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ASEAN Disaster Preparedness Seminar

Proceedings, Issues and Recommendations

Manila

January 27 - February 2, 1980

#0001

ASEAN Disaster Preparedness Seminar

Proceedings, Issues and Recommendations

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SPONSORED BY

The Office of U.S. Foreign Disaster Assistance
Agency for International Development
Washington, D.C. 20523 U.S.A.

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FOREWORD

Manila was the scene of the ASEAN Disaster Preparedness Seminar, conducted January 27-February 2, 1980, which brought together nearly one hundred dedicated persons from both the ASEAN (Association of Southeast Asian Nations) governments and the international disaster assistance community. Much was discovered, considered and debated during the process of that gathering and all of the attendees returned home with a greater appreciation for each other's problems and successes. The discussions during the seminar left us all with a better understanding of our own roles and the interrelationship of the many diverse aspects of the disaster preparedness universe.

The ASEAN Disaster Preparedness Seminar was not intended to solve the disaster problems of Southeast Asia: it was designed as a forum in which those problems and some potential solutions could be identified and explored. It may be a long time before ultimate solutions are implemented, but I am confident that together we have made a good start.

The proceedings which follow are divided into sections which correspond with the daily thematic emphases of the seminar agenda: vulnerability; preparedness; prevention; prediction and warning; relief and rehabilitation; and reconstruction and development. This report also contains the recommendations adopted by the ASEAN representatives, a seminar participant list and a variety of planning aids for disaster preparedness. We believe that this report is an accurate recapitulation of what transpired in Manila. We hope it will serve as a useful guide to information and resources concerning disaster preparedness not only for the ASEAN participants, but also for others who have similar concerns.

I share with the other participants in the ASEAN Disaster Preparedness Seminar a sense of pride and accomplishment for our efforts. We also share a conviction that there is much we can do together to mitigate the effects of natural disasters throughout Southeast Asia.

Sincerely,

Joseph A. Mitchell

Joseph A. Mitchell
Director
Office of U.S. Foreign
Disaster Assistance

ASEAN Disaster Preparedness Seminar

	SUNDAY JANUARY 27	MONDAY JANUARY 28	TUESDAY JANUARY 29	WEDNESDAY JANUARY 30	THURSDAY JANUARY 31	FRIDAY FEBRUARY 1	SATURDAY FEBRUARY 2
MODERATOR	Clark	Cole	Huden	Krumpe	Jansen	Carter	Cole
THEME		VULNERABILITY	PREPAREDNESS	PREVENTION	PREDICTION & WARNING	RELIEF & REHABILITATION	RECONSTRUCTION & DEVELOPMENT
9:00							
9:55	ARRIVAL	Welcome	Disaster Plan (Huden)	Why Natural Phenomena Become Disasters (Panel A)	Prediction Tools & Scientific Analysis (Panel B)	Assessment of Damage & Needs (Oliver-Smith, Marshall, Wilcox)	Disaster As Opportunity (Lewis, Marshall, Oliver-Smith)
10:05		COFFEE BREAK					
10:55		Seminar Directions (Mitchell)	Organization & Coordination of Resources (Carter)	Benefits/Costs of Prevention (Incl. Compensation and Insurance) (Jarrell, Lewis)	To Warn or Not to Warn (Arnold, Carter, Jarrell)	Resources Of Relief Organizations (Brijl, Carter, Olsen)	Mutual Assistance Projects for ASEAN (Panel C)
11:05			COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	COFFEE BREAK	
12:00		Hazards Affecting ASEAN (Kintanar)	Community Preparedness - Ideas That Work (Krimgold, Marshall, Olsen)	Education As Prevention Tool (Higashiura, Krimgold)	Communication & Community Response (Carter, Marshall, Oliver-Smith)	Communications (Helm)	
1:30	REGISTRATION	LUNCH	LUNCH	LUNCH	LUNCH	LUNCH	
2:00		Acceleration of Vulnerability (Lewis)	Land Use & Flood Mapping (Carter, Panel B) / Shelter Concerns & Building Std (Krimgold)	Field Trip to National Disaster Coordination Center (Pagulayan)	Geophysical Prediction (Algermissen, Arnold, Lockwood) / Typhoon & Storm Surge (Jarrell, Vermillion)	Regional Response Capabilities (Panel C)	Field Trip To Mount Taal (Pagulayan)
2:20							
3:00		COFFEE BREAK			COFFEE BREAK		
3:10		Tools for Assessing Vulnerability	COFFEE BREAK			COFFEE BREAK	
3:30					Fire, Search & Rescue (de la Cruz) / Drought Assessment (Steyaert, Strommen)		
4:00		Met/Hydro (Jarrell, Krumpe, Vermillion) / Geological (Algermissen, Arnold) / Environmental (Currey, Gratt, Steyaert Zadroga)	Afforestation (Fernandez, Zadroga) / Oil Spills & Environmental Pollution (Gratt, Jarrell		Health Surveillance & Medical Aspects (Faich) / Predicting Food Shortages (Currey)	How Can ASEAN Disasters Plans Be Modified To Achieve Goals Of Mutual Assistance? (Panel C)	
EVE	Reception & Dinner					Reception & Dinner	

PANEL A:

Arnold
Brijl
Lewis
Steyaert

PANEL B:

Algermissen
Currey
Helm
Krumpe
Strommen
Vermillion

PANEL C:

Chiefs of Delegations

Vulnerability

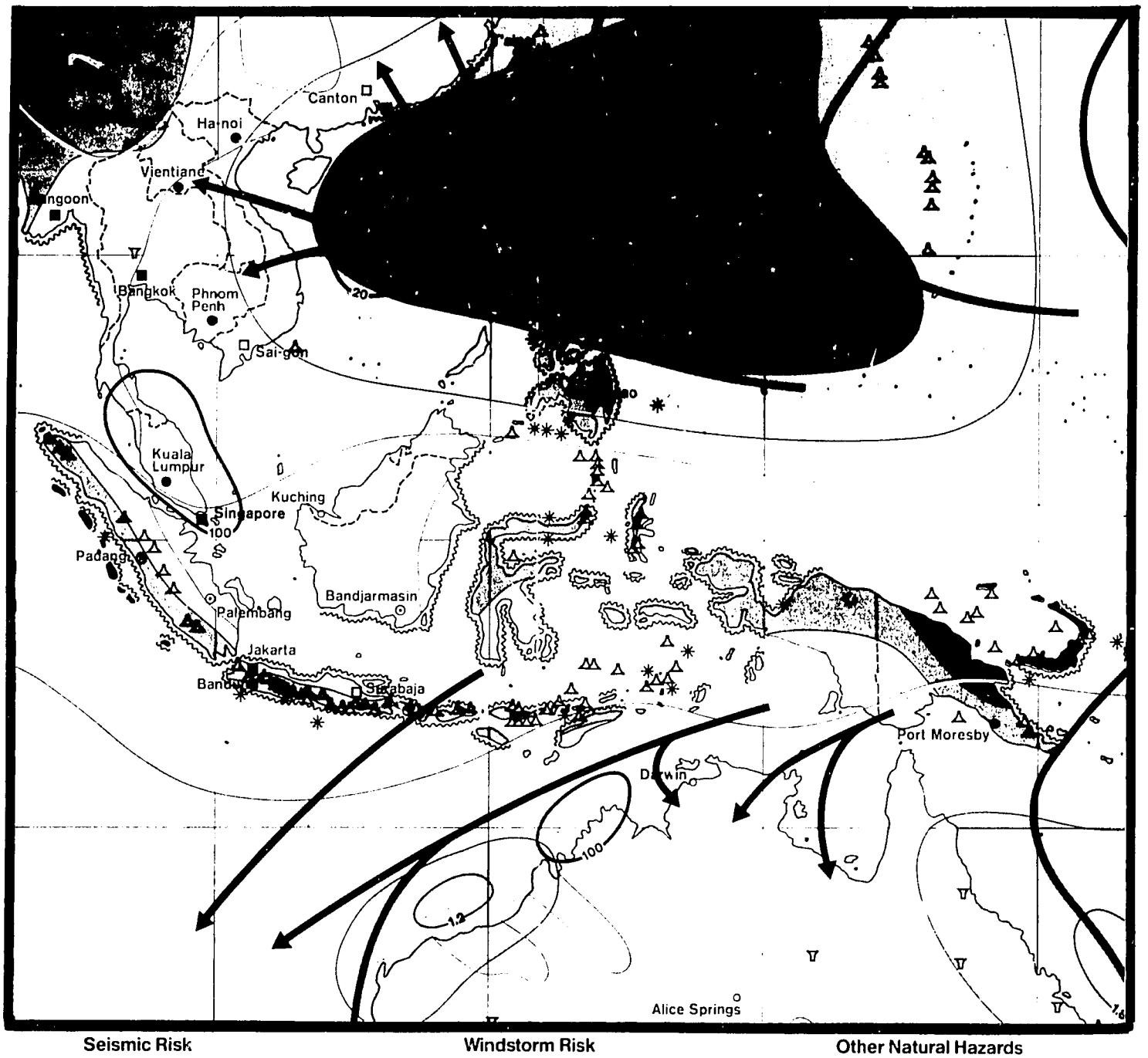
Natural hazards affect all regions of the world. Populations which live in the path of such hazards are vulnerable to disaster. The extent to which they are vulnerable is determined not only by the frequency and force of the natural phenomena which threaten them, but also by the effectiveness of the measures they use to prepare for them. Vulnerability analysis is a relatively new field of concentration which attempts to assign a measure of risk to specific populations on the basis of scientific and historical evidence. Because we have insufficient knowledge of the mechanics of natural hazards and how they affect our world, vulnerability is measured in terms of the probability that an event of a presumed magnitude will happen at a certain place in a given time-span. If we are to protect our populations we must use all the tools available to understand the hazards which threaten us and the potential for their causing damage. With this knowledge we can prepare our communities to live with acceptable risks.

Hazards Affecting ASEAN

Dr. Roman Kintanar

Earthquakes, volcanic eruptions, tsunamis, droughts, floods, landslides, avalanches, storm surges and monsoons are all natural adjustments in the atmosphere and surface of the earth. Seen from afar, these adjustments are relatively minor. But from the perspective of man, they are powerful forces that threaten disaster--especially when human response to these forces is inadequate.

In the distant past, man had a very logical response to natural hazards: he modified his land use patterns to reduce his risk. As populations increased, however, and more homes were built and more land was cultivated, options became limited. This was compounded by the fact that the memory of man is short, and often a given generation did not learn of events that occurred in the past. Increasingly, there is a need to initiate extensive preparedness measures to compensate for the vulnerability of man.



Seismic Risk

Maximum intensity
(Mercalli Scale)
once in 50 years,
for average ground conditions

- V and below
- VI and VII
- VIII
- IX
- ✳ epicentres of magnitude 8 earthquakes (1897–1977)

Windstorm Risk

Tropical storms and cyclones
(Beaufort 8 and above)
number per year

- 0.1–1
- 1 –3
- above 3

1.8 isoline of maximum frequency

preferred tracks

Winter gales
(Arabian Sea: monsoon gales)
percent frequency of
Beaufort 7 and above
N-Atlantic, N-Pacific: December
S-Hemisphere, Arabian Sea:
June

20 isoline

Tornadoes
number per year

- 1
- 50

Other Natural Hazards

- Tsunami (seismic sea wave)
- Active volcanoes
- Limit of iceberg drift
- Temporary pack ice
- Permanent pack ice
- Sea fog frequency above 30% (July)
- 100 Isoline of thunderstorm days, number per year

□	Lima	1,000,000
⊙	Dakar	100,000 1,000,000
○	Hilo	100,000
●	Bonn	Capital city
⊙	Perth	Seat of MR office

----- State boundary

Political boundaries should not be regarded as having official significance

Source: World Map of Natural Hazards, published by
Münchener Rückversicherungs-Gesellschaft, Königinstrasse 107
D-8000 Munchen 40
Federal Republic of Germany

To illustrate what can be done, the World Meteorological Organization initiated the Tropical Cyclone Project (TCP). Unlike other meteorological projects, TCP deals not only with the technical aspects of the natural phenomenon but also with their implications for disaster--which has resulted in increased activities among ASEAN countries to counteract hazards. The Philippine government, for example, has projects underway to increase the public's awareness of the hazards to which it is most vulnerable and to establish a flood forecasting system throughout the Pampanga River Basin in Luzon. This will be similar to the forecasting systems already in place in the Bicol, Agno and Cagayan River Basins. The Philippines has also proposed the establishment of a research and training center to promote disaster preparedness among all ASEAN countries.

These are only a few of the many activities that can be undertaken to mitigate the effects of the natural forces affecting the region. The challenge is to continue to secure support for the full range of preparedness activities by convincing officials and the public that gradual adaptation is no longer a sufficient response to hazards; that preparedness planning is essential. Disasters are effects which occur only when man is present, over which man has considerable control.

Acceleration of Vulnerability

Mr. James Lewis

We cannot say with certainty that hazards have been increasing, but clearly the risk is greater today because--

- population growth rate in disaster-prone countries is high;
- more people live in unsafe areas (near active volcanoes, in floodplains, in coastal areas susceptible to storm surge, etc.);
- watersheds retain less water when forests are cut and the deforested land is improperly managed, resulting in increased likelihood of flooding during the wet season and drought during the dry season;
- some technologies of development threaten the environment, as when surface mining pollutes rivers or irrigation of marginal lands promotes erosion;

- building design, materials, and construction techniques make some structures less resistant to floods, earthquakes or severe winds;

- farmers have begun to plant a single cash crop rather than a variety of subsistence crops, increasing the threat of agricultural failure;

- buildings, dams, sea walls, etc. are not adequately maintained; and

- communities have become less self-reliant.

Vulnerability has increased in those areas where preparedness measures have not kept pace with the changes taking place. Research indicates that the smallest administrative districts tend to suffer the greatest impact from disasters, relative to their capability to prepare and respond. Research also indicates that inland, rural areas are far more vulnerable than has been supposed. Unless we come forth with concerted, innovative programs, populations may suffer far more than they have before.

Tools for Assessing Meteorological/Hydrological Vulnerability

Messrs. Jerry Jarrell, Paul Krumpe and Charles Vermillion

Assessing vulnerability consists of determining the frequency and magnitude of a particular phenomenon, the area at risk and risk aversion alternatives. Tools for assessing vulnerability to typhoons, floods and storm surge include:

- equipment to collect and transmit data such as stream and tidal gauges, land-based radar, remote data collection platforms, doppler radar and aircraft reconnaissance, remote sensing satellites, telemetry and communications satellites;

- equipment to analyze data, high speed computers in particular;

- statistical modelling techniques to forecast rates of run-off and erosion, height of storm surge, movement of a flood crest or severe storm; and

- mapping techniques to determine land use patterns and areas affected by typhoons, floods and storm surge, based on historical records, direct measurement, aerial photography and remote sensing satellites.

Risk aversion alternatives include:

- preventing settlement in areas vulnerable to floods, flood waves, storm surge, etc., based on detailed mapping of risk (microzonation);
- stabilizing river embankments, constructing and maintaining floodways, retardation basins, flood control dams, sea walls and breakwaters;
- avoiding pumping groundwater from low-lying coastal areas to prevent subsidence;
- improving data collection;
- improving data analysis; and
- promoting proper watershed management to reduce run-off.

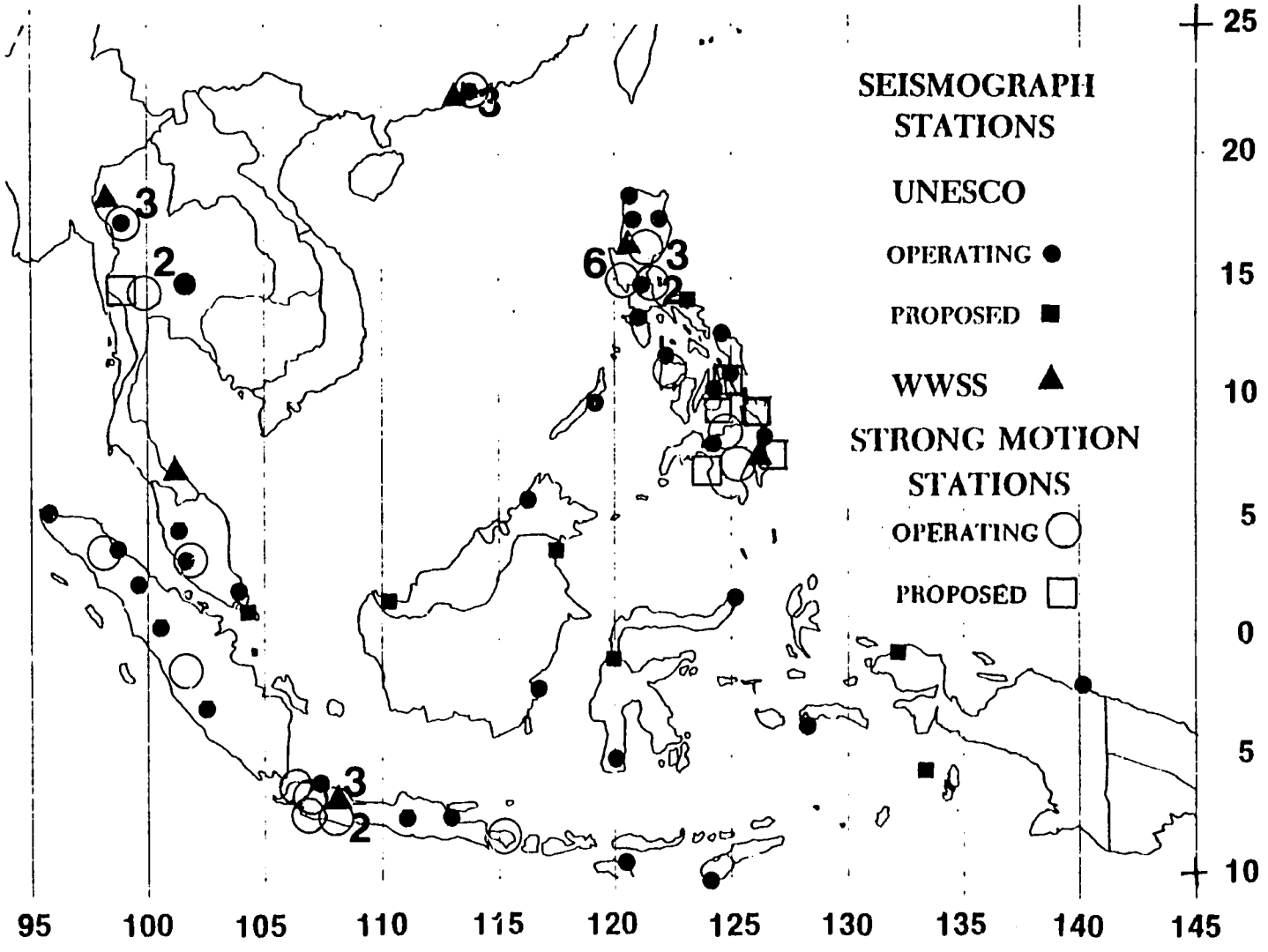
Tools for Assessing Geological Vulnerability

Drs. Ted Algermissen, Ed Arnold and John P. Lockwood

The theory of plate tectonics provides the basis for risk analysis of seismic hazards. Large earthquakes occur where plates converge, although they may also occur along transform faults, ridges and (much less frequently) within the plates themselves. The convergence of three great plates in Southeast Asia, together with the complex movements of several smaller plates, makes Southeast Asia one of the most seismically active areas in the world. Vulnerability to earthquakes is a function of seismicity, the attenuation of energy from source to site, and the materials on site. It is possible to make rough estimates of vulnerability to earthquakes based on studies of active faults, ground motion, liquefaction and landslide potential, spatial distribution of the population, and structures exposed to the hazard.

The installation of instruments to detect and record seismic activity is underway in many of the seismically active areas of the world including Southeast Asia. The existing network, however, needs more standard short-period and long-period stations, portable seismographs, better station locations and computer assistance to locate earthquake epicenters. A simple

and relatively inexpensive method of obtaining information on the attenuation of seismic energy and site amplification effects is to make a field investigation of all earthquakes of importance. Theoretical studies of ground amplification can be greatly enhanced by these field investigations of actual damage. To forestall obliteration of evidence of damage, trained observers should initiate their investigations immediately after the shock. Intensity (isoseismal) maps should be constructed on the basis of these investigations.



To the extent that there is data available regarding earthquakes that occurred decades or centuries ago, the historical data should be recomputed to be consistent with intensity scales used presently. Similarly, modern techniques should be used to re-evaluate the historical data with respect to focal mechanisms and the location of earthquake epicenters. Studies of soils, structures (shelters, dams, water distribution systems, etc.) and land use patterns are also necessary to assess vulnerability to earthquakes.

A population's vulnerability to volcanic eruption is related to a variety of hazards. The most significant hazards in Southeast Asia include ash falls, ash flows, lahars (mudflows), cataclysmic explosive eruptions and poisonous gas accumulations. The specific hazards of individual volcanoes are best understood by determination of each volcano's past history. This historic record is preserved in rock deposits on and adjoining all volcanoes and is best evaluated by preparation of geologic maps which show the types and distribution of volcanic deposits around each volcano. Mapping of these deposits will indicate the patterns of past activity and will provide the best guide to the nature of future activity. Dating of these deposits, chiefly by radiocarbon (carbon-14) analysis of buried wood and charcoal, can indicate the recurrence interval of past activity, and can determine patterns of eruptive periodicity.

Armed with good geologic maps and carbon-14 dates, derivative volcanic hazard maps can be made for individual volcanoes to facilitate land use planning. These maps classify lands adjoining each volcano into zones of varying hazard. Areas of high hazard are best suited for agricultural and recreational purposes, whereas areas of lower hazard are suitable for low density residential use, and areas of lowest hazard are suited for capital developments such as office buildings, factories and high density residential structures.

Tools for Assessing Environmental Vulnerability

Drs. Bruce Currey, Lawrence Gratt, Louis Steyaert and
Professor Frank Zadroga

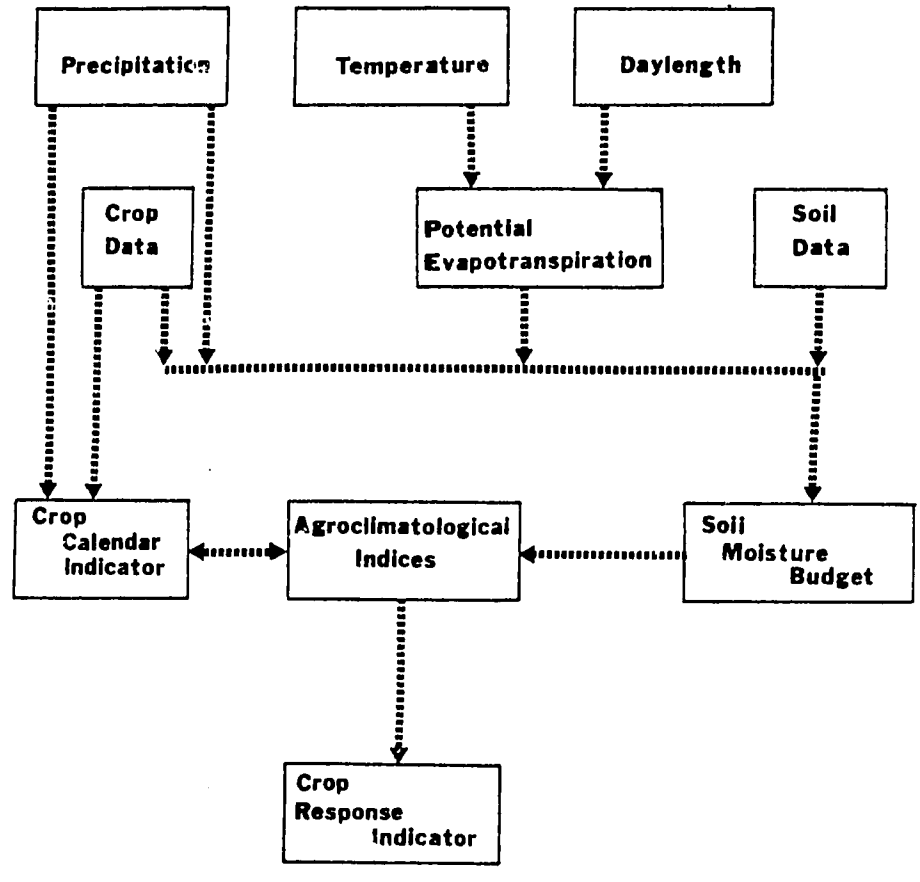
A geographer, an oil spill expert, a meteorologist and a forest hydrologist described ways of noting and interpreting changes in the environment which could affect the availability of food. Tools range from empirical-statistical approaches to risk mapping.

Severe droughts have had substantial impact on ASEAN member countries, resulting in reduced crop yields, food shortages and other disruptions to society. Detailed statistical analysis of historical rainfall data is the primary tool for assessing drought vulnerability, but analysis of large-scale atmospheric circulation patterns also contributes to understanding of the temporal and spatial distribution of rainfall. It is possible, for example, to calculate rainfall probabilities for 30-60 days based on analysis of atmospheric pressure, sea surface temperature, and wind patterns.

Other environmental factors can combine to create a condition referred to as pseudo-drought. The potential for pseudo-drought is the result of land use practices that reduce the water storage capacity of soil. Typically, these practices fail to preserve the vegetative cover--thereby affecting soil structure--during logging, mining and farming.

The assessment of vulnerability can then be taken one step further using a climate/crop yield model to forecast crop shortfalls. Based on crop type, crop calendar and soil moisture available to plants, the model can

AGROCLIMATIC ANALYSIS



predict crop shortfalls up to one month in advance. Other factors that affect crop yields include the availability and cost of labor, fertilizer equipment and fuel. Famine, in turn, is affected not only by crop yields but also by patterns of food distribution, individual and collective purchasing power, health status, etc.

What man does to the land critically affects man's ability to cope. Determination of land use capability is a first step; it compares the actual land use and answers the question: what is the maximum sustained use without causing environmental degradation? Erosion inventories are important tools in evaluating the potential of different sites; hydrological measures include erosion plots and hydrographic analysis which provide data on the timing of runoff. Vegetative cover conditions further illuminate impact of deforestation with the potential for positive and negative effects in the competition for food, fiber and energy. Hydroelectric projects too should be scrutinized for impact on sedimentation and effects downstream. For details of preventive measures, such as reforestation, afforestation and watershed management, see Professor Zadroga's presentation on page 23.

A statistical tool has been developed to assess the potential environmental impact of transporting, storing and using hazardous materials. The method assigns probabilities to future events. The probabilities for each initiating event are combined with the probabilities for each of the system's events to provide a single number for an estimate of risk. Initiating events that could lead to a shipping-related oil spill, for example, might include normal operations, natural events, collisions with other ships, and other man-induced incidents. Having assigned probabilities to events that could lead to a spill, the probable consequence of a spill must be determined. This involves assigning probabilities to the size and location of the spill, dispersion of the vapor from the spill, ignition and effects of ignition, etc. This method is a form of statistical modeling known as "risk assessment".

A problem with risk mapping is that vulnerability cannot be truly shown in a map. As an example, despite the complex and dynamic nature of factors influencing food availability, certain structural components with a proclivity to famine remain fairly constant over time. Other problems associated with famine risk mapping were discussed with reference to Dr. Currey's map, Areas Liable to Famine, prepared for the Ministry of Relief and Rehabilitation of Bangladesh. He emphasized the importance of gathering data at the local level and integrating ameliorative measures into rural development plans.

Land Use and Flood Mapping

Air Vice-Marshal W. Carter, Mr. Paul Krumpe, Dr. Norton Strommen and Mr. Charles Vermillion

Land use mapping and flood mapping are examples of techniques for analyzing vulnerability that are extremely important to planners. The analysis of vulnerability proceeds from a macro view which identifies large areas deserving closer scrutiny, to a micro view which deals with the threat to individuals within their communities.

Charles Vermillion and Paul Krumpe discussed the NASA film, "The Wet Look", which shows how LANDSAT treats macro-analysis of water resources and their destructive capacity. LANDSAT's thematic mapping capability provides a conceptual overview of the hydrologic (and other) phenomena which create risk for populations. Over a period of seasons, the panoramic view from space can effectively suggest geographic parameters of threat from flood or drought. The constraints of LANDSAT--long periods between orbits over a particular spot on earth, distortion over ASEAN countries and inability to penetrate clouds--were noted. LANDSAT imagery receiving stations are expensive; Mr. Vermillion put the cost at roughly US $5 million. Norton Strommen noted that the cost should not be considered prohibitive, since LANDSAT offers many diverse benefits. Meteorological satellites, although their resolution is far less, also are extremely useful for flood analysis.

Aircraft reconnaissance, traditionally used more widely for mapping in the ASEAN countries, offers the middle ground between macro- and micro-analysis. With its high resolution and many technical variations (radar, stereoscopic vision, color, infrared, etc.) aerial photography offers many advantages to the mapper; albeit with considerable costs in time, fuel and recording media.

There is a great need for "ground truth" data, information collected by people on the ground to confirm, correct and interpret what is learned from airborne and orbiting sensors. The traditional mapping tools of the surveyor and cartographer are as valid as ever. With the new panoramic and multi-thematic perspectives provided by air and space imagery, terrain analysis and flood plain mapping gain a new dimension.

Thailand is currently planning a comprehensive LANDSAT analysis facility, including a training center. Indonesia sees great potential for LANDSAT in delineating water resources. Malaysia has considerable experience in applying aerial photography to base maps which aid in flood prediction.

Joseph Mitchell, Director of the Office of U.S. Foreign Disaster Assistance, outlines the directions of the ASEAN Disaster Preparedness Seminar.

Preparedness

The seminar structure defined preparedness as those activities which help organizations, whether regional, national or community based, to prepare themselves to face the threat of disaster. Such activities--the development of organizations, the enactment of enabling or constraining legislation, the allocation of money and resources and the definition of emergency procedures are properly described in the disaster plan, whether it applies to a nation, province or community. Such planning must indicate the responsibilities for providing and coordinating services. Although the importance of planning at all levels cannot be overstressed, the most critical element to be considered is at the community level--where people live and die. When it comes to the test, talk about community preparedness is useless; only effective actions can protect people.

The Disaster Plan

Gudrun Huden

A national disaster preparedness plan outlines measures to minimize human and economic losses from disasters and to facilitate effective rescue, relief and rehabilitation. The disaster plan spells out what is to be done before, during and after a calamity by whom, when and how. By anticipating these extraordinary events and acting to minimize their effects, a plan helps to secure the continuity of growth and development. By defining responsibilities and procedures, a disaster plan serves to stimulate planners' awareness of the factors which must be interrelated to achieve an effective preparedness, mitigation and response program.

There is no universally acceptable plan. Each country's plan is a reflection of political reality, the quantity, quality and distribution of resources, the degree of development and traditional ways of cooperating within regions and with neighboring countries ... all expressions of past history incorporated with views of the future. It is safe to assume that long-term planning as found in disaster preparedness almost always runs counter to the economic interests of some. It is, therefore, the difficult and tedious task of government to recognize that the welfare and protection of citizens is of primary significance. Governments must take seriously the molding and constant improvement of the disaster plan as a lawful instrument.

An illustrative disaster plan had been made available to each of the delegates in advance of the seminar. This was to aid countries to focus on known requirements and to identify their special needs in relation to ASEAN country plan development. The important points of each country's national disaster plan were shared by the delegates.

Indonesia

Programs were outlined for the National Coordinating Board for the Mitigation of Natural Disasters, for the Regional Coordinating Boards, and for the Local Coordinating Boards with communal posts at the under-district level and sub-command posts at the village level. Drs. Harun's presentation was supported by the document, The Main Pattern for Preventive and Rehabilitative Actions Against Natural Disasters in Indonesia, issued by the Directorate General for Social Assistance, Department of Social Affairs, Jakarta.

Malaysia

The country's relief and preparedness plan is centered around floods -- flash floods and seasonal monsoon flooding -- as the main natural disaster threat. The National Disaster Relief Organization operates through a committee system set up by the National Security Council at federal, state and district levels. At the federal level, the Malaysian National Disaster Relief Committee (MNDRC) coordinates flood relief measures; it is served by the Working Group on Supply and the Working Group on Transport and Communication. At the state level, the State Disaster Relief Committee (SDRC) coordinates flood relief measures. At the district level, the District Disaster Relief Committee (DDRC) is responsible for relief operations and rehabilitation including establishment of communications systems, evacuation, recording of flood prone areas, rivers and water levels; establishment of supply centers, warning systems and transportation. Mr. Aziz detailed the functions of the Disaster Relief Control Centers at all three levels; the role and duties of ministries and departments; re-activation procedures and states of alert, readiness and emergency. A flow chart on flood control machinery in Malaysia was appended to the seminar paper, "Malaysia's National Disaster Relief Plan and Preparedness".

The Philippines

Work on the Philippine National Disaster Preparedness Plan was initiated in 1970, revised and updated to its present form in 1976 and strengthened by Presidential decree in June, 1978. The plan states objectives, concepts, organization, tasks, coordinating instructions, administration and logistics. The aim is to make full use of all available governmental and private resources. It is based on the concept of self-reliance -- promoting and encouraging self-help and mutual assistance among local officials and their constituents. Taking full advantage of agency specialization insures judicious use of resources, avoids redundancies and conflicting functions.

The plan provides for the organization of coordinating bodies, called Disaster Coordinating Councils, from the national to the grassroots level, the barangay. The councils are responsible for the following services: health, evacuation, relief, fire, police auxiliary, warning, rehabilitation and public information. Each council has an operations center with units for disaster intelligence and analysis, plans and operations, and resource management. Mr. Rivera noted that planning efforts do need re-appraisal now and then towards continual improvement of disaster mitigation.

Singapore

Fires, air crashes, oil spills and occasional floods make up the disaster history of this small, compact country. Backed by legislative acts covering emergency and disaster situations, there is a coordinated system to ensure that pre- and post-disaster needs are met. Ministries involved are Home Affairs, Defense, Health, Environment, Social Affairs, Foreign Affairs, Communications, Culture and Finance. Various ministries and departments have their own contingency plans. Plans are reviewed and updated frequently; simulation exercises are also held. Dr. Chew mentioned that plans do exist to deal with specific disasters, such as airplane crashes and accidents, fires, oil spills and floods.

Thailand

According to the Civil Defense Law promulgated March 22, 1979, the National Civil Defense Committee (NCDC) is headed by the Minister of Interior as Chairman, with the Director-General of the Department of Local Administration serving as Secretary. The NCDC determines civil defense policy; puts its stamp of approval on the principal civil defense plan; determines methods

of inspection, follow-up, evaluation, training and financial management. It is assisted by the Civil Defense Secretariat which acts as the administrative body of the national civil defense director, studies, researches, analyzes and disseminates technical information; writes and reviews the civil defense plan (with revisions every 3 years); provides training. Mr. Pratuang Saiyapant noted that civil defense directors exist on a number of levels: national, provincial, district and local. The law spells out the categories and components which the civil defense plan is to cover. After the plan has been officially accepted by the NCDC, each province must draw its own plan modeled after the national plan. The Division of Disaster Relief of the Department of Public Welfare functions as the central body to facilitate disaster relief efforts made by the Regional Disaster Relief Centers. The latter may dispatch mobile units to support relief efforts of provincial authorities.

Organization and Coordination of Resources

Air Vice-Marshal W. Carter

The principles and major factors affecting the organization and coordination of resources to prevent or mitigate disasters were reviewed. A nation's ability to respond effectively depends on:

- a clear and accurate definition of the threat;
- a national philosophy and concept of prevention, preparedness and response;
- appropriate legislation or governmental direction;
- a planning base;
- a pattern of organization; and
- a research/training capability.

These factors should be kept under constant review and updated as necessary.

Once requirements for counter-disaster activities have been analyzed, resources need to be assessed. This includes determinng the existing capability at all levels and identifying additional measures which may be required to achieve an optimum level of resources. Manpower and equipment need to be evaluated in terms of capability, availability and durability.

Once resources are known, certain organizational factors can be applied to ensure their effective utilization, including:

- adherence to the approved organizational pattern;
- a record of successful efforts over time;
- coordination of resources with planning concepts;
- clear allocation of roles and responsibilities to avoid overlapping and confusion;
- effective systems of communication, direction and information;
- an appropriate training/exercise system; and
- other locally specialized considerations.

Evidently, the failure to coordinate resources is a recurring problem in disaster situations. The misconception that coordination is easy to achieve, and the misdirection of efforts to achieve coordination, exacerbate the situation; the pressure of a crisis increases the need for coordination.

A plan for the effective organization and coordination of resources must have a scope broad enough to cover a variety of organizations, a process to be followed throughout, and a clear definition of responsibility. Coordination can be achieved through planning, training and operations.

Effective organization and coordination of resources is of key importance in counter-disaster activity. It cannot be tackled or achieved in isolation; its ramifications impinge on almost every other aspect of preparedness and relief. This organization and coordination, therefore, needs to be seen as an integral feature of any nation's overall preparedness for dealing with disaster.

Community Preparedness--Ideas That Work

Drs. Frederick Krimgold, Mac Marshall and Mr. Asbjorn Olsen

The need to improve communication between communities and external resources was emphasized by Asbjorn Olsen. Community preparedness can be promoted by a mutual understanding of socio-economic traditions and inter-community relationships. Voluntary agencies must adapt what is effective in one society to local conditions elsewhere.

To achieve success in community preparedness programs, there should be mutual understanding and joint participation in the process of planning and implementation. A "common language" must be developed between government officials and community organizations in order to encourage dialogue necessary to reach a full understanding of disaster preparedness ideas.

Large budgets do not necessarily guarantee preparedness; in fact, smaller budgets can actually encourage community participation in preparedness activities since the community must then contribute some of its own resources. Smaller budgets can also encourage more efficient use of resources. Economic self-reliance, as a goal of community preparedness programs, encourages commitment and joint responsibility for preparedness projects.

Mac Marshall distinguished between the major kinds of community preparation for natural disaster: physical preparation and social preparation. Physical preparation includes construction of reinforced buildings, tying down roofs and safe-guarding communication systems. While physical preparation is of obvious importance in mitigating the impact of a typhoon, social preparation is equally important yet frequently overlooked and undervalued. Social preparation involves the building of a network of social ties and social relationships; the selection of public buildings for possible use in a disaster; the creation of a system of inter-community mutual assistance; and the establishment of a chain of command among involved groups, agencies and villages. In this context, there is a need to establish local village committees devoted to disaster preparedness that will organize preparedness activities along existing social groupings.

Three critical elements regarding community development planning are: (1) effective communication about the steps to be taken in the event of a disaster; (2) creation of, and education about, a disaster plan which will help to insure the appropriate response to disaster warnings and destruction; and (3) maintenance and institutionalization of functioning disaster plans even when disaster does not appear imminent.

In discussing these issues, Dr. Marshall raised the following questions: Who will take shelter, when and where? What will be done about cooking and distributing food and water after a disaster has struck? Might inter-community mutual assistance pacts, which could be brought into play immediately after a disaster, be organized in advance? What sorts of coordination might be effected ahead of time between a community and various disaster assistance agencies to avoid confusion and duplication of effort when a crisis arises?

Prevention

If we can protect people and their property from the effects of hazards, we can say that we are preventing disasters. Protection can be afforded in many ways. Expensive dams or river diversion projects may prevent catastrophic flooding; anti-seismic design and building practices may save lives and property in an earthquake. Prevention can also be provided by relatively inexpensive public education or community preparedness programs; land use regulations, although they may be politically costly, are very affordable in terms of money. To fully understand the potential scope of disaster prevention we must first recognize the basic problems which precipitate disasters. The seminar examined the range of options with the purpose of defining the feasibility, the advantages and the costs of each.

Why Natural Phenomena Become Disasters

Dr. Ed Arnold, Messrs. Jacques Briji, James Lewis and Dr. Louis Steyaert

Occurrences such as floods and earthquakes are not, in themselves, disasters. It is only when populations cannot cope with such natural phenomena that they become disasters. Inability to cope may be attributed to a variety of factors including the following:

- failure to establish national priorities;
- lack of political will to formulate or implement preparedness plans;
- inappropriate organizational structures;
- failure to assign responsibilities and designate authority;
- inadequate technical capabilities;
- insufficient financial resources;
- ineffective warning and communication systems;

- low levels of community preparedness; and
- inadequate or inappropriate preparedness education and training.

To reduce the potential for disaster, officials and the public should plan and implement preparedness activities in a timely manner. This includes improving technical capabilities and strengthening structures likely to sustain damages. Scientific research and analysis can also contribute to disaster prevention and mitigation by providing a basis for both early warnings and long-range planning. An example of the prevention of a regional disaster occurred during recent cold winters in the United States. NOAA used statