CHAPTER 3

Responses to Fires and Haze in the Region

[This chapter discusses the varied responses, at several levels, to the recent fires and haze, particularly those of 1997-1998, and analyzes trends in donor assistance.]

Nature of Initiatives

There have been various responses to past fire outbreaks, but the recent round of fires in Indonesia and neighboring countries led to several new initiatives, and the reviving or revamping of old ones, to address the problem.[18]

The new initiatives in response to the 1997-1998 fires included formulation of national strategies for coordinated action, regional efforts within ASEAN, and international support. Many countries and international organizations have provided emergency assistance in cash and kind, including equipment, materials, medicine, and firefighters. Some of these initiatives had emergency and disaster abatement dimensions. Others had short-term (for addressing damage control) and medium- and long-term (sustainable improvement) perspectives. Some of the post-fire initiatives involving reviews, planning, and investment studies belong to the latter category, supporting sustainable development.

To help establish and ensure effective coordination of these mutually reinforcing initiatives, ADB has provided technical assistance at the regional level to the ASEAN Secretariat and advisory technical assistance at the national level to Indonesia (see also Chapter 4).

In the 1990s, the world focused its attention on sustainable development and sustainable forest management. Indonesia, for its part, has reported that in response to UNCED decisions, *Agenda 21*, and Forest Principles, it has developed a framework to strengthen national efforts to realize proposals of the Intergovernmental Panel on Forests (IPF), which included protection of forests from fires (GOI/MOFEC 1998c).

The aftermath of a forest fire, Indonesia, 1998.

Photo: Anonymous

ASEAN Response to Fires and Haze

Nearly all of the fires and haze in the ASEAN region over the past two decades have been caused by direct human interference rather than occurring naturally. This means that control of fire and haze is within the collective grasp of AMCs, a fact that has not been lost on ASEAN.

Collective Commitments

Beginning in the early 1980s, AMCs launched several national and regional initiatives aimed at controlling these problems. The first of these, with far-reaching regional influence, occurred in 1985 with the adoption of the Agreement on the Conservation of Nature and Natural Resources, which made specific reference to air pollution and "transfrontier environmental effects."

Between 1990 and 1997, ASEAN initiatives targeted control of fires and haze. Transboundary atmospheric pollution was also highlighted in the 1990 Kuala Lumpur Accord on Environment and Development. Environmental pollution issues were again extensively discussed at the Bandung Conference of 1992, which itself gave rise to a number of workshops and meetings on transboundary atmospheric pollution, held in Indonesia and Malaysia between 1992 and 1995.

The 1992 Singapore Summit identified transboundary pollution as one of ASEAN's major environmental concerns and addressed it in its 1992 Singapore Resolution on Environment. Concern over transboundary atmospheric pollution was once again voiced in the 1994 Bandar Seri Begawan Resolution on Environment and Development.

At the informal ASEAN Ministerial Meeting on Environment (AMME) held in Kuching, Malaysia, on 21 October 1994, environment ministers discussed transboundary pollution and agreed that ASEAN should collaborate actively to build up its member countries' expertise and capacity to address the problem, as well as to minimize its effects. As a result, an ASEAN Meeting on the Management of Transboundary Pollution was convened in Kuala Lumpur in June 1995, at which the ASEAN Cooperation Plan on Transboundary Pollution was adopted.

Haze Technical Task Force

Three months later in September 1995, the ASEAN Senior Officials on Environment (ASOEN) convened their sixth meeting in Bali, Indonesia, at which they established a Haze Technical Task Force (HTTF).

HTTF's initial objective was to put into operation the measures included in the 1995 ASEAN Cooperation Plan on Transboundary Pollution, relating to atmospheric pollution, including the following tasks:

- demarcate critical areas of land and forest fires;
- identify the critical periods for occurrence of haze;
- develop a system for National Focal Points to alert ASOEN on impending haze;
- organize proper collection and effective dissemination of meteorological data, including satellite photographs of "hot spots" by the ASEAN Specialized Meteorological Centre (ASMC) in Singapore and the countries concerned;
- develop a proper monitoring system for actions taken on the ground to fight and contain land and forest fires; and
- monitor and report on the status of projects relating to the management and control of transboundary haze pollution involving international organizations and developed countries.

HTTF was also charged with producing a manual on implementing measures to mitigate and control haze-causing land and forest fires.

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The HTTF, which includes all AMCs and is chaired by Indonesia, met for the first time in Jakarta on 16-17 October 1995.

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Following the 1997 fires, the affected AMCs assumed a more operational stance toward the fire and haze disasters than previously. Indonesia and Malaysia signed a bilateral memorandum of understanding on 11 December 1997 that allowed the two countries to jointly address certain aspects of transboundary haze and to undertake joint responses to other disasters. Malaysia supported Indonesia with personnel and equipment for firefighting.

Regional Haze Action Plan

At the ASEAN level, a Regional Haze Action Plan (RHAP) was formulated by HTTF and endorsed by the ASEAN Ministerial Meeting on Haze (AMMH)[19] held in Singapore on 22-23 December 1997. The signing of this instrument, the third of its type to be endorsed by the AMCs, has proven to be a turning point in the region's approach to preventing and mitigating the damage from recurrent fires and haze.

Objectives of Haze Action Plan

The primary objectives of the RHAP are to:

- prevent forest fires through improved natural resource management policies and enforcement of relevant legislation;
- establish operational procedures for monitoring land and forest fires; and
- strengthen regional firefighting capabilities as well as other mitigation measures.

An operating assumption of the RHAP is that developing fire suppression mobilization and response strategies at national and regional levels is necessary if future fire-and-haze disasters on the scale of that of 1997 are to be avoided (see Appendix 2).

