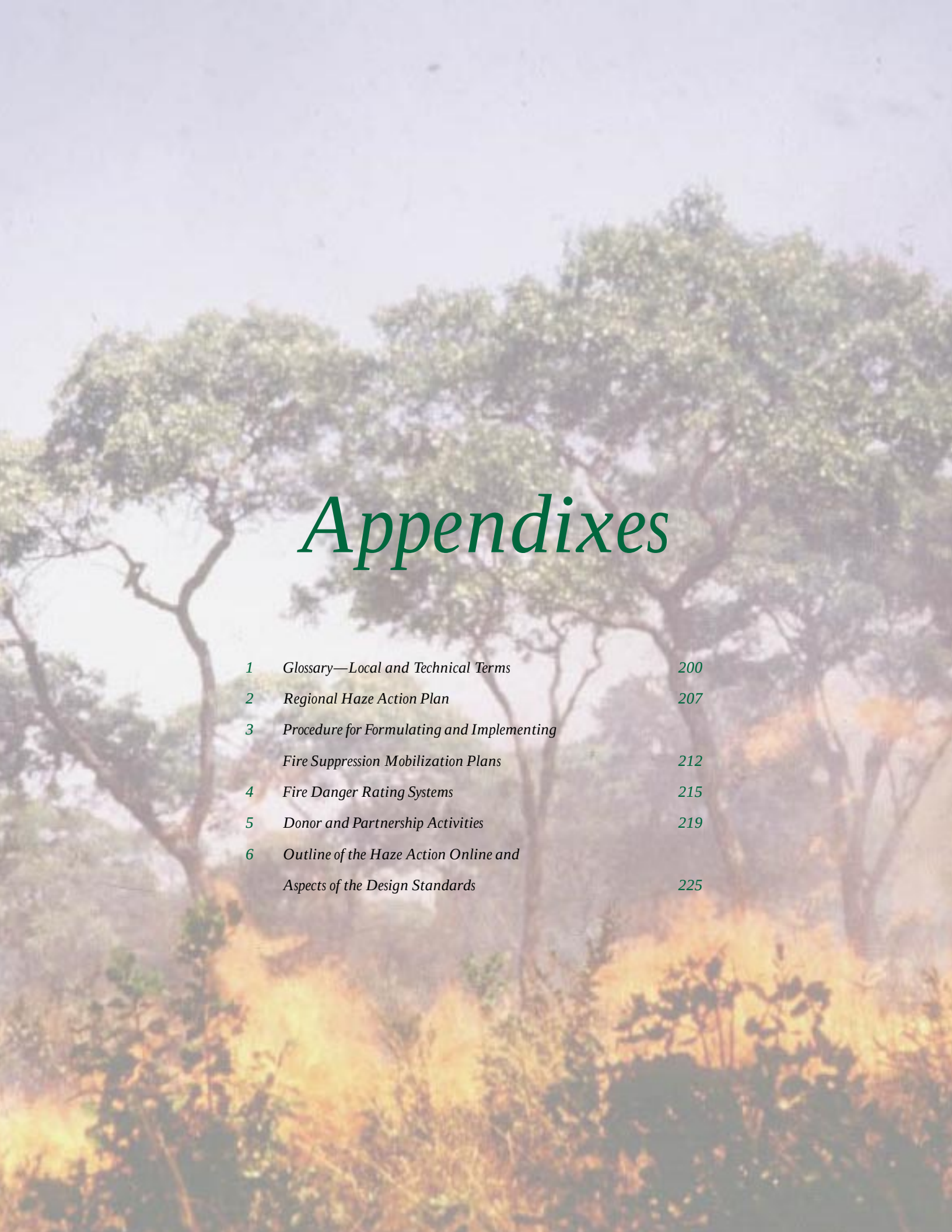

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APPENDIX 1

Glossary—Local and Technical Terms

Aerial fuels	The standing and supported forest combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, bark, lianas, and other vines. In general, they easily dry out and may carry surface fires into the canopy.
Afforestation	Establishment of a forest by artificial means on an area from which forest vegetation has always or for a long time been absent.
Agroforestry	Land use system in which woody perennials are grown and/or used on the same land as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence.
Alang-alang	*Imperata* grass (in Indonesia and Malaysia).
Atmospheric mixing depth	The vertical depth of atmospheric mixing (usually away from the surface) determined mainly by the atmospheric temperature profile.
Backfire	A fire set along the inner edge of a control line to consume the fuel in the path of a forest fire and/or change the direction of force of the fire's convection column. Note: A small-scale fire with closer control, in order to consume patches of unburned fuel and aid control-line construction, is distinguished as "burning out," "firing out," or a "clean burning."
Barangay	Village, organized community (in the Philippines).
Biodiversity	The variety and abundance of plants, animals, and microorganisms as well as the ecosystem and ecological processes to which they belong. This includes diversity within species, between species, and of ecosystems.
Broadcast burning	Allowing a prescribed fire to burn over a designated area within well-defined boundaries for reduction of fuel hazard, as a silvicultural treatment, or both.
Center firing	A method of broadcast burning in which fires are set in the center of the area to create a strong indraft; additional fires are then set progressively nearer the outer control lines as indraft builds up so as to draw them in toward the center.
Closed forest	Forest with stand density greater than 20 percent and the crowns approaching general contact with one another.
Controlled burns	Fires started purposely to achieve specific objectives.
Control a fire	To complete a control line around a fire, any spot fires therefrom, and any interior islands to be saved, and cool down all hot spots that are immediate threats to the control line,

	until the line can reasonably be expected to hold under foreseeable conditions.
Convection	Vertical exchange of air parcels, sometimes resulting in cloud formation.
Counterfire	Fire set between main fire and backfire to hasten spread of backfire. Also called draft fire. The act of setting counterfires is sometimes called "front firing" or "strip firing."
Crown fire	A fire that advances from top to top of trees or shrubs more or less independently of the surface fire.
Deforestation	To remove, kill, or destroy all or most of the trees of a forest so that reproduction is impossible except by artificial means.
Drip torch	A hand-held apparatus for igniting prescribed fires and backfires by dripping flaming fuel on the materials to be burned. The device consists of a fuel fount, burner arm, and igniter. The fuel used is generally diesel or stove oil with gasoline added.
Early burning	Prescribed burning early in the dry season before grass, tree leaves, and undergrowth are completely dry, or before the leaves are shed; as an insurance against more severe fire damage later on.
Ecosystem	An ecological system, the basic functional unit in ecology, a dynamic complex of plant, animal, and microorganism communities and their associated nonliving environment interacting as an ecological unit.
El Niño Southern Oscillation (ENSO)	A fluctuation in interpolitical pressure, wind, sea surface temperature, and rainfall and an exchange of air between the southeast Pacific subtropical high and the Indonesian equatorial low.
Environmental services:	Includes the maintenance of biodiversity, protection of soil and water resources, moderation of climate, influencing of rainfall, sequestering of carbon dioxide, providing habitat for wildlife, and maintenance of the earth's natural balance.
Fine fuel	The component of the biomass that, when burning, contributes to the flame front. (Forest fires have a flame height and flame depth that are approximately equal. The flame front moves through the fuel matrix with a speed of propagation that depends on the dryness of the fine fuel, the wind speed, and the quantity of fine fuel. Thick fuels burn after the passage of the flame front. Fine fuels are usually defined in terms of the thickness of the thinnest dimension. A leaf that may be 2.5 mm thick, 100 mm long, and 40 mm wide would be classified as a 2.5 mm fuel. Fine fuels usually range between 0 t per ha (for freshly burned country) to 4-10 t per ha for

	grasslands, 5-25 t per ha for dry forests, and up to 45 t per ha for wet forests.
Firebreak	Any natural or constructed discontinuity in a fuelbed utilized to segregate, stop, and control the spread of fire; or to provide a control line from which to suppress a fire; characterized by complete lack of combustibles down to mineral soil (as distinguished from fuelbreak).
Fire climax	Vegetational climax maintained by occurrence of fires at regular intervals (also known as pyric climax).
Fire danger rating	A component of a fire management system that integrates the effects of selected fire danger factors into one or more qualitative or numerical indexes of current protection needs.
Fire hazard	A fuel complex, defined by volume, type, condition, arrangement, and location, that determines the degree both of ease of ignition and of fire suppression difficulty.
Fire intelligence	All infrastructures, communication, base data, and other hard- and software that provide the inputs to an information and decision support system in fire management.
Fire intensity	The quantity of heat liberated in the flame front for every meter of fire width. It is calculated by the Byram Line Intensity Index (I megawatts per meter where I = HWR. *H* is the calorific value of the fuel and can be taken as 17 megajoules per kilogram, *W* is the fuel concentration in kilograms per square meter, *R* is the rate of spread in meters per second).
Fire retardant	Any substance except plain water that by chemical or physical action reduces the flammability of fuels or slows their rate of combustion, e.g., a liquid or slurry applied aerially or from the ground during a fire suppression operation.
Fire risk	Measure of the likelihood that a wildfire will be ignited naturally or through human action.
Flame depth	The distance from the leading edge of the flame front to the point at the back of the flame front just outside the flame mantle.
Forestry	The scientific management of forests and trees for the continuous production of goods and services. Forestry has evolved to include, in many countries, groups of scattered trees, agroforestry plots, urban tree planting, small woodlots, and also wildlands that do not support tree populations. In fact, forestry has evolved from tree management to the management of complex ecosystems, and their utilization.
Forest influences	All effects upon water supply, soil, climate, and health resulting from the presence of forests.

