plays a determining role in the conservation and rational utilization of forest resources, according to Cardeña, who added, "It is essential that we who are experts in this subject should be capable of motivating and interesting our governments through convincing and viable plans and actions based on projects that combine the economic, ecological and social benefits of forest activities.

■ The Economic component:

The international economic crisis has made clear the necessary interdependence among the countries of the world in order to face common problems, such as the protection of natural resources. "Full recognition of the present and potential contribution of forest resources," Cardeña said, "should be an important point of reference for governments to channel economic resources, which will at the same time permit the development of forest activities and guarantee the improvement and conservation of the plant cover."

■ The Biological component:

Cardeña said it is important to give appropriate recognition to the fact that we living things depend on the quality of our environment and that this in turn is the result to a great extent of the quantity of plant cover. He said this obligates us to work for the care and protection of forest resources, since this is the only way to assure the well-being of future generations.

■ The Physical component:

The quantity and quality of the water, air, soil and vegetation, as well as their fragility—depending on the ecosystem or their state of deterioration—will also be an unequivocal guideline for making decisions on managing and protecting those resources, Cardeña continued. On the other hand, he said we should consider that the presence of fire in the forest cover is as old as the vegetation itself and has played an important part in the formative and dynamic processes of forest ecosystems in various regions of our planet. However, uncontrolled fire in the forest areas, which to a great extent is the result of the growing presence of man in rural areas, has been growing, with a consequent impact on the water cycle, the soil and, generally, on changes in the ecological balance.

Cardeña noted that this conference constitutes an unprecedented effort by all participating countries, "and it is very clear that it will enable us to confront the problem of forest fires from broader perspectives."

Jesús B. Cardeña Rodríguez

Director General
Normatividad Forestal
Mexico

*This conference
will enable us
to confront
the problem of
forest fires from
broader perspectives.*

Roger Underwood

General Manager
Department of Conservation
and Land Management
Western Australia

*The most serious fire
problem in Australia
occurs at the interface
of the major cities and
the agricultural
and forest regions.*

Oceania Region

Physical and Biological Issues

The Oceania region (encompassing Indonesia, New Guinea, Australia and New Zealand together with innumerable smaller island countries) is vast and diverse. Similarly, the human systems found in this region range across the full social and economic spectrum from tribal life to the urban populations located in the cities.

There are six principal vegetation zones in the region:

- The wet tropics, dominated by tropical rainforests. There is almost no year-to-year wildfire problem in undisturbed tropical rainforest. Problems occur when the forest is opened up for agriculture, by logging, or when a prolonged dry spell causes the forest to dry out sufficiently to enable a fire to run.
- The wet/dry (monsoonal) tropics comprising open forests and woodland, tall grasslands and ephemeral wetlands. The area is vast and sparsely populated.
- The temperate forests and woodlands. The wildfire problem in these forests is of major concern. These areas are relatively densely populated. Each summer strong dry continental winds are associated with very high temperatures. Overlying this annual weather pattern are regular cycles of consecutive years of below-average rainfall. The forests are highly flammable, and rapidly build up heavy levels of ground fuels. At the same time, the forests have major commercial and conservation values. The result is that high intensity fires occur somewhere in this region virtually every year, and their potential for damage is great.
- Tall wet forests and temperate rainforests, found in the most southerly latitudes of Australia, New Zealand and Tasmania. Few wildfire problems exist in New Zealand, but in southeastern Australia a fire season occurs every year and very serious fire weather on top of drought can occur every decade or so.
- The arid and semi-arid zones, comprising the bulk of continental Australia. This vast arid region is dominated by hardy grasslands and low shrublands. Rainfall is generally light, and droughts of several years duration are commonplace. Fire has always occurred regularly in this area. Lightning from summer thunderstorms is commonplace, and this was supplemented (until recent decades) by widespread burning by Aborigines. In long unburnt areas, fires are intense and can travel long distances.
- The agricultural zones, where crops, pasture and plantations, largely replace the native vegetation of all the first four types listed above. Wherever crops or pastures are grown which accumulate dry matter over a dry season, fires may occur. Such fires are of significant economic consequence, and can threaten human life and resources.

The most serious fire problem in Australia occurs at the interface of the major cities and the agricultural and forest regions. Here there is an expansion in the number of urban-employed people living in the countryside. They have little experience or interest in the rural economy and practically no experience of bushfires. In many cases, conservation interests oppose prescribed burning, and this allows heavy fuels to accumulate close to residences. Elsewhere the special challenge is to develop a fire management approach which protects human life and values and does not degrade environmental values.

Asia Region

Physical and Biological Issues

"The increase of population and the enhanced demand for agricultural land," Johann Goldammer said of Asia, "have created a tremendous pressure on all kinds of vegetation. Most forest and other wildland fires are caused by the rural population." He added that this is a result of slash-and-burn agriculture, grazing, hunting and improving the yield or collection of non-wood forest products.

Goldammer gave an overview of the four most important forest biomes of Asia: boreal conifer; submontane; tropical dry deciduous; and lowland tropical rain forest.

He noted the worldwide attention that followed the 1987 wildfires, which covered 1.33 million hectares (including 870,000 hectares of boreal coniferous forest) in China's Heilongjiang Province. But since lightning still causes more than a third of all wildfires during the past twenty years, he said this implies that "fire must have played an important role in the forest development of the region."

In the submontane elevations of the Himalayas and other regions of tropical Asia, pine forests are a predominate feature, Goldammer said. Over centuries these forest ecosystems have developed under anthropogenic fire influence and can be regarded as fire climax. Fire exclusion in many cases, he said, would lead to the invasion and predominance of fire-sensitive broad-leaved species. Added Goldammer: "Recent increase of fire frequency caused by the expansion of uncontrolled sylvopastoral land use leads to large-scale degradation of the mountainous pine forests. The most important watersheds become increasingly destabilized due to subsequent erosion, landslides and flooding. In addition, forests become weakened by secondary pests. Fire management, which would include the prescribed burning component, needs to be developed and strengthened in almost all countries of tropical continental and islands of South Asia."

The tropical dry deciduous forests of mainland Southeast Asia are relatively low and open, Goldammer said. Most of the leaves of these savanna forests are shed by January/February and have become a highly flammable surface fuel. He added that every year fires are set in most of the savanna forest lands for a wide range of purposes. Although the forest is fairly adapted to the annual surface fires, he said that severe erosion may occur when the denuded and unprotected soil is hit by the first monsoon rains. The large areas burned each year affect air quality by emission of particulate matter, gases and subsequent photochemical reactions.

In describing Asia's lowland tropical rain forest, Goldammer said, "Under the recent climatic conditions, natural forest fires may be started only during extreme droughts." He said most fires today are set by slash-and-burn cultivators and for large-scale forest conversion. Fire is the cheapest but most destructive tool for this; it often gets out of control and burns large areas of primary and secondary forest vegetation. Most of the rain forest burning takes place in Borneo, according to Goldammer, where a high pressure by migration programs, uncontrolled settling, and exploration/exploitation of natural resources builds up. Because of the effect of this major burning on regional and global climate, he called for national and international initiatives to stop them.

The Asia wildland fire areas are complex and diverse, and they do not allow a generalized fire management solution. He said individualized fire management policies must be based on the cultural roots of society and be socio-economically feasible.

Dr. Johann G. Goldammer
Department of Forestry
University of Freiburg
West Germany

*The Asia wildland fire
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Ricardo Velez

Chief, Service for the Defense
Against Forest Fires
Instituto para la Conservación
de la Naturaleza (ICONA)
Spain

*More than 75 percent
of the fires in Europe,
and 95-98% of the area
burned, occur in the
Mediterranean
basin region.*

*Forest fires do not
represent a passing
problem...but rather a
permanent condition of
forest policy and of the
management of
natural spaces.*

Europe Region

Physical and Biological Issues

Ricardo Velez observed that the antiquity and intensity of human activities throughout the length and breadth of Europe and particularly in the Mediterranean basin have changed practically all ecosystems, adapting them to the needs of the societies that have occupied these areas.

More recent developments have prevented growth of forested areas, he said. For example, in the countries of central and northern Europe, there is damage from pollution. In the southern countries, around the Mediterranean Sea, the problem is forest fires.

"Forest fires are currently the most important cause of destruction in the Mediterranean basin," Velez said. "Around 50,000 fires begin each year, covering 700,000 to 1,000,000 hectares of forest and causing high economic and ecological losses, including the loss of human life." More than 75 percent of the fires in Europe occur in this region, and these fires account for 95-98 percent of the total area burned in Europe. This is especially unfortunate because all the countries of the Mediterranean basin are so short of this raw material.

Velez pointed out that recovery of the affected forests is very costly and sometimes impossible, because of changes to the soil. Heavy rains follow the usual fire season, and erosion is worse without the trees to anchor the soil. Because of the problem soil, restoration often requires specific hardy pioneer species—generally pines—which in the first years after planting present a very high danger of fire.

"The effects of forest fires, said Velez, "embrace sufficiently large areas to influence the processes of desertification that threaten this part of the world, forcing us to view them as something more than isolated events."

Of on-going concern, of course, is the threat of fires to human life. Velez noted 160 victims from wildfires in Spain from 1961 to 1988.

"The greatest current problem in countries with a Mediterranean climate stems from the fact that the recurrent cycles of fire are rapidly growing shorter in numerous places," Velez described the influence of two basic factors:

- Population growth places greater pressure on forest areas because of the demand for arable land and grazing land in some regions and for recreational lands in other regions.
- Fluctuations in climate give rise to long droughts that increase and extend the risk of fires in both time and space.

He explained that the results of these facts often is to prohibit fires of a general character. But one result is a conflict between urban society, which prohibits fires, and the agrarian society, which wishes to continue using fire for its own purposes.

These and similar conflicts have resulted in an interruption of the removal of kindling, firewood and underbrush, giving the forest a higher combustibility.

Meteorological factors are also at work. Velez described how in the dry, hot season the moisture content of the light dead fuels falls below 10 percent. The dry season may last from June to October, sometimes longer. The seasonality of the risk, according to Velez, makes it difficult to maintain permanent, specialized fire fighting services.

The causes of forest fires in this region, said Velez, "reveal a strong human action in their initiation, both due to negligence and to intention.

"All of this makes it clear," concluded Velez, "that forest fires do not represent a passing problem that will disappear by itself in the short term, but rather a permanent condition of forest policy and of the management of natural spaces."

Latin America Region

Physical and Biological Issues

MEETING GLOBAL WILDLAND
FIRE CHALLENGES

"The Latin American and Caribbean region possesses more than half of the world's dense tropical forests," began Hugo Knockaert Pasquali, who explained that 60 percent of the total area of this region is forest. Plantations cover some six million hectares, and Brazil has more than half of that. The plantation area increases by 650,000 hectares per year, although it is only a tenth of the area deforested in the same period. More than a million cubic meters of wood are taken from the forests every day, mostly for firewood.

Not all of the Latin American countries maintain detailed statistics, Knockaert said, but it can be seen that February and March are the months with the highest fire incidence. This is the period of high temperatures and low precipitation. Individual countries show variations, however; fires increase in Brazil from August to December.

Knockaert pointed out that the majority (55.6 percent) of fires in the region cover 10 hectares or less. The proportion of fires covering 1,000 hectares or more was 11.4 percent. Country differences show that Uruguay's fires are mostly in the small area range, while in Argentina half of its fires exceed 1,000 hectares. In Chile 86 percent of the fires are controlled at 5 hectares or less.

Using fire as a land-clearing tool accounts for almost 40 percent of all fires recorded in the region. Other intentional fires add approximately 20 percent. Climatic characteristics, Knockaert explained, do not contribute to natural fire occurrence, and less than one percent of fires are from natural causes. When individual countries are considered, land-clearing and agricultural fires account for 70 percent in Bolivia and 73 percent in Costa Rica. Other intentional fires total 75 percent in Guatemala.

"Latin America and the Caribbean are no strangers to the problem of forest fires," Knockaert said. "The historical background indicates that, despite the fact that fire is an extraordinarily positive tool in growing and managing lands for silviculture and animal husbandry, it has been used on repeated occasions as an instrument of destruction under the pretext of making land available for productive purposes."

Knockaert addressed the wide range of fire fighting and also land management capability in the region: "Few countries have available a clear and effective organizational structure [handling] the problem of forest fires and the use of fire, in which various private and governmental organizations participate..."

Panama, for example, has no specific organization to combat a major forest fire. Its Forest Law provides for calling on institutions and the community in general in case of emergency. In Bolivia, with more than 75 million hectares of forest, there is no fire fighting organization. Activities are performed on a voluntary basis.

Knockaert indicated a need for international cooperation in the region, so that countries having existing organizations can provide technical assistance to others.

"In a large percentage of countries, there is no basic information that makes it possible to plan actions or even size up the problem," he added. "It is of the greatest importance to reverse this situation, encouraging the gathering of reliable and exhaustive statistics and assuring a certain level of standardization among fire management programs."

Knockaert called for more instruction in the region on all kinds of renewable resources and said that fire prevention should be encouraged more.

Hugo Knockaert Pasquali

Jefe Nacional Programa de
Manejo del Fuego
Corporacion Nacional
Forestal
Chile

*The Latin American
and Caribbean region
possesses
more than half
of the world's
dense tropical forests.*

Dr. Charles Philpot

Director, Pacific Northwest
Research Station
United States Forest Service

*To visualize the
natural fire regimes
of a region, we must
discard human time
frames and learn to
"think like a forest."*

North America Region

Physical and Biological Issues

Charles Philpot described the continental pattern of natural, lightning-caused, fire regimes in pre-settlement times in North America, "so that we will better understand the biological and physical effects of fire as an ecosystem factor." This also helps in planning fire management programs regardless of fire's natural role.

He called knowledge of an area's fire potential "absolutely essential," but added that fire history information has certain limitations, including changes in cultural activities, climate, grazing patterns, and new vegetation species. In certain ecosystems it is difficult to date fire events, and fire chronologies that are not cross-dated may impair the accuracy and amount of information collected. Then, some managers do not fully recognize the importance of fire history information.

"An ecosystem can be called fire-dependent," Philpot said, "if periodic changes in the system due to fire are essential to functioning of the natural system. In such systems fire is a significant environmental factor that initiates and terminates key vegetational successions, controls the age structure and species composition of the vegetation, ... affects insects and plant diseases, influences nutrient cycles and energy flows, regulates the productivity, diversity and stability of the system, and determines the habitats for wildlife."

Philpot described seven fire frequency and intensity patterns for various lightning fire regimes of North America. The seven patterns range from no natural fire (or very little) to very infrequent crown fires in combination with severe surface fires and covering 5,000 to 50,000 acres.