The signing of the RHAP by the nine ASEAN Environment Ministers signaled a new stance toward ASEAN multilateral cooperation in confronting regionwide fire and haze disasters. The two previous "action plans" were, in fact, strategy documents that provided a broad-brush description of the steps the region should take in mitigating the impact of transboundary haze.[20] In contrast, the RHAP has an operational focus, the intent of which is to identify actions to be taken by specific parties at regional, subregional, and national levels for mitigating the impacts of fires and haze.

The RHAP document is, therefore, a reflection of the AMCs' determination to actively tackle the problem rather than simply describing a broad-brush approach to it. This determination to take action is obvious from the frequency of the meetings of both HTTF and AMMH, which in 1997 increased sharply relative to previous years. At the peak of the 1997-1998 fires and haze, AMMH meetings were held every six weeks, with the meetings of HTTF and subregional working groups occurring even more frequently.

During the course of these meetings, two points became clear to AMMH. First, the region's fire-and-haze issue constitutes a recurrent problem that is far too large for any one agency to address effectively; coordinated and concerted action by all AMCs, as well as donors, will be required. Second, if the RHAP is to succeed in reducing the prevalence or the impact of transboundary haze, it will have to be fully put into operation.

Scope of Haze Action Plan

Transboundary pollution and other crossborder impacts from fires are issues of regional significance, so it is appropriate that there should be a regional plan to address these.

The term "haze" in the title may raise some doubts and questions. Why haze plan? Why not fire plan? Is haze the only issue of concern to

arise from land and forest fires? The word "haze" seems more appropriate, particularly in the regional context as it drifts disastrously over other territories away from the source. It is the "dirty cloud of haze" that gives the fire a regional or transboundary dimension and brings in the social dimension of health and safety. The term "haze" internalizes all the factors leading to the production of haze—the condition of forests, land clearing, combustible residues, and ignition source. To control haze, one has to address all the factors that lead to it. The RHAP is a plan for fire management and more.

The scope of the RHAP includes establishing and enhancing fire prevention; improving capabilities for fire suppression in the event of occurrence to minimize any impact; and strengthening regional mechanisms for fire monitoring and early warning.

The RHAP, thus, has three major components—prevention, mitigation, and monitoring. Specific countries have been designated to spearhead the activities that fall under each of the three RHAP components. Malaysia takes the lead in prevention, Indonesia in mitigation, and Singapore in monitoring of fires and haze. This notwithstanding, all of the AMCs will undertake actions at the national level that relate to all three of the RHAP components. In addition, individual actions supporting prevention, mitigation, and monitoring will also take place at subregional and regional levels.

HTTF realized that it must focus fire management efforts in specific areas. The concept of Subregional Firefighting Arrangements (SRFAs) was endorsed at the third AMMH held in Brunei Darussalam on 4 April 1998; and a work program was initiated to develop SRFAs for Borneo and Sumatra.

Contribution of Regional Institutions

Specific technical/scientific contributions can be provided by individual institutions. Examples of such institutions involved in issues relating to fire and haze include: the Asian Disaster Preparedness Center (ADPC), ASEAN Institute of Forest Management (AIFM), ASMC, and Economic and Environment Program in Southeast Asia (EEP-SEA).

National-Level Initiatives

The Front-Line Countries

The front-line countries that most felt the impacts of the fires were Indonesia and Malaysia, followed by Brunei Darussalam and Singapore.

While the major efforts of firefighting were to be taken up by Indonesia, Brunei Darussalam and Malaysia also experienced their share of fires, though on a considerably smaller scale. All the countries, however, had to fight the haze problem.

National efforts involved priming of organizational arrangements, coordination of activities, relief and rehabilitation measures, and post-fire evaluation. Follow-on actions included formulation and implementation of National Haze Action Plans (NHAPs).

Assessment of Response

The arrangements made to combat fire disasters formed part of an emergency plan. This will require reviews of suitability to develop a stable system of fire management and promotion of forest rehabilitation, consolidation, and long-term development.

An ADB study[21] has investigated these and other institutional issues with regard to Indonesia. One of its major findings was that the roles of agencies involved in fire and disaster management were unclearly defined, and a lead agency for coordination and provision of

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strategic direction was lacking. This led to confusion where disaster response (relief and aid distribution), interagency coordination (for eliminating duplication and implementing compatible strategies), and fire suppression activities were undertaken by multiple agencies. Many communities did not understand who was in charge, nor did they know whom to turn to for assistance. The question of responsibility for provision of funds for fire suppression was unclear and significant delays in securing approval for funding contributed to confusion in mounting suppression action. In some cases, the delays were so chronic that no fire suppression measures were undertaken (BAPPENAS 1999). While the study had not recommended that a single agency should be responsible for all fire management, there is still room for one agency to play a lead role to coordinate other inputs at national, provincial, and local levels.

Application of Technology

Forest Fires and Haze Monitoring

In addressing the fires and haze, an important measure, which calls for reasonably sophisticated technological know-how, is monitoring. Monitoring techniques vary considerably among the AMCs, with respect to fires, haze, and climate change.

Forest Fires

In the ASEAN region, most land and forest fires are detected by local dwellers and ground patrols. Lookout towers are used where available. To a much lesser extent, aerial surveillance is also used to detect fires. Satellite detection of fires is gradually being accepted as an institutional mechanism for fire detection. Satellite detection is cost-effective compared to conventional methods because the satellite can see large areas simultaneously. It can also provide an operational means to monitor fires throughout the year, since these are available on a daily basis.

The most commonly used satellite for fire detection is the NOAA[22] polar orbiting satellite. The satellite carries many sensors on board to measure a host of different parameters on the earth. The sensor to detect forest fires is the AVHRR. It has five channels to measure outgoing radiation from the earth in five different wavebands. The third channel of the AVHRR is sensitive to high temperature targets such as land and forest fires. Thus, by processing the AVHRR data at each pass, it is possible to extract latitude and longitude coordinates of suspected fires daily to a precision of about 1 km, which is the resolution of the AVHRR sensor.