Forest residue	The accumulation in the forest of living or dead, mostly woody, material that is added to and rearranged by human activities such as forest harvest, cultural operations, and land clearing.
Forest type	A descriptive term used to group stands of similar character with regard to composition and development due to certain ecological factors by which they may be differentiated from other groups of stands.
Fuel	All combustible organic material in forests and other vegetation types, including agricultural residue.
Fuelbreak	Generally wide (20-30 m) strips of land on which either less flammable native vegetation is maintained and integrated into fire management planning, or vegetation has been permanently modified so that fires burning into them can be more readily controlled as distinguished from firebreak. Some fuelbreaks contain narrow firebreaks that may be roads or narrower hand-constructed lines. During fires, they can quickly be widened either with hand tools or by firing out. Fuelbreaks have the advantages of preventing erosion, offering a safe place for firefighters to work, low maintenance, and a pleasing appearance.
Genetic resources	Actual or potential characteristics of plants and animals that are transmitted genetically and may include disease resistance, rapid growth, yield or quality factor, or the presence or absence of a chemical. These characteristics, i.e., genetic diversity, reside in the germ plasm of different cultivars, races, and varieties of a species.
Greenhouse warming	A possible increase in global temperatures associated with changes in atmospheric trace gases.
Ground fire	A fire burning in organic terrain, e.g., dried tropical swamps and peat layers.
Hadley circulation	A north-south circulation of air in low latitudes, with air rising in the intertropical convergence zone and sinking in the adjacent subtropical zone.
Intertropical convergence zone	The zone of persistent convergence of trade wind airflow in the lower troposphere in low latitudes.
Kabupaten	Regency (subdivision of a province, in Indonesia).
Kecamatan	Subregency (district, in Indonesia).
Ladder fuels	Fuels that provide vertical continuity between stratums. Fire is able to carry from surface fuels into the crowns of trees or shrubs with relative ease and help assure initiation and continuation of crown fires.

Land-use capability	The production capacity or usefulness of soil based upon its quality with reference to nutrient status, climatic factors, drainage, degree of slope, etc.
Mass fire	A fire resulting from many simultaneous ignitions. These fires generate high levels of energy output.
Mesoscale	A spatial scale for weather systems with typical horizontal dimensions of ~10-1,000 km.
Nonwood forest products	Consist of goods of biological origin other than wood, as well as services, derived from forests and allied land uses.
Pioneer species	A plant species capable of establishing itself in a bare or barren area and initiating an ecological cycle.
Preattack planning	Fire planning within designated blocks of land, covering the following items: locations of firelines, base camps, water sources, helispots, transportation systems, probable routes of travel, constraints of travel on various type of attack units, determining of construction of particular firelines, the probable rate of line construction, topographic constraints on line construction, etc.
Prescribed burning	The controlled application of fire to wildland fuels in either natural or modified state, under specified environmental conditions that allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to attain planned resource management objectives.
Prescribed fire	A fire burning within prescription. The fire may result from either planned or unplanned ignitions.
Presuppression planning	All measures of fire intelligence and preparedness for fire suppression actions.
Primary forest	Unlogged forest.
Productivity	The relationship between the output of goods and services and the input of resources (factors of production) used to produce them.
Production forest	Forest designated for the sustained production of timber and other forest products, often with protection and/or nature conservation as recognized secondary objectives, chosen because of their potential to provide a yield of high-quality timber in perpetuity. This category may also include degraded areas appropriate for reforestation. In general usage, the term covers natural forests, forest plantations, woodlots, agroforestry plots, homestead forests, etc.
Protection forest	An area wholly or partly covered with woody growth, managed primarily for its beneficial effects on water, climate, or soil

	rather than for forest products or services, and involving fragile lands, critical soils, catchment areas, steep slopes, and land at high altitudes. Controlled sustainable extraction of nonwood forest products is often allowed in protection forests.
Quasi-biennial oscillation	An (approximately) two yearly reversal in wind direction that occurs in a number of parts of the earth's atmosphere.
Radiosonde	A balloon-borne device allowing upper air measurements of temperature, humidity, pressure and/or height, wind speed, and direction.
Rate of speed	The speed that a fire front travels ranges up to 25 kilometers per hour (km/h) for grasslands to about 12 km/h for forests. Most fires travel at much slower speeds and typical speeds are usually less than 1 km/h for grasslands and 0.5 km/h for forests.
Reforestation	Restocking and/or replanting of an area that has been cleared of its forests earlier.
Rotation	The period of years required to establish and grow forest crops to a specified condition of maturity.
Seasonal forest	A closed deciduous forest, or an open forest with continuous grass cover, distinguished from other tropical forests by distinct seasonality and low rainfall. Includes closed forests made up of deciduous hardwoods that shed their leaves during the dry season and woody and/or tree savannahs.
Secondary forest	A forest subjected to a light cycle of shifting cultivation or to various intensities of logging but still containing indigenous trees or shrubs.
Shaded fuelbreak	Fuelbreaks built in forest areas where the trees on the break are thinned and pruned to reduce the fire potential, yet retain enough crown canopy to make it possible to control surface fires more easily.
Shifting cultivation	Farming system, carried out in the forest areas, in which the land is periodically cleared, farmed, and then returned to fallow.
Slash-and-burn agriculture	Farming, (usually small-scale), in which plots are prepared by cutting and burning off vegetative cover.
Smoke management	The application of knowledge of fire behavior and meteorological processes to minimize air quality degradation during prescribed fires.
Stand	An aggregation of trees or other growth occupying a specific area and sufficiently uniform in composition, age arrangement, and condition so as to be distinguishable from the forests or other growth on adjoining areas.
Succession	The gradual supplanting of one community of plants by another. Inherent in the definition are three considerations:

	(i) succession is orderly, directional, and therefore predictable; (ii) succession can occur when the community itself modifies the physical environment so that other populations can be established; and (iii) succession culminates in a relative stable community.
Surface fire	Fire that burns only surface litter, other loose debris of the forest floor, and small vegetation.
Sustainable forest management	Forest management for multiple uses (including biodiversity preservation, timber harvesting, extraction of nonwood products, soil and water conservation, tourism, recreation, and enjoyment of natural amenities) based on an ecosystem concept that allows utilization of forests without undermining their use by present and future generations. Different systems of management would be required for each category of forests depending on the intended output.
Sustained yield	As applied to policy, method, or plan of forest management, implies continuous production with the aim of achieving at the earliest time an approximate balance between net growth and harvest, either by annual or somewhat longer periods.
Sustainable yield:	The measure of material that a resource can yield annually or periodically in perpetuity.
Swidden	See *"slash-and-burn agriculture."*
Trade wind	Low-level tropical easterly winds representing the lower component of the Hadley circulation.
Troposphere	The lowest part of the atmosphere, where temperatures generally decrease away from the surface.
Vegetation fires	Fires in all vegetation types including forests, grasslands, scrublands, and agricultural lands.
Walker circulation	A thermally driven east-west cellular circulation extending across the Pacific Ocean, from Indonesia to close to the Peruvian coast.
Wildfire	Any fire occurring on wildland except under prescription.

APPENDIX 2

Regional Haze Action Plan

(Approved in December 1997)

A. Introduction

1. Smoke haze affected Southeast Asian countries during the dry seasons in 1991, 1994, and 1997. From July to October 1997, members of the Association of Southeast Asian Nations (ASEAN), in particular Brunei Darussalam, Indonesia, Malaysia, and Singapore, were badly affected by smoke haze caused by land and forest fires. The Philippines and Thailand were affected to a lesser degree. The severity and extent of the smoke haze pollution were unprecedented, affecting millions of people across the region.
2. The economic loss suffered by countries during this environmental disaster was enormous and has yet to be fully determined. Several economic sectors, including air, water and land transport, shipping, construction, tourism, forestry, and agriculture, were severely affected. The haze pollution also resulted in a considerable health impact on the people of the countries affected; the long-term health effects have yet to be determined.
3. In June 1995, ASEAN Environment Ministers agreed on an ASEAN Cooperation Plan on Transboundary Pollution. The Cooperation Plan contains broad policies and strategies to deal with transboundary pollution. In light of the latest haze experience, the ASEAN Environment Ministers agreed on a Regional Haze Action Plan (Action Plan), which sets out cooperative measures needed among ASEAN member countries (AMCs) to address the problem of smoke haze arising from land and forest fires in the region.

