Executive Summary

Background

In recent years, forest fires influenced by rapid demographic changes, increased human activity, and unpredictable climatic variability have become a major environmental problem in the tropical ecosystems of the Association of Southeast Asian Nations (ASEAN) region. Fires and associated haze have adversely affected the natural environment and threatened the sustainable development and management of natural resources. Hence, fire and haze management has acquired a new dimension in land resources and environmental management that must be accorded urgent and utmost attention. The problem and the causes if not addressed urgently may not only affect the countries in the region, but its many impacts may also extend beyond and acquire global dimensions.

Early humans used fire as a tool to alter their surroundings and later to prepare land for cultivation. The use of managed fires became a common practice in land conversion. However, once out of control due to negligence, carelessness, or arson, the fires led to long-term land degradation and resulted in other detrimental impacts, to the ultimate disadvantage of human society.

Every year, millions of hectares of the world's forests are being consumed by a large number of fires, big and small, resulting in billions of dollars in suppression costs and causing tremendous damage in lost timber, declines in real estate and recreational values, property losses, and deaths. Wildfires have influenced many aspects of our life: the flow of commodities on which we depend, the health and safety of the communities where we live, and the resilience of our natural ecosystems.

Southeast Asian Fires and Haze

Tropical rain forests are the natural vegetation in large areas of Southeast Asia. These forests grow under conditions of abundant rainfall, high temperature, and humidity, rendering them less vulnerable to fires and more resistant to burning.

Wildfires in Southeast Asia since the Pleistocene age were made possible only by periods of reduced rainfall, long enough for rain forests to become dry and vulnerable to burning. In the Ice Age, extended periods of minimal rainfall occurred in Southeast Asia, making large areas of the region vulnerable to fires. Only recently, long-term climate variability, i.e., glacial vs. nonglacial climate and short-term climate oscillations caused by *El Niños*, have regularly created conditions that make even the rain forests vulnerable to wildfires. Forest and landfires are also linked to human interventions.

Humans have used fires as they settled in the forests for thousands of years to practice swidden agriculture and to help in hunting. Traditional use of fire is thought to have little long-term ecological impact on the forests; but increased population density, shortened fallow periods, and cash cropping made shifting cultivation an agent of ignition, along with several other factors.

Since 1982, there have been five major fire outbreaks in Southeast Asia, with small fires occurring almost annually. The last major fire was in 1997-1998, destroying an estimated land and forest area of more than 9 million hectares (ha) in Indonesia alone.

Underlying Causes

Availability of dry fuel, a source of ignition to set fire, and a transport mechanism such as wind to feed a conflagration are the main factors behind all major forest fires and associated haze. Three factors enhance the magnitude of such occurrences: direct and immediate causes, contributing factors or constraints, and indirect or influencing factors.

Direct Causes

Most tropical fires are set or spread accidentally or intentionally by humans and are related to several causative agents; some of them linked to subsistence livelihood, others to commercial activities. Foremost among the various underlying causes of catastrophic fires in Southeast Asia in 1997-1998 are the use of open burning techniques for conversion of forestland to other land uses, e.g., estate crops, industrial plantations, and other commercial

enterprises; traditional slash-and-burn agriculture; and speculative burning to stake land claims.

According to a study conducted by the Ministry of State for Environment in Indonesia,* the fires and haze of 1982-1983, 1987, 1994, 1997, and 1998 were due to a wide range of factors. These include:

(i) lack of institutional commitment at regional, national, provincial, and local levels to make investments in preventing land and forest fires as opposed to mitigation;

(ii) increased vulnerability of forestlands to fires from unsustainable forest management and harvesting practices;

(iii) conflicting roles and responsibilities of institutions concerned with managing forestlands and forest fires, especially on the mandate, authority, financial resources, and accountability;

(iv) indifference to the cyclical nature of fires and haze in the region on the part of institutions charged with managing forestlands and forest fires, and disregard for early warning announcements on the onset of *El Niño*;

(v) inadequate information and systems for communication, including ineffectiveness of such systems from institutional failure;

(vi) vested interests that marginalize issues relating to fires and haze to favor a particular sector, corporate body, or individual;

(vii) lack of incentives to promote logging techniques that lead to sustainable output of production forests, and mechanical land clearing;

(viii) inadequate research into the use of logging residues as productive inputs and development of logging products;

(ix) indifference of the private sector (industry, large-scale agriculture, and smallholders) to the environmental consequences of large-scale fires;

(x) poorly specified property rights that caused mutual conflicts among numerous classes of land claimants (local residents, government, transmigrants, industry);

(xi) indifference of government and entrepreneurs to local customary rights, livelihood strategies, and traditions that eroded customary law, social cohesiveness among indigenous groups, and traditional knowledge regarding prevention and control of fires;

(xii) inadequate knowledge of fire prevention and mitigation techniques exacerbated by a lack of operating procedures and appropriate institutional arrangements for coordinating mitigation activities at the national, regional, and international levels;

(xiii) inadequate prevention and mitigation capacity, i.e., trained personnel, equipment, and facilities at the regional, national, and local levels; and

(xiv) inadequacy or nonexistence of committed funding for prevention and mitigation activities at the regional, national, provincial, and local levels.

Contributory Factors

Apart from direct causes, there are contributory factors that increase the potential of fire danger. These include political, economic, physiographic, sociocultural, and institutional factors. In fact, the most important of these are policies and institutions.

Lack of political will, inappropriate and poorly specified policies, weak legislation, ambiguous regulations, bureaucratic procedures, land-use conflicts, and inadequate resources for enforcement of laws and regulations were again and again crucial and crippling constraints. Policy gaps and conflicts in land use, tenure security, and economic development add considerably to the dangers posed by forest fires.

Indirect Factors

Indirect and influencing factors such as climate and climatic variation often play a significant role in the setting off of forest fires and associated haze. Climate is an overriding control factor in fire occurrence and frequency. It determines not only the vegetation characteristics in a general sense, but also influences soil microorganism activity and thus the litter decomposition. In tropical lowland environments,

*Ministry of State for Environment, Republic of Indonesia and United Nations Development Programme. 1998. *Forest and Land Fires in Indonesia*. Volumes I and II.

litter decomposition is generally fast, and organic matter accumulation is rarely an important factor. However, climatic seasonality in terms of wetness and dryness is the most important parameter related to fire occurrence. In tropical conditions where seasonal changes are less evident, the weather variations due to climatic disturbances lead to cyclical drought conditions.

Meteorologists consider *El Niños* as one of the significant aggravating factors behind the rise in temperatures and consequent drought in Southeast Asia during major fires and haze in the past years. *El Niños* are an oceanographic phenomenon of strong and extensive warming in the upper ocean of the tropical eastern Pacific. An *El Niño* arises, periodically, to upset global weather patterns. *El Niños* lead to the strengthening of a warm ocean current called the equatorial counter-current in the mid-Pacific, causing the entire weather mechanism to be disrupted. Rainfall is delayed, crops are adversely affected, and storms occur where they should not.