There are many nonmeteorological satellites (NMSs), which also have fire detection capability. The Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) has a unique capability to detect low levels of visible—near infrared—radiance at night.[23] The resolution is similar to that of the NOAA AVHRR sensor. A proposal to make the DMSP/OLS data available to the ASEAN region is being considered. Commercial high-resolution satellite data, e.g., SPOT and LandSat, can provide valuable confirmation and exact coordinates of forest fire locations. However, such data are expensive and not suitable for operational monitoring of fires. Further, these satellites have sampling intervals of two to three weeks, making it impossible to follow the development of forest fires.

A weather satellite soon to be launched by Japan, the Multifunctional Telecommunication Satellite (MTS), will carry a multispectral sensor similar to that on the GOES. This will provide hourly hot spot virtual analysis. However, the resolution of the sensor is about 5 km, making

it less precise than the NOAA AVHRR sensor.

Currently, at least five agencies in the region are providing satellite detection of hot spots through ground stations in Bogor, Jakarta, Palembang, Samarinda, and Singapore. While satellite data are vital, there are constraints that require more direct observations be carried out to supplement the satellite information. Satellite detection of fires is often difficult due to:

- inability to penetrate cloud;
- often nonoptimal flyover;
- false alarms from nonfire targets near the threshold temperature;
- poor resolution (1 km at the center, 7 km at the edge), and
- decreased detection performance in heavy smoke haze. (BAPPENAS 1999)

Most of the NMSs have the capability to receive Geostationary Meteorological Satellite (GMS) and NOAA satellite imagery, which means that they theoretically would also be able to detect hot spots and haze. However, some of the NMSs lack the capacity to use this satellite imagery to detect large-scale fires and haze. A training course has been developed by ASMC to help NMSs process satellite data for hot spot detection. Being able to detect hot spots using US NOAA satellite imagery will enable the NMSs to better support their national fire response effort through faster responses to detect fires with their own satellite capability.

Some national-level institutions other than NMSs also have specialized monitoring capabilities, including the ability to determine the exact coordinates of large-scale fires. These include Lambaga Antariksa Penerbangan National or National Institute for Aerospace (LAPAN) of Indonesia and the Malaysian Centre for Remote Sensing (MACRES). This capability allows the NMSs and specialized centers to directly assist national governments in locating land and forest fires, which greatly reduces the amount of time required for dispatching crews to fire sites.

Haze

Available operational monitoring of haze from the ground comes through regular meteorological bulletins required by member countries of the World Meteorological Organization (WMO). The NMSs normally operate an array of ground observing stations within the country. Under WMO requirements, the stations will make reports called Synoptic Reports (SYNOP) at three-hourly intervals. This report will consist of local measurements of temperature, pressure, visibility, reactive humidity, winds, cloud, type of weather, and additional meteorological parameters. The visibility and weather type will reveal details about the extent of haze conditions, if any, at the locality. These will be transmitted through the national telecommunication network to the main weather headquarters. The report will be consolidated along with others across the country and transmitted to WMO countries. Through this method, concerned countries can monitor the haze conditions of designated areas of another country, provided they are also member countries of WMO. The disadvantage is that most of these observing stations are not colocated near the forest fires, therefore the report does not represent the worst conditions.

If the observing station is colocated in an aerodrome, it is also obliged to send hourly reports of weather conditions, called Meteorological Aerodrome Reports (METAR), under International Civil Aviation Organization (ICAO) requirements. The METAR is similar to the SYNOP report and will also reveal the extent of haze conditions nearby.

Aerial reports about haze are occasionally reported by commercial flights traveling in the region. But this reporting is voluntary and the

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reporting format does not include a haze description. Occasionally, some pilots will report visibility conditions and haze depth.

The best method of monitoring haze is through remote sensing. The Japanese GMS[24] carries the Visible/Infrared Spin-Scan Radiometer (VISSR), which is capable of detecting smoke haze. Since it is geostationary, it will provide hourly visible images during daytime. With these images available, it is possible to track the development and spread of haze to different regions. GMS, unfortunately, is unable to provide quantitative measurements of haze concentration. Another satellite suited to detect haze is the Total Ozone Mapper Spectrometer (TOMS) sensor on board the Earth Probe (EP) satellite. TOMS can detect smoke particles from a variety of ground-based sources, such as biomass burning, whether naturally occurring or caused by agriculture, oil industry fires, or industrial smoke.

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The TOMS data are able to provide a quantitative approximation of aerosol concentrations in the haze by correlating to measurements made on the ground. The EP satellite is polar orbiting, like NOAA, therefore only one image is available daily.

Monitoring Experience during 1997–1998 Forest Fires and Haze

Experience of monitoring the 1997-1998 fires and haze in Indonesia, and Brunei Darussalam and Malaysia, are reviewed here.

Indonesia

Fire detection systems in the country use sophisticated technology (satellite imagery) as well as conventional methods such as fire towers and terrestrial patrols.

During the 1997-1998 fires and haze in Indonesia, MOFEC and several other organizations monitored hot spots appearing on NOAA weather satellite images, tracked where fires were burning each day, and provided early warnings about fire dangers to the fire teams through a chain of command structure at national, provincial, and district levels.

There are six NOAA-AVHRR satellite stations in Indonesia. Two in Jakarta are located at the Agency for Meteorology and Geophysics (Badan Meteorologi dan Geofisika or BMG) and LAPAN that are mainly for weather monitoring purposes; and there is one each in Bogor (West Java), Palembang (South Sumatra), Samarinda (East Kalimantan), and Palangkaraya (Central Kalimantan). The specialized system for fire detection and monitoring by satellite is primarily held by the MOFEC with support from funding agency projects. The Bogor station, supported by the Japan International Cooperation Agency (JICA), operates NOAA AVHRR and a smoke-tracking Himawari. Overlaid with NOAA images (hot spots), the Himawari images could confirm the existence of fires. The stations produced hot spot maps daily and sent these to provinces where the hot spots existed. The basic constraint was the poor communication system between stations and receiving addresses (provinces, districts, and fields). This rendered the detection and control system inefficient.