B. Objectives

4. The primary objectives of the Action Plan are to:
   (i) prevent land and 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 capability and other mitigating measures.

C. Preventive Measures

5. AMCs recognize the need to strengthen national policies and strategies to prevent and mitigate land and forest fires. While some AMCs have already developed their national policies and strategies, others are in the process of advancing them based on their own development needs, priorities, and concerns.
6. AMCs will develop national plans to encapsulate their policies and strategies to prevent and mitigate land and forest fires. The plans should contain the following common elements:
   (i) policies to curb activities that may lead to land and forest fires and control emissions from mobile and stationary sources, including the prohibition of open burning and the strict control of slash-and-burn practices during the dry period;

(ii) strategies to curb activities that may lead to land and forest fires and control emissions from mobile and stationary sources, including the following:
   (a) formulation of air quality management legislation to prohibit open burning;
   (b) strict enforcement of laws and legislation;
   (c) implementation of air quality monitoring and reporting regimes, and setting up surveillance on local sources of emissions, both mobile and stationary;
   (d) establishment of a national task force and/or committee to develop strategies and response plans to deal with fires and smoke haze; and
   (e) utilization of information technology to provide haze-related information to relevant agencies to prevent and control spread of fire, and to enhance public awareness on the haze situation;

(iii) guidelines and support services to discourage activities that can lead to land and forest fires;

(iv) operating procedures for the early mobilization of resources to prevent the spread of fires; and

(v) development of markets for the economic recovery and utilization of biomass (e.g., briquette) and appropriate methods for the disposal of agricultural waste.

7. These national plans were completed by March 1998. An ASEAN workshop was conducted in April 1998 to facilitate cross-comparison of the National Plans and exchange of information, including the exchange of legal experience in managing land and forest fires.

C. Regional Monitoring Mechanisms

8. The Action Plan will strengthen the region's early warning and monitoring system to provide an alert of the first outbreak of land and forest fires, an assessment of meteorological conditions, a prediction of the spread of smoke haze, a systematic tracking of the control and spread of fires and haze, and the necessary data to support enforcement action. As part of this effort, the ASEAN Specialized Meteorological Centre (ASMC) will be further streamlined and strengthened. ASMC will serve as a regional information center for compiling, analyzing, and disseminating information derived from satellite imagery and meteorological data necessary to detect and monitor land and forest fires and the occurrence of haze.

9. ASMC will operate by March 1998 an intranet among the relevant ASEAN meteorological service and environmental agencies to improve communications and enhance the effectiveness of existing early warning and monitoring systems. Information that will be made available on the intranet will include the following: satellite imagery, wind charts, visibility information, air quality information, and other meteorological and environmental information useful for haze monitoring.

10. In early 1998, the ASMC will conduct a regional workshop involving meteorological experts from within and outside ASEAN to discuss climate prediction for the region in 1998-1999. In the longer term, ASMC will further enhance the intranet system by including the following: seasonal climate prediction, haze dispersion modeling products, and a forest fire danger rating index.

D. Firefighting Capability

11. National and regional land and forest firefighting capability will be strengthened through the following measures:

    (i) Complete by March 1998 the ongoing preparation of the inventory of land and forest firefighting capability of each country (agencies, human resources, equipment, available land and forest fire hazard maps, and other resources) and identify resources that can be made available for regional firefighting efforts.

    (ii) Formulate by March 1998 a program to strengthen the firefighting capability of individual countries and the region, and compile a list of equipment and technical expertise that is needed at the regional level to tackle land and forest fires.

    (iii) Identify by March 1998 the sources of technical assistance for within and outside ASEAN and, if required, formalize an assistance program with each donor country. Technical assistance may include forest firefighting equipment, aircraft such as water bombers, and high-tech equipment and experts for command post operations.

    (iv) Establish by June 1998 an operating procedure to activate the deployment of the firefighting resources in each country for regional firefighting operations.

    (v) Establish by June 1998 a mechanism in each country to provide, in the event of an outbreak of land and forest fires, regular updates to the Haze Technical Task Force (HTTF) on progress made in efforts to fight the fires. The updates would include the number of hot spots and their locations, analysis of fire types, problems encountered, adequacy of deployed resources, and effectiveness of enforcement and ground operations.

E. Detailed Scope of Technical Assistance

12. ADB's assistance was sought to provide consultancy services in support of the Action Plan. The scope of the technical assistance is as follows.

13. The following short-term measures will be completed within three months of commencement:

    (i) Compile and analyze ongoing national and regional fire and haze prevention programs with a view to sharing relevant experience, improving coordination, and avoiding duplication of effort. Based on the findings, make recommendations how national and regional fire and haze prevention measures can be improved in the short and medium term.

    (ii) Inventory existing fire management and suppression capabilities in the affected AMCs, and develop technical assistance programs and partnerships within and beyond the region to strengthen these capabilities. (Several international and bilateral organizations had expressed interest during the 1997 fires and haze to offer assistance in this area).

    (iii) Strengthen the capacity of the ASEAN Secretariat, ASEAN Senior Officials on Environment (ASOEN), the working group on transboundary pollution, and the Haze Technical Task Force (HTTF), in the effective delivery of their functions in fire and haze prevention and mitigation.

(iv) Improve information management and dissemination in the ASEAN Secretariat related to fire and haze prevention and mitigation, including the sharing of knowledge and experience, dissemination, coordination, and monitoring of national, regional, and international initiatives with institutions concerned in the region. This includes the establishment and maintenance of an intranet between institutions in the region and a public information service through the ASEAN worldwide web home page.

(v) Compile initial results of ongoing studies on the impact of transboundary atmospheric haze pollution on affected ASEAN countries, collect additional information where required, and compile a comprehensive impact assessment covering all economic sectors concerned as well as social (including health related), and environmental impacts. Detailed assessment would be carried out over the medium term.

(vi) Compile and analyze existing policies and legislation in countries concerned regarding sustainable land-use practices with and without the use of fire for land clearing, and recommend appropriate changes.

(vii) Compile experience within and beyond the region with fire prevention and control, including land-clearing fires and wildfires, mitigation strategies, etc., and document relevant lessons learned.

(viii) Based on the outcome of the above items (i-vii), provide assistance to the HTTF in finalization of the Action Plan, identification of institutions responsible for various implementation actions, including institutionalized monitoring and review of policies, strategies, legislation, guidelines, early warning pertaining to fire danger and potential pollution hazard, personnel mobilization for prevention of spread of fires, and other aspects of the Action Plan; and providing regular updates to members concerned on the progress of actions taken or pending and need for follow-up actions.

14. The following medium-term measures will be completed within 12 months (several of these measures will be initiated concurrently with the short-term measures):

(i) Strengthen the capacity of ASMC in Singapore to compile and analyze available ground, atmospheric, and remotely sensed data on land and forest fires, haze, related climate and weather patterns, and other relevant environmental parameters, in collaboration with national meteorological agencies, and to disseminate the information, including early detection and warning through established institutional arrangements with national agencies concerned. The collaboration with national agencies is particularly necessary to compile data from a larger geographical area.

(ii) Compile available information within and beyond the region regarding the use and marketing of biomass and logging residue products, such as briquettes, mulch, and compost. This includes a study of market-based instruments to promote such products and thereby stimulate mechanical land-clearing methods.

(iii) Taking due account of various national and regional initiatives, evaluate the existing and proposed systems pertaining to fire danger rating, and fire detection and monitoring: based on these initiatives and the information thus generated, promote the development of land and forest fire hazard maps, and standardized national and regional fire danger rating and fire detection and monitoring systems.

(iv) Develop regional training programs, exchange visits, secondments, partnerships, joint training exercises, in fire management, remote sensing of fires and haze, the application of geographic information systems (GIS), and other priority subjects.

(v) Compile the results of ongoing studies on the impact of transboundary atmospheric pollution on affected AMCs, collect additional information where required, and compile a comprehensive impact assessment covering all economic sectors concerned as well as social (including health related) and environmental impacts. The assessment would include the results from the national impact assessment in Indonesia financed under the complementary advisory technical assistance. It would compare the impact of the 1997 fires and haze with that of previous episodes, and would provide scenarios of possible future impact according to the level of concerted preventive action taken by affected AMCs.

(vi) Develop technical assistance programs and partnerships to undertake scientific studies to improve the monitoring and prediction of transboundary atmospheric pollution, including analysis of the chemistry of emissions, climate, and meteorological patterns affecting pollution formation and dispersal. Such programs would likely involve ASMC, national institutions in AMCs, and partner institutions within and beyond the region, including the World Meteorological Organization and interested bilateral organizations. This would be based on an inventory and analysis of ongoing and planned scientific studies related to forest fires and haze. The project would financially support selected studies to improve the knowledge of haze formation and distribution. One such study could gather information on the chemistry of emissions of land-use fires, to support the haze transport modeling being undertaken by ASMC.

15. Based on the outcome of the above items (i-vi), and in support of and complementary to the earlier developed Action Plan, develop a comprehensive time-bound plan for prevention, monitoring, mitigation, and institutional strengthening, identifying required investments, both at the national and at the regional levels.

16. HTTF will meet monthly to review the progress of implementation of the Action Plan. The ASEAN Environment Ministers will meet regularly to provide guidance on implementation of the Action Plan.

APPENDIX 3

Procedure for Formulating and Implementing Fire Suppression Mobilization Plans

Fourteen Steps for Implementing FSMPs

1. The first step in the exercise is formulation of the initial FSMP document. This requires dispatching a team of fire management specialists with expertise in FSMP drafting to the geographic area to which the FSMP relates. The FSMP drafting team must at the minimum meet with all agencies, organizations, and groups that might cooperate in fire suppression activities in the area. These are likely to comprise local representation of government agencies, nongovernment organizations (NGOs), civic organizations, religious groups, and virtually anyone wishing to cooperate in community-based fire suppression activities.
2. Agreement in principle must at this stage be achieved by all parties that have agreed to cooperate in implementing the FSMP. Without their later support, fire suppression activities will most certainly be compromised. During this step, FSMP formulation comprises the writing out of all resources (personnel, fire suppression tools, communications equipment) available for mobilization in the geographic area to which the particular FSMP relates. The model FSMP is used as a template for this purpose.
3. The output of this step is an initial draft of the FSMP document. *Initial FSMP documents are rarely "complete," in the sense of describing all of the implementation details of upgraded fire management capacity in the geographic area to which they relate.* The initial FSMP document instead describes how *existing* fire suppression resources could most efficiently be mobilized. The actual procedures for organizing and mobilizing fire suppression resources in the geographic area in question are sorted out as part of the overall FSMP exercise. The sorting out of standard operating procedures (SOPs) for mobilizing existing resources in the most efficient manner possible takes place during the FSMP exercise. As these SOPs are sorted out, the initial FSMP document is amended to reflect the SOPs and other measures for improving efficiency of fire suppression activities in the geographic area to which the FSMP relates.
4. The initial FSMP could therefore correctly be thought of as a vehicle for arriving at a destination (i.e., efficient fire suppression operations using existing resources), rather than as a destination in and of itself. In short, FSMPs are meant to evolve as the exercise proceeds, rather than sketching out in advance a description of the evolved fire suppression capacity that is the goal of the FSMP exercise. Thus, while a base time frame for formulation of an initial FSMP document would be somewhere of the order of 2-20 weeks, a best-case scenario time frame for completing the FSMP exercise would be a minimum of 18-24 months.
5. The second step in the FSMP exercise is to put into place an iron-clad, detailed inventorying and tracking system for all equipment and personnel that will be mobilized when the

mobilization plan is activated. This system *must* be sustainable without outside support. The recording system to be used in the Borneo and Sumatra cases should assume a complete lack of computer facilities. Manual recording should thus be assumed to be the basis of the inventorying and tracking system.

6. While at first glance such a system might seem technologically unsophisticated, this is the system used successfully for inventorying and tracking equipment and personnel in several countries with advanced wildland fire suppression capability. Until recently, computer-based systems were used as an adjunct to such manual recording systems. Manual-recording-based inventorying and tracking systems can function efficiently, and are often the best means of mobilizing resources from neighboring jurisdictions.
7. Computerized or not, *all* inventorying and tracking systems must—at the minimum—include the following information for each piece of fire suppression equipment: description, model number and specification; current status (available, unavailable, or committed); exact location; and most important, the contact information for the person authorized to release the piece of equipment in question. A similarly-detailed inventorying and tracking system must be put into place to catalogue contact information for personnel.
8. Once the inventorying and tracking systems for equipment and personnel have been put into place, the third step is undertaken, which is to conclude simple, written interagency agreements among all parties that have agreed to participate in the plan. This is perhaps the critical step in the FSMP exercise, since the details of how each agency cooperates in fire suppression activities must be agreed upon and specified *in writing* well in advance before addressing any fire emergency the FSMP is to address.
9. The fourth and fifth steps comprise the formulation and execution of a desktop mock drill, or Tactical Exercise without Troops (TEWT [pronounced "toot"], to use the correct fire suppression terminology). Formulating a TEWT is a more extensive process than executing a TEWT, and therefore is likely to require external expertise (either from a Subregional Firefighting Arrangement [SRFA] member country or an international fire management agency). The purpose of the TEWT is to test the adequacy of the FSMP, and to determine how it should be revised so as to strengthen it. TEWTs are preferred to real-world mock drills in the Association of Southeast Asian Nations (ASEAN) setting, since they can adequately point out weaknesses in existing FSMPs.
10. Following execution of the TEWT, the sixth step is undertaken, which is revision of the FSMP, so as to address any weaknesses uncovered by the TEWT. The seventh step is then ratification of the TEWT. The eighth step comprises formulating and implementing an annual review of the FSMP.
11. The 9th, 10th, 11th, and 12th steps pertain to formulating a program for upgrading of fire suppression capability under the auspices of the FSMP to an objectively-defined, predetermined level. The ninth step involves determining the personnel and training requirements for executing the upgrading program, while the 10th and 11th steps comprise determining the equipment and communications requirements for executing the upgrading program.
12. The 12th step is formulation of the upgrading program, which requires time, since all details of procurement, payment, inventorying, training must be transparently stated in the program.

13. The 13th step is the execution of the upgrading program, which includes the assimilation of all new equipment and training into the inventorying and tracking systems for equipment and personnel.
14. The 14th and final step is incorporating provisions for sustaining the FSMP over time.

(A summary outline of generic FSMP is given as Attachment 1)

Attachment 1

Summary Outline of Generic FSMP

Section 10 Objectives, Overall Procedures, and Participating Agencies
- 11 Objectives
- 12 Overall Procedures
- 13 Participating Agencies

Section 20 Administrative Procedures
- 21 Terminology
- 22 Scope of Operations
- 23 Levels of Coordination
  - 23.1 Communications Procedures
  - 23.2 Reporting Procedures
  - 23.3 Procedures Governing the Use of Satellite Imagery
- 24 Dispatch Procedures
  - 24.1 Mobilization
  - 24.2 Safety
  - 24.3 Accident and Incident Reporting
  - 24.4 Requests for Assistance
  - 24.5 Financial Procedures
  - 24.6 Demobilization Procedures
- 25 Incident Priorities
- 26 Aircraft Operations
  - 26.1 Procedures Governing Aircraft Operations
  - 26.2 Communications
  - 26.3 Funding Arrangements

Section 30 Organization

Section 40 Cooperation
- 41 Cooperative Arrangements

Section 50 Directory

Section 60 Personnel

Section 70 Equipment
- 71 Fire Suppression Equipment
- 72 Radio Equipment
- 73 Specialized Equipment

Section 80 Aircraft Inventory (if any)

APPENDIX 4

Fire Danger Rating Systems

Introduction

There are several fire danger rating systems (FDRS) available globally. They are, however, not being proposed for the Association of Southeast Asian Nations (ASEAN) region and will not be considered here. It is sufficient to say that most of these systems are fairly complex systems designed for the fuel types, soil behavior, and atmospheric conditions characteristic of their regions. Furthermore, some systems would require specific inputs that may not be readily available in the region or may entail additional measurement techniques.

The purpose of a FDRS is to alert the relevant authorities to a buildup of a seasonal fire risk so that appropriate preventive measures can be taken to reduce fires. In the tropics, the single most important factor that can lead to a buildup of fire risk is a deficit of rainfall. Vegetation that is moist is not susceptible to fire or does not burn easily. However, in the absence of rainfall, vegetation will start to dry out and fire risk increases. The extent of the drying out of the vegetation should be conveyed by a suitable fire risk index. Factors that can also affect the drying out process are temperature, wind, and humidity. In the tropics, these three factors do not vary significantly and may not add new information to a fire risk index.

An appropriate FDRS for this region needs to be:

1. simple and intuitive,
2. easy to implement,
3. economical to maintain,
4. requiring minimal input data,
5. yielding easy classification of fire risks, and
6. flexible for further development and expansion.

Canadian Fire Danger Rating System

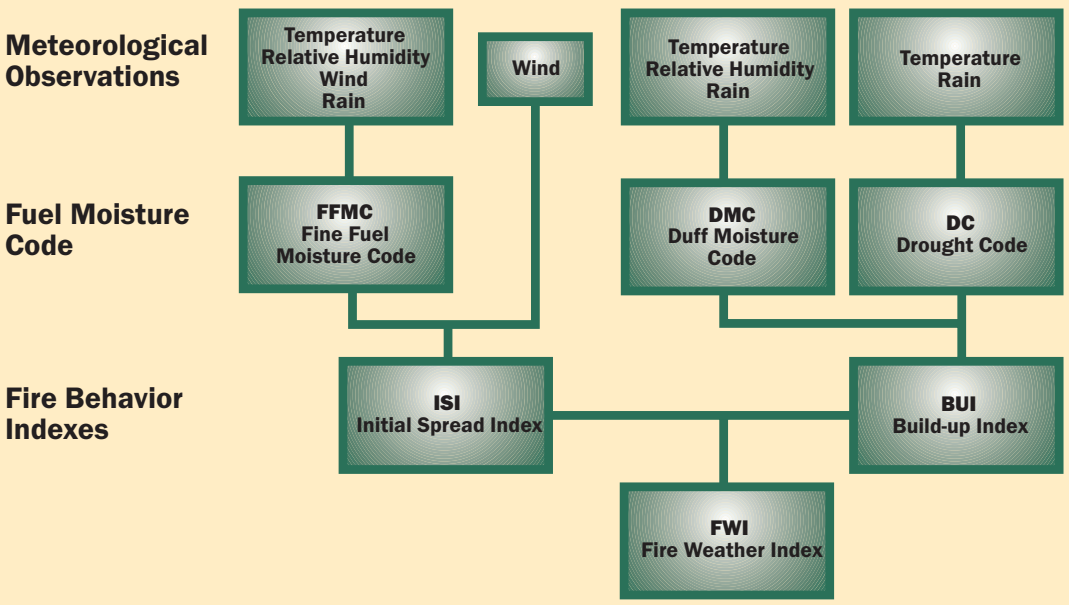
The Canadian system is a comprehensive FDRS consisting of five components. It is also the most complex system that is proposed and comprises five subsystems:

1. Fire Weather Index system,
2. Fuel Classification and Maps,
3. Fire Behavior Prediction system,
4. Wildfire Threat Assessment, and
5. Fire History.

Although there are five subsystems, the first component is considered the most important module of the whole system and can adequately perform as a stand-alone system. The inputs to this component are temperature, relative humidity, wind, and rainfall. (Refer to the flow chart overleaf for calculation of the fire weather index.)

The flow chart suggests that three important fuel types contribute to the computation of the final index. However, these fuel types are probably not applicable to the region and the appropriate fuel components need to be identified for the index to work properly. It could be a lengthy

FIGURE 5 Flow Chart of Canadian Forest Fire Weather Index System



Source: RETA 5778: *Strengthening the Capacity of the ASEAN to Prevent and Mitigate Transboundary Atmospheric Pollution* Draft Final Report.

exercise to determine moisture characteristics of tropical forests, plantations, peatswamps, etc., for the region. If it is recognized that the majority of forest fires are due to human activities, such a study while useful in the long term, may not address the immediate needs of the region.

The implementation of the index requires investment in new computing resources and extensive adaptation studies of the index to the region. Furthermore, the maintenance of the system within the Indonesian or ASEAN context may not be feasible.

Keetch-Byram

The Keetch-Byram Drought Index (KBDI) was originally developed to describe the dryness of fuels in the southeastern United States. It is basically a cumulative or bookkeeping index. To use the index requires heavy rainfall exceeding 200 millimeters when the index is set to zero. Subsequently, on a daily basis, an amount is *subtracted* (to represent drying by evaporation during the last 24 hours from a look-up table) on a no-rain day or the rainfall equivalent is *added* if there has been rain during the last 24 hours. The other meteorological inputs are maximum temperature and relative humidity.

The advantage of the KBDI is its simplicity of usage and familiarity among fire managers. The KBDI has been used by the Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) for East Kalimantan for some years already. The ASEAN Specialized Meteorological Centre (ASMC) is testing a trial system of the KBDI for Sumatra and Kalimantan.

The disadvantage is that there has not been any rigorous validation or calibration of the KBDI either in the tropics or elsewhere outside the region of the southeastern United States. It assumes

a maximum of 2,000 for the index and drying factors of the fuel, forest type, and soil structure similar to those of the southeastern United States. This is not strictly correct since the drying force of a dry and arid environment would be different from the moist and hot environment of the tropics. Without a proper recalibration of the drying tables, the KBDI will seriously overestimate the fire risk in the tropics. However, some compensation has been incorporated in the KBDI by having different drying tables based upon average rainfall, assuming that more humid environments have a higher rainfall.

Despite its weaknesses, it is a simple and intuitive index. The input meteorological parameters are readily available to ASEAN National Meteorological Services and can be easily computed with existing resources. ASMC can extend the KBDI to other parts of ASEAN when the trials have been completed.

Rainfall Debt

The Report of the ADTA INO 2999 recommends the use of a rainfall debt as an early warning indicator of fire risk. In the tropics, where maximum temperature and relative humidity do not vary significantly from day to day, the information content of an index is not substantially increased by incorporating these two parameters. Similar arguments apply to wind and other classic parameters of a fire danger model.

The most important parameter is the last 24-hour rainfall. Solar radiation as expressed through cloudiness may affect evaporation rates to some extent and should be evaluated for its contribution to the rainfall debt.

The calculation of this simpler index consists of subtracting the 30-day running rainfall total against the normal monthly mean rainfall. This rainfall deficit can then be expressed as a percentage of the normal monthly mean rainfall. Thereafter, this value is to be known as rainfall debt.

Rainfall debt is an intuitive concept and relates to the relative dryness of a region with respect to its monthly mean rainfall. At selected rainfall debt levels, fire risk warning levels can be triggered and relevant authorities can take the appropriate action. Such a value can be easily calculated as long as one has daily rainfall measurements in the region.

The rainfall debt concept is still in its developmental stage for the region and has to be evaluated for its appeal and effectiveness as a fire risk indicator. The rainfall debt values can be evaluated for a period of several months prior to the haze in 1997 until several months after the haze in 1998. The exercise could determine the rainfall debt levels appropriate to trigger heightened fire risk level warnings to be set in place.

Recommendations

The recommendations of the ADTA and RETA 5778 are for the KBDI and Rainfall Debt to be implemented concurrently. The KBDI is readily acceptable to fire managers and is already being operationally implemented in East Kalimantan by GTZ. ASMC is evaluating the KBDI against the haze of 1997 and 1998 for the regions of Kalimantan and Sumatra.

Simultaneously, a trial is being carried out to operationally calculate the KBDI for Kalimantan and Sumatra using daily meteorological data. ASMC has carefully selected a list of stations on Kalimantan and Sumatra that have available daily rainfall and maximum

temperature data to compute the KBDI. The number of stations will be expanded when more data become available.

Rainfall debt is a new suggestion but the concept is simple and practical. It is likely to gain acceptance in the region because it is easy to implement and economical to maintain. Further, fire risk associated with rainfall deficit is intuitive as well as common knowledge. ASMC can evaluate the rainfall debt for the haze of 1997 and 1998 in order to assess its suitability as a fire risk indicator. If the evaluation is positive, the rainfall debt can be first implemented by ASMC for Kalimantan and Sumatra. At a later stage, the rainfall debt computation can be expanded to other ASEAN member countries (AMCs).

Technical Expertise and Training Requirements

Both KBDI and Rainfall Debt can be easily implemented by national meteorological services. The meteorological data required is already available on a daily basis, and past climatological data can be used to evaluate the effectiveness of the indexes in each country. ASMC can provide basic training, if any is necessary, to help set up the capability in individual AMCs.

Source: RETA 5578: *Strengthening the Capacity of the ASEAN to Prevent and Mitigate Transboundary Atmospheric Pollution* Draft Final Report.

APPENDIX 5

Donor and Partnership Activities

There has been a general concurrence throughout the Operationalized Regional Haze Action Plan (ORHAP) process that the fire-and-transboundary-haze issue confronting the Association of Southeast Asian Nations (ASEAN) region is a problem that is so large that no single agency can address it. Funding agencies have been equally aware of this fact throughout the fires and haze that have impacted the region over the past two decades. In fact, donors have provided a substantial amount of funding to short-term suppression activities. While this has no doubt been appreciated by the ASEAN member countries (AMCs), sustained funding of short-term fire suppression over an indefinite period is neither feasible, nor would it be an efficient use of scarce funding or affected-country resources.

The challenge now is to use the intervening period between the end of the recent *El Niño* and the onset of the next to put into place an institutional framework that will prepare the ASEAN region for subsequent periods of vulnerability to fires and transboundary haze. This preparation should enhance ASEAN's capability to manage periods of heightened risk of large-scale fires without resorting to a crisis management mode of response, as it did during the 1997-1998 fire-and-haze disaster.

Accomplishing this will require funds to be used as efficiently as possible. This means that the role of the funding agencies in addressing the fire-and-haze issue will also have to evolve. In short, fire-and-haze-related activities must now be integrated via explicit partnerships, rather than simply becoming aware of "what other funding agencies are doing about the fires and haze."

A start has been made in this direction by integrating funding agencies' activities directly into the RHAP Detailed Implementation Plan (DIP). When used as it was intended, the DIP places the onus of developing an integrated operational plan for confronting the fire-and-haze issue directly on to the AMCs and ASEAN itself. Once the ASEAN region has determined the actions it needs to take to address fires and transboundary haze, the financial costs of these actions can be determined, and the areas where gaps between available AMC resources and requirements exist can be identified. At this point, it is appropriate for funding agencies to determine which of these gaps they can most efficiently fill, given their particular emphasis or area of expertise. The scenario described directly above is the manner in which the funding agencies can most effectively make use of the RHAP DIP.

Because of the urgency of the fire-and-transboundary-haze issue, RETA 5778 temporarily performed the dual role of operationalizing the concept of DIP as a planning tool, and simultaneously catalyzing integration of fire-and-haze-related funding agency activities directly into the emerging ORHAP DIP. Once the plan is fully operationalized, it is more important to manage the information necessary for funding agencies to be able to use the ORHAP DIP as their own planning tool.

Several funding agencies have become directly involved and integrated into the ORHAP DIP process. The activities of these donors are briefly described (in alphabetical order by donor

name) below, in order to make funding agencies new to the ORHAP DIP process more conversant with the roles that those already involved are playing, and how these roles fit into the overall ORHAP DIP.

* * *

Australia announced a contribution of A$660,000 to the ASEAN fire-and-transboundary-haze initiative in late July 1998. These funds were to be used to support three separate components. First, a contribution of $100,000 equivalent will be used to directly support the ADB RETA Project's program of activities, and will include funding for three applied studies: (a) Operationalization and Refinement of AMC National Haze Action Plans, with particular reference to Indonesia; (b) Formulation of a Fire Mitigation Training Program for the ASEAN Region; and (c) Formulation of an operating procedure for activating fire suppression resources in AMCs, with particular reference to Indonesia (other outputs, including formulation of possible long-term solutions to the fire-and-haze issue, and a broad-brush plan for upgrading Indonesia's communication infrastructure for fire suppression, will also be generated by this study).

The second component of Australia's contribution will support component 1 of the Programme to Address Regional Transboundary Smoke (PARTS), which was formulated by the World Meteorological Organization (WMO). PARTS component 1 will increase ASEAN's capability in using satellite monitoring to prevent, detect, and track fires and haze in the region. Support for this component will be channeled through the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP). The third component of the Australian contribution (now being programmed) will support fire mitigation activities, or more likely, training of firefighters.

* * *

BIOTROP-GCTE Impacts Center for Southeast Asia (IC-SEA) is now actively studying the many facets of the link between national level economic and natural resource policy with the use of fire as a tool for land-clearing or a weapon. Three studies of this type are ongoing and a fourth study on the health impacts of haze will integrate the work that Deutsche Gesellschaft fur Technische Zusammenarbeit (GTZ) and the World Health Organization (WHO) have done in this area.

* * *

The **Canadian International Development Agency** (CIDA) is preparing a system for implementation of its Fire Danger Rating System (FDRS) in the region. This system, which includes fire risk mapping, will initially be implemented in three AMCs: Indonesia, Malaysia, and Singapore. In order to ensure AMCs' ownership of the system, counterpart funding will account for about half of total direct implementation costs.

* * *

The **European Union** (EU) is linking activities under its ongoing Forest Fire Prevention and Control Project with activities of the SRFA-Sumatra. This project operates at community level and includes training, satellite monitoring, early warning and fire danger rating, and other activities. The early warning and/or fire danger rating system is being integrated with CIDA's FDRS described.

* * *

GTZ has an ongoing Integrated Forest Fire Management Project (IFFM) in East Kalimantan that includes numerous components, one of which is fire danger rating. Like the EU early

warning system, the GTZ system is being integrated with CIDA's FDRS. GTZ is also actively involved with the Consultative Group on Indonesian Forestry in numerous forestry policy areas, and has ongoing work on the health impacts of haze in Indonesia.

* * *

Hanns Seidel Foundation (Germany) is directly supporting the activities of RETA 5778 by providing the costs of air transport and sponsorship for three German interns (two to six person-months each) that will work together with the Project Management Unit (PMU) specialists in the areas of forest fire management, information management, and policy and legislation analysis.

The newly-established Southeast Asia Fire Monitoring Center (University of Freiburg, Germany) is planning to link up with ASMC and activities of the ORHAP.

* * *

Japan International Cooperation Agency has a satellite monitoring initiative based in Kalimantan, and a community-based Forest Fire Prevention and Management Project (FFPMP) in Indonesia.

* * *

The **United Nations Environment Programme** is supporting a number of activities relating to operationalization of the RHAP via its Emergency Response to Southeast Asian Fires Project. Major components supported by this $750,000 project include: (a) funding agencies' coordination, (b) an international meeting for organizing short-term fire suppression activities, (c) aerial surveillance operations under the SRFAs, (d) training for firefighters, (e) public awareness, and (f) early warning and/or fire danger rating. Component f will complement and be integrated with the CIDA FDRS.

* * *

United States is supporting operationalization of the RHAP via its Southeast Asian Environment Initiative (SEA-EI). The SEA-EI includes two components: (a) a regional component that will support 10 subprojects, for a total amount of $4 million, and (b) an Indonesia-only component, for a total amount $2 million.

The SEA-EI's regional component, each of which will be implemented by a US Government agency, includes the following subprojects: (1) upgrading of ASMC's capacity in climatological forecasting (US National Oceanic and Aeronautics Administration [NOAA]); (2) upgrading of ASMC's capacity in haze transport modeling (Environmental Protection Agency [EPA]); (3) upgrading of ASMC's capacity in haze monitoring (EPA); (4) analysis of the health impacts of haze (EPA); (5) guidelines on the health impacts of haze (Center for Disease Control and Prevention [CDCP]); (6) technical assistance on peat fire suppression (US Forest Service); (7) technical assistance on coal seam fire suppression (Office of Mines, US Department of the Interior); (8) reduced impact timber harvesting (to make logged forests less vulnerable to fire) (US Forest Service); (9) support to the Asian Disaster Preparedness Centre, Bangkok (US Office of Foreign Disaster Assistance); and (10) analysis of the impact of the 1997-1998 Fires and Haze (partial funding to a project undertaking this work that will be performed by the Centre for International Forestry Research in conjunction with the International Center for Research in Agroforestry, both located in Bogor, Indonesia). The regional component also supported provision of a forest fire management expert from the US Forest Service directly to the PMU, who worked together with the regional technical assistance forest fire management specialist.

WHO prepared Guidelines on the Health Impacts of Haze, which will be valid worldwide for all haze generated by large-scale land and forest fires.

* * *

WMO has formulated PARTS (described above), and is actively involved in numerous activities that support upgrading of the ASEAN Specialized Meteorological Centre (ASMC). These activities include a series of workshops on transboundary atmospheric pollution, the first of which was held in Singapore on 2-5 June 1998.

* * *

The World Bank has rechanneled $300,000 in unused funds from an earlier project with the BAPEDAL, Indonesia. These funds will now be used for three initiatives relating to fires and haze, one of which is formulation of a proposal for an ASEAN-wide Firefighting Training and Research Center at the University of Palangkaraya, Indonesia.

* * *

The wide-ranging support described above is clear evidence of funding agencies' commitment to address the problems related to the forest fires and associated transboundary haze. It augurs well for the ORHAP. Nevertheless, numerous gaps still remain, as is apparent from even a casual analysis of the DIP. This would point to the need for enhanced and targeted funding agency support and collaboration. As all participating funding agencies will ultimately have access to the intranet version of the ORHAP, the opportunities available and the roles each can play will become increasingly apparent (see Attachment 1).

Attachment 1

Updated Position of Funded Projects in Direct Support of ORHAP Implementation (catalyzed by the Asian Development Bank Regional Technical Assistance Project)

AusAID

1. Three-component program of support to ASEAN in addressing fires and transboundary haze (A$660,000);
   - $100,000 (A$160,00) direct to RETA-PMU to support:
     - Study on Formulation of Operating Procedure for Activating Forest Firefighting Resources in the ASEAN Region with Particular Reference to Indonesia. (Mitigation)
     - Study on Training in Fire Management in the ASEAN Region. (Mitigation)
     - Applied Study on Formulation of National Haze Action Plans with Particular Reference to Indonesia. (Mitigation)
   - A$200,000 direct support to training in fire management (with option to switch these funds to the component directly below. (Mitigation)
   - A$300,000 direct support (via UN-ESCAP) for implementation of PARTS component 1. (Monitoring)

2. Direct support (provision of one forest fire management specialist) to the Inventory and Assessment of Fire Management Capacity in the ASEAN region. (Mitigation)

CIDA

1. Funding of a feasibility study on a Fire Danger Rating System for the ASEAN Region. (Prevention)
2. Direct support (provision of one forest fire management specialist) to the inventory and assessment of fire management capacity in the ASEAN region. (Mitigation)
3. Funding of implementation of the Haze Technical Task Force (HTTF)-endorsed Fire Danger Rating System for the ASEAN Region. (Prevention)

EU

1. Direct support in the form of backstopping to the Inventory and Assessment of Fire Management Capacity in the ASEAN Region. (Mitigation)
2. Direct support in the form of backstopping to the formulation of Prototype Fire Suppression Mobilization Plans for critical districts in Riau and South Sumatra Provinces. (Mitigation)

GTZ

Implementation of a study on the health impacts of haze in Indonesia. (Prevention)

Hanns Seidel Foundation

Catalyzing of interns from the University of Passau that provided direct general support to RETA PMU, and direct support in the form of backstopping to the Inventory and Assessment of Fire Management Capacity in the ASEAN Region. (Mitigation)

WHO

Convening of a Workshop on the Health Impacts of Transboundary Haze Pollution in the ASEAN region. (Prevention)

WMO

Convening and cofinancing (with RETA 5778) of a workshop on Transboundary Atmospheric Pollution in the ASEAN Region. (Monitoring)

UNEP

Provision of experts in international legal instruments relating to negative environmental effects. These experts wrote the concept paper for a Framework Agreement on Transboundary Pollution in the ASEAN Region, as well as terms of reference for a feasibility study on Formulation of a Framework Agreement on Transboundary Pollution in the ASEAN Region. (Prevention)

USAID

Implementation of the Southeast Asia Environment Initiative, which included 10 subprojects as follows:

Related to Prevention Program of ORHAP

- Strengthening Capacity in Disaster Readiness in the ASEAN Region (with the Asian Disaster Preparedness Center).
- Analysis of the Human Health Impacts of Transboundary Haze in the ASEAN Region during the 1997-1998 fires and haze (US EPA).
- Identification of a further research agenda on the Human Health Impacts of Transboundary Haze in the ASEAN Region (US CDCP).

Mitigation Program of ORHAP

- Technical Assistance to Development of Techniques for Coal Seam Fire Suppression in the ASEAN Region.
- Technical Assistance to Development of Techniques for Peat Fire Suppression in the ASEAN Region.
- Strengthening Fire Management Capacity in the ASEAN Region (three components).
  - Direct support to RETA-PMU in the form of assistance to the RETA Forest Fire Management Specialist.
  - Funding and provision of six senior fire management experts for the Inventory and Assessment of Fire Management Capacity in the ASEAN Region.
  - Funding and provision of six senior fire management experts for the formulation of Prototype Fire Suppression Mobilization Plans for critical districts in Riau and South Sumatra Provinces.

Monitoring Program of ORHAP

- Provision of financing and technical expertise for implementing PARTS component 2 (US NOAA with ASMC).
- Provision of financing and technical expertise for implementing PARTS component 3 (US NOAA with ASMC).
- Study on the formation, transport, and dispersion of transboundary haze pollution in the ASEAN region (US NOAA with ASMC).
- Study on strengthening the monitoring of transboundary haze pollution in the ASEAN region (US NOAA with ASMC).

APPENDIX 6

Outline of the Haze Action Online and Some Aspects of the Design Standards

Part I. Outline of the Haze Action Online

Introduction

The Operationalized Regional Haze Action Plan (ORHAP) is a complex undertaking. Apart from the regional level plan, it involves implementing the nine (soon to become 10) National Haze Action Plans (NHAPs) and two (and possibly more) Subregional Firefighting Arrangements (SRFAs). Separate Detailed Implementation Plans (DIPs) (12 soon to become 13) have been correspondingly formulated to supplement each action plan and to help determine the minimum implementation strategy of actions, activities, and funding and investment requirements necessary to implement the ORHAP. While the various Action Plans and their corresponding DIPs provide a medium-term accounting and projection of efforts required to mobilize the ORHAP, a six-year implementation program has also been established to strengthen regional fire suppression capacity, principally through Fire Suppression Mobilization Plans (FSMPs) and SRFAs.

Three high-level Association of Southeast Asian Nations (ASEAN) bodies (ASEAN Ministerial Meeting on Environment [AMME], ASEAN Ministerial Meeting on Haze [AMMH], and ASEAN Senior Officials on Environment [ASOEN]) are accountable for ORHAP implementation, while specialized ASEAN agencies and subgroupings (the ASEAN Secretariat, the Haze Technical Task Force [HTTF], the three HTTF lead countries, the HTTF Working Groups of SRFA-Borneo and SRFA-Sumatra, and ASEAN Specialized Meteorological Centre [ASMC]) are responsible for technical implementation of the ORHAP. Also included are the national meteorological services (NMS), the national fire suppression agencies, the national disaster coordination authorities, funding agency collaborative partnerships, nongovernment organizations (NGOs), and private sector organizations. Within the ASEAN Secretariat alone there are six different units that collect and disseminate fire-and-haze-related information.

The key informational materials of this operational structure and framework comprise the following constituent elements:

- RHAP umbrella document;
- ORHAP document elucidating the general strategy and guidelines for RHAP implementation along with a six-year operational program;
- DIP of the ORHAP;
- DIPs for the SRFAs (Borneo and Sumatra);
- DIPs for the NHAPs (for all ASEAN member countries);
- Fire Suppression Mobilization Plans (FSMPs);
- Inventorying and Tracking System for Fire Suppression Resources;
- ASMC-Centered Monitoring and Hydrological-Meteorological Information System;

- collaborative partnership programs and projects; and
- framework of international agreements and protocols.

The documents and informational materials can be categorized into formalized (dynamic and static), nonformalized referenced, and nonformalized, plus other information and data sets. The complexity of the ORHAP operational framework necessitates a carefully planned and designed information technology solution. For this purpose, the establishment of an Information Management System (IMS) is highly necessary and feasible. The IMS will be at the core of the Regional Information Center and Clearinghouse. Details of the requirement analysis, logical and physical design, conversion requirements, and implementation are provided.

Requirement Analysis

External connectivity through the Internet allows for the exchange of data interactively. The Internet is recognized as a reliable medium to share data of all types. It is also possible to utilize the Internet for secure data transmission cost-effectively by utilizing the "intranet" aspect (ADB/ASEAN 1999).

Feasibility of Intranet Utilization

The term intranet defines a computer network, or the sum of several networks in a certain geographical area, which runs on the Internet protocol. This approach enables the use of the same type of data servers and data browsers used for the World Wide Web for internal applications distributed over a Local Area Network (LAN), or Wide Area Network (WAN). Because intranets are based on the Internet protocol, they are platform-independent. Hence Windows, Macintosh, Novell, and UNIX networks can all share information by overlying TCP/IP on their existing network transmission protocol. In economic terms and because of this feature, intranets are generally inexpensive to implement. The majority of HTTF member countries, their focal points, key supporting agencies, and the ASEAN Secretariat have Internet connectivity, making the use of the Internet as a way of networking, broadcasting and transmission, and database management highly feasible. All information, data sets, and databases of the IMS could be adopted to suit Internet technologies.

Logical Design

The IMS study of RETA 5778 recommends the bifurcation of the IMS into a publicly accessible Internet system and a virtual private network utilizing the Intranet. Internet technologies make it possible for such a system to reside in one web site. The focus here is on the requirements for an intranet system, which will be the most vital component in direct ORHAP IMS implementation.

To implement an intranet within any organization it is important to distinguish between two distinct components: content and transport. The term "content" describes the actual data distributed through the intranet, while the "transport" is the mechanism that carries the data from its origin to its destination(s). Virtually all the information systems identified can be computer-automated, but certain systems comprise of, or are supplemented by, a manually driven system.

Physical Design

There are several design options in linking the ASEAN bodies responsible for ORHAP implementation. These are summarized in the following table:

TABLE 6 **Design Options**

Type	Advantages	Disadvantages
Dedicated connection (leased line circuit between Secretariat and other countries)	High level of security; high speed	Very high cost
Internet connection	Good security with secure-server software; low cost	Lower speed than dedicated connections (depends on country access speed, in most case acceptable)
Internet connection with tunneling protocol	Security almost at same level of dedicated connection; low cost.	Lower speed than dedicated connection (depends on country access speed, usually acceptable)

The table shows the most common solutions. Initially, the system can be operated by restricting external users access through user name and/or password requirements. Once the intranet is in place, external users can access the information and update database forms through a log on process. This is usually secure enough for piloting purposes. After the system is stabilized, the LAN manager can install a tunneling protocol for additional security. A tunneling protocol is a set of data transmission rules that establish a virtual "pipe." Data can then be securely moved inside the pipe between two points. Although the pipe itself is not considered secure, the data it contains are accessible only from the originating and destination points. Tunneling protocol is used today to establish inexpensive Private, Virtual Networks (PVNs) using regular Internet Service Provider (ISP) networks.

A specialized ASEAN Internet and intranet web site without a tunneling protocol, based on a Windows NT operating system (and the related Microsoft Internet information services and other Internet network services that the Windows NT offers) named "ASEAN Haze Action Online" has already been established.

Implementation

ADB's RETA Project had installed for its Project Management Unit (PMU) and Coordination and Support Unit (CSU) a Sub-LAN Windows NT operating system for networking the project among staff and consultants within the ASEAN Secretariat. This system has been upgraded with the appropriate Internet technology into a full-service web server for the enhanced IMS of ORHAP with the site address: **www.haze-online-or.id**

CSU will be responsible for the content of the web site, that is, the overall "look and feel" of the intranet site, and for keeping the information fresh and well organized, This requires updating the material to the site on a daily basis, or sometimes continuously through the day. It is also necessary to establish "entry points" throughout the ORHAP institutional arrangement to input

data directly into the Intranet. CSU should also be responsible for maintaining a logical, coherent, and easily navigable menu structure. Other CSU responsibilities include the creation of hypertext markup language (HTML) pages, the creation of the forms used in formulating and returning database queries, and sometimes even the programming of the query mechanism itself. Competence and training in the following areas are required:

- HTML language;
- use of graphic applications and image manipulation;
- scanning techniques;
- database technology; and
- office procedures and archival schemes.

Part II. Design Standards

Based on the regional fire and haze information and web design techniques available to date, the following design standards have been compiled for designing the ASEAN Haze Action Online web site. When designing or redesigning a web site, each of these guidelines should be applied where appropriate.

Background and Objectives

Operationalizing the RHAP ultimately depends on an efficient flow of information among the various parties, agencies, and countries implementing the Plan at the national, subregional, and regional levels. The information management system is the means by which implementation of each action defined in the DIP at each of the levels is monitored.

The heart of the ORHAP information management system is a computerized retrieval system that can be accessed through the Internet. The Intranet Information System also provides up-to-date information to help in decision making.

ASEAN Haze Action Online allows the sharing of knowledge and experience, and coordination and monitoring of national, regional, and international initiatives with institutions in the region. This includes an intranet linking institutions in the region and a public information service.

The establishment of the ASEAN Haze Action Online Internet/intranet information system is based on one of the RETA 5778 terms of reference components to develop, establish, and operationalize an improved information management, exchange, and dissemination system in the ASEAN Secretariat related to fires and haze prevention and mitigation.

The objectives of the establishment of the ASEAN Haze Action Online Internet/Intranet Information System are to:

1. provide a medium for information exchange between institutions at the regional and national levels;
2. support and monitor implementation of regional, subregional, and national haze action plans;
3. provide a link to ASMC's products;

4. support and monitor implementation of the ASEAN Regional Fire Suppression Mobilization Plan;
5. provide a database and/or inventory of equipment, firefighters, fire experts, and addresses of contact persons and institutions at regional and national levels;
6. provide information on meetings and events, a calendar, and scheduling;
7. provide a library of information and/or document center related to fires and haze;
8. provide linkages to all of the available fire and haze information sources on the Internet;
9. provide comprehensive, accurate, and up-to-date information on all funding agency projects that are supporting the regional, subregional, and national haze action plans;
10. provide funding agencies with a full range of project coordination functions to better target development assistance by matching specific needs to funding agency priorities;
11. provide the ASEAN Secretariat with an alternative medium for public awareness, education, and outreach programs on fire-and-haze-related information; and
12. provide the ASEAN Secretariat with a medium for internal awareness and outreach program on fire-and-haze-related information.

Target Users

In order to create compelling and useful content and applications, target users should be defined. Once the site is implemented, user feedback and analysis of user log files generated by the web tracking system should be used both to fine-tune the site and to confirm the users.

The ASEAN Haze Action Online web site will target the following:

- AMME;
- AMMH;
- HTTF;
- government agencies responsible for the fire and haze prevention, monitoring, and mitigation activities;
- ASEAN Secretariat:
  - Environment Unit,
  - Information and Library Unit,
  - Culture and Information Unit,
  - Agriculture and Forestry Unit,
  - Computer Unit, and
  - Coordination Support Unit;
- collaborative partners; and
- the general public.

Any addition to the web site should be tailored to these users.

Site Structure

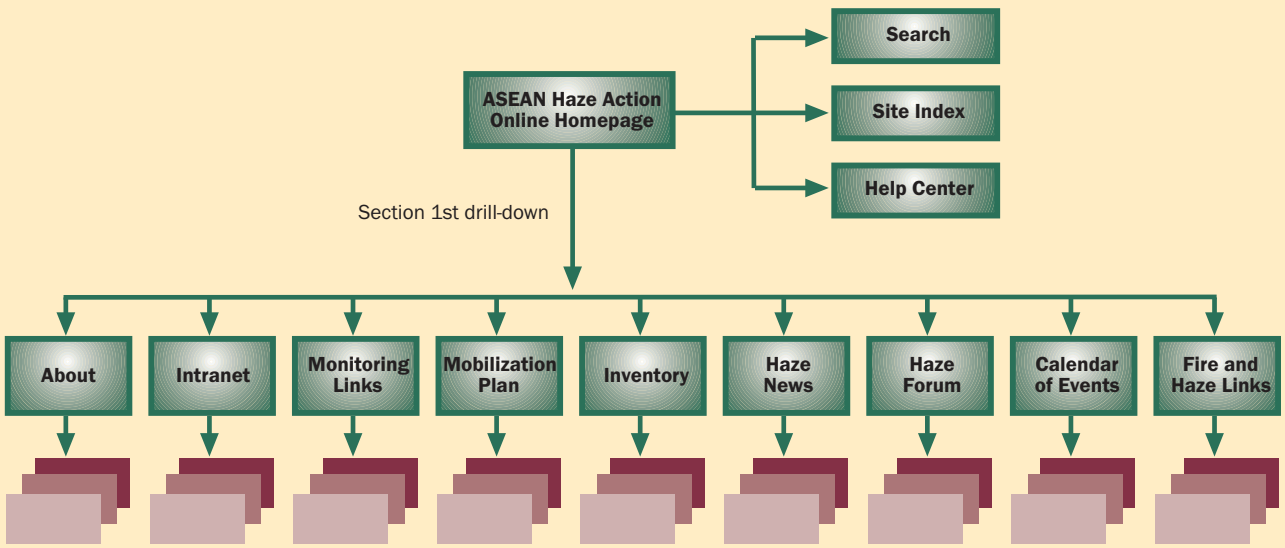
Users need predictability and structure with clear functional and graphic continuity between a site's sections and subsections. Below is the structure of the ASEAN Haze Action Online web site and a short description of the major sections. Any new content to be added to the web site should fit into this structure.

- ASEAN Haze Action Online Homepage: www.haze-online.or.id
- Search: Search ASEAN Haze Action Online web site.
- Site Index: Table of Contents to quickly locate information within the site.
- Help Center: Help on how to access and/or navigate through the site.

Section 1 drill-downs

- About: A brief introduction to ASEAN transboundary haze initiatives and the RHAP
- Intranet: Registered users (HTTF members, partners) can access the following RHAP information management tools:
  - DIP information system,
  - information on donors' collaborative partnership program and projects,
  - RHAP Document Center,
  - contact information databases for all persons and institutions concerned with RHAP implementation,
  - Calendar of Events and Activities database, and
  - Firefighting Resources Inventory System and Intranet Discussion Forum.
- Monitoring Links: Hyperlinks to the web sites of institutions specializing in monitoring of fires and haze in the region.
- Mobilization Plan: Information on ASEAN regional FSMP initiatives.

FIGURE 6 **Site Structure**



Source: ASEAN, RHAP-C54.

- Inventory: Information on the regional inventory and assessment of fire management capability.
- Haze News: New reports, press releases, situation summaries, links to the online version of the *International Forest Fire News*, and other information about the current fire-and-haze situation in the region. Users can also use this feature to suggest additional fire-and-haze hyperlinks.
- Haze Forum: An electronic forum allowing users to post their views and opinions on fire-and-haze-related issues, and to discuss them with other users.
- Calendar of Events: This feature gives the schedule and venue of all past, present, and future fire-and-haze-related events including seminars, workshops, training classes, and other activities.
- Haze Links: Links to other fire-and-haze-related web sites. Users can also use this feature to add Uniform Resource Locator (URL) links to the fire-and-haze-related web sites.

Supported Browsers

The ASEAN Haze Action Online web site is designed for the latest release versions of the Netscape Navigator and Microsoft Internet Explorer browsers. The reasoning for this decision is as follows:

- Cost: The more browsers that are supported, the greater the cost to develop the web site.
- Popularity: Netscape and Microsoft clearly lead the Internet browser market.
- Supported features: Both Netscape and Microsoft's browsers support many advanced technology features (i.e., Java, Shockwave, etc.). These companies are pushing each other to add functionality, which is causing their products to converge.

The ASEAN Haze Action Online web site is not implementing features that are not common to the identified browsers. If a feature is supported by one of the identified browsers and not by the other (i.e., VBScript), it should not adversely affect the look and feel of the site when viewed in the unsupported browser. And as Internet Explorer and Navigator converge, this issue will become negligible.

[Note: For details on Standard Page Design, HTML Coding Standards, System Architecture, etc., see the Final Report of ADB's RETA 5778: *Strengthening the Capacity of the ASEAN to Prevent and Mitigate Transboundary Atmospheric Pollution*.]