Investigators of the fires and haze in Southeast Asia indicated that while the *El Niño* phenomenon created dry conditions, the direct causes of the damaging fires were habitual use of uncontrolled, open, and broadcast fires as cheap means of land clearing and preparation by owners of plantations; small farmers; and slash-and-burn agriculturists.

Impacts

Burning of forests and biomass has serious impacts, often resulting in loss of life, livestock, and capital. The damage caused by fires is often difficult to quantify, especially when nontangible losses are involved. Impacts of forest fires have several dimensions—economic, environmental, ecological, social, and others that could be onsite and offsite, direct and indirect.

The extent of impacts would depend on the frequency and intensity of fires, fuel load, type of forests involved, and climatic factors.

Human interventions make tropical forests far more vulnerable to fire than otherwise. The greater the degree of human intervention into the natural tropical forest ecological system, the more vulnerable these forests become to fire. This conclusion has obvious implications for conversion of natural forestland to other uses. The Indonesian Ministry of State for Environment Report quoted earlier provides fresh empirical evidence that supports the above conclusion. According to the report, of a total area of 4.8 million ha consumed by fire in 1994, 88 percent comprised logged-over forests or land under cultivation by traditional dry land agricultural techniques.

In contrast, shifting cultivation accounted for only 5 percent, transmigration farmland 4.5 percent, plantations only 0.8 percent, and natural protected forests a scant 0.2 percent. The figures for 1997 tell a similar story. Of all land area consumed by forest fires during the year, logged-over production forests accounted for 62 percent. The remainder comprised the national parks, 20.6 percent; protection forests, 8 percent; nature reserves, 6.5 percent; and recreation parks, 0.6 percent.

Economic Impact

An estimated spatial distribution of areas affected by 1997-1998 fires included more than 6 million ha in Kalimantan, more than 1.5 million ha in Sumatra, some 1 million ha in Irian Jaya, about 400,000 ha in Sulawesi, and about 100,000 ha in Java. Of the burned area, 4.65 million ha is forestland.

The economic loss has been estimated to be about $6 billion. This does not include the full environmental costs, e.g., loss of biodiversity or the cost of social suffering.

Apart from the loss of material goods and services, forest fires have caused serious direct economic losses through damage and decline in the quality of forest growing stock, reduced landscape stability, increased proneness to pests and diseases, reduced availability of forest-based raw material supplies, and the need for new investments in forest rehabilitation and fire protection measures. Indirectly they have affected agricultural productivity and tourism.

They have also had an impact on indigenous populations and their means of livelihood, and jeopardized the prospects and ability of the rural poor to improve their standard of living.

Forest fires have also degraded surviving forests by exerting potential impact on composition, regeneration, productivity, protection functions, and aesthetic values.

Ecological and Environmental Impacts

Ecological impacts of forest fires are reflected in the degradation of vegetation quality, expansion of savannah and sterile grasslands, erosion of biodiversity, damage to the health of the forest ecosystem, plant mortality, loss of wildlife habitat and wildlife, pollution in rivers and estuaries, and overall ecological retrogression. Fires affect the quality and productivity of soil by destroying humus and altering its chemistry, increasing soil temperature, destroying microbial inhabitation, reducing moisture retention capacity of the soil, causing erosion of surface soil and nutrient loss, increasing run-off, lowering the subsoil water table and causing desertification, and ultimately, reducing the carrying capacity of the land involved.

Forest fires contribute to global climate change and warming. Burning of forests destroys an important sink for atmospheric carbon, while biomass burning is recognized as a significant global source of emissions, contributing as much as 10 percent of the gross carbon dioxide and 38 percent of tropospheric ozone.

Haze formation and dispersion have important environmental dimensions that include air pollution both within boundary and transboundary. Other effects include reduced visibility, transport disruption, and health hazards. Apart from public health, social welfare is adversely affected through displacement of communities, loss of income sources, and dwindling livelihood opportunities.

Responses

Global Concern

The recurrence of increasingly large forest fires has attracted world concern, particularly in the industrialized countries, for the last several years. In those countries, fire science and technology have developed considerably and sophisticated systems are being employed to forecast and monitor fires and haze through the use of satellite and space-borne sensors, and climate and transport models. Some of these new technologies are being transferred to tropical developing countries, but considerable efforts are required to balance and tune them to their needs.

The increasing frequency and intensity of fires and haze are alarming and have led to several parallel initiatives globally. The Antalya Declaration of the Sixteenth World Forestry Conference in 1997 highlighted the urgent need for improved and integrated forest fire management.

ASEAN Response

The major haze source countries in the region affected by the 1997-1998 fires have experienced similar occurrences during the last 20 years. Despite these, their capability to adequately respond to the situation has not matched the needs. In this connection, ASEAN has assumed the central role. For several years ASEAN was concerned with the issue of transboundary atmospheric pollution in the region and some general instruments have been put in place.

Regional Haze Action Plan

Intergovernment efforts of the ASEAN member countries (AMCs) to address transboundary atmospheric pollution, in the wake of the 1997 forest fires and haze, resulted in the Regional Haze Action Plan (RHAP), approved for implementation in December 1997. The primary objectives of the RHAP are to: (i) prevent forest fires through better management policies and enforcement, (ii) establish operational mechanisms to monitor land and forest fires, and (iii) strengthen regional land and forest firefighting capacity with other mitigation measures.

The RHAP has three major component programs: prevention, mitigation, and monitoring. Different countries have been designated to spearhead the activities that fall under each of the three RHAP programs. Malaysia takes the lead in prevention, Indonesia in mitigation, and Singapore in monitoring of fires and haze. All AMCs will undertake the national-level actions of the three RHAP programs. Prevention, mitigation, and monitoring will also take place at the subregional and regional levels. A considerable amount of donor assistance was forthcoming for this crucial initiative, in which the Asian Development Bank (ADB) played a catalytic role.

Role of the Asian Development Bank

The RHAP was signed during a period of intense fire, smoke, and transboundary pollution. It was formulated and endorsed within an abbreviated time frame, so it was not possible for

the ASEAN Ministerial Meeting on Haze (AMMH) or the Haze Technical Task Force (HTTF) to work out the implementation details prior to endorsement by the nine AMCs. What the Ministers had in mind when they endorsed the RHAP document was to initiate a *process*.

The document had also made it clear that ADB's assistance would be sought to implement the plan. ADB's response to the requests of ASEAN was fast and firm. It adopted a two-pronged approach, in the form of regional and national initiatives.