Caution is required in using hot spot data from satellite images to detect and evaluate fires, because of the limitations described earlier. The total number of hot spots counted on images taken during the day decreases on similar images taken at night, probably due to daytime changes in humidity. Hot spots may represent heat sources other than from land and forest fires, including burning coal seams, gas flares, and activities in settlement areas. The information provided also has not always been effective due to the coarse scale (resolution) of the images and communication delays. The

experiences of the 1997-1998 fires have shown that much improvement is needed to strengthen the early warning capability through a combination of enforcement and awareness programs at the local level.

While aerial surveillance with multispectral scanners and fire detection by satellite sensors represent the higher side of the technology, at a practical field level it is necessary to have a system of fire (lookout) towers, surveillance teams with two-way communication equipment, fire patrol teams, and local informants for immediate detection of fires. Local villagers are often the key informants and they need to be provided with adequate incentives.

The results of automatic processing of satellite images as well as of surveillance measures must be transmitted immediately to the local firefighting units for ground verification and fire suppression, as warranted. This calls for an effective and efficient communication system, linking all levels in the fire management system.

Aerial surveillance using aircraft or helicopters is limited. Although the aerial surveillance exercises held in Riau by the SRFA-Sumatra found the system to be effective for detecting fires on a real-time basis, it is still considered inefficient due to its high operational costs. MOFEC is cooperating with domestic commercial airlines for surveillance; requiring the airlines to report to the closest airports any fires they spot during their regular flights. Then the airports forward this information to the closest MOFEC office for further action.

Along with information generation, it is essential to ensure that there are adequate capability and preparedness to quickly respond to firefighting needs, including personnel, tools, techniques, skills, infrastructure, and mobility.

Brunei Darussalam

Brunei Darussalam has adequately controlled its forest fire and haze pollution problems. The Fire Services Department, which is responsible for fire and haze management, has developed a national contingency plan for combating fires.

The areas of concern have been compartmentalized into five jurisdictional zones: Commands A, B, C, D, and E. In terms of fire hazard, the Forestry Department established a Fire Hazard Rating and Zoning scheme that is based on the following factors: (i) the presence of communities and settlements, (ii) historical data on frequency of fire occurrence, and (iii) abundance of combustible materials.

Taking these factors into account, the department classified the country into three Fire Hazard Zones: (i) Low Hazard Zone, (ii) Medium Hazard Zone, and (iii) High Hazard Zone. The zoning system is useful in prioritizing or concentrating the surveillance for fire detection and control.

The Government has established an "Airborne Command" stationed at the Royal Brunei Air Force Second Squadron at the international airport. The Command uses helicopters and helitankers for controlling fires, under an operation called "Clear View." This is aimed mainly at providing quick and accurate information for water bombing. It also helps with the early fire detection and warning system. So far, the system has been effective and efficient.

In addition to these sophisticated measures, Brunei Darussalam is still practicing a "word of mouth" approach to fire detection. This encourages citizens to promptly report any fire in their district. The Fire Services Department is promoting this approach through a public relations program.

Local villagers are often the key informants and they need to be provided with adequate incentives

Malaysia

Malaysia has been widely practicing aerial surveillance for fire detection and monitoring, even though it still depends principally on ground patrolling. Hot spot information is received from, among others, the National Meteorological Services. A word of mouth approach is also a component in the system. The people's concerns about the consequences of burning and strict law enforcement have made the approach effective.

Fire Prevention and Mitigation Technology

An analysis of the situation with regard to fire prevention and mitigation as a background for assessing future needs is given later under the respective sections (see Chapter 5).

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Acquisition of Technology

Science and technology relating to forest fire covers various aspects; there is need for an appropriate balance of focus, depending on perceived needs.

While most of the skills needed at the field level are to be developed locally, certain sophisticated technology can be acquired through technology transfer. The use of geosynchronous satellites and space-borne sensors for early warning of fires and atmospheric pollution; investigation of candidate systems for fire weather and fire danger forecasting; assessing influence of inter-annual climate variability; and interpretation of fire scar characteristics are some of the areas where most tropical countries will need to build national capability. ASMC, BMG, and LAPAN are examples of institutions that can appropriately be strengthened.

Science and technology relating to forest fires at the forest end are weak. There is no long-term research being carried out to address fire-related problem areas. Urgent action is needed to address weaknesses in management and technology.

Southeast Asian Fire Experiment

SEAFIRE is a research project in the planning and preparation phase and will be conducted under a scheme of the International Geosphere-Biosphere Programme (IGBP). The International Global Atmospheric Chemistry (IGAC) project is a core project of IGBP. One of the activities of IGAC (Natural Variability and Anthropogenic Perturbations of the Tropical Atmospheric Chemistry) investigates the impact of biomass burning on the atmosphere and biosphere (Biomass Burning Experiment or BIBEX [http://www.mpch-mainz.mpg.de/~bibex]). SEAFIRE will establish the fire research component within the Integrated Study on Land-Use Change in Southeast Asia, with linkage to other activities of IGBP.

SEAFIRE will explore the ecological impacts of fire in land use (fires used in forest conversion and shifting cultivation, grassland, and seasonally dry forests) and the characteristics, the regional and global means of spreading, and the atmospheric chemical impacts of the resultant smoke. Land and marine sources of trace gases and aerosols will be considered, as well as industrial sources (fossil-fuel burning, secondary chemical products). Special emphasis will be given to climate variability (ENSO vs. non-ENSO). SEAFIRE will also coordinate with other regional activities in fire management and research.