For example, in the middle range—under the category of frequent, low-intensity surface fires of a few hundred to a few thousand acres in area (5 to 25 year return intervals for small areas), often combined with very long interval crown fires and/or high intensity surface fires—he listed:

- Sierra mixed-conifer forest, including associated species of the west side of California
- Montane zone on the drier slopes of the Cascades in Washington and Oregon and the east slopes of California
- Montane zone of the Intermountain and Rocky Mountain Regions
- Montane zone of the interior mountains of the Southwest
- The coastal plain and lower Piedmont regions of the Southeast, especially the southern pine forests

The areas where natural fires are rare or absent included:

- Coastal Alaska, some west slopes of the Olympic Mountains in Washington, some coastal areas of British Columbia
- Wetter regions of the Eastern deciduous forest
- Most subalpine forests of the high Adirondack and New England mountains.

To visualize the natural fire regimes of a region, Philpot said we must discard human time frames and learn to "think like a forest." If that can be done we may begin to enjoy some practical applications of the information gained, including:

- A basis for fire behavior predictions on wildfires
- An aid in prescribed fire planning
- Key information to gain homeowners' attention that fires are inevitable in many plant communities
- Information to guide development of post-fire rehabilitation programs.

The Social, Political, and Economic Issues of Decision-Making

In introducing the speakers for the Tuesday morning program, Giancarlo Calabri noted that all over the world most forest fires begin from human activities. According to U.N. statistics, during the period 1983-1985 the percentage of total known fires attributed to human causes (arson and negligence) was about 97 percent in Europe, 92 percent in the U.S.A. and 59 percent in Canada.

"Therefore all decisions on wildfire management," said Calabri, "have to take into account social, political, and economic factors influencing human activities."

In the past, human activities causing forest fires were mainly pasturage and agriculture. Now, Calabri said the most dangerous situations derive from the crisis in forest economy affecting all industrialized Mediterranean countries. Many wooded areas are neglected, no longer exploited. Hazardous fuels grow, and the development of underbrush lessens any possibility of access and fire control. Rural exodus has meant lack of local people experienced in fire prevention and suppression. Residual agricultural and pastoral activities are carried out without precautionary measures.

Meanwhile, arson is gaining ground. He called incendiary fires the most dangerous and difficult to control, also noting that "What is really worrying is the diminishing age of trespassers. Children seem to enjoy setting fire more and more."

Fire damage assessment is not an easy task, Calabri said. Timber loss is readily evident, but the public places different values on the multiple benefits of the forest. He reported on a small study carried out in the Mediterranean countries, in which people ranked the following benefits in decreasing priority: 1. Recreation and landscape; 2. Dwelling; 3. Fauna and flora; 4. Soil and watershed; 5. Grazing and farming; 6. Timber. Put another way, a fire sweeping some brush in a tourist resort may give rise to greater complaints than a fire destroying an important high forest away in the mountains.

Calabri said there was general agreement on the advantages of public information and education for forest fire prevention. But he also described some drawbacks. For example, exaggerated and inappropriate messages, scaring people by magnifying forest losses and forecasting complete destruction in the near future, may be counterproductive. He said they spread skepticism and resignation about the usefulness of fire prevention and control, and they also excite pyromaniacs.

"The mass media normally insist on the spectacular aspects of fire suppression," he said. "They emphasize certain forces, especially aircraft, and forget the necessary contribution of other people on the ground, to say nothing of fire prevention. Consequently ground forces tend to commit themselves less and less and call for aircraft even in cases of small fires without any important value at stake."

Enforcement of fire laws is not always effective, he said. Lack of surveillance and trained investigation personnel is common. Strict regulations in conflict with local traditions are often detrimental and even illusory, he cautioned, because disobedient people will continue burning but do it secretly.

Calabri believes that prospects for forest fire protection are poor in the years to come, especially in the developing countries. The public is not overly concerned. People resign themselves to so many calamities, and fire does not appear the worst of them. On the political side, many countries have allowed a neglect of forest management, giving subsidies to agriculture but not to forestry. For the fire fighting services he listed training, coordination and equipment modernization and standardization as items needing much more attention in many countries.

Giancarlo Calabri

Chief of the Forest Fire
Service
Ministry of Agriculture and
Forestry
Italy

*Wildfire management
decisions have to take
into account social,
political, and economic
factors influencing
human activities.*

Kofi Portuphy

Director of Operations
National Mobilization Program
Ghana, West Africa

*What is essential,
however, is
the political will
of both the
government
and the governed.*

Africa Region

Social, Political, and Economic Issues

Kofi Portuphy described much of the intentional burning of African grasslands as a "social habit" legitimized through rituals and impervious to logic and science. The practice continues, therefore, despite its contribution to the problem cycle of burning, deforestation, erosion and dessication.

He compared his country's fuels to those in the U.S. Ghana's savannah and grassland vegetation is similar to that of southern Arizona. His woodlands are similar to those in Oklahoma and Arkansas. The high forests are similar to the coastal plains and marshes of the southeastern U.S.

In 1982 and early 1983 Ghana experienced massive wildfires unknown in its history. Large acreages of farmlands were lost, as well as villages and people. These fires also swept to neighboring countries.

In response, a National Anti-Bushfire Committee was formed of members from all facets of life in that country. Its purpose was to advise government on all matters pertaining to bushfire prevention and control and to provide guidelines for similar committees at the regional and village levels. Volunteer squads have been organized to serve as fire wardens and to extinguish fires in the bush. As fire wardens the volunteers also supervise all prescribed burning operations in their areas. The government also passed a law providing severe penalties for setting fires for any purpose other than certain agricultural, forestry and game management uses.

Portuphy explained that Ghana also requested help from the Agency for International Development, Office of U.S. Foreign Disaster Assistance. Cooperation in several areas enhanced Ghana's capability to manage and control the bushfire program. Farmers have been encouraged to create greenbelts around their farms. The bushfire season in Ghana lasts from October to March. During that time hunting and all burning is completely banned.

"We are looking forward," Portuphy said, "to a subregional workshop on bushfires as a first step to cooperation among African states, under U.N. sponsorship."

He mentioned that an early warning and crop forecasting mechanism has been put in place to strengthen hazard mapping. Tree planting programs are also being operated in most vulnerable communities. Providing more education is an on-going effort.

Portuphy said the response by Ghanaians to the National Anti-Bushfire Campaign has been overwhelming. "What is essential, however, is the political will of both the government and the governed. Fortunately, this much-needed political will is very much alive in Ghana. The head of state has personally on several occasions taken helicopter flights to assist rural committees put out devastating bushfires.

"The uphill task, however, is the education of the people not only in Ghana or the subregion, but in Africa as a whole to recognize the need to abandon traditional beliefs, customs and traditional festivals which tend to support their consistent bush burning practices."

Portuphy called on the international community to support these efforts, saying, "If Africans will have to burn the bush in absence of the requisite land clearing equipment, if Africans will have to hunt for game by burning the bush to create an imbalance in the world's ecosystems, then the industrialized world has an obligation to assist Africa in her effort to modernize."

Oceania Region

Social, Political, and Economic Issues

MEETING GLOBAL WILDLAND
FIRE CHALLENGES

Jale Baba defined Fiji's two-pronged fire problem as similar to many other countries. First, the environmental apathy of the people is perpetuated by a contemporary perception of wildfire as being an acceptable part of legitimate economic activities. Then, economic problems often result in insufficient resources, if any, directed to fire management.

"Failure of policy makers to recognize and address this problem," he said, "has resulted in the deterioration of the physical and biological environment, and subsequent reduction in the welfare of society." Are policy makers aware of the detrimental effect of uncontrolled fires? Baba believes all indications are that "they regard wildfires either as unfortunate and unintended effects of legitimate economic activities, or as the price for development. The effects of wildfires were taken into account only if they were compelled to do so."

Baba described the Fijian attitude toward nature as "an element that may be activated, oriented and used, as expediently as possible to meet the daily demands of life, or as a continuous obstacle to be combated day by day."

A frequent clearing method used by hunters, gatherers and farmers was the simplest: fire. An increasing population meant a greater total area burned each year. He explained that while the relationship between the actual number of fires and the increasing number of households may be linear, the area of burned land increases exponentially.

Off-site effects of wildfires can be pervasive, he noted. Smoke from the East Kalimantan fires in 1983 lingered over the islands for weeks and reached Singapore, where it interfered with air navigation. Airports in East Kalimantan were closed for weeks. Fire-induced changes to the physical environment alter the species composition of the forest, Baba said. This leads to disease problems and unavailability or inadequate recycling of nutrients. The survival of a diversity of forest species is of great importance to Fijians since only forty percent of the plant species they reportedly use are found in home gardens in a cultivated state. A remarkable number of species of animals and plants are found nowhere else in the world.

Attempts by government to improve welfare through agrarian reform only placed more stress on the environment, Baba noted, adding that he was not against development. But if any development project is to succeed, "agents of reform should be equipped with the necessary soft and hard technology appropriate for sound husbandry. Otherwise we will continue to address the symptoms instead of the source of the problem."

One obstacle to addressing the problems is that no reliable data are maintained at the national level, which Baba called a reflection on the decisionmakers' poor appreciation of the situation. This makes economic analysis very difficult.

Baba reported a strong correlation between the level of political activity (such as re-election campaigns) in the country and the number of fires. The continuing situation is that "the government of the day lacks the political will to change cumbersome and ineffective fire legislation or institute new laws."

In order to meet the challenges of the future, Baba said, "Our strategic plan should be to increase public awareness of the threat of wildfires to our development efforts and build up the capability to meet any exigencies." He added that until the policymakers change their orientation, international governments and organizations will have to continue to play a lead role in wildfire management in Fiji.

Jale Baba

Plantation Manager
Fiji Pine Commission
Fiji

*(Presented by
Dr. David Harcharik
Director of International
Forestry
United States Forest Service)*

*Our strategic plan
should be
to increase
public awareness
of the threat
of wildfires...*

A.G. Oka

Inspector General of Forests
Ministry of Environment and
Forests
India

*When social issues are
the cause of fires, the
social concerns must be
dealt with first.*

*For a country to
advance, any policy
decisions must be
advantageous for the
whole country.*

Asia Region

Social, Political, and Economic Issues

Devastating fires in Borneo in 1982-83 and the 1987 fire in China brought the need to do something about wildfires to the attention of the public, began A.G. Oka. He turned then to the population pressures on the land in Asia, saying that Asia's population exceeds three billion people, which is 60 percent of the total world population while the land area is only 25 percent of the earth's surface. The number of people living in rural areas in Asia exceeds the total population of Europe and North America combined.

Oka described how rural graziers feel forced to use fire as the most economical and traditional tool to obtain a new green flush of grass for grazing. When the graziers first started this practice only grasslands were burned, but as more land was needed for cultivation, fires spread to the forests.

Another social issue noted by Oka was shifting cultivation. When this practice started the grasslands and forests did not have to provide sustenance for the large number of people that they do today. Areas were slashed and burned until the soil became unproductive. Then the people would move to another area and repeat the process. Now the available productive land is much more limited. Still, large areas are burned every year.

A fire program can be effective in technical matters, Oka said, "but when social issues are the cause of fires, the social concerns must be dealt with first."

The need for developing countries to increase their standard of living has lead some countries to seek a larger industrial base. This policy emphasis has forced the rapid development of some wood industries. Some forest areas were logged without regard to protection needs. Oka said old trees were removed and regeneration started, but the new vegetation was more fire prone.

Oka returned to the agricultural use of fire, saying that non-woody forest products produce employment, income, food and shelter for the rural population. The income received from these forest products is the only income the forest residents may earn some years. Most non-woody forest products are harvested during the fire season; the collection of grasses, fruits, flowers, honey, etc., are facilitated by setting fires. Because these products meet the needs of lower income families, they are vital to the national economy at the same time. When the fire manager attempts to reduce the burned area, the cost of harvesting goes up.

Changing these conditions will not be easy, even though the fires have a devastating effect on the forest itself. These social issues have developed and been accepted over a long period of time. The dependency on the use of fire is established, he said. Agreeable alternatives must be developed before any change can be implemented.

Political issues that developing countries face are different from those in developed countries, but in either case, reminded Oka, for a country to advance, any policy decisions must be advantageous for the whole country.

The fire manager in Asia clearly cannot look for a solution to the fire problem without first looking at the social, political and economic issues. Oka said this solution becomes all the more important when population figures indicate that Asia's rural population will grow by half a billion people by the year 2000. This growth alone is twice the population of the United States at the present time.

Europe Region

Social, Political, and Economic Issues

MEETING GLOBAL WILDLAND
FIRE CHALLENGES

Looking at the Mediterranean basin, Pierre Delabrazé said, "The acceleration of human concentrations for the past several decades on these slopes directly facing the sea has been accompanied by a thinning of the populations in the hinterland, which is nevertheless nearby. In particular, the rural exodus has reached a critical threshold: fallows overgrown with brush and trees have developed over a very large area of former agricultural and grazing land, while isolated residential buildings and the restoration of abandoned farms have attracted the lovers of natural spaces."

In this climate and in these plant landscapes, populations are frequently forgetful of the severe constraints of nature and the reactions of the land. The severity of the phenomenon of fire in these more or less natural spaces, said Delabrazé, threatens the level of civilization that one hopes to develop there. More than ever, he said, a reasoned policy of fire prevention and control can only be founded on a knowledge of the biological and physical mechanisms that initiate the fire and favor its development. Such a policy should also necessarily take into consideration causes of a social, psychological, economic and political nature, which appear more and more to be determining factors, but which are particularly variable in space and time. The reason is that the origin of these fires is mainly human."

France has been accumulating information on fire causes since 1972, with the intention of improving the effectiveness of the services responsible for preventing and controlling fires, Delabrazé said. So far it has satisfactory data on almost 35,000 forest fires and 110,000 other rural and suburban fires. Under sponsorship of the European Economic Community and based on technical exchanges, efforts have been made to expand this data system for Spain, Italy and Greece.

With good data, Delabrazé said, some assumptions have been changed. It now appears that there was an underestimation of the risk of lightning and electric lines and the resumption of old fires, which were incorrectly identified as new fires because of ignorance of the profound environmental modification that takes place far in advance of the lines where fires are stopped. It also appears that there was an overestimation of malevolent acts and some negligence.

With these data, he pointed out that results can be immediate. For example:

- The electric utility has admitted that the information is well founded and is already changing the installation of high-voltage lines and moving the pylons closer together in order to avoid arcs between lines that are accidentally brought together by winds. It is also developing the use of insulated cables in the sectors classified as sensitive.
- The highway department has discontinued the use of pine-bark mulch on plants placed in the median strip between lanes. Cigarettes and sometimes hot exhausts have ignited the bark fragments, which are then carried beyond the highway by the wind.
- Fire retardant particles are spread around the edge of sensitive areas, including roads, electric line right-of-ways, etc.