The regional technical assistance (RETA) 5778: *Strengthening the Capacity of the ASEAN to Prevent and Mitigate Transboundary Atmospheric Pollution*; and advisory technical assistance (ADTA) INO 2999: *Planning for Fire Prevention and Drought Management* were approved in early 1998. Implementation of these technical assistance grants has been completed.

The focus of ADB's RETA Project was to strengthen ASEAN's capacity in operationalizing and implementing the RHAP. The complementary ADTA was designed to estimate the economic damage caused by the 1997-1998 fires in Indonesia, to provide a basis for policy change, and identify investments needed for prevention and mitigation of forest fires at the country level.

The main objective of the RETA Project was to strengthen and formalize cooperation among ASEAN countries affected by forest fires and haze by supporting the

- short-term measures aimed at operationalizing the RHAP;
- medium-term measures to strengthen the capacity of relevant institutions in implementing the RHAP, and improve scientific understanding of large-scale fires and transboundary atmospheric pollution; and
- strengthening the capacity of institutions to implement and institutionalize the RHAP.

These called for several actions to achieve the following:

- identify actions to be taken by the AMCs to establish an institutional framework to address the region's transboundary haze pollution problem on a long-term, sustainable basis;
- decide the required investments, if any, to support the institutional framework;
- catalyze donor collaborative partnerships and activities to directly complement the AMCs' planning in confronting the region's transboundary haze pollution problem;
- share knowledge and experience as well as efficient and economic use of regional firefighting equipment;
- develop formalized cooperation arrangements among countries of the region and beyond, to enhance scientific understanding of the causes and consequences of transboundary atmospheric pollution; and
- establish a regional level framework for joint response mechanisms through enhancement of ASEAN and associated institutions' capacity in the effective implementation and monitoring of the RHAP.

One of the prime needs was to channel all efforts, whether funded by the AMCs, ASEAN, or international assistance agencies, through an operational network of national, subregional, and regional arrangements. The RETA Project was able to do this effectively, particularly obtaining donor resources for the implementation of RHAP components.

In tandem with the inception workshop of the RETA Project, an open forum for donor's participation in assistance for fires and haze was held in early 1998. This led to a number of commitments complementing the RETA Project activities, and taking over of some activities within the Project's scope. Resources were utilized for important underfunded activities. The assistance of Australia and the United States in implementing the World Meteorological Organization (WMO) program to address the regional transboundary haze as well as United Nations Environment Programme (UNEP) support in various areas of fires and haze mitigation deserve special mention.

Achievements of the RETA Project

The RETA Project's achievements through direct intervention and collaboration with other donors were gratifying. These include the following.

A. Through direct intervention:

- Compiled baseline information through surveys, studies, and assessments.
- Conducted an inventory of the regions' firefighting resources and fire suppression capabilities.

- Established and strengthened subregional firefighting arrangements.
- Carried out studies and evaluations on ASEAN's existing forest fires and haze monitoring system to promote their upgrade.
- Undertook policy studies on the use of market-based instruments to promote adoption of mechanical zero-burn land clearing methods and marketing of products using biomass residues as productive inputs.
- Reviewed national and international laws, policies, and institutional arrangements connected with forest fire and haze issues and developed a legal framework and facility for cross-border cooperation.
- Helped to develop regional and national facilities for fire and haze monitoring, e.g., ASEAN Specialized Meteorological Centre (ASMC).
- Developed and strengthened the system of information management at the ASEAN level and supported the establishment of a regional information center and clearinghouse, which included the setting up of ASEAN Haze Action Online.
- Assisted in operationalizing a RHAP that includes a system of detailed implementation plans at the regional, subregional, and national levels.
- Assisted in organizing institutional mechanisms, particularly for regional coordination, through the establishment of a Coordination and Support Unit.
- Promoted a continuous dialogue among ASEAN members and partners as an ongoing system for effective regional cooperation.

B. Through collaboration with other donors:

- Formulated an operating procedure for activating forest firefighting resources in the ASEAN region, with particular reference to Indonesia.
- Designed a model fire suppression mobilization plan and initiated the preparation of Fire Suppression Mobilization Plans (FSMPs) for specific areas.
- Conducted studies on haze transport and climate models and harmonization of pollution indexes.
- Catalyzed and collaborated in conducting studies on health impacts of haze pollution.
- Promoted development of facilities for training and research studies relating to forest fires and haze management.
- Mobilized donor support for fire-and-haze-related projects, e.g., program to address regional transboundary smoke (PARTS), forged collaborative partnerships with other international institutions, and facilitated donor coordination.

Operationalized Regional Haze Action Plan (ORHAP)

The prime output of the RETA Project was an operationalized version of the RHAP (ORHAP), which was approved for implementation by the ASEAN Senior Officials on Environment and HTTF in July 1999. ORHAP had two major beneficial impacts on ASEAN. First, it helped ASEAN to address the fire-and-haze issue directly, with actions that increase the region's capacity to manage future forest fires and haze. It also catalyzed the beginning of ASEAN's reorientation from a passive agency that responds to challenges in an ex post manner to a more forward looking institution that anticipates challenges and responds to them ex ante.

The programs and activities of the ORHAP are defined considering three basic parameters:

- the region's transboundary pollution problem is ultimately driven by national-level policies;
- haze pollution itself results from behavior heavily reinforced by profit considerations; and
- climate factors act to worsen the tendency of the above two parameters to produce haze.

And five strategic considerations:

- the primary goal of the ORHAP is to prevent the recurrence of transboundary haze and this calls for a focus on fire management;
- endorsement of the RHAP and ORHAP by an ASEAN country implies limitations on land conversion;
- measures in the ORHAP that remove or address "binding constraints" on preventing or mitigating transboundary haze pollution will be given highest priority. Measures that address successively less binding constraints will be assigned successively lower priority.
- the purpose of ORHAP-related measures at regional and subregional levels is to catalyze and complement,

rather than to substitute for, the measures carried out at the national level; and

- wherever alternative measures for achieving the same objective exist, the one that costs less will be implemented.

The ORHAP is designed as a rolling plan with a short-term horizon, to be updated annually, i.e., a detailed implementation plan for year one plus a regular ORHAP for the succeeding five years. Thus, the ORHAP is a document meant to be continually refined and updated. Depending on the evaluation of activities conducted and completed in the previous periods, future activities can be modified, new activities added, and redundant ones deleted. These additional activities are expected to be of two types: those undertaken directly by the AMC governments themselves and those for which donor support will need to be catalyzed.

The three major programs of ORHAP: prevention, mitigation, and monitoring were divided into 20 activities and 50 actions. To implement these programs, the ASEAN region was subdivided into member countries, and each AMC had its own system of provinces, districts, etc. The country plan, including subplans on fires and haze includes the National Haze Action Plans (NHAPs), with the countries free to adopt their own program structure. The NHAPs are linked to the ORHAP. As in the case of programs, there could also be parallel linkages due to overlapping of interests or other expediency criteria. The two Subregional Firefighting Arrangements (SRFAs) (Borneo and Sumatra) within the umbrella of the ORHAP are cases of parallel spatial linkages at subregional level in respect of a program activity, i.e., firefighting. Spatially, nine NHAPs and two SRFAs are appropriately linked.

Detailed Implementation Plan

The core of the ORHAP is a Detailed Implementation Plan (DIP), which contains the provision for actual implementation of activities. Each DIP is prepared based on commitments from the AMCs, assistance agencies, donor countries, nongovernment organizations (NGOs), community groups, and other voluntary organizations.

In addition to detailing the organization and designating the persons responsible for each action, the DIP also presents a detailed matrix of the budget, source of funding, time frame, and a monitoring variable to determine the successful implementation of actions. Thus the DIP matrix can function also as a vehicle for monitoring ORHAP implementation. Transparency in monitoring is assured by dissemination of the entire DIP matrix to all concerned parties by a restricted access, i.e., password-required, intranet.

While the ORHAP details the steps that ASEAN itself will take, donor-assisted initiatives only support the steps taken by ASEAN. The full complement of concrete measures that will comprise the implementation strategy also need to be laid out.

Since the actions are undertaken at regional, subregional, and national levels, correspondingly, the DIP is divided into three. The DIPs relating to various levels together comprise the ORHAP DIP, which collectively form the detailed "to-do" list that guides implementation over six years. The ORHAP is thus composed of one regional, two subregional, and nine national DIPs.

At the ASEAN level, HTTF will monitor the progress of ORHAP implementation and take action in shaping the region's infrastructure for fire protection and mitigation. A brief description of the three major programs follows:

Prevention

While the program defines its scope, funding determines the actual number of incorporated activities. Accordingly, the first six-year rolling ORHAP include 10 activities:

- forecasting climatological conditions that are likely to result in fires and haze;
- mapping areas subject to heightened risk of forest fires, including how these at-risk areas expand or shrink in response to seasonal, annual, or multi-year changes in climate;
- managing and disseminating information on fires and haze, the geographical areas that may be affected by haze, and the human health impacts or likely impacts of existing or forecasted haze presence or movement;
- reviewing the existing policy framework at the national level to determine how the economic incentives that it

provides are likely to shape the use of fire as a tool or weapon;

- bringing about appropriate policy changes to ensure that the economic incentives provided by the policy framework at the national level are consistent with the policy on open burning;
- providing market-based and other economic incentives for promoting the adoption of new products and technologies that use biomass, logging, and land-clearing residues as productive inputs;
- formulating, operationalizing, and implementing NHAPs as a foundation to operationalize the RHAP, and increase the degree of readiness to meet forest fire emergencies at the national level;
- harmonizing and integrating NHAPs at the ASEAN level to ensure collective consistency and effectiveness in jointly responding to regional forest fires and haze;
- developing and implementing institutional arrangements for linking national firefighting capabilities in any combination within ASEAN, e.g., SRFAs, or other mechanisms for coordinating multiple national firefighting capabilities; and
- formulating, ratifying, and implementing an ASEAN-wide Forest Fire Readiness Protocol that formalizes national-level firefighting linkages by putting into place institutional arrangements that facilitate rapid deployment.

In the context of the ORHAP, prevention signifies control of transboundary haze pollution and related damage, both environmental and material, to the fullest extent possible. It involves efforts on two fronts:

- preventing fires from outside, e.g., agricultural areas, burning forests and other natural vegetation; and
- managing the use of fire for land clearing and refuse disposal so that the extent and density of burning are controlled.

Fires should be prevented as much as possible, since control and mitigation is more difficult and expensive. Prevention is one of the most effective ways of tackling land and forest fires. Management of the land conversion process needs to be addressed through policy and regulatory measures. The prevention of land and forest fires embraces a wide range of measures that either modify the fuels found within or around the fire-threatened resources to reduce the spread and intensity of fires, or reduce the chances of human-caused ignition.

Various categories of fire prevention measures include scientific resource management, policy reforms and modifications, command and control, public education, and moral suasion.

Scientific forest resource management regarding fires comprises hazard reduction measures, including rational and controlled use of fire, such as prescribed burning. Forest fire management can be an important aspect of sustainable forest management practices to ensure that negative impacts are minimized and positive impacts maximized.

Policy measures involve removal of anomalies in the existing land conversion and related policies, improving the policy environment with nondistortionary incentives, and introducing zero-burn land-clearing systems and market-based instruments.

The regional project carried out a special study on the potential of promoting mechanical land clearing and marketing of products based on residues. It noted that the technical feasibility of zero-burn land-clearing methods has been proven and demonstrated in a number of cases in the region. It was the skewed system of incentives involved in the free use of open fire for land clearing and the landowners' efforts to maximize private profits that created doubts about its economic advantages. From an overall national and socioeconomic point of view, the system has several merits. In Sarawak, Malaysia, land clearance for cultivation is mostly carried out mechanically and land preparation for planting follows "zero-burn" methods.

Market-based instruments or approaches can be applied in several variations to encourage land clearing through zero-burn techniques and to promote products that use the biomass resulting from mechanical land clearing as raw material. The exact extent and conditions under which zero-burn land-clearing techniques are financially feasible or applicable are still being worked out. However, available evidence suggests that these conditions are likely to vary widely. What is certain is that in some haze-source ASEAN countries, explicit and implicit subsidies for land clearance

reward the use of open burning. For environmentally conscious operators, the existing indirect subsidies act as a strong disincentive to the use of zero-burn methods. The incentive system, thus, subsidizes the behavior that contributes to transboundary haze pollution and penalizes the behavior that attempts to prevent it. The use of market-based instruments will partially remove the two-edged bias against the use of mechanical land-clearing techniques.

The rationale for market-based instruments is to prevent people from using fire as a land-clearing tool for their own motives at little cost, shunting the bulk of the burden to haze-recipient populations. On the other hand, operators using mechanical land-clearing techniques bear all of the costs of land-clearing. Thus, even if open burning was not subsidized, the operator using open burning enjoys more profit than the operator using mechanical land-clearing techniques. Allowing this is inconsistent with economic efficiency and market principles where producers compete on an equal footing so that society can obtain products at the lowest possible cost. If for any reason this equal footing is weakened, damaged, or destroyed, society-at-large is the loser. The introduction of market-based instruments promotes competition on an equal footing and brings about economic efficiency with society as a whole benefiting.

Command and control is an expression to cover all legal measures including instruments, regulatory mechanisms, legal sanctions, and restrictions. Legal measures form an important fire prevention tool. Command-and-control measures directly regulate human use of fire by imposing sanctions against persons who use it in unapproved ways. Command-and-control measures are therefore implementable only at the national or subnational level. Nonnational entities at the regional and subregional levels can play a role in facilitating or supporting implementation of command-and-control measures at the national or subnational levels.