International Response

Most international assistance projects to address Southeast Asia's fires and haze are country projects in Indonesia. Assistance at regional level is mostly in the form of regional seminars and meetings. While there are international

assistance projects relating to, or having components of, fire and haze management in some of the other AMCs (e.g., Malaysia, Philippines, and Thailand), details are not available.

Based on experience, many of the projects have undergone revisions and modifications. It was therefore difficult to obtain a fully updated situation.

A list of active funding agency-assisted activities is given in Appendix 5.

Emergency and Immediate Term Assistance, 1997–1998

In spite of Indonesia's experiences of the previous few years with fires and haze and the efforts to build capacity for fire management, the fires of 1997-1998 attained disastrous dimensions as the IDNDR entered its last quarter. This prompted several emergency actions.

In response to the escalating fire and drought emergency, a UNDAC Team was dispatched to Indonesia at the end of September 1997 to provide assistance in terms of needs assessment, resource mobilization, and coordination of international support (Dennis 1998). The UNDAC Team cooperated with the national authorities, local donor country representatives, UN agencies, and international nongovernment organizations (NGOs).

UNEP and the UN Office for the Coordination of Humanitarian Affairs (OCHA) made a joint appeal for emergency assistance to the region. Donors responded with direct financial and in-kind assistance. An OCHA-UNEP mission was again dispatched to Indonesia toward the end of March 1998 to assess the impact of fires in East Kalimantan, with the worsening of drought and fire situation.

Realizing the gravity of the 1997-1998 forest fires, the UN Secretary-General appointed the Executive Director of UNEP to monitor and coordinate the global assistance and expertise provided by international agencies through the UN system. A meeting was organized in Geneva to mobilize resources from the funding agencies. Firefighting experts, other UN agencies, international organizations, and donors were invited to participate. Through its facilities at GRID-Sioux Falls, in the United States, UNEP provided daily satellite images via the Internet showing hot spots and some spatial data layers such as population, elevation, drainage, and land cover to help in fire suppression planning. UNEP also supported a web site showing the biodiversity loss and species in danger due to the forest fires.

Contributions

Emergency assistance in cash and kind (material supplies, equipment, expertise, services of firefighters, use of water bombing aircraft, helicopters, communication facilities, masks, and other types of humanitarian aid) was received from different sources. These included countries such as Australia, Canada, PRC, Denmark, Finland, France, Germany, Japan, Republic of Korea, Malaysia, New Zealand, Norway, Russia, Singapore, Sweden, Switzerland, Thailand, UK, and US, as well as from UN and other agencies including the United Nations Development Programme (UNDP), UNEP, United Nations Children's Fund (UNICEF), United Nations Educational, Scientific and Cultural Organization (UNESCO), WHO, Global Environment Facility (GEF), World Bank, ADB, Organization of Petroleum Exporting Countries (OPEC), EU, and ASEAN. With assistance coming from so many different sources, the problems of coordination were compounded. This assistance represented considerable emergency-related expenditure. For instance, Germany provided about $5.5 million in direct

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assistance for 15 firefighting vehicles, forest protection equipment for 50 teams of 20 persons each, and small mobile water treatment plants and drilling equipment. The United States contributed a $2 million emergency fund in 1998, in addition to $3.5 million provided earlier.

NGO Relief Efforts

SKEPHI, TELAPAK, Wahana Lingkungan Hidup (WALHI), WWF, and the World Resources Institute (WRI) were some of the international and national NGOs that provided support in addressing the forest fires and haze. The Indonesian NGOs raised public donations for relief projects, supplied masks and medicines, and provided other forms of humanitarian assistance. Forest Watch Network, a global network of NGOs with WRI at the lead, helped raise public awareness and concern about the Indonesian fire disaster. The Forest Watch Network has a central node, regional nodes, and subnodes. TELAPAK, located in Bogor, is Indonesia's nodal organization. Haze Busters based in Singapore funded by Asia Foundation and others, is a unique voluntary effort serving as a link between donors and recipients.

Meetings

A full count of all the national, regional, and global meetings (including conferences, workshops, and seminars) organized by different agencies, on various aspects of the 1997-1998 fires and haze in Southeast Asia is not available. The following are illustrative of the range: Asian Regional Meeting on *El Niño* Related Crisis, 2-6 February 1998, Bangkok, hosted by ADPC and cosponsored by the United States Agency for International Development (USAID)/DFID/NOAA; Asia-Pacific Regional Workshop on Transboundary Atmospheric Pollution, 27-28 May 1998, Singapore, organized by the Germany-Singapore Environmental Technology Agency (GESTA); Bi-Regional Workshop on Health Impacts of Haze Related Air Pollution, Kuala Lumpur, 1-4 June 1998, organized by WHO; JICA/ITTO International Cross-Sectoral Forum on Forest Fire Management in Southeast Asia, 7-8 December 1998 in Jakarta; and Workshop on Regional Transboundary Smoke and Haze in Southeast Asia organized by WMO, 2-5 June 1998, Singapore.

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Medium- and Long-Term Assistance

Early Fire Projects

The 1982-1983 fires and haze brought the issue of (and the need for) forest fire management to world attention. Between 1982 and 1992, short- to medium-term international assistance was provided to Indonesia to address the problem. This included (i) fact-finding, needs assessment, and consultation missions; (ii) emergency assistance; (iii) technical aid and equipment; (iv) training courses and seminars; and (v) management support. Several agencies and countries such as the European Community, FAO, Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ), ITTO, JICA, UNDP, UN Disaster Relief Organization (UNDRO), Australia, Canada, Finland, and United States were involved. During this period, six medium-term projects, two seminars, three training courses, and 10 missions were undertaken.

The Bandung Strategy of 1992

The forest fires and haze of 1991 in Southeast Asia emanated mainly from the Indonesian archipelago. To avoid a recurrence, the Indonesian Government called for international cooperation to support national fire management. In June 1992 an international conference on "long-term

integrated forest fire management" was held in Bandung in which national agencies involved in fire management, international development organizations, and potential donors participated. The aim of the conference was to develop the framework for a concerted action plan for Long-Term Integrated Forest Fire Management in Indonesia. The Bandung strategy became a reality in 1994 when the bilateral Indonesian-German project on "integrated forest fire management" became operational, followed by other projects supported by EU and JICA.

Ongoing Pre-1997 Projects

Projects related to land and forest fires are being undertaken by different government and nongovernment agencies, educational institutions, and others (see also Appendix 5). As of September 1998, there were 34 donor-assisted ongoing and planned projects under the purview of MOFEC. Of these, seven projects were directly or indirectly related to forest fire management (FFM). Four of them were long-term projects started after the Bandung meeting, with three projects having forest fires as their main concern.

The four projects are:

(i) GTZ's Integrated Forest Fire Management Project (IFFM) in East Kalimantan (1994-2002);

(ii) JICA's Forest Fire Prevention and Management Project (FFPMP) in Bogor, Jambi, and West Kalimantan (1996-2001);

(iii) EU-Forest Fire Prevention and Control Project (FFPCP) in Southern Sumatra (1995-1998); and

(iv) the Indonesia-UK Tropical Forest Management Programme (ITFMP).

ITFMP was started in 1992 and comprised a number of components related to fires, as part of its overall forest management objective. All four projects have locally installed NOAA AVHRR satellite image receiving systems in order to detect and monitor fire hot spot activity. In addition to strengthening the institutional capacity of MOFEC to deal with fires, FFPCP, IFFM, and FFPMP have also adopted rural or community-based approaches to fire prevention and control.

Achievements of the Early Projects

IFFM. At the village level, socioeconomic studies were carried out to investigate the concept of community-based fire management and organize volunteer fire response crews. Fire centers have been established in 10 forest divisions linked to provincial fire centers. Fire damage rating and early warning systems have been set up and demonstrated, and fire protection equipment and tools supplied and training provided to local people and army personnel. The integration of IFFM into the structures of government forestry departments (central and provincial) provides direct access to those concerned with fire- and haze-related decisions. Planned activities include the preparation of a fire management strategy; setting up of a fire-GIS; refining the early warning and fire detection systems; and undertaking improved training and capacity building programs.

FFPMP. The overall goal of the project is to prevent forest devastation and environmental disturbances caused by wildfires and smoke. The project aims to strengthen the capability of MOFEC at central level, in Jakarta and Bogor, to deal quickly with forest fires and also to improve prevention and initial suppression at the local level. The project components include early warning and detection; a system of forest fire base maps; extension and training in the use of pumps, hoses, and hand tools;

Projects related to land and forest fires are being undertaken by different government and nongovernment agencies, educational institutions, and others

After the 1997 fires, numerous short- and medium-term fire projects were proposed and started

participatory forest fire prevention involving innovative institutional structures; and use of firebreaks, trenches, and fire-resistant tree species, along with other improved land management methods.

For farmers involved in the program, the project provides seeds, seedlings, and fencing materials; while labor is provided on a self-help basis.

FFPCP. The objectives are: (i) to obtain an understanding of the occurrence of fire and the present means of control in the province of South Sumatra; (ii) to develop an operational NOAA fire monitoring and early warning system in Palembang (South Sumatra); and (iii) to establish forest fire prevention and control systems in three different pilot areas representing three important forest types.

Other aspects covered by the project include social forestry, research on fire management and fire risk, and GIS for forest fires.

ITFMP. The emphasis of the program was on sustainable forest management. The program consisted of five projects: senior management advisory team, provincial forest management, forestry research, training, and community-based conservation management. The last project incorporated components relating to forest fires.

Others. Two other projects within the purview of MOFEC with a component on fire management are: (i) forest sector support program and integrated forestry radio communication project with support from EU, and (ii) strengthening the management capabilities of MOFEC, supported by GTZ.

New Fire and Haze-Related Medium-Term Assistance

After the 1997 fires, numerous short- and medium-term fire projects were proposed and started. These have varied in scope, focus, magnitude, and budget, etc. Some were national in coverage, while others are regional. Some of the important ones are briefly described here.

UNEP Initiatives

UNEP is implementing a medium-term project on "Emergency Response to Combat Forest Fires in Indonesia and to Prevent Regional Haze in Southeast Asia." This project, funded with $750,000 under the GEF, has five major components. Most significant among these is an early warning and emergency response system that uses a combination of aerial surveillance and satellite imagery to detect fires and allows firefighting teams to respond quickly.

Another component of the UNEP project is focusing on development of international agreements relating to transboundary atmospheric pollution. The UNEP project collaborates closely with ADB in this regard, as well as in other subinitiatives to promote the RHAP. UNEP has also helped ASEAN countries in implementing the Sumatra Firefighting Surveillance Pilot Project. It is also assisting other AMCs in developing the ASEAN Protocol/Agreement on Addressing the Regional Fire and Haze Problem.

ITTO-CFC National Guidelines on Forest Fire

This project is being carried out in collaboration with the Directorate General of Nature Conservation (PKA) and Institute Pertanian Bogor (IPB). National guidelines are being finalized. Apart from these, the project envisages several other outputs: skills development, training of trainers, equipment supply, communication development, coordination, financing and budgeting aspects, and public awareness.

GTZ: Sustainable Forest Management Promotion in East Kalimantan

This is a new component on a pilot basis, added to the IFFMP in January 1998 to assist forest enterprises (private and state-owned), and local people to take the necessary steps to rehabilitate fire-affected forests and integrate these into management systems.

WWF-Indonesia

WWF-Indonesia provided additional input in the analysis of the causes and impacts of forest fires and haze and formulation of an Integrated Conservation Development Plan. The latter incorporates a buffer zone protection plan and impact of fires on conservation areas.

UNDP Assistance

UNDP provided support in the preparation of an action plan for prevention and management of forest and land fires. This project has recently been completed. UNDP is concentrating its efforts on immediately strengthening the ability of the Indonesian Government to assess and monitor environmental disasters.

CIFOR-ICRAF-UNESCO Project

This project will study the underlying causes and impacts of fires in Southeast Asia. This is a three-year in-depth study. The Centre for International Forestry Research (CIFOR), International Centre for Research in Agroforestry (ICRAF), and UNESCO propose a three-tiered approach: (i) a general overview of the fire situation in the Indonesian archipelago; (ii) a more detailed assessment in Kalimantan and Sumatra (to assess how their fire characteristics are representative of Indonesia as a whole); and (iii) a detailed assessment of causes and effects at specific sites (in Kalimantan and Sumatra).

The research is designed in a modular way; with each module standing independently, but complementing and supporting the others (CIFOR-ICRAF-UNESCO 1998).

The combined expertise and field knowledge of these three institutions is unique in supporting the study. While some funding commitments have already been received, more are expected soon.

ADB Assistance Program

ADB's assistance on forest fires has included two separate but interrelated technical assistance projects (see Chapter 4). The first of these is ADB support for a national initiative through an ADTA to Indonesia. This will assess the extent of economic damage caused by uncontrolled fires in 1997 and assist the Government to bring about the necessary policy reforms and investments in prevention of future fire disasters and better management of droughts.

The second project consists of support to ASEAN through a regional technical assistance (RETA) project for strengthening ASEAN's capacity in preventing and mitigating transboundary atmospheric pollution resulting from the forest fires, and improving cooperation among fire and smoke-affected ASEAN countries.

ADB (through the latter project) and ASEAN were instrumental in mobilizing support of other donors and establishing partnership arrangements to address forest fires and haze. The following three assistance programs were catalyzed by ADB/ASEAN.

WMO Program to Address Regional Transboundary Smoke (PARTS)

PARTS was formulated by WMO in 1995 in response to a collective request from AMCs. It consists of three components.

ADB and ASEAN were instrumental in mobilizing support of other donors and establishing partnership arrangements to address forest fires and haze in the region

All the three PARTS components include technical assistance and training via workshops, and twinning arrangements such as exchange visits that emphasize on-the-job training

(1) *Upgrading of ASMC's capability in the use of satellite imagery to detect fires and haze*. This includes automated fire detection, upgrading of hardware in preparation for the coming generation of satellites and sensors, expanding ASMC's capability in analyzing the chemical composition of smoke plumes, and developing satellite-based meteorological surveillance techniques of selected AMC national meteorological services.

(2) *Upgrading of the region's capability in the modeling of long-range transport of haze and other pollutants*. This will involve installation of atmospheric transport models at ASMC's facility in Singapore, training of ASMC staff in the use of their models, and visits of ASMC staff to NOAA facilities in the US.

(3) *Designing and implementing a strategy for regional monitoring of transboundary atmospheric pollution* with assistance from appropriate international experts.

All the three PARTS components include technical assistance and training via workshops, and twinning arrangements such as exchange visits that emphasize on-the-job training.

The Australian Government will directly finance PARTS component 1 as one of three of its initiatives for assisting ASEAN in addressing the impacts of fire and haze in the region.

The US Government will finance PARTS components 2 and 3 as two separate subprojects under the Southeast Asian Environment Initiative (SEA-EI).

Australian Assistance

Australian assistance is provided through a project to combat fires and haze in Southeast Asia. This project, running for two years, covers Indonesia and Malaysia. There are three components covering fire prevention, mitigation, and funding of PARTS.

- Improving the capability for using satellite technology for fire and haze detection and monitoring at ASMC, in association with relevant national-level institutions (component 1 of PARTS).
- A program directly contributing to ADB's RETA 5778, consisting of three subcomponents:
  - (i) support for an Applied Study on Formulating a Regional Fire Suppression Training and Research Program;
  - (ii) support for an Applied Study on Strengthening NHAPs for AMCs, with particular reference to Indonesia; and
  - (iii) support for an Applied Study on Formulating a Framework for a Fire Suppression Mobilization and Response Plan, with particular reference to Indonesia.
- Support for training in fire mitigation and prevention, which will build on the Applied Study on Formulating a Regional Fire Suppression Training and Research Program.

US Assistance under SEA-EI

SEA-EI is a regional assistance program package consisting of US contributions through different agencies for 10 projects under three groups: forest management, fire prevention, and firefighting; and climate prediction and environmental monitoring.

The 10 projects are as follows:

- causes and impacts of forest fires in Southeast Asia—technical assistance to CIFOR/ICRAF;
- reduced impact logging—extension of the

technology including training;

- alternatives to slash-and-burn agriculture;
- subregional fire disaster response coordination;
- coal and peat fire suppression. This has two components: (i) building capacity to extinguish coal seam fires in Indonesia, and (ii) assessing peat fires in eastern Malaysia. Assistance is provided through the Indonesian Ministry of Mines and Energy and Malaysian Fire and Rescue Department;
- climate impact forecasting: establish climate models that will generate and distribute regional climate forecasts up to one year in advance;
- atmospheric modeling capacity: to help develop and enhance the region's atmosphere modeling capability in ASMC (component 2 of PARTS);
- smoke and haze monitoring: assistance to enhance the region's physical monitoring capacity (component 3 of PARTS);
- disaster reduction applications of climate forecasting: USAID's Office of Foreign Disaster Assistance will work with ADPC in Bangkok; and
- health assessment: providing support to the Malaysian Centre for Disease Control (CDC) to devise health directions to minimize the impact of haze on affected populations.

The US Government has approved more than $5.28 million for this initiative.

Others

There are other initiatives, some of which are self-funded and others fully or partly financed by donors from resources of approved projects. These include: Canadian International Development Agency (CIDA)/ASEAN fire danger rating system for Indonesia; CIDA-BAPPENAS development planning assistance; WHO project on air quality monitoring and mitigation of health implications of forest fire and haze; burned area estimation using SPOT quick-look mosaics and mapping the extent of Indonesian fires by CRISP. There are two EU projects to address tropical deforestation and fires: (i) Fire in Global Resources and Environmental Monitoring, and (ii) Tropical Ecosystem and Environmental Observation by Satellites.

Proposals and Pipeline Projects

Forest Fire Hazard Mapping

UNEP has proposed a project for an Early Warning System and Forest Fire Hazard Mapping in Indonesia.

The proposed project output will include satellite data to demonstrate technical possibilities, creation of a GIS database, forest fire hazard maps, an early warning system, forest fire models, and improved capacity in fire hazard mapping. The project will address the need for a proper spatial database at 1:50,000 scale with thematic layers (e.g., elevation, hydrology, geology, vegetation, soil, and land use).

UNEP has proposed a project for an Early Warning System and Forest Fire Hazard Mapping in Indonesia

Joint ASEAN Program in Fire and Haze Management

This proposal is for the development of an ASEAN-wide fire and smoke management strategy and operational system, by sharing responsibilities and resources, focusing on: prediction of fire hazard and fire effects on ecosystems and atmosphere; detection, monitoring, and evaluating fires; and sharing fire suppression technologies and resources (this program is expected to evolve during the Operationalized Regional Haze Action Plan [ORHAP] and would eventually represent its ASEAN core program).

Project Firefight

A World Conservation Union and WWF Project, Firefight, proposes to establish a global network for forest fire prevention and control. The project aims to raise public awareness about the dangers of fires; improve forest fire management worldwide; and eliminate adverse environmental, social, and economic impacts of forest fires (IUCN/WWF 1998).

Technology Assessment and Applications

The application of modern technology to the different aspects of fire management such as weather monitoring, wide-area surveillance, and speedy communication is being discussed as a potential project of vital importance to the region and some of the major donors appear to be interested.

Trends in Fire and Haze Projects

After studying in detail the objectives and activities of 35 projects, training courses, and missions, Dennis (1998) observes that fire projects arise out of extreme fire outbreaks. The worse the problem, the more likely attention will be attracted, with the two experiencing a direct functional relationship. Interest in fire has only been short-lived after a spurt of activities following a major blaze.

Earlier projects addressed issues of fire prevention and control. After the 1994 fires, which created extreme transboundary pollution, the projects also started focusing on the causes. Of the 35 projects, missions, and training courses, six are mainly directed at understanding the problem, 19 at doing something practical, and 10 address both issues. Most current projects are of short-term scope, investigating the underlying causes. Some address specific aspects, such as capacity building and biodiversity conservation. In the case of several recent projects, there are overlaps or similarities in objectives, activities, inputs, and outputs, even though their geographical locations differ. A lesson to be learned from the degree of overlap is that cooperation, openness, and dissemination of results among projects and the relevant government departments is of paramount importance.

A trend in the new generation fire projects is the emphasis given to sophisticated space-borne remote sensing technology of monitoring and prediction, compared to practical presuppression and suppression

A trend in the new generation fire projects is the emphasis given to sophisticated space-borne remote sensing technology of monitoring and prediction, compared to practical presuppression and suppression. There are also no projects that seriously address post-fire rehabilitation. Because of the difference in technological competencies and conditions between these two levels, a barrier to the transfer of technology, even the transfer of information, is created. The projects analyzed were implemented by different national agencies, further creating problems of coordination and counterpart support (Dennis 1998).

In Indonesia, the bulk of the fire projects arising from the 1997 disaster deals with assessment of damage and development of capacities to undertake necessary activities to prevent, monitor, and control fires. However, no direct provision was made for facing the reemergence of such devastating fires, so soon, in 1998. There was, therefore, no adequate source of funding to fight the 1998 fires in East Kalimantan other than that provided by the Indonesian Government.

Neighboring Sarawak, on the other hand, has no exclusive or major forest fire projects and the current projects emphasize sustainable model forest management. Yet, Sarawak's forests have been comparatively safe from fire. It has to be said, however, that the 1998 fires in East Kalimantan would have overtaxed any fire suppression arrangements, in the absence of an adequately planned integrated approach.

Notes

[18] A comprehensive account of past, present, and proposed fire projects in Indonesia during 1982-1998, with details such as objectives, component activities, target groups, geographical coverage, time horizon, counterpart agency, budget level, and where relevant, achievements and impacts, can be found on the Southeast Asia web site of the Global Fire Monitoring Center (http://www.uni-freiburg.de/fireglobe) and in a recent publication of CIFOR-ICRAF-UNESCO-EU, *A Review of Fire Projects in Indonesia (1982-1998)* by Rona Dennis (1998). The book covers the history of fires, forest fire activities of donor countries, ongoing and proposed fire projects, projects in the aftermath of the 1997 fires, Indonesia's response to the fires and smoke haze, and international relief assistance.

[19] AMMH is in fact a meeting of the ASEAN Ministers of Environment focusing on haze.

[20] The two previous "action plans" referred to are: (i) the Long-Term Integrated Forest Fire Management Strategy for Indonesia, which was one of the outputs of the Bandung (Indonesia) Conference of 1992; and (ii) the ASEAN Cooperation Plan on Transboundary Pollution, which was adopted at the ASEAN Meeting on the Management of Transboundary Pollution convened in Kuala Lumpur in June 1995.

[21] ADTA INO 2999: *Planning for Forest Fire Prevention and Drought Management*.

[22] The US NOAA satellite is a meteorological satellite and its access is free to member countries of WMO.

[23] This capability enables the instrument to detect clouds illuminated by moonlight; and lights from cities, towns, industrial sites, gas flares, and ephemeral events such as fires and lightning-illuminated clouds.

[24] The GMS satellite is in stationary orbit, at a constant location 36,000 km above the at-risk areas of the ASEAN region.