"It is still difficult," Delabrazé said, "to obtain the disinterested cooperation of several services, and has been for decades. However, the collection of dynamic and substantial databases remains the surest solution for studying and analyzing phenomena as complex as those provoked by fires in the natural and forest environment."

Pierre Delabrazé

National Agronomic Research
Institute
Department of Forest Research
France

*The collection of
dynamic and
substantial databases
remains the surest
solution for studying
(these) phenomena.*

Omar Tesolin

Director of Research and
Protection
National Forests Institute
Argentina

*Latin America's forests
are being replaced by
other agrarian activities
because they do not
satisfy urgent socio-
economic needs.*

Latin America Region

Social, Political, and Economic Issues

"Although social concern over environmental deterioration is increasingly serious," Omar Tesolin reported, "financial limitations have impeded any large-scale organizational measures to fight forest fires.

"In general terms it may be said that while the capabilities to prevent and control forest fires have improved, the available capacity is insufficient to do what is necessary to stop the process of deterioration in the forests, a process that is strongly conditioned by circumstances that are totally beyond the sphere of control of the organizations responsible for suppressing forest fires."

Tesolin described the broad range of man-caused fires experienced in the impoverished areas of Latin America: Burning of degraded forests for reforestation with exotic species or for the increase of pastures; burning of pasture lands adjacent to forests to improve grazing; burning of forests for the purpose of obtaining dry firewood; forest fires caused by illegal hunters; deliberate arson prompted by dissatisfaction or resentment; and negligence of tourists with campfires and cigarettes.

The burning of pasture lands and fires set for agricultural purposes were cited as the principal causes of forest fires and, said Tesolin, "are a clear indication that the forests of Latin America are being replaced by other agrarian activities because they do not satisfy the population's urgent socioeconomic needs at the present time, although this will act against long-term settlement in the affected areas. These urgent actions result from economic deprivation and are generally enhanced by accelerated population growth." He added that the population of Latin America has grown 298 percent in the past sixty years.

Losses in the forests, he said, are in part the result of ignorance regarding the fragility of natural ecosystems and the grave consequences that deforestation can entail, as well as the ineffectiveness and weakness of public bodies devoted to conserving forests, supervising their rational use and warning of the fatal consequences of deforestation. "The fundamental cause, however, is the low relative value that society assigns to the products obtained from forests and the services forests provide," Tesolin said.

He believes the prospects for seeing improvements are bleak, but added, "It is worth the effort to try to do so for the sake of our children, ourselves and the forest resources that are the certain insurance of our own survival."

Improvements will be expensive, and Tesolin said that developing countries do not possess the financial resources to adequately resolve the problems of pre-suppression and suppression through fire management programs. Among the financial possibilities mentioned by Tesolin, "The World Bank would have to consider that middle-income countries of Latin America merit receiving credits with concessional rates of interest when those loans serve or tend to improve the conservation of natural resources."

Tesolin also described plans that would give investors incentives to invest in Latin America through special advantages granted by the recipient countries and by guarantees from its own country's government with regard to the recovery of profits and capital assumed by the recipient country. He said this would be of great importance to finance fire management programs without constituting a significant disbursement in terms of the total volume of the debt. In addition, "it would make possible both vertical and horizontal international cooperation that would permit common objectives to be attained without being interrupted by lack of financing," Tesolin concluded.

North America Region

Social, Political, and Economic Issues

Rafael Hernandez Ochoa's presentation discussed activities in Mexico, Canada and the United States. He stated that the contribution of the forests to society is expressed through two basic categories of products—goods and services. The magnitude of this contribution depends on its value for each type of society—developed and developing.

He described Canada and the U.S. as developed countries oriented primarily to forest protection. In those countries, the contribution of silvicultural activity to the gross national product is high (6 to 10 percent), the population density is low, the balance of trade is favorable, technological challenges have been practically overcome, and the forest potential is very close to being fully realized.

He described Mexico as a developing country with a rural population and unrealized potential. The contribution of the forests to the GNP is low (less than 2 percent), the density of the rural population is high, the forest crop is not developed, there is a diversity of plant life, and many technological challenges have not been overcome.

From this classification it is evident, he said, that different emphases and solutions are necessary to achieve utilization, conservation and protection of the forest resources. At the same time, the present international economic situation has made clear the interdependence among the nations of the region and the impact of economic, political and social factors on resources and their future.

"The region's forest resources and environment," said Ochoa, "are being put in danger by the destruction, alteration and deterioration of the temperate and tropical forests and deserts and semideserts—in Mexico, principally because of socio-economic factors and problems of rural subsistence; and in the other two countries because of environmental pollution and deterioration."

Ochoa also noted that the complexity of the forest system and the importance of its products and benefits make it clear that its conservation and its functioning "cannot be the exclusive responsibility of central governments, but must rather be that of all the components of society whose mutual participation is essential to develop and protect the forest in any country."

A challenging series of actions can help achieve this, including: promoting the confidence, acceptance and support of the population and second-level organizations; decentralizing forest management; changing planning procedures for forest management so they will be pluralistic and allow more participation; and maintaining bureaucratic controls over forest production to the extent required.

Despite all efforts, according to Ochoa, Mexico just had one of the worst forest fire seasons in the last ten years. More than 380,000 hectares were affected, with one fire near Cancun destroying more than 100,000 hectares, fueled by combustible material left in the wake of Hurricane Gilbert.

The future of forests in the region and the world, Ochoa said, "depends on our capacity to put technology at the service of the socio-economic and political aspects of development in order to adapt to the new challenges of a world in profound transformation and increase the contribution of the forest sector to the needs of development."

Ochoa concluded by stating, "Although the destiny and development of each country is based primarily on its own efforts, the development of the region and of the world requires a sense of solidarity, respect and cooperation among nations, which we should maintain for the sake of future generations."

Rafael Hernandez Ochoa

Sub-secretario Forestal
Secretaría de Agricultura y
Recursos Hidráulicos
Mexico

*Conservation
and its functioning
cannot be
the exclusive
responsibility of
central governments...*



International Cooperation



Fire Suppression Training for Latin America: The Tie That Binds

Ken Dittmer briefly described the rural/wildland fire suppression training program, a result of cooperation between the Office of U.S. Foreign Disaster Assistance (OFDA) and the USDA Forest Service's Office of International Forestry. He also gave an overview of the mandate of OFDA, reporting that it responds to an average of 50 international disasters, both natural and man-caused, per year. Preparedness and training are critical to OFDA's fire strategy. OFDA works with both urban and rural fire agencies.

Four international training courses have been held for Latin America. This three-week course is conducted entirely in Spanish, training about 60 participants each time. Several countries have also conducted additional fire training courses within their borders focusing on their particular needs.

The USFS Disaster Assistance Support Program (DASP), an effort to enhance disaster management skills in developing countries, has also emerged from this cooperative international training. "The DASP has assumed a good part of the fire management training responsibility as well as that of actual response to wildfire and other emergency situations."

Jay Perkins then further described the international wildfire suppression course. Much of the three-week course is spent in the classroom in theoretical discussions and exercises. The first week looks in part at fire behavior. Why a fire acts the way it does is crucial in the decision-making process for determining tactics and strategies. Week one also introduces the students to fire prevention concepts and the importance of public contact.

The second week is dedicated to fire fighter safety, tactics and strategies, and the use of aircraft. The focus is on the two basic phases of suppression: initial attack and extended attack. Time is spent discussing organizational techniques from the command function to fire camp operations. Fire fighter safety is also woven throughout the course, Perkins said, because this is the number one consideration and priority in wildfire suppression activities.

Week three features prescribed fire and the field trip. Discussions cover burn organization, firing techniques, use of various ignition equipment from hand to aerial, how to build a fire prescription, and fire effects. From two to four days are spent in the field practicing the lessons from the classroom. Perkins said that during the fourth course in Mexico students prepared prescribed burning plans for an area, and the three best plans were used for the actual burning. The students executed the burns under the watchful eye of the instructors. This offered them the opportunity to be involved in a controlled burn.

The course concludes with the final examination. Participants were given copies of the lesson plans and all supportive training aids so that they could be taken to home countries and used to provide similar training to local colleagues. He said that as a member of the group designing the first course, it has been extremely gratifying to see the changes that have come about in the course and as a result of the course. "The course has spawned international cooperation, and graduates have done great things in advancing programs in their own countries," Perkins said.

The 1990 course in Spain will be an advanced course to build on the techniques learned by the Latin American participants in the previous courses. The use of the computerized fire behavior prediction system will be taught, as will other uses of the computer.

Jay Perkins

Fire Management Specialist
Klamath National Forest
United States Forest Service

Ken Dittmer

Director
National Advanced Resources
Technology Center
United States Forest Service

*The course has
spawned international
cooperation, and
graduates have done
great things in
advancing programs
in their own countries.*

Ralph Roberts

Director
Canada International
Development Agency
Canada

*Effective cooperation
is a catalyst
to this growth and
development process.*

Canadian Assistance to China

Ralph Roberts' presentation reviewed the model fire management project which Canada and China are undertaking in northeast China. Forestry was one of four parts of the program of cooperation requested by the Chinese. He said cooperative approaches often get their start when people have the chance to meet, in a forum such as this conference, to discuss common concerns.

Forest resources in northeast China are similar to Canada, Roberts said. Mixed hardwood and softwood stands dominate the region, and extensive grasslands border and run through the forest areas. One significant difference: This part of China has less water resources. The forests there can be divided into two zones. In the southern region, population densities are high and man-caused fires predominate in mixed forest and grasslands. In the northern region, population densities are low and lightning-caused fires are the norm in forest cover with little grassland.

As part of the agreement between the countries, Canada provided training, technical advisory assistance and equipment. The training totaled 200 person-months. Technical assistance was for 110 person-months. Equipment was provided to support the systems being developed. The result of the program was to be a centralized command and control center, which had five components: detection, communications, suppression, preparedness and prevention.

The program was originally planned to cover a five-year period (1984 through 1989) at a total cost of approximately \$8.4 million, Roberts reported, with Canada contributing 5.1 million dollars and China contributing 3.3 million. The large wildfire in China midway through the program caused delays, and the program has been extended for two years.

"It sounds easy," Roberts said, "Bring in the technology, train the people and change the system. It's not that easy. Change is often difficult to introduce, especially when what seems to many like an acceptable system is already in place. To help effect the change, a massive demonstration and education program based both in Canada and China was undertaken. Training covered a large range of activities, from pump operation and maintenance to designing forest fire management systems."

He observed that these changes required a very high level of trust and cooperation in China, saying, "You cannot run two different systems side by side to meet the same objective without incurring the very high costs and very high risks of a large forest fire developing."

One of the largest fires ever in China began in May 1987. Most accounts estimate the fire covered one million hectares, and it extended into Russia, where it was largely unreported. The losses were truly extensive.

"One of the positive outcomes of this fire," reported Roberts, "was a detailed review of forest fire management systems in [China]. This review affected the move to a centralized command and control system much sooner than would have been possible without the fire. It was an expensive price to pay for change."

He called the effects of international cooperation immeasurable, saying that cooperation has led to the establishment and strengthening of a number of informal networks through which exchanges of information, people, skills and knowledge in all forms are taking place. Meanwhile, enhanced conservation of limited forest resources will play a major role in the growth and development of northeast China. Effective cooperation is a catalyst to this growth and development process.

World Bank Cooperation with China

William Jones described additional cooperation with China through the World Bank. As an economist working for a bank, he indicated that he was interested in forest protection "because it is an investment, something that costs now and generates benefits later. Banks give you money now and get it back later, on time and with interest, we hope. Any good banker wants to lend for investments that generate the wherewithal to pay back the loan, development bankers in particular." And that led to the investment in China.

The situation in China in 1987 before and after the big fire in May was that China had a list of equipment for fire detection and control (much of it said to be inappropriate) and also wanted financial aid for a classical replanting program.

The World Bank mission's findings were that salvage of 34 million cubic meters of affected trees was urgent. If the wood was not salvaged, it would be lost to beetles in the next summer. There would be a very high return to this mobilization/investment, Jones said.

Another judgment was that due to the high labor costs in the cold north of China, classical replanting would not pay off. However, the World Bank decided that greatly expanded forest protection would be a worthwhile investment.

Each year about one percent (180,000 hectares) of the forest in China burns (disregarding the big 1987 fire). The average fire burns about 1,300 hectares, and this was said to be unacceptably high for the densely populated Chinese, who are very short of wood. On average there is only one-tenth of a hectare of forest per person in the country. The annual wood production was only one-quarter cubic meter, and wood imports were rising rapidly.

Detection of forest fires was a problem. The low number of lookout towers meant that only one-eighth of the forest was visible from them. Furthermore, the towers had no radio communications. This resulted in an average fire size at detection of 60 hectares.

For suppression, aerial support was lacking, from few (and inappropriate) planes and airstrips. Inadequate roads meant that crews may have a four or five hour hike to a fire. Once there, direct attack was with branches, hand tools and backpack pumps.

The objectives of the World Bank involvement were:

- Aerial detection coverage once or twice a day in season.
- Detect all fires before they spread to two hectares in size.
- Firefighting crews to reach any fire within two hours by helicopter or three hours by ground.
- All fires to be extinguished within one hundred hectares.
- Annual fire damage to be reduced from 180,000 to 30,000 hectares.

The cost would be \$70 million (US) over three years, of which the World Bank would finance \$33 million (US).

Jones presented a chart of the financial considerations for the recommended program. It listed the yearly total costs starting in 1988, subtracted by the value of the benefits, mainly wood harvested (and wood not imported). The break-even point was to be reached in the third year, 1990, with a projected payback period of seven years. He listed the internal rate of return as 29 percent.

Two lessons of this cooperative investment program with China were noted. Take time to perform a proper traditional economic analysis. And stop talking about exotic benefits and start trying to quantify and value them.

William I. Jones
World Bank

*Take time to
perform a proper
traditional
economic analysis.*

David Jolly

Regional Forester
Southwest Region
United States Forest Service

*We quickly learned
that our
respective agencies
shared many
problems and
mutual objectives.*

*We face exciting,
challenging times
ahead and look
forward to many more
cooperative programs...*

International Cooperation Between the U.S. and Mexico

David Jolly explained that his region of the United States shares 500 miles of common border with Mexico. Wildfires have always posed a problem along the border. In the past when fires threatened to cross from Mexico into the U.S., or they blazed on both sides, fire fighting personnel from the U.S. simply crossed the international boundary and took the appropriate fire suppression action and quietly returned to the U.S.

Jolly said this was usually done with the knowledge of local Mexican authorities but without official approval by either government.

"Such action can no longer be allowed," Jolly said, "due to the changing nature of the border lands. Communities and single dwellings are increasing in number north of the border. Traffic—both legal and illegal—is increasing as is danger to law-abiding citizens. Also growing in importance is liability for property loss or damage and human injury or death."