Public education and moral suasion objectives can be achieved through dissemination of information and use of the media. Public education and awareness programs reduce transboundary haze pollution by informing stakeholders of the broader negative effects of open burning and haze pollution. Once they are made aware of these effects, at least some of these stakeholders will limit open burning or even stop this practice altogether. ASEAN will therefore promote such new programs and expansion of existing ones in all member countries by sponsoring workshops and training programs, especially in key fire-and-haze-prone areas.

Moral suasion initiatives reduce transboundary haze pollution by publicly informing stakeholders who are tempted to practice uncontrolled open burning of the broader negative effects of the practice. ASEAN undertakes such initiatives by meeting directly with representatives of relevant private sector firms as appropriate, and discussing the broader negative impacts of uncontrolled open burning and transboundary haze pollution.

Mitigation

To reduce the impacts of fires and haze, mitigation calls for action at three stages: pre-event, during the event, and post-event. These three stages consist of the following activities: (i) preparedness to face fires where actions on infrastructure, equipment, strategies and logistics, training, crew fitness, surveillance, etc., are planned and implemented; (ii) suppression, including aspects of detection, quick communication of information, crew mobilization and dispatch, provision of water, movement of equipment, coordination of field action, e.g., of aerial and ground operations, firefighting, and extinguishing of fires; and (iii) relief to those affected by haze pollution and fires, including medical attention and compensation, and rehabilitation to repair damage to property and resources.

Mitigation is closely linked with other ORHAP programs. Prevention, e.g., firebreaks, fuel load control, other preventive measures, and monitoring includes weather monitoring, fire modeling, fire spotting, and early warning. Many of the time-consuming operations are carried out when there is apparently no fire danger. For example:

- developing and maintaining infrastructure, water storage, firebreaks and fire corridors, aircraft landing sites;
- acquiring, maintaining, and stock verification of tools and equipment, e.g., hand tools, heavy equipment, water hoses and tankers, communication equipment, etc.;
- preparing and revising fire maps, information materials, guidelines, and instructions for crew;

- planning for fire emergencies, covering strategies and logistics;
- establishing fire detection, surveillance, i.e., aerial and ground, and intelligence systems;
- preparing resource mobilization plans;
- contacting community leaders, cooperating agencies, and volunteers;
- conducting training and retraining for various levels;
- reviewing, modifying, or improving organizational arrangements, and standby and response orders; and
- conducting dry runs and intensive drills, and keeping the crews in good shape.

The activities are carried out as per plan to keep the whole system in a "well-oiled" condition, and ensure that no details are overlooked and "the war is not lost for want of a nail." Two important initiatives to promote "better preparedness" undertaken during the execution of the RETA Project, and still continuing, were: (i) preparation of a system of FSMPs; and (ii) establishment of working groups for SRFAs.

FSMPs are required to start from the village level and move upwards through the institutional hierarchy, to be linked at district, provincial, and SRFA levels to ensure an effective functioning system.

When the process of formulating or upgrading FSMPs for various areas is completed, a database containing all relevant information such as the training and equipment requirements, operational costs of implementing the FSMPs, and inventory of skilled personnel and equipment needs to be assembled. This must be carried out individually for each geographic area, and the results aggregated at the national level. Regular and continuous updating of this database would ensure better utilization at the time of need. The government agency performing this task at the national level should be assigned the lead role in fire management.

SRFAs: The main rationale for subregional cooperation in fire management and suppression is cost effectiveness. One means of increasing the cost effectiveness of fire suppression at the national level is by risk pooling at the international level. This involves supranational sharing of fire suppression resources during periods of peak demand.

Because the risk of large-scale fires occurring simultaneously in all countries in a regional or subregional grouping is slight, resources on standby in a member country not threatened by fire can be used to augment those in places where fire suppression resources are fully employed.

Since the overall risk of transboundary haze and the fires that cause them is so unevenly spread across the region, the subregional level is the key in organizing and carrying out cooperative mitigation-related activities under the ORHAP. The same is true with monitoring activities.

Two SRFAs are in place. SRFA Sumatra's membership comprises Indonesia as lead country, Malaysia, and Singapore. SRFA Borneo's membership comprises Brunei Darussalam as lead country, Indonesia, and Malaysia. A third SRFA for the Greater Mekong subregion (SRFA-GMS) has yet to be officially formed, because the impetus for this, i.e., extensive large-scale fires within the area, has not yet arisen. SRFA-GMS would group all AMCs through which the Mekong River flows: Cambodia, the Lao People's Democratic Republic, Myanmar, Thailand, and Viet Nam. Its formation would leave the Philippines as the only ASEAN country not a member of an SRFA. This deficiency could easily be repaired by the Philippines joining SRFA Borneo, which would be fitting, because of the country's proximity to Borneo.

ORHAP activities to be carried out at the subregional level must avoid violating an individual member country's national sovereignty in two key areas. First, the requesting country only may trigger the physical entry of fire management personnel and equipment from one member country into another's territorial boundaries. The host country alone must decide when the threshold at which large-scale fires can no longer be contained by national fire management resources has been breached, and suppression resources drawn from the supranational level will be required to prevent haze from violating another country's airspace.

Second, the deployment of suppression resources drawn from the supranational level must take place on the basis of an agreed subregional FSMP, rather than on an ad hoc basis improvised at the spur of the moment. The subregional FSMP should, as a first step, work out logistics for efficient deployment of national fire management resources. Only

then should deployment of supranational resources be integrated into the national level framework.

The ORHAP's mitigation program has identified four priority activities for the first six years of the rolling plan: (i) formalizing arrangements for improved training and retraining of forest firefighters at the national and regional level to ensure that trained personnel are adequately equipped to cope with future forest fires; (ii) inventorying existing firefighting capability at the national level, including all aspects of equipment and personnel, to determine the maximum scale of forest fire that existing resources are equipped to handle; (iii) strengthening firefighting at the national level where each AMC's capability is sufficient to cope with forest fires likely to occur on an annual basis; and (iv) ensuring the continued readiness of firefighting capability at the national level through regular maintenance of equipment and upgrading of skills of firefighting personnel.

Monitoring

There are large variations in the scope, methods, types, purposes and objectives, and outputs of monitoring. Monitoring can be an event, a process, or an output; it can be discreet, continuous, or incremental; it can be tackled directly, indirectly, or by proxy measures; it can be done from ground (site) or air (remote).

It can employ simple methods or measures, i.e., number, area, volume, profit or sophisticated technology involving satellites, computers, and systems science providing for multiple linkages, e.g., weather data, economic data, management information system, geographic information systems, and facilities to import and export information.

The data needs of sophisticated monitoring systems are often tremendous, ranging from land-use changes and demographic trends to socioeconomic indicators, hydrometeorological factors, spatial and temporal distribution of relevant factors, and environmental standards.

While the ORHAP has defined the scope of monitoring based on the needs and priorities of the region, six activities were included in the ORHAP's current monitoring program, including:

- detecting wildfires;
- predicting and tracking the movements of the resulting haze;
- forecasting the degree of wildfires likely to generate haze, as well as the type or composition of emissions that might be generated;
- determining the likely health impacts from typical or particular haze;
- identifying the areas historically affected by forest fires and haze in the region, or those likely to be affected by particular occurrences; and
- assessing the impact of past forest fires, including the extent of area burned, the composition of flora and fauna destroyed, and the socioeconomic cost of particular forest fires at the local, national, and global levels.

The scope of monitoring of fires and haze covers early warning and fire danger rating, large-scale fire management assistance, atmospheric pollution, and health impacts of haze and *ex-post* monitoring.

Early warning system. The early warning system aims to provide a measure of the risk of fires and to communicate the information in a timely manner to the central, provincial, and district authorities and the community as a whole. Fire danger warning is probably the central function of a fire monitoring system, and most other activities are, in one way or the other, related to this important aspect. Simplicity is the primary hallmark of any early warning system. The warning system is based on climate models and forecasting of weather trends. The *El Niño* Southern Oscillation index is a useful predictor of fire weather in the region.

Nearly all fire danger rating systems incorporate three base weather variables: rainfall reflecting wetness or dryness, relative humidity, and maximum temperature. More sophisticated indexes add fuel types and land use classification to the base weather variables.

Relative humidity and maximum temperature remain relatively uniform in the parts of the ASEAN region affected by forest fires over the past two decades. They are thus poor predictors of fire activity. Neither are the data on fuel types particularly helpful, since the purpose of deliberate open

burning is to consume whatever fuel is present. Therefore, there is need to develop a fire danger index that is most appropriate to the situation in the ASEAN region. Efficacy of different systems such as the Keetch-Byram Drought Index (KBDI), Rainfall Debt, and the Canadian Fire Weather Index in their modified forms have been assessed. However, a decision on a common fire danger index for the region is yet to be taken.

Large-Scale Fire Management Assistance. If a wildfire occurs in spite of the early warning system and the preventive measures taken, the monitoring system should be able to detect the fire and begin tracking changes in its status. The system should determine first the precise location of the fire so fire management resources can be deployed quickly to the fire site. It should then track any spread of the fires and resulting haze, thereby assisting national and regional authorities in managing the fire and in activating any preestablished haze response systems. The important technical activities that comprise an appropriate fire-and-haze detection and tracking system include intensive surveillance and haze transport modeling. The regional and national capabilities in this regard are being enhanced through international assistance.

Atmospheric Pollution and Health Impact of Haze. The nature and severity of the smoke emission, the direction and velocity of its dispersion, its persistence and duration, i.e., atmospheric residence-lifetime, the height at which it resides, its impacts on the economy and society, and smoke attenuation, etc., are influenced by various factors and form the specifics of haze monitoring. The fuel type and the interaction of haze with other atmospheric pollutants influence the nature and chemistry of the smoke, its particulate conversion ratio and carbon monoxide and carbon dioxide ratio in haze, as well as its impact on visibility. These in turn define the Pollutant Standard Index (PSI) and/or Air Pollution Index (API). Wind movement and velocity and other climatic factors decide the residence time of haze over the atmosphere. A considerable amount of research is still needed to fully understand the haze formation and dispersal phenomenon.

The negative impacts of haze on human health are closely related to the density and chemical composition of the emissions that escape from large-scale fires. The main purpose of atmospheric monitoring is to provide timely haze warnings based on the PSI and API. A warning system for haze relies on the ability to predict deterioration visible in any place over a long period, as meteorological forecasting skills permit. The most basic forecasting tool is a box model that accepts the generated smoke into a fixed volume air.

Ex-post monitoring. The purpose of ex-post monitoring is to correctly measure the various impacts of fires and haze, to plan remedial measures.

Information Needs. The types of monitoring data and measurements involved in fires and haze are varied in nature, e.g., land-based measurements, ship-platform-borne measurements, aircraft-borne measurements, satellite and spacecraft-borne measurements, and a wide range of meteorological information.

To obtain high accuracy, data need to be properly calibrated and validated. The analysis of data will require the availability of a geographic information system database, which must comprise regional vegetation distribution map, fuel map, fire risk map, and land use map with information on fire agents, causes, etc. For combined fire-smoke analysis, this kind of database can then be linked to atmospheric chemical analyses.

ASMC in Singapore is the prime regional institution for monitoring forest fires and associated haze and gathering related information, supported by national meteorological services. Together they carry out (i) traditional activities related to meteorological monitoring and forecasting; (ii) monitoring and surveillance functions, including hot spot identification through satellite imageries, haze trajectory modeling, compiling monthly and seasonal climate prediction information, and activities related to air quality monitoring; and (iii) effective and prompt dissemination of information to environmental and other agencies engaged in fire and haze response and management, and to the public through the Internet and news releases.

Institutions. Under the ORHAP, there is no program on institutions. However, strengthening of institutions is a crucial requirement, impacting on other programs. The aspects and subjects falling under institutions are (i) organizational arrangements, (ii) regulatory and legal

instruments, (iii) capacity building, (iv) donor collaboration and partnership arrangements, (v) a system for continuous planning, and (vi) information management.

Organizational System. The ORHAP is a niche in the organizational structure of ASEAN and benefits from the existing infrastructure and arrangements. However, strengthening will be needed in areas of particular relevance to the ORHAP, e.g., information management.

Within the ASEAN system, HTTF has the primary responsibility to manage and monitor the ORHAP. HTTF shares this responsibility with a number of regional and national institutions, i.e., vertically and laterally. The following is a list of responsible institutions:

- ASEAN Ministerial Meeting on Environment;
- ASEAN Ministerial Meeting on Haze;
- ASEAN Senior Officials on Environment;
- HTTF: Indonesia (Mitigation), Malaysia (Prevention), and Singapore (Monitoring);
- Working Group on SRFA-Borneo;
- Working Group on SRFA-Sumatra;
- ASEAN Secretariat-RHAP Coordination and Support Unit, supported by the Environment Unit, the Agriculture and Forestry Unit, Information and Library Unit, Computer Unit, and Culture and Information Unit;
- ASMC, Singapore;
- dialogue partners and collaborative partnerships; and
- NGOs and the private sector.

With such a long list, the need for coordination is evident. The role of the RHAP Coordination and Support Unit (CSU) within ASEAN is crucial. CSU needs considerable strengthening of resources, facilities, and expertise.

Regulatory and legal instruments. Policy and legal instruments are interrelated. The present policy approach concerning response to wildfires and land-use fires is often an ad hoc reaction to a situation that has already developed, rather than proactive mitigation before the emergency arises. Frequently, policy development does not consider the underlying causes of fire incidence and spread, which may lie outside the forest sector, such as rural poverty and deprivation or the effects of other public policies related to land use and incentives. Sometimes forest fire incidence and spread may be caused by ill-conceived forest management, in particular, total fire exclusion policies that have led to fuel accumulation and catastrophic fire outbreaks.

Policy objectives and measures relating to forest fire management need to be clearly articulated and be in tune with the nation's environmental and socioeconomic policies. Forest fire laws and regulations should be developed for the enabling policy objectives to be translated realistically into action and linked to overall environmental and forest laws. There should also be mechanisms with adequate capability and powers to deal with environmental crimes relating to fire.

In short, public policy on fire should be a dynamic political manifestation of the people's concern for their environment, health, and social welfare, and trust in the system of resource governance. Their trust should not be betrayed.

A viable and efficient legal system is important for translating policies into action. Legal instruments help to achieve policy objectives and to implement policy measures. The legal instruments covering the laws, rules, regulations, agreements, and covenants empower an institution to take appropriate action for achieving its mission. Laws contain enabling provisions to establish adequate regulatory measures to ensure achievement of policy objectives. They define the power of the State and the nature and scope of its sectoral institutions.

Legal instruments at the national level as a means of contributing to the achievement of policy objectives affect governmental agencies and the public. Government agencies stipulate the responsibilities and actions that the agency and its personnel are to carry out, and explicitly or implicitly, the limits of its authority.

Smooth implementation of the ORHAP at the regional, subregional, and national levels through cooperative, collaborative and joint activities, and related institutional arrangements calls for a number of interagency and international agreements for legally formalizing such arrangements within the ambit of a mother agreement and/or an operational protocol. An initiative to establish an ASEAN Agreement on Atmospheric Haze Pollution in the

form of a mother agreement is in progress and expected to become operational by 2001.

Capacity Building. Capacity building needs to be undertaken on a continued basis to avoid redundancy. Two aspects that need to be underlined in this connection are research and development, and education and training. Currently, there are several project components being implemented to improve the capability of AMCs in fire and haze management.

Donor Collaboration and Partnerships. Donor support and resources have made vital contributions to address the impacts of repeated forest fires and haze. The donors provided a substantial amount of funds for short-term suppression activities. While this has no doubt been appreciated by AMCs, the sustained funding of short-term fire suppression over an indefinite period is neither feasible nor would it be an efficient use of scarce donor or affected-country resources.

The challenge now is to use the intervening period between the end of the last *El Niño* and the onset of the next to put into place an institutional framework that will prepare the region for subsequent periods of vulnerability to forest fires and haze. This preparation should be such that ASEAN will never again have to resort to a crisis management style response during periods of heightened risk, as it did during 1997-1998. Accomplishing this will require donor funds to be used as efficiently as possible.

While assistance projects play vital roles, it is crucial to ensure that they are fully owned by the AMCs and integrated into the ORHAP, so that activities can run on effectively even after the external assistance is terminated. The role of the donors in addressing the fire-and-haze issue will also have to be redefined. Fire-and-haze-related donor activities will have to be integrated through explicit partnerships, rather than each of the donors simply becoming aware of other donors' involvement. A start has been made in this direction by integrating all donor activities directly into the ORHAP-DIP. When used as intended, the DIP places the onus of developing an integrated operational plan for confronting the fire-and-haze issue directly on the AMCs and ASEAN itself.

System of Continuous Planning. Planning is an institutional responsibility. Preparation of a plan involves several institutional players and inputs from experts and stakeholders. Conceptually, the ORHAP has all the important characteristics of a formal plan, specifically of an action plan. The nature and emphasis of certain levels of actions may vary when compared to a sector plan or a development plan. However, the ORHAP can and does function within the confines of a broader planning framework. The system of continuous planning incorporates updating of the six-year rolling plan and the DIP, monitoring and implementation of the ORHAP, and establishment and operation of an ASEAN Haze Fund.

ASEAN Haze Fund. A study aiming to determine the feasibility, purpose, concept, and alternative financing vehicles for the establishment of an ASEAN Haze Fund was carried out under the auspices of the RETA Project. It also identified various management and institutional arrangements, including operational guidelines for the fund. The study concluded that the creation of the ASEAN Haze Fund is not only feasible but urgent to finance ORHAP-related activities, particularly fire suppression and mitigation operations.

This can be achieved through a cohesive and integrated framework, drawing on the resources of AMCs, including other sources of funding. Action to establish the fund is pending.

Information Management. The importance of information on fire and haze management cannot be overstressed. While the communication system has achieved a high level of sophistication in various spheres of life, there are gaps in the system being used in fire and haze management in Southeast Asia. At site or near fires in comparatively underdeveloped areas, there is often no access to new communication systems.

The following are some of the important problems relating to fire information management identified during the 1997-1998 fires and haze in Southeast Asia:

- data are spread out around various institutions that are often reluctant to share them. If and where available, data are not consistent or in compatible format, and are of low quality and expensive;
- data cannot be communicated in time when needed because telecommunication facilities are not adequate;

- reliable human resources to gather and process data are limited. Data on the 1997-1998 fires were mostly monitored by three foreign-funded satellite-monitoring projects operated by foreign experts;
- data processing was not adequate to produce information for supporting fire management; and
- there is lack of a proper communication plan.

A study carried out by the RETA Project identified four broad categories of information management functions: (i) policy, planning, and program development; (ii) regulatory and technical services; (iii) administrative services and support; and (iv) internal information management, which together formed the ORHAP information systems architecture. The purpose was to summarize the information packages and database to suit the needs of fire and haze management. These are now being put into practice.

Regional Information Center and Clearinghouse. Based on the study, a regional information center and clearinghouse was established at the ASEAN Secretariat. It includes: real-time satellite imagery; a continuously-updated inventory of relevant donor-assisted initiatives; information on past, present, and future meetings, workshops, seminars, and training programs related to transboundary haze; and numerous other features. As the most efficient means of disseminating this information, a public-access web site available over the Internet (http://www.haze-online.or.id) on fires and transboundary haze was established in the region. The Coordination and Support Unit (CSU) is now responsible for the information center and clearinghouse.

To ease the flow of information connected with the implementation of the ORHAP among members of the HTTF, AMMH, and international agencies, a restricted access, i.e., password-required, intranet was established in parallel with the public access Internet web site. This is being used to allow continuous updating of the various DIPs required for ORHAP implementation.

Training programs in the operation and maintenance of the web site were formulated and conducted by the RETA Project. Trainees included ASEAN Secretariat staff who would maintain the web site's content, as well as staff from the Secretariat's Computer Unit, who would be responsible for integrating the web site into the ASEAN Secretariat's overall network of computer users. Separate training programs were conducted for staff supporting the work of HTTF members, to ensure that they would have continuous access to the information posted on the ORHAP intranet.

Looking Ahead

Endorsement of the RHAP document was a watershed in ASEAN's approach to managing the region's transboundary haze pollution problem. While several activities have already been initiated during the last two years under the operationalized RHAP, it still needs to be consolidated as a sustainable system.

Based on past lessons and studies about the future outlook of fire factors and likelihood and fire and haze, there is a pressing need for strengthening the ASEAN regional collaboration in various areas and aspects related to fire and haze management. These include joint activities, continuation and completion of ongoing activities, consultation and undertaking of new activities, fine tuning of fire-related policies, common standards and approaches, a legal system to facilitate regional cooperation, instruments for transboundary haze pollution control, institutionalization of forest fires and haze management, providing a perspective framework for the ORHAP, and elevating institutional strengthening to the status of a program.

Joint Activities. Joint activities of different nature, i.e., collective, cooperative, collaborative, and coordinated, suitable for the different contexts are important means of strengthening the regional approach. Policy studies, research and development, specialized training, remote sensing and satellite-based monitoring, and SRFAs are some of the activities where cooperation has been initiated. This cooperation needs to be further strengthened.

As and when conditions becomes more conducive, and if economy and efficiency warrant it, more and more activities related to fire management can be brought under the regional preview.

Continuation, and Completion of Ongoing Activities. Several activities have been initiated by the ORHAP under the auspices of the RETA Project. Some activities have been started and are ongoing, some are in a nascent stage, and others are still in the form of a plan awaiting approval for

funding. Some activities are of considerable magnitude, some are complex in nature, some are short term, and others are of a medium-term nature.

An important task ahead is to carry these activities forward, enhance their functioning, or complete them as necessary to realize the goals. Some of the activities to be seen through are: (i) Completing the network of FSMPs, linking village units all the way up to the regional (SRFAs) level; (ii) increasing and improving the monitoring capacity of ASMC, and establishing an effective monitoring system network; (iii) completing the work on policy changes involving introduction of market-based instruments, system of responsible land clearance bonds, mechanical land clearing, and model codes of practice; (iv) providing training programs on firefighting, fire management and monitoring; and (v) establishing the Regional Fire Research and Training Center for Land and Forest Fire Management.

Consultation, Program Modification, and New Activities. A means of strengthening regional collaboration is through regular and periodical consultation among the AMCs to review the implementation of the ORHAP and assess the need for program modification, including new activities. Some ideas have already come up. These include publication of the ASEAN *Forest Fire Bulletin*, establishment of Pan-ASEAN Fire Centers; incorporation of public health-related activities in the ORHAP; and promotion of dedicated satellites for fire monitoring.

Fine-Tuning Policies. There is no separate forest fire policy in the AMCs. Fire-related policies are included as clauses or provisions in other related policies, e.g., forest policy, environmental policy, land development policy, etc. Separate regulations corresponding to these policy clauses are often issued. These lead to inconsistencies and even conflicts as far as forest fire and haze-related actions are concerned. There is a need for fine-tuning of fire-related policy provisions by removing inconsistencies and providing appropriate focus. *Better still, a separate policy statement on forest fires and haze can be formulated following the accepted procedure involving policy formation, articulation, and formulation.*

Catalyzing policy changes relating to the use of fires that cause atmospheric pollution is not easy. This is a medium-term task that is being undertaken by some countries with bilateral support from international agencies.

An ASEAN regional framework policy on forest fire and associated haze can serve as a model for AMCs to formulate or modify their own policies to suit their needs.

Common Standards and Approaches. For the joint efforts as envisaged in the ORHAP to succeed, it is necessary to adopt common standards and common approaches. The need for harmonization of haze pollution indexes, standardization of the fire danger rating system and hot spot algorithms, common curriculum for fire management training, standard terms and definitions, and common and harmonized system of weights and measures exemplify the importance of common standards and approaches.

Legal System for Regional Cooperation. The different levels in the legal system of the ORHAP will roughly be (i) regional level convention or a mother agreement; (ii) specific agreements such as on transboundary haze pollution; (iii) agreements related to situation and transaction, such as an agreement for sharing meteorological information; and (iv) standard operating procedures for actions falling within the purview of specific agreements, i.e., standard operating procedures for cross-border transfer of firefighting equipment.

For international agreements to be drawn up for various aspects of ORHAP implementation, an enabling legal instrument is necessary. Sustained implementation of the ORHAP would be facilitated significantly by a mother agreement, or a comparable legal instrument that embodies various agreements at the bilateral, subregional, and regional levels. The ongoing initiative for an ASEAN Agreement on Transboundary Haze Pollution is a priority that needs to be seriously pursued.

Institutionalizing Forest Fire and Haze Management. Sustainability of human-made systems such as forest fire and haze management depends on how effectively it has been institutionalized with appropriate mission, structure, and controls for continued and efficient functioning. It is necessary to ensure that the institutional framework is sound and capable of systematic enhancement.

A Perspective Framework for the ORHAP. The emphasis of the ORHAP is on implementation and action. As a rolling six-year plan, its horizon is short. While this has merits from the short-term operational point of view, its lack of a long-term perspective has some serious disadvantages, particularly affecting the consistency of approach and direction. In the absence of a long-term perspective within which the ORHAP could be designed across a rolling time frame, there are no long-term scenarios or reference points to guide annual forward planning. This can lead to planners' bias in the add-on plans, potentially leading to unsteady or even a lack of progress.

On the other hand, a long-term perspective plan, of which the ORHAP will be a part, has the advantage that it can better rationalize the program structure and balance, to achieve the goals in the shortest possible time. As the perspective plan by definition will be closely linked with other related sectors, it also helps to obtain a holistic understanding of the ecological and human aspects of forest fires and haze.

This is an aspect to be considered along the way ahead and acted upon.

Program Status for Institutional Strengthening. In spite of the ORHAP principle that the fire and haze problem of ASEAN region cannot be fixed, but should be managed, there exists the potential danger that it may still concentrate mostly on technical fixes. It is to be noted, however, that the most important impediment in fire and haze management has been the weaknesses and rigidities of institutions and institutional instruments. The three programs of the ORHAP (prevention, mitigation, and monitoring) are technical programs; it may be worthwhile to incorporate institutions or institutional strengthening as another program.

Conclusions

The ORHAP has been designed as a people-oriented, public-interest-propelled system, with a mission to defend the human environment and particularly to prevent transboundary haze. Through its mission to manage forest fires and associated haze, the ORHAP can and should serve as a stabilizing force to support land- and forest-based development in the region. The laudable commitment of ASEAN in this regard needs to be kept undiminished. Complacency should avoided, as it would blunt this commitment.