When representatives from both sides began to consider the situation they quickly learned that their respective agencies shared many problems and mutual objectives. The initial concept of cooperation was expanded. For example, Jolly said that in 1988 the Forest Service helped train and equip Mexican fire fighters. Presently both countries are jointly working on fire suppression, detection and pre-suppression activities on both sides of the border.

On December 9, 1988, at a meeting in Nogales, Mexico, Jolly and Mexican officials signed a formal agreement. He said it was the first-ever cooperative agreement reached between the Forest Service and the government of Mexico for the express purpose of wildfire prevention and suppression along the common border.

The terms of the agreement include a six-part program covering fire suppression, fire prevention, communications, tool use, training and other administrative details.

Under fire suppression, both sides shall take appropriate action on all fires that threaten natural resources, property or lives, regardless of whether the fire is in the United States or Mexico. Under communications, a fire mobilization guide has been developed to facilitate communication between Forest Service and Mexican officials during joint suppression actions. The Forest Service will continue to furnish personnel to assist in training Mexican fire crews. The Forest Service is also providing tools and protective equipment for three suppression crews in Mexico.

Each agency is responsible for its own suppression costs, no matter where the fire originates or is contained. An annual meeting will review accomplishments and make necessary changes.

Jolly said that in the first few months there have been joint suppression actions taken on at least twelve wildfires.

Meanwhile, the Forest Service has established direct communication links with government personnel in Sonora, Chihuahua and Mexico City. Scientists from both countries have exchanged ideas and research. Jolly reports that now there is growing interest in expanding the agreement east and west along the international boundary.

"We face exciting, challenging times ahead," Jolly concluded, "and look forward to many more cooperative programs, many more years of working hand in hand with our colleagues in Mexico."

FAO's Program on Forest Fire Protection

MEETING GLOBAL WILDLAND
FIRE CHALLENGES

Jan Troensegaard reviewed activities of the Food and Agriculture Organization (FAO) program on forest fire protection for the period of 1970 to 1989. FAO has two major programs. The Field Program deals with technical assistance directly through national or regional field projects, and the Regular Program focuses on global or regional technical issues from its headquarters in Rome. Regular Program staff devote half their time to technical support of field projects.

The Regular Program conducts meetings and seminars. The 1986 Seminar on Methods and Equipment for the Prevention of Forest Fires, held in Spain, recommended that efforts be made to increase the collaboration with North African and Near East countries in future training activities in the Mediterranean region.

"The increased attention that forest protection and, in particular, forest fire prevention and control has received during recent meetings of the FAO statutory bodies," Troensegaard said, "has led FAO to assign more resources to this field. As of 1990, a new regular post will be filled at FAO headquarters that will deal exclusively with forest protection."

Among FAO publications is a 1975 report describing the adverse effects of forest fires on the human environment. It identified three areas of the world that are highly susceptible to fires (Mediterranean, Central America and African savannah) and recommends a long-term program of work aimed at solving some of the most urgent problems.

Two regional forest fire studies were carried out in 1986, one covering eleven Mediterranean countries, and the other dealing with the countries of Central America and the Caribbean.

Troensegaard said FAO receives regular requests for forest fire information from all over the world. Reasonably accurate statistics are available for countries of the European Economic Community and a few other countries, but for the rest of the world, "we have unfortunately no adequate estimates on number of fires and area burned per year. For this reason some preliminary studies have been carried out by FAO in West Africa and Brazil employing NOAA satellite imagery."

During the period reviewed by Troensegaard, the Field Program gave direct assistance to 36 developing countries through 66 projects—24 in Africa, 20 in Asia, 17 in Latin America, and 5 in Europe and the Near East. He said practically all of the projects have produced one or several reports, some of them of lasting value. Many provide valuable information and guidance for national or international foresters and planners working in the countries concerned.

A universal issue in any technical assistance project is how to determine what is the appropriate technology to recommend in any given situation. "The problem is particularly relevant," said Troensegaard, "to forest fire management where even minimum requirements will include sophisticated communication equipment."

Troensegaard observed that practically none of the consultants and technical advisers recruited on forest fire come from the developing countries due to lack of qualified candidates. He called this a regrettable fact.

Jan Troensegaard
Senior Forestry Officer
Food and Agriculture
Organization
United Nations
Italy

*A universal issue
in any technical
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what is the appropriate
technology.*

India's Modern Fire Control Project

J.P.L. Srivastava

Project Director
Modern Forest Fire Control
Project
India

*The Project has played
an important role in
creating better general
awareness of the public
and the government.*

J.P.L. Srivastava said the recorded forest area of India is about 75 million hectares, or almost 23 percent of the total area of the country. However, according to a study carried out by the Forest Survey of India using satellite imagery the extent of forest cover was actually 64.2 million hectares. The area under good forest cover is about eleven percent. The area found to be under degraded forest cover is about 28 million hectares.

Starting in 1984, Srivastava said, India made a significant step to protect its forests with the signing of an agreement between the government of India, the United Nations Development Program, and the Food and Agriculture Organization to develop a forest fire control program in the country.

He said most of the forest fires in India are surface fires that burn the ground cover and the undergrowth; few occurrences of crown fires have been reported from the coniferous forests. It has been estimated that at least 98 percent of forest fires in the country are man caused, whether accidental or deliberate. The majority of fires set deliberately are widely acknowledged to be inversely related to the socio-economic conditions in the area.

Srivastava reports that shepherds constitute the largest category of people who are responsible for starting fires on a large scale. Their intent is to generate the lush growth of grass, but also resulting in widespread destruction of vegetation and valuable organic humus and soil nutrients.

He also described the practice of burning the dry leaves under scattered mahua trees to get a clean patch of floor to facilitate collection of the edible flowers. The mahua crop is of considerable value to the poor villagers, particularly in years of shortages. Though the intention is to clear only a small patch of ground under individual trees, the fires often spread into the forest by negligence. Similar activities that cause fires are collection of Tendu leaves and Sal seeds. Negligent smoking further contributes to the problem.

Weather conditions create fire seasons at different times of the year in different parts of the country. However, he said one study of an area of 1,628 square kilometers in central India indicated that a majority of the fires responsible for the total area burned occur in March and April. In northern India, this holds true in April and May.

India's population is increasing at the rate of about 25 percent every ten years, Srivastava said. At this time he said the per capita forest area in the country is 0.1 hectares, compared to a world estimated average of 1.0 hectares. Cattle population is also increasing at an alarming rate and needing more grazing space.

Modern methods of fire management have been introduced with the assistance of international cooperation, especially that of FAO and UNDP. Firelines have been constructed to divide the forest into smaller units. Results: the percentage of large-size (more than 120 hectares) fires has been reduced from 44 to less than two percent.

The new Modern Forest Fire Control Project has played an important role in creating better general awareness of the public and the government, according to Srivastava. The Eighth Five-Year Plan of the Government of India proposes the largest amount of funds ever for forest fire control, an impressive accomplishment for so short a time. He said it has been possible with the support and cooperation of FAO and the United Nations Development Program.

Fire Management Study Group, North American Forestry Commission

The Fire Management Study Group (FMSG) of the North American Forestry Commission (NAFC) has been operating since 1962, according to Harry Layman. He said the group has met twenty-two times and managed a number of significant accomplishments.

Its parent organization is the Food and Agriculture Organization (FAO), an autonomous, independent organization operating within the United Nations. The purpose of FAO is to help member nations increase output from farms, forests and fisheries, raising the levels of nutrition and standards of living. Within FAO are six departments, one of which is forestry. The Forestry Department is further divided into six regional commissions.

FAO established the North American Forestry Commission in 1960. It was a triumvirate of Mexico, Canada and the United States. One of the first orders of business for NAFC was to form five working groups, one of which became the Fire Management Study Group.

The main objective of this group is to provide a forum for the exchange of ideas and information and to promote mutual assistance among the three participating countries in matters relating to forest fires.

Layman described some of the FMSG projects and said, "One of the most important—and possibly least recognized—is the act of assembling at regular intervals the fire control leadership of the three member nations. The informal exchange of ideas is probably at least as important as the information presented in the formal agenda."

The following list illustrates some of the accomplishments of FMSG:

- Four specialists traveled to Mexico in January 1989 to assess the damage caused by Hurricane Gilbert and to recommend approaches for dealing with the damage, with special attention paid to the probability of devastating fires. The expected fires are now taking place, and actions to combat them are more effective because of the early identification of the fire potential.
- *Forest Fire News* provides communications between the three nations. The publication has between twenty and forty pages of illustrated articles printed in English and Spanish. It is published and distributed by the Canadian Forestry Service.
- FMSG has sponsored three fire study tours, which were designed to give participants a better understanding of fire problems in other countries, as well as the methods used to solve them.
- Dealing with the wildland/urban fire problem will receive an increasing emphasis. FMSG members cooperated with the National Fire Protection Association, USDA Forest Service and other agencies in sponsoring a four-day conference. Fire protection in the wildland/urban interface is a significant problem in the three countries.
- A certificate, honoring fallen fire fighters or acknowledging exemplary action, has been prepared.
- An English-Spanish glossary of fire terms was prepared to assist the interaction of international technical groups.

"Cooperation will continue," Layman said, "in the coordination of future fire management study tours, the sharing of information through *Forest Fire News* and other reports, in research efforts, and in furthering fire protection through the support of the wildland/urban interface initiative efforts."

Harry Layman

State Forester, North Carolina
United States

*The main objective is to
exchange ideas and
information and pro-
mote mutual assistance.*

H.E. Rothsay

Deputy Chief Officer
County Fire Authority
Australia

*As a result
of the holocaust
at least 75 people,
including 14
fire fighters,
lost their lives.*

The "Ash Wednesday" Story

H.E. Rothsay described the devastating "Ash Wednesday" fire that swept over southeastern Australia, beginning in February 1983. As a result of the holocaust at least 75 people, including 14 fire fighters, lost their lives. In Rothsay's state of Victoria alone, 2,080 homes were damaged or destroyed, 33,000 head of stock were lost, and the burned area was approximately 200,000 hectares (approximately 500,000 acres). On this day the County Fire Authority reported 180 different fires fought by 15,000 fire fighters and hundreds more emergency services personnel and volunteers.

Victoria had a state disaster plan in effect at the time of this fire, Rothsay said. The plan provides clear definitions of the roles and responsibilities of all organizations involved and establishes appropriate guidelines. The plan is a statement of principles; it does not tell the organizations how to fulfill their allotted roles.

Operating involvement in the disaster plan is from state, regional and municipal levels. To assist in the coordination of planning and associated measures, several committees operate. Explained Rothsay: "Whilst all committees have an essential role in the planning and coordination of fire prevention and suppression, the Regional and Municipal Fire Prevention Committees have a key role in ensuring that adequate and efficient fire mitigation and readiness measures are maintained."

Certain preparedness measures are applied prior to and during the fire season:

- Reduction of fuel levels by controlled burning and clearing.
- The imposing of fire restrictions.
- Arrangements for the imposition of total fire bans when necessary.
- Warning to the public via the media of daily levels of fire risk.

In conjunction with preparedness measures, Rothsay said arrangements exist to promote appropriate public awareness and education.

Rothsay listed some of the lessons learned from the Ash Wednesday Fire. He said there is a need for the owners of properties to be better informed in safety and survival measures. He suggested that some form of training be made available to them.

Organizations with responsibility for fire protection need to review preparedness from time to time, he said, to ensure that procedures are up to date and capable of combating the emergency.

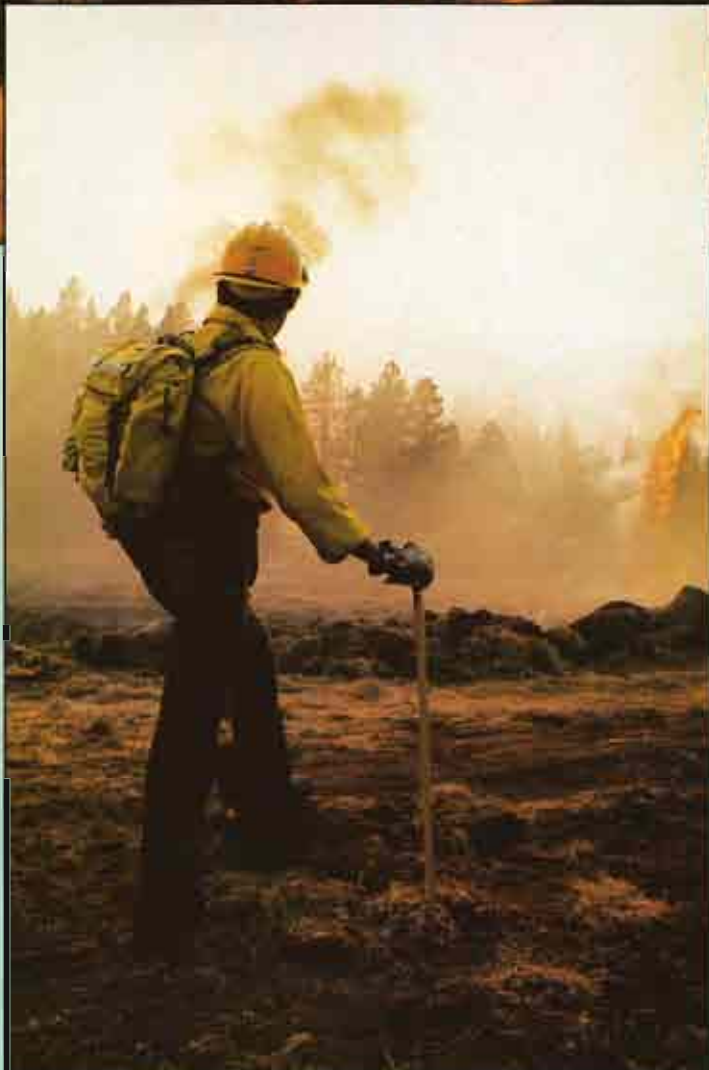
"People who live in a fire-prone, volatile environment with population encroachment need to understand that if they choose to 'live in the bush' they must accept the fire danger which this may involve," said Rothsay.

He also called for more fire awareness emphasis in schools, since this pays long-term dividends, and tougher penalties for offenses with a potential to cause bushfires. When major fires occur despite fire prevention efforts, a warning siren on local radio and television was recommended to alert the public of imminent danger.

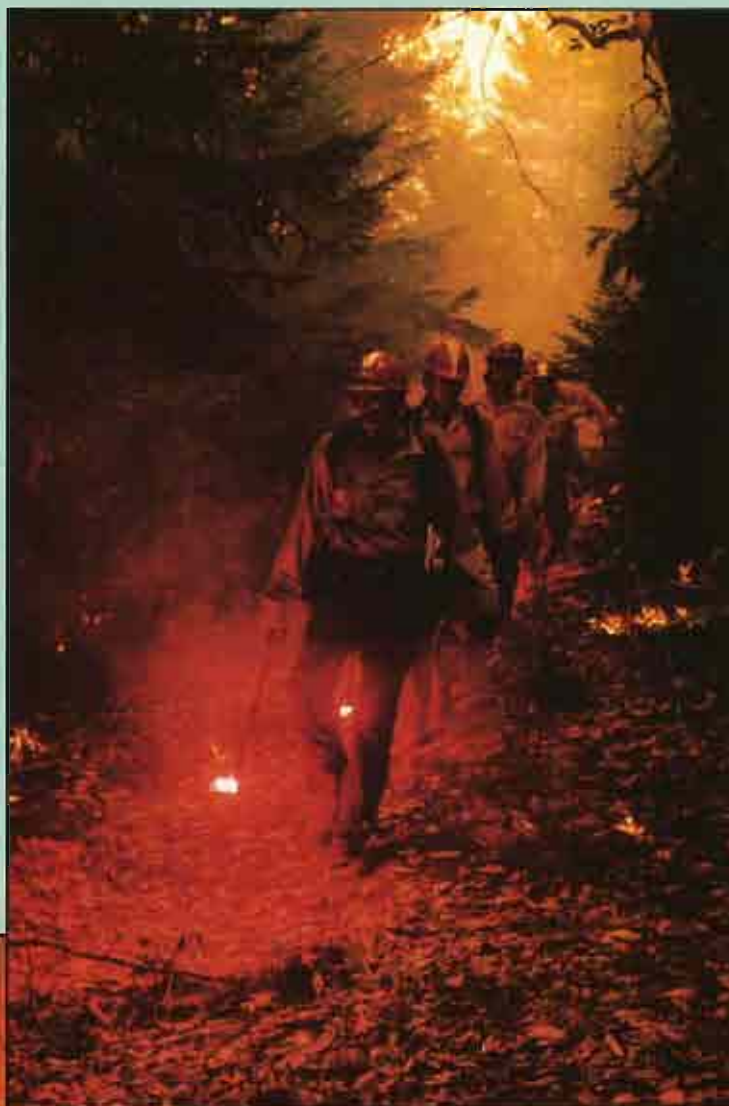
Rothsay noted that in recent times the weather patterns have produced relatively mild fire seasons and said, "Hopefully the respite from major fires has enabled procedures to be implemented that will allow all to be better protected in the future."

History says it could happen again. A 1939 fire there killed 71 people. Tasmania fires in 1967 killed 62. On a single day in 1969 there were 280 fires raging. Rothsay compared their weather patterns to those in California and France.

**MEETING GLOBAL WILDLAND
FIRE CHALLENGES**



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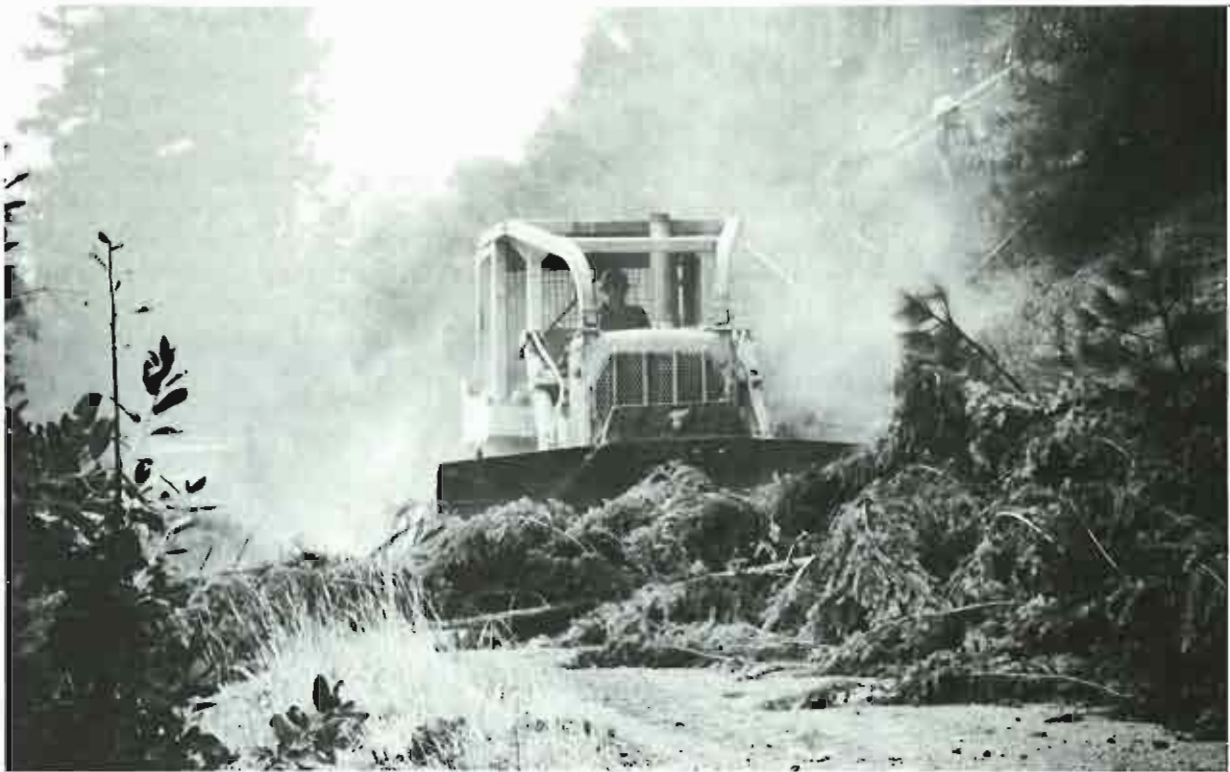




**MEETING GLOBAL WILDLAND
FIRE CHALLENGES**









Panel: Why Programs Are Successful



Four Case Studies of International Cooperation

MEETING GLOBAL WILDLAND
FIRE CHALLENGES

The worldwide wildland fire scene in the late 1980s, according to Johann Goldammer, is characterized by an increasing trend in fire occurrence and area burned by wildfires. He said the regions most affected are within the tropics and subtropics. The burning of forests by shifting agriculture has reached an alarming dimension which considerably exceeds the deforestation rates as assessed in the early 1980s. Furthermore, catastrophic large-scale wildfires in tropical Southeast Asia and in boreal Northeast Asia have been following in the wake of forest exploitation and droughts during the recent past.

Goldammer said severe disasters such as flooding and landslides are visible as related effects. Soil productivity and forest resources are highly endangered. The long-term impact of deforestation, wildfires and biomass burning, especially within the tropics, has a considerable impact on the severity of atmospheric and global climate change.

Goldammer presented four case examples about international cooperative fire research and management programs.

1. Brazil: Integrated fire management in industrial plantations of Paraná

By end of the 1970s large-scale overexploitation of forest resources had reduced the total forest cover to about eight percent of the land area. In order to meet the economic demands the government stimulated afforestation activities and especially the establishment of industrial plantations. Most plantations were established by using exotic species such as *Pinus* spp. and *Eucalyptus* spp. Under the prevailing climatic conditions and on moist sites the fast growth of these tree species leads to high fuel accumulation and extreme wildfire hazard.

In 1963 more than two million hectares of forested land in the State of Paraná were affected by wildfires, among which a total of 33,000 hectares of plantations were burned. 1981 was another extreme fire year.

It was recognized that in these industrial afforestations fire had to be "restored" by prescribed burning in order to reduce the overall losses caused by uncontrollable wildfires. Since prescribed burning was not yet known in the forest management of Brazil, methods and techniques had to be developed and trained in order to reduce the surface fuels and aerial fuels without damaging the stands.

This program was carried out by Freiburg University (West Germany) and the Brazilian counterpart institutions in 1981-82. The project was sponsored by the German Agency for Technical Cooperation and the German Research Foundation. The overall results of the project brought an improved knowledge of the following:

- forest fuels (load, distribution and moisture)
- safe and efficient prescribed burning techniques in heavy fuel accumulations
- ecologically sound methods of burning by reducing the fire impact on soil and mesofauna
- basic findings about the resistance of pines against fire and fire-related secondary pests.

2. The Philippines: Integrated fire management in mountainous pine forests

The middle and upper elevations of northern Luzón are covered by almost pure fire climax pine forests. Increasing mountain population and recent socio-cultural changes have resulted in degradation of forest lands in which the wildfires now play

**Dr. Johann
G. Goldammer**
Department of Forestry
University of Freiburg
West Germany

*The worldwide wildland
fire scene in the late
1980s is characterized
by an increasing trend
in fire occurrence and
area burned...*

*In these forests,
fire had to be "restored"
by prescribed burning
in order to reduce the
losses from uncontrol-
lable wildfires.*

Preliminary findings of the studies show that all kinds of fire (wildfires as well as prescribed fires) may attract bark beetles to the burned sites.

a more detrimental role as compared to previous times.

In addition an exotic secondary pest is dramatically expanding. The bark beetle, which was introduced from the Americas in the late 1940s has spread and attacks mainly freshly burned stands.

The need was recognized to introduce an integrated fire management system in order to maintain the stability of the mountain forests. It was obviously unrealistic that the detrimental wildfires could be completely suppressed because of the social environment and the accessibility of the terrain. On the other hand it seemed problematic and dangerous to introduce prescribed burning for wildfire hazard reduction because of the expected bark beetle infestation after burning.

A common research and development project with the Forest Management Bureau was initiated. The research carried out with the Forest Research Institute covers primarily the interactions between fire-host tree-infestation by bark beetles. Technologies were made available to determine the vigor/stress of trees induced by fire and drought.

The preliminary findings of the studies show that all kinds of fire (wildfires as well as prescribed fires) may attract bark beetles to the burned sites. A successful infestation and killing of trees by bark beetles occurs only if the vigor of trees had been reduced by severe crown consumption through fire.

Training was provided for various levels. The national research project leader and the designated leader of the management project underwent on-the-job training in Australia and in the U.S.A. respectively. Local training in research methodologies and fire management were provided by foreign experts.

The cooperative projects, which are not yet completed, are bringing an improved knowledge or technology transfer relative to the following:

- Fire history/ecology of the mountain pine forest dynamics
- Mechanisms of insect-host tree-fire interactions
- Potential methods to use synthetic (environmentally compatible, non-toxic) repellent pheromones for protection of single damaged trees or small stands against bark beetle infestation
- Establishment of a project on forest fire management
- Introduction of safe prescribed burning methods as a part of integrated forest fire management

3. Indonesia: Regeneration of burned tropical lowland rain forest

Large-scale forest conversion, uncontrolled slash-and-burn agriculture and controlled migration have brought a tremendous fire pressure on the rain forest lands of eastern Borneo. In dry spells such as the 1982-83 and the 1987 droughts, several million hectares of rain forests have been burned over by wildfires escaped from the forest-clearing fires.

The government initiated fire management measures in various levels. In addition, it was recognized that the burned forests should be rehabilitated despite a prevailing opinion to convert the burned forests to agricultural lands.

In order to determine the rehabilitation potential of the burned tropical rain forest it was necessary to obtain basic knowledge on fire-related forest dynamics and recovery. With these findings forest management could be enabled to prepare and carry out forest rehabilitation programs.

During the project the University of Mulawarman at Samarinda, Faculty of Forestry, was supported by a German forestry team. In close cooperation with the University of Freiburg, main emphasis was placed on investigations on natural regeneration of the tropical dipterocarp rain forest. Fire ecological and fire history research was added by other input of the University of Freiburg.

The Department of Forestry was the government implementing agency of a FAO program. Among other tasks the group had to review fire-related legislation, to identify research needs and to prepare a national forest fire management plan.

The various national and international projects are not yet terminated.

Preliminary results are summarized as follows:

- Fire ecology studies have shown a high regeneration potential
- Basic and appropriate fire management tools were made available through the FAO project
- High-tech airborne fire suppression equipment was obtained by the government. Training for aerial fire suppression was given to pilots/ copilots.
- The government with the aid of FAO experts drew up a national forest fire management plan
- Members of the staff as well as students of the forestry faculty, University of Mulawarman, receive academic education in rain forest ecology and silviculture with emphasis on disturbed forest ecosystems

This case study shows the need and success of cooperative approaches between various independent projects within one country.

4. People's Republic of China: Integrated fire management and silviculture in the montane-boreal coniferous forest

Exploitation and management of forest resources in the montane-boreal coniferous forests in Northeast China have been underway for the last 20 years. Wildfires represent the most serious threat to the reforestation concepts. Although at present most wildfires are started by man, natural fires (lightning) still play an important role in the region.

The conflagration of 1987 which burned more than one million hectares of land has shown the necessity of improving fire management capabilities. Recognizing the historical role of fire in forest development, future forest management and fire management strategies should be based on an integrated concept in which both natural and prescribed fire will play a key role.

A combined research and training program was initiated between the University of Harbin and University of Freiburg. The program intent was to examine forest and fire history. The project was initiated in 1988 and is in its first phase of implementation at present. However, basic results are already available through the pilot study.

The montane-boreal coniferous forest is characterized by a forest mosaic in which larch and pine play a major role. The composition and dynamics of these coniferous stands have largely been determined by lightning fires.

It is evident that despite (or even because of) frequent natural fires, valuable coniferous forest stands have developed. The present practice of clearcutting and large-scale afforestations has brought dramatic changes to the forest ecosystems in which wildfires play a more detrimental role now. It is assumed that fire needs to be introduced as a silvicultural and integrated fire management tool in order to avoid large-scale destruction of afforestations as in 1987 and other dry years.

In his final comment, Goldammer gave an outlook toward the future of tropical forests. He underscored that more than 600 to 1,000 million hectares of savanna-type wildlands, as well as the deciduous and semideciduous tree formations, are burned annually. Along with other human and animal pressure on vegetation, wildland fires play an important role in the overall degradation and conversion of tropical forests followed by all kinds of ecological and economical disasters. The biomass burning within the tropics contributes also to the release of greenhouse gases to the atmosphere and the expected global climatic change. The expected increase of wildfires and the resulting losses of natural resources give highest priority to all preparatory and planning measures in wildland fire management. Fire management measures cannot just be transferred from a northern industrial nation to a southern developing country. Wildland fire management systems must be socio-economically feasible in the context of the local ecological and cultural conditions.

Wildland fires play an important role in the overall degradation and conversion of tropical forests, followed by all kinds of ecological and economical disasters.

Lowell Smith

State Forester, Nevada
United States

*We, as wildland
fire agencies,
must cultivate the
agencies we have
generally overlooked
in the past.*

*Agencies must begin
to commit to total
cooperation.*

Building Blocks for a Successful Program

"We in the wildland fire service have been arrogant in the past in our handling of our responsibilities, said Lowell Smith. "We jealously guarded our territorial responsibility. We have built programs that trained ourselves in a command system that only we know. We devised our own language to be used only on our own radio frequencies. We each purchased equipment to fill our individual agency needs. Separate dispatch centers for each agency existed and still do in many parts of the country."

Smith called for attitude and organizational changes to fight the fires of the 1990s. He said an emphasis must be placed on regional or sectional planning for coordination of effort.

Dispatching can achieve coordination, cooperation and efficiency, he said, when all jurisdictions are combined into a single dispatch center. Even if this starts with only cohabitation, with phased full integration as an ultimate goal, agencies must begin to commit to total cooperation.

Providing the best possible overall coverage is the only way to meet each agency's responsibility to the public. To accomplish the best coverage, Smith called for a "closest forces concept," in which the nearest available unit makes an initial attack, regardless of technical jurisdiction. This is possible, he said, through a unified dispatch center and a commitment to cooperation. The combining of crews, air operations, heavy equipment and other specialized equipment saves time and total resources. Fire prevention is another example of a function that can be combined. He said combining efforts and assigning tasks broadens the efforts and increases efficiency without duplication.

"The effect of the broader cooperation and understanding of the jobs of others is the most important aspect that must be considered," Smith added. "We, as wildland fire agencies, must cultivate the agencies we have generally overlooked in the past. The agencies that have some jurisdiction—local law enforcement, local fire districts, local or county municipalities—all have a place or responsibility they must perform with or without coordination."

He believes that with the better understanding that comes from working together, political understanding can increase, and with that comes a more effective allocation and direction of resources. All of this, he said, contributes toward increased public support.

Smith observed that without joint planning and coordination, all forces fighting a wildland/urban interface fire are usually committed to protect structures and life, thus leaving the main wildfire to spread. "This is what is expected by the public and political subdivision," he said.

This allows the threat to structures and lives to continue. But coordinated efforts can better designate some suppression forces to bypass structures and make the aggressive attack on the main fire threat. Smith admitted that it is very difficult to dispatch units past threatened structures to fight the main wildland fire unless coordination actually works to provide total protection. He said this must be understood by the public and the politicians.

In closing, Smith said, "The building blocks to a successful wildland fire program is a reassessment of the existing agencies or departments to provide the public we serve with the best possible service available."

Forest Fire Management in Israel

The area under forest cover in Israel is 116,000 hectares, consisting of 76,000 hectares of man-planted forests and 40,000 hectares of natural forests, according to Menachem Sachs. Practically all of the forests are in public ownership. He added that forests cover only 5.6 percent of Israel's land area, compared to 60 percent desert. "When all forest-fires in Israel are man-caused," Sachs noted, "and 35-75 percent of them are caused by 'political arson,' one has to establish a proper fire management program which will minimize the fire events and the fire damage."

The Forest Department, as part of the autonomous Land Development Authority, is the sole forest administration in Israel and responsible for all activities concerning the establishment, management and utilization of the forests. Sachs said fire management is the largest budgeting and personnel item (up to 20 percent) of the yearly expenditure of the Department.

"Since 1985 the fire statistics have indicated an alarming sign of a change for the worse—a sharp increase in the number of fires and in arson, and 1988 turned out to be a record year," Sachs said.

This situation led to a re-evaluation of the fire planning and management programs of Israel. He reported that in 1987 Israel hosted a team of three experts from the USDA Forest Service, who were asked to recommend proper adjustments and improvements based on their experience in fire management in the U.S. New objectives and goals have been in effect since the spring of 1988. Some of the changes identified by Sachs include:

- An intensified forest roads network in existing forests and at new sites. Access to fires is one of the most important factors for containing fires at a minimum size and reduced cost. In all new plantations it is compulsory to have forest roads spaced no further than 200 meters apart and to have a perimeter road bordering the planted area.
- Silviculture improvements include diversification of species in new plantations and on rehabilitated forest sites, pruning young coniferous trees (up to 2-3 meters); adopting the practice of whole-tree logging and utilization in thinning operations (to minimize the amount of slash on the forest floor).

Sachs said the establishment of administrative programs, on both national and departmental levels, is of major importance. Some accomplishments at the national level are:

- Elevating the issue of wildfires in forests and open areas from the institutional to the governmental level.
 - Increasing public awareness in an effort to minimize negligence and carelessness and to ensure immediate reporting of every fire.
 - All agricultural fire permits are issued through the regional forest offices.
 - More severe court punishment of arsonists who are caught and convicted.
- Sachs also listed changes at the Forest Department level.

Why are programs successful? Sachs listed three keys from the Israeli experience:

- Fire planning on the largest scale and implementation according to priorities and funding limitations.
- Using original and/or adapted new technologies as necessary, and implementing them through the right trained personnel.
- Cooperation among all organizations.

Sachs closed by stating: "We cannot allow man-induced desertification to return to our region and we are working hard to fight this possibility through minimizing forest fire damages and by replanting several trees for each burnt one."

Menachem Sachs

Director
Land Development Authority
Israel

The fire statistics have indicated an alarming sign of a change for the worse—a sharp increase in the number of fires and in arson.

We cannot allow man-induced desertification to return to our region...

Oliver Davidson
Assistant Director
Office of U.S. Foreign Disaster
Assistance
Agency for International
Development
United States

*Improved domestic
cooperation means
better international
disaster responses.*

Successful International Cooperation: What Does It Take?

The central office to coordinate all United States government assistance to international disasters is the Office of U.S. Foreign Disaster Assistance (OFDA) in USAID, said Oliver Davidson. As mandated by Congress, OFDA provides assistance not only for international disaster relief and rehabilitation, but also for disaster preparedness, early warning and mitigation. The Director of OFDA reports directly to the USAID Administrator, who is the President's special coordinator for international disaster assistance. OFDA's three geographic divisions—Africa and Europe, Asia and the Pacific, and Latin America and the Caribbean—provide country-specific expertise to respond to relief and preparedness needs in each region.

Davidson explained that OFDA responds to requests for emergency assistance in an average of 50 disasters a year and monitors another 40 situations which could become disasters. When disaster strikes, OFDA mobilizes government resources and coordinates the response with that of voluntary agencies, international organizations, and other donors.

A 1987 wildfire in northeastern China added a new perspective regarding the serious impact forest fires may have on human lives, property and natural resources. This fire reportedly burned more than 2 million acres, killed about 200 people, damaged 12,000 houses, and forced over 60,000 people to evacuate their homes.

"Fires at the wildland/urban interface have been striking the international home front in increasing numbers recently," said Davidson, "For example, the Ash Wednesday Fire disaster in 1983 burned more than 840,000 acres of urban, forested, and pastoral lands in Victoria and South Australia, killing 77 people, injuring 3500, and destroying 2528 homes. A new international focus on wildfire prevention and preparedness programs clearly will be a high priority to reduce the threat of fires to people, property, natural resources, and agriculture."

He said much has been learned in their responses to international disasters. He shared some observations on how they try to optimize international cooperation:

- OFDA sponsors and develops international training courses. Most courses sponsored by OFDA are of the "train the trainer" type, so that those trained can offer additional courses in their countries or region. This concept has been applied to wildfire training courses in Ghana in 1987 and Indonesia in 1988.
- Improved domestic cooperation means better international disaster responses. Examples have been the response to international disasters by emergency units from federal, state, local, and private organizations.
- Entering into grants, agreements, and other formal and informal relationships to expand capabilities and numbers to respond to international disasters.
- Providing leadership in the design and development of a Disaster Operations Management System.
- Evaluating and documenting "lessons learned" from international disasters.
- Providing effective support to Disaster Assistance Response Teams.
- Instituting a balanced international disaster assistance program, to include an appropriate mix of prevention, preparedness, training, and emergency response activities.
- Identifying and training disaster response specialists in advance.
- Guiding appropriate donor and individual contributions to stricken countries.
- Developing "how-to" guidebooks and manuals to help others carry out effective actions.



Tuesday Luncheon Workshop

*Let us reach across our
luncheon tables to each
other, in the spirit of
improving wildland
fire prevention and
suppression efforts.*

Dave Wright, Forest Supervisor, Allegheny National Forest, said it was his "distinct pleasure to serve you as your working luncheon host as we embark on a group effort to explore opportunities on how we might meet international wildland fire challenges in the future. Prior to this conference our committee mailed to each participant an International Survey to assess the state of wildland fire management throughout the world. Many of you took the time to complete this survey for which we on the luncheon committee are most grateful. You have presented us with a very interesting and extensive overview of wildland fire management throughout the world. To our knowledge this is the first time such an assessment has been completed on a global scale."

Referring to the International Survey, Wright said, "We have analyzed your responses and prepared a summary of the survey findings that will be presented to you tomorrow in a document that we believe will be of great value to you and to others with whom you might share this information back home. The survey asked a number of questions about the identification of issues and barriers that keep us from being more efficient in wildland fire management. There were a total of twenty-four general issues and thirteen barriers which were identified in your survey responses (refer to Appendix 1).

"This brings me to the purpose of our luncheon exercise. During this exercise we want to solicit your thoughts on cooperative opportunities that can be explored to overcome these issues and barriers you identified. Our luncheon committee has taken the liberty of summarizing the issues and barriers into the following key areas:

1. Communication and geographic barriers limit international cooperation.

Luncheon Objective: How can we reduce communication and geographic barriers that presently limit international cooperation?

2. Need to share personnel and equipment across international boundaries in emergency wildland fire situations.

Luncheon Objective: How can we better share personnel and equipment across regional boundaries in emergency wildland fire situations?

3. Need to generate and share applicable research, training and appropriate technology.

Luncheon Objective: How can we develop and share applicable research, training, and appropriate technology to enhance global wildland fire preparedness?

4. Need to recognize the global economic and ecological relationships associated with wildland fires.

Luncheon Objective: How can we improve our understanding of the global economic and ecological relationships with wildland fires? How can we increase public awareness?

In conclusion, Wright said that this conference, and most especially this Tuesday Luncheon, provided a wonderful opportunity to share ideas to improve wildland fire cooperation throughout what really is a very small world.

Said Wright: "Let us take advantage of this expertise and the camaraderie we have developed with each other the past couple of days, and reach across our luncheon tables to each other, in the spirit of improving wildland fire prevention and suppression efforts."

Exploring International Cooperation: Tuesday Luncheon Results

A forum was provided during the Tuesday Luncheon enabling all conference participants to:

- discuss four major issues identified by the international survey;
- study the opportunities to increase international cooperation identified by the survey; and
- identify additional opportunities to increase international cooperation in wildland fire management.

All of the ideas were recorded and are presented on the following pages.

Ideas common to all issue areas identified at Tuesday's luncheon are:

- in many instances wildland fire is the symptom of more serious social and economic problems of a nation. The answer may not lie in the acquisition of more technology or manpower; but rather in the treatment of the social or economic situations.
- develop regional emergency fire cooperative agreements.
- exchange fire management personnel at all levels from basic suppression crews to fire management leaders.
- improve the dissemination of information among nations.
- standardize international training in wildland fire suppression, equipment and communication.

As we leave the conference and return to our homes and continue our wildland fire management responsibilities, let us be sensitive to the needs of our neighbors and find ways to implement the opportunities we have identified at this conference.

*Let us be sensitive to the
needs of our neighbors
and find ways to
implement the opportu-
nities we have identified
at this conference.*

Major issue identified by the Survey:

1. Communication and geographic barriers limit international cooperation.

Opportunities identified by the International Survey:

- cultural awareness and language training
- develop and implement regional mutual aid agreements
- use compatible communication systems

Opportunities identified at the Tuesday Luncheon:

- Encourage national governments to address international wildland fire issues.
- Request technical organizations to promote technical assistance through cooperative programs.
- Schedule annual global conference for managers.
- Establish an International Fire Center similar to Boise Interagency Fire Center/Canadian Interagency Forest Fire Center.
- Each country develop its ability to communicate with the International Fire Center.
- Encourage the Food and Agriculture Organization and other international organizations to strengthen the Forestry Commissions.
- World Bank to provide funding to assist the developing countries.
- Publish and distribute conference proceedings.
- Develop international definitions, terminology, and standards.
- Establish an international fire information system for publications in several foreign languages.
- Standardize equipment commonly used internationally.
- Adopt the Incident Command System.
- Standardize communications systems.
- Establish mutual-aid agreements before disasters strike.
- Capitalize on existing bilateral agreements/exchanges of staff (both ways).
- Make documents available in necessary languages.
- Develop a FAX network and distribute FAX machines to everyone.
- Establish a Peace Corps-type approach of fire personnel exchange.
- Computerized translation from one language to another.
- Develop compatible software for computers.
- Better education of the younger generation of global problems.
- Create World Forestry Commission.
- Allow National Forests and Regions to initiate exchanges.
- Make it easier to cross borders.

Major issue identified by the Survey:

1. Communication and geographic barriers limit international cooperation (cont'd).

- Create opportunities for spouses to work.
- International directory of fire management people around the world.
- Better coordination at international boundaries/borders for local fires.
- Regional and international information systems.
- Food and Agriculture Organization conference to share information.
- Establish training standards.
- Political activist groups to lobby governments.
- Use military assistance for emergencies.
- International fire information system which can be given to the media.
- Computer link-up among nations.
- Universal wildfire symbols.
- Expand and update international glossary.
- Distribute information about conferences.
- Publish and distribute an international newsletter.
- Establish incentives to learn another language and culture.
- Increase cooperation between countries with common boundaries.
- Disaster response teams for varied emergency situations.
- Include international component and social science training in forestry.
- Emulate in other parts of the world the project developed in Northern China between China and Canada.
- Scholarships to send students from developing countries to developed countries for education in fire. Two levels: academic and technical.
- Develop regional centers for wildland fire research and training along with coordination centers-including: research, communication, training, and logistical support.

Major issue identified by the Survey:

2. Need for authority to share personnel and equipment across international boundaries in emergency wildland fire situations.

Opportunities identified by the International Survey:

- enabling legislation to authorize payments and facilitate entry through customs
- develop, adopt and implement bilateral and/or multi-lateral operating agreements

Opportunities identified at the Tuesday Luncheon:

- Establish diplomatic agreements and legislation *before* the emergency. This may include a mutual aid treaty any country could use.
- Exchange technical equipment.
- Establish a global center for case studies on the effectiveness of technology and equipment - a planning group.
- Work on common standards (i.e. equipment and personnel, command structure, terminology, and training). The Incident Command System on a global scale.
- Establish a standard exchange network for sharing information—an international clearinghouse.
- Remove political and/or legal barriers that may exist.
- Develop coordination centers.
- Pre-identify an international cadre of liaison officers/coordinators/facilitators/trainers.
- Prepare a list of common resources between neighboring countries that could be shared. (A world directory)
- Develop “briefing packages” that may be distributed throughout organizations.
- Develop an economic cost plus benefit analysis.
- Establish an international fund to pay for cooperation, possibly through the World Bank.
- Utilize international emergency organizations like the Red Cross.
- There is no need to prepare for the entire world, just preselected regions that are impacted by wildfire.
- Keep passports up to date. Possibly have an international passport for members of fire fighting forces.
- Establish intercontinental fire caches in predesignated areas.
- Establish an international “suppression force” to be sent to a nation in need (International Hotshot Crews).

Major issue identified by the Survey:

2. Need for authority to share personnel and equipment across international boundaries in emergency wildland fire situations(cont'd).

- Reduce competition among nations.
- Educate fire service personnel to governmental operational difficulties, and educate politicians as well.
- Implement global monitoring for Fire Danger Rating.
- Develop an International Wildland Fire Coordinating Group.
- Evaluate the magnitude and conditions of the wildfires to determine the level of assistance needed.
- In addition to agreements, meetings among the people/countries involved are needed.
- Developing nations may not be able to afford assistance—the developed nations need to be prepared to assist.
- Establish a worldwide chart showing fires by season.
- Establish a world fleet of available aerial firefighting resources.

Major issue identified by the Survey:

3. Need to generate and share applicable research, training and appropriate technology

Opportunities identified by the International Survey:

- develop and implement additional international training programs
- interchange of research personnel and training specialists

Opportunities identified at the Tuesday Luncheon:

- Center for receiving and distributing information, technical development center and professional center and liaison.
- Newsletter for information dissemination geographically. Strengthen existing Forest Fire Newsletter; include a directory of local fire management organizations.
- List of contacts specific to discipline.
- Fire management committee on world basis (International Wildland Fire Coordinating Group-IWFCG).
- Expand international training courses (USA, Chile, Canada, Mexico).
- Make better use of research taking place at universities.
- Make requests to universities to do specific, needed projects.
- Use international computer-generated information.
- Change in immigration laws to allow easier exchange of people.
- Standardize training format between nations to ease exchange.
- Establish funds to help institutions teach more about fire problems around the world. (World Bank, FAO, and AID)
- Americans should speak more languages and expand worldwide cultural knowledge.
- Video training package housed in a universal library.
- International Union of Forestry Research Organizations (IUFRO) should be more active in fire.
- Use International Decade for Natural Disaster Reduction to resolve wildland fire issues.
- Make international fire courses available to fire managers *early* in their careers.
- Enhance international forestry programs.
- Develop international wildfire working teams, i.e. equipment, communications, etc.
- National Advanced Resources Technology Center (NARTC) act as clearing house for source of international materials.
- Utilize international fire management directory to locate specialists

Major issue identified by the Survey:

3. Need to generate and share applicable research, training and appropriate technology (cont'd).

when need arises.

- Utilize private management for international cooperation rather than government agreements, i.e. Partners of the Americas.
- Establish world fire research experimental stations.
- Organize existing information groups into an international clearing house.
- Create an international professional organization to promote fire management.
- Develop an international fire assessment such as Fire Danger Rating System to assess emergency situations.
- Prepare relevant fire management literature in multiple languages.
- Develop scholarships for foreign students to study fire.
- Identify fire management as a "profession."
- Utilize expert systems technology.
- Establish training priorities for each individual country.
- Promote international exchange of technical personnel and fire management instructors.
- Capsulize for the news media the international wildfire issues to inform the public and provide a support base for government action.
- Develop a global wildfire monitoring process.
- Conferences such as this are part of the solution.
- Prior to going international, research programs need to be developed on a local level.
- Universal research and training opportunities need to be identified.

Major issue identified by the Survey:

4. Need to recognize the global economic and ecological relationships associated with wildland fires.

Opportunities identified by the International Survey:

- develop capabilities to organize and coordinate cooperation
- build national and international commitment to cooperate

Opportunities identified at the Tuesday Luncheon:

- Maintain dialogue with international delegates for constructive changes.
- Develop media material on role of fire—economically and ecologically.
- Obtain more accurate estimates of costs of wildfire for public and politicians.
- Fire cannot be studied in isolation. Need to continue research on all ecological relationships.
- Develop an international fire effects monitoring program.
- International agency to oversee fire projects—coordinate logistical movements.
- More research on the social, economic, and ecological relationships with fire.
- Develop world perspectives on economics and ecology.
- Emphasize social/cultural factors as major contributors to the problem. Solutions—i.e. birth control, awareness of surrounding, environmental education.
- Increase awareness of relationships between high population densities and wildfire impact.
- In developing countries increase economic and ecological education and display the impact it has on social problems and issues.
- Utilize international “problem solving teams” to reduce issues between fire and ecological and economic factors.
- Developed countries need to take leadership roles in looking at global social/economic problems.
- Maintain emphasis on global nature of wildfire problems and issues.
- Increase amount of long term scientific exchange programs.
- Clarify relationship between wildfire and global warming.
- Arrange a U.N. debate to pass a resolution.
- Invite media (T.V., papers, radio) to attend sessions like this.
- Recognize that solutions to wildfire problems in one country may not work in other countries.

Major issue identified by the Survey:

4. Need to recognize the global economic and ecological relationships associated with wildland fires.

- Share solutions, problems, and lessons learned, regarding the economic and ecological interrelationship of wildland fire both regionally and internationally.
- Need better utilization of vegetation modification to increase benefits to resources.
- Need (better) quantification of global relationships/ecology.
- Share more information on fire losses to increase public awareness of the problem.
- Form a commission through the United Nations Food and Agriculture Organization to analyze biological/physical/social/economic/political relations with fire.
- Organize visits to “exceptional” or dramatic sites to help increase awareness of public and politicians. (i.e. Yellowstone, well managed areas)
- There is need for more understanding by developed countries of the values and needs that developing countries put on their forests.
- Need to show viable solutions to destructive land management practices.
- Need more research on effects of soil deterioration, wildlife loss, etc. (amenity values) due to fire.
- Look for ways to improve world economics for survival.
- Increase awareness of the International Decade for Natural Disaster Reduction and similar efforts.
- Further develop internal fire infrastructures.



Cornerstone Presentations

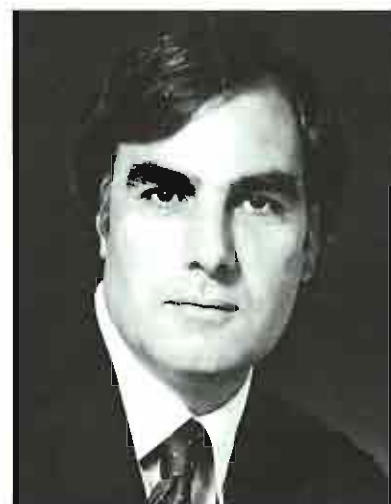


Issues and Opportunities of International Cooperation

MEETING GLOBAL WILDLAND
FIRE CHALLENGES

Dr. Robert Lee

Professor of Forestry
University of Washington
United States



...conference participants have been engaged in one of the most difficult but exciting challenges—understanding people from different cultures.

"Any discussion of opportunities for international cooperation," Dr. Lee began, "must begin with recognition that people from various nations, and even groups within nations, are separated by social and cultural differences. We are all rooted in distinctive identifications with languages, places, peoples and traditions. And we often find it stressful to seek common ground for transcending our differences. Yet the search for common ground has been exactly what this conference is about."

He said the response to the international survey and contributions to the Tuesday luncheon discussion demonstrate commitment to building common understanding about wildfire management.

"It would be unrealistic for us to expect full cooperation between all concerned nations," Lee continued. "Cooperation is not always possible or desirable. Effective intercultural communication is itself a significant achievement. Communication can lead to harmonization of working relationships. Harmonization will enable nations to maintain their own ways of doing things while still benefiting from working with other nations in pursuit of a common purpose. Full cooperation will occasionally be possible, and will involve shared objectives, approaches, organizational structures and technology. What is important is to reinforce the need for the co-participation and co-responsibility mentioned by Señor Ochoa of Mexico."

Lee pointed out that for three days conference participants have been engaged in one of the most difficult but exciting challenges—understanding people from different cultures. He said results from the international survey indicated that communication was one of the most common factors thought to inhibit international cooperation. The difficulties of communicating internationally through formal channels of government bureaucracies was also thought to be an inhibiting factor. More than a third of the 89 barriers noted by survey respondents involved one of these two communication problems.

Even within nations, Lee observed, communications is at the root of the problem of public awareness, which the survey revealed as the most important domestic issue associated with managing fires.

"International communication is not as simple as learning a foreign language, or gaining experience through travel, although both of these are essential ingredients for successful interchanges," Lee said. "To know what people mean—to grasp their realities—it is necessary to understand indigenous cultures and customs. Attempts to communicate about fire illustrate the magnitude of this challenge."

To illustrate how knowledge of culture and social organization can help us communicate about fire, Lee summarized the historical development of fire control and management. He said that as agents for complex organizations with advanced technologies, "we often assume the superiority of our fire management practices. We have difficulty imagining other successful forms of fire management."

He reminded the audience that fire management by agents for a centralized nation state is only the most recent of many ways for organizing social and ecological control. Lee said it was especially important to realize that any means for using basic institutional structures for managing fire is simultaneously a means for exercising control over people. "Although many fires originate from malicious, disturbed or criminal behavior, a significant fraction of what is termed arson might better be identified as an expression of social conflict over rights to land."

Balanced fire management programs did not appear until alternative mechanisms for maintaining social order began to emerge in the 1960s.

Looking at the evolution of centralized fire suppression organizations, Lee said, "There is no evidence that ... attempts to exclude all fire from fire-prone ecosystems could be sustained. The natural equilibrium of fire-free climax forests turned out to be an unachievable ideal. And the fuels that accumulated during periods of protection only made fires more intense and destructive when they did burn, as they inevitably would. We have heard from Dr. Philpot and others how these practices generated disturbances far more catastrophic than are found in the historical biological record."

Lee noted that centralized fire suppression appears to have had far more to do with attempts to control social and political turbulence than to control wildfire. He added that at least it was enormously successful at the former and generally unsuccessful at the later.

In the United States, Lee said, early fire prevention campaigns presented fire as an ever-present threat waiting to release chaos. Sustained vigilance was required in the face of this threat, and immediate mobilization was the habitual response to a wildfire, just as it was the response to over seventy years of national crises and wars. "Fire suppression, like military mobilization, was a product of a nation that had discovered social stability by focusing the energies of its citizens on external threats. What was sustained was not our use of fire in sustenance activities, but the social order of a rapidly growing nation."

According to Lee, our modern search for a balanced fire management program did not appear until alternative mechanisms for maintaining social order began to emerge in the 1960s. During this time the legitimacy of almost all national institutions was questioned. Fire suppression was questioned along with other institutions empowered by cycles of threat and mass mobilization.

"Modern fire management was born when fire was viewed as a morally neutral physical process, not good or bad, not a destroyer or creator of life. The enemy was vanquished, and its heroic slayers were replaced by scientifically trained fire managers who used socially responsive fire management plans to decide where, when and under what conditions fire would be suppressed or allowed to burn. Rational consideration of the costs of fire suppression relative to its effects on natural resource losses or gains replaced blind commitment to attacking all fires at any cost."

Change is still occurring. Lee said it appears we are entering an era in which decentralization of authority, interest group mobilization and social cooperation are replacing state-orchestrated action. He observed that new opportunities for cooperation may be arising from unexpected sources as powerful energies—previously channeled toward combating internal and external enemies—are refocused.

Referring to comments from the Tuesday luncheon meeting, Lee said it was significant that few people mentioned the need for agreements between national governments, with top-down implementation. For most of the suggestions, fire managers themselves would be the initiators of cooperation. Also significant, he said, was recognition that fire management cooperation involves far more than sharing fire suppression equipment and expertise during emergencies.

Lee turned to a number of issues that emerged from the Tuesday luncheon meeting, saying that several will require substantial attention at future international forums. Three such issues are:

- Is it necessary for nations to have centralized fire management organizations in order to communicate or cooperate effectively? Effective communication, even full cooperation, is already taking place between nongovernmental organizations in separate nations. In fact, Lee said, such relationships have proven to be one of the most effective means for stimulating successful development activity. The question for fire managers is whether decentralization of knowledge and authority in relation to fire management will permit energies to be channeled through subnational organizations. He said cooperation between the Coronado National

Forest in the U.S. and the Mexican State of Sonora is an example of how such energy can work toward developing a sustainable fire management system.

- How can indigenous knowledge necessary for sustainable fire management in human-dominated ecosystems be perpetuated? Lee said the development of centralized fire management organizations, together with degeneration of sustainable native fire management systems, has resulted in the rapid loss of information on how to use fire effectively in sustenance activity. For example, a student returning from China reported that only the old men know how to burn the plots without destroying the soil nutrients. Lee said scientific research is a very expensive way to reinvent the wheel when managers discover the need to use fire as a tool.

- How will global ecological changes affect existing forest and brush fire regimes? How will fires affect global ecological change through converting carbon stored in biomass to CO_2 ? Lee indicated there is a possibility that global warming could alter how fire behaves in natural ecosystems, especially in polar regions. If scientific models are correct, climates in higher latitudes will grow much warmer over the next several decades. Whether this could result in more frequent or severe fires deserves study and contingency planning. He reported that results from the preconference international survey showed either a lack of awareness of this possible problem, or so much uncertainty, that it was mentioned only once as an issue.

In his conclusion, Lee said that he was encouraged by the rationalization of fire—the belief that fire is a morally neutral phenomenon. He repeated that this approach to fire, evolving since the 1960s, has led to rapid changes in both policy and technology.

He then said myth stands as a barrier between people, constituting separate realities about which it is difficult to communicate. Added Lee: "Since communication is the first step toward cooperation, mutual understanding of fire mythologies is essential. Harmonization can take place when people discover ways to work together without abandoning their own way of thinking and doing things. But cooperation will require that people either share the same myth or rationalize fire, freeing energy that can be channeled to forms of cooperation that will benefit all of the human community."

Harmonization can take place when people find ways to work together without abandoning their own way of thinking and doing things.

John Goodman

Executive Director
Forest Resources Group
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Resources
Canada



*Major forest losses
due to wildfire in any
part of the world affect
each of us in one way
or another.*

Approaches to International Cooperation

Quoting Australian Prime Minister Hawke: "The environment can only be destroyed once. But when it is protected and preserved, the benefits are permanent and will be appreciated for generations to come." John Goodman added that if the needs of the world are to be met on a sustainable basis, the natural resource base of the Earth must be conserved and enhanced. "Fire protection is more than just the preservation of trees and forests," he said. "It is the conservation and enhancement of air quality, water quality, land, wildlife and habitat. In many cases forests are the loom on which we weave the social and cultural fabric of our societies. Major forest losses due to wildfire in any part of the world affect each of us in one way or another."

We have long recognized the need to prevent and suppress wildfires. These activities have involved a spirit of cooperation, he said, whether it involved fire fighters, equipment or aircraft during a time of critical fire emergency, or simply by receiving training or advice during quieter times.

"The North American fire community came to realize, as we all do, that fire respects no boundaries, and the occurrence of wildfire in or near a jurisdictional border is no time to determine who should respond," said Goodman. "Mr. Robertson earlier in the conference expressed it very succinctly when he said we cannot afford to wait until the midst of crisis to make cooperation work. At the same time Mr. Robertson reminded us that our turn is coming to have the 'bull by the tail'."

Goodman described some examples of successful international cooperation. Mexico, Canada and the United States formed the North American Forestry Commission and created wildfire working groups. Reciprocal fire fighting agreements were developed between the U.S. and Canada and between the U.S. and Mexico, which allow for the cross-border movement of equipment and personnel during fire emergencies. He said we have shown a number of times that these arrangements work. Last year alone, hundreds of American fire fighters and tons of equipment were flown to Ontario to assist in battling one of the worst fire seasons on record. During this conference, he added, fire suppression forces across Canada are working in Manitoba as part of a national mutual-aid agreement. He noted that it was well over 5,000 kilometers across Canada; this demonstrates that great distances can be overcome during emergencies and through cooperation. He reminded the participants that extensive cooperation such as this comes only from a step-by-step process. He said each opportunity to assist someone else was also an opportunity to learn from them.

Among other benefits of cooperation, he said, "We are able to avoid costly duplication of effort in the field of research and development. We are able to combine experience and knowledge in the fields of fire prevention, staff training and fire suppression."

Goodman cautioned that national and international cooperative efforts must be structured and managed. Both Canada and the United States have national coordinating and facilitating agencies through which all requests for outside assistance are channeled and filled.

"In developed neighboring countries, creating mutual aid agreements and national organizations are easy," he said. "We have a common social and cultural fabric. Other parts of the world must first hurdle basic barriers that we have never had to face. Those parts of the world do not have the same opportunities to share planning or resources. We must develop the innovative mechanisms which will

allow us to work toward those common goals."

He said one prime example of sharing ideas and planning was the results gained in The People's Republic of China. Ontario was selected to play the lead role in the creation of a model forest fire management program in northeastern China. The five-year project resulted in numerous exchanges of fire personnel from both sides. The transfer of appropriate technology and people now means that together the two nations have laid the foundation from which China can adapt and structure its own regional fire management organizations.

Another example given was the use of Canadian aerial tankers in the United States and in South America. Said Goodman: "We were only too happy that we were in a position to be able to help, and that administrators in the respective fire jurisdictions had the foresight to pave the way. Cooperation on an international level is more than just possible—we are doing it and it works. Now we must develop innovative ways to move even further."

Goodman admitted that the participants were not going to leave this conference having formed or even recommended a global fire management network. That was not the intent. "However, we have seen that cooperation at specific levels does work, and we have some excellent case studies to follow."

He discussed obstacles impeding the progress of global cooperation. Communications was one. But he said language barriers can be overcome through interpreters and training. Cultural differences can be better understood and accepted through a program of mutual awareness. He noted that programs of international cooperation in other fields have had to face the same problems. They have been overcome, and we would be wise to learn from them.

According to Goodman, technological systems that are differing, inadequate or outmoded pose greater barriers to cooperation than language and culture. So, if a nation has to start from scratch, the ultimate solution is modern, effective and internationally compatible technology. The barrier to this solution is funding. "Surely this is where developed countries, perhaps through the United Nations, will play the lead role," Goodman said.

He reminded that it is easier, cheaper and safer to prevent fires than it is to suppress them, saying, "It is the establishment of appropriate land use policies and environmental ethics compatible with a nation's societal needs that will pay larger dividends."

Returning to the recommended step-by-step program of international cooperation, Goodman called the process "pragmatic incrementality." First, develop agreements with neighbors, starting with those with whom there is more in common in terms of fire suppression problems and solutions, forest ecosystems and the ability to communicate.

This conference, Goodman observed, will be of primary benefit to developing nations. "But by assisting those in greatest need, we help ourselves by diminishing a global problem that has global implications."

On the other hand, he said developed nations must resist imposing solutions on developing countries. Instead, the focus must be on strengthening that nation's institutions.

One way of providing assistance is to take a more forgiving approach to the debt problems of developing nations, according to Goodman. "As it is, it makes little sense to suggest or impart new technology to developing nations that can ill afford to implement and maintain that technology. It is in the best interest of developed countries to investigate and to support ways of assisting developing nations' efforts to implement effective fire protection programs."

Goodman listed six key groupings of suggestions from the Tuesday luncheon meeting discussions:

- Wildland fire is the symptom of more serious social and economic problems. The answer may not lie in more technology but in treatment of the social or economic malaise.

*Cooperation on an
international level
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and it works.*

- Develop regional fire cooperative agreements.
- Exchange fire management personnel at all levels.
- Develop formal communications instruments.
- Standardize international training equipment and communications.
- Improve the dissemination of fire data between nations.

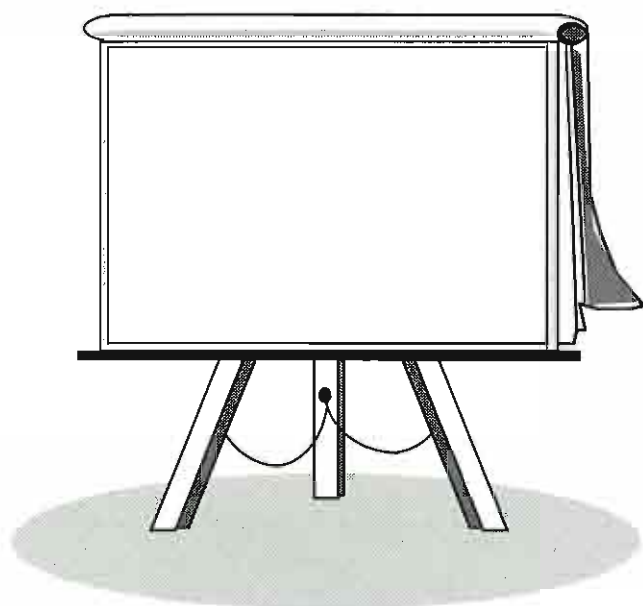
He called for the immediate formation of a working group tasked with the responsibility of preparing an action plan based on the ideas and energy generated at the conference. He said it should include a formal link with the United Nations through UNDRO to capture the opportunity presented by the International Decade for Natural Disaster Reduction.

Good communication was said to be an essential element for furthering the conference objectives. He said it would seem imperative that delegates to this conference and others who were unable to attend should be linked via a regular newsletter from the working group. There is already a world wildfire newsletter being produced on a limited scale by Dr. Johann Goldammer through the United Nations ECE/FAO team. Perhaps it may be worthwhile exploring further development and distribution of that newsletter, Goodman said.

"If we are to pursue the potential discovered through this gathering," said Goodman, "we shall have to meet again, perhaps in two years' time. If we are to meet again, we must use the interim time to build, to capitalize, to forge ahead."

In any event, he said, everyone should realize that fire management is a complex subject, and that the art and science of fire management is meshed with the social, political and economic fabric of individual nations.

*If we are to meet again,
we must use the interim
time to build,
to capitalize,
to forge ahead.*



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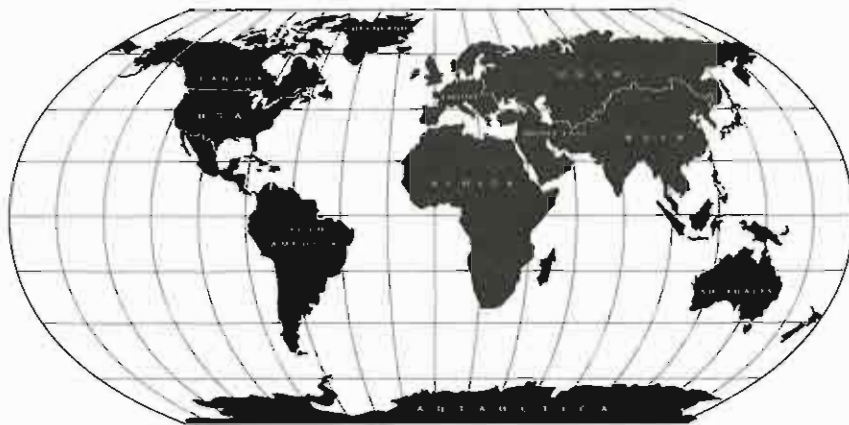
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Appendix

Definition of Issues and Barriers from the International Survey

Definition of Issues

- **Wildland/Urban Interface**—urban development and movement of populations into hitherto undeveloped wildland areas has created many problems for fire managers including increased fire hazards and risks, increased need for fire prevention programs, complicated and conflicting fire suppression tactics and strategies, increased demands on limited fire suppression resources, and increased losses of human lives, homes, and natural resources due to catastrophic fires.
- **Public Awareness**—there is a general lack of awareness, approaching indifference, on the part of the general public and governmental officials, relating to fire risk, prevention, and suppression, as well as the natural role of fire in ecological systems.
- **Local or Regional Climatic Conditions**—conditions which are conducive to the spread of wildfire, including high air temperatures, low humidity, winds, drought conditions, etc.
- **Fire Policy and Planning**—lack of overall fire management policy relating to risk assessment, the use of prescribed fire, fire prevention, contingency planning, and legislation, regulation and enforcement, etc.
- **Inadequate Resources**—inadequate, outmoded, or unavailable firefighting equipment, technology, trained personnel, and/or fire command structure.
- **Organization and Coordination**—refers to a lack of a central national fire organization, with responsibility for organizing and coordinating, and/or the lack of coordination or cooperation between local, regional and national fire organizations.
- **Training and Technology Transfer**—Training and knowledge of technological applications is often lacking. Training of personnel and fire managers often receives low priority compared to other duties.
- **Safety and Health**—Safety considerations and long-term health risks for firefighting personnel. Also includes public health and safety issues related to wildfires, prescribed burning, atmospheric pollution.

- **Funding**—inadequate domestic budgets to finance recognized training, prevention, suppression, and public education needs within country; lack of foreign currency to pay for assistance from the international community; lack of funding to finance assistance to other countries.
- **Fire Research**—need for more regional and local fire research to provide relevant information on risk assessment, fire detection, fire behavior, suppression methods, ecological role, and environmental effects (both positive and negative).
- **Communications (equipment)**—inadequate, outdated communications equipment; compatibility problems between equipment of different organizations, countries.
- **Language and Culture**—experienced fire personnel and fire managers may lack multilingual skills and knowledge of the culture and customs of countries other than their own.
- **Natural Ignition (Lightning)**—a major cause of wildland fires.
- **Agriculture/Forestry Related Fire**—associated with agricultural and forestry practices, including indiscriminate forest and brushland clearing (slash and burn), burning to “enhance” forage production, etc.
- **Arson or Negligent Fire**—intentional setting of fires for various reasons including, driving game animals into the open for hunting, to gain temporary employment in the subsequent fire control efforts, harassment, etc.
- **Increased Hazard and Risk**—due to lack of an active hazard reduction program (i.e. prescribed burning, grazing, etc.) to reduce fuel loading, fuel ladders, etc. in wildlands.
- **Economic Consequences**—including expenditures of limited financial resources to suppress wildfires; loss of economic products such as timber and forage; adverse effects on recreation or tourism based economies; conversion of areas to less valuable vegetative types.
- **Environmental Consequences and Ecosystem Effects**—including soil erosion, water quality degradation, increased risk of flooding, effects on soil fertility and productivity, and destruction or modification of wildlife habitat; localized and regional atmospheric pollution from smoke; and favorable environmental effects.
- **Potential Global Consequences**—concern for global warming, climate modification, etc.
- **Overall Environmental Policy and Planning**—lack of overall environmental policy to guide development of fire planning. Such a policy would provide a context for further action and would recognize the benefits of fire as well as the negative effects.

- **Terrain and Logistics**—mountainous, isolated and inaccessible terrain inhibits the early detection and rapid response needed to effectively and efficiently combat wildfires.
 - **Vegetation and Fuel Types**—particularly conducive to catastrophic wildfire: very flammable, rapid spread rate, continuity, etc.
 - **Slash and Burn Forest Conversion**—specifically refers to the practice, prevalent in tropical forests, of intentional cutting and burning of the forest vegetation to clear land for agriculture. Severe erosion and nutrient depletion usually results.
 - **Other**—permafrost; deep burning peat fires; high intensity, low frequency fires, etc.
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Definition of Barriers

- **Communications**—lack of multilingual capability of firefighting personnel and experienced fire managers; lack of knowledge or experience relating to foreign travel, culture, and customs; and lack of knowledge of international agency capabilities.
- **Bureaucratic and/or Political**—procedural problems related to travel documentation requirements, foreign travel limitations, payment/reimbursement, customs restrictions and import duties on equipment, and subsequent lengthy delays.
- **Organization and Coordination**—Lack of national organization in either the “host” and/or “assisting” countries with responsibility and authority to coordinate the requests for and assignment of firefighting resources.
- **Strained or Hostile Relations**—Regional conflicts, border disputes, political differences, and/or other hostile relations between countries.
- **Logistical Difficulties**—Geographic isolation, remote locations within country, lack of roads or other transportation systems, etc., affecting the availability, transportation and management of resources.
- **Provincial Perspective**—a local or nationalistic perspective rather than regional or global. There is resistance on the part of individuals, organizations, or governments to accept “outside” assistance or try new techniques or methods. Conversely, there is a similar resistance to extend assistance to others outside of the local area.
- **Misdirected Resources**—misplaced government priorities in directing international assistance, resulting in ineffectual use of resources, i.e., less pressing problems receiving attention at the expense of more significant issues or areas of need; lack of criteria for intervention and/or assistance.

- **Training and Technology**—varying degrees of wildland fire training and technological capability between nations and a poor understanding of the differences and similarities.
- **Funding**—includes the source (local, national, or international); inadequate levels; lack of foreign currency to pay for outside assistance.
- **Equipment and Organizational Compatibility**—communications, fire apparatus, specialized equipment, etc.
- **Apathy**—apparent lack of concern or commitment on the part of government officials to bring about improved international cooperation in fire management.
- **Insufficient Trained Personnel**—shortage of trained, experienced personnel to send abroad to assist other countries; in some instances this is a seasonal shortage, where fire activity in home country limits availability of personnel to assist in other regions.
- **Timing of Risk**—periods of greatest fire risk are the same in neighboring countries, limiting availability of resources to assist those countries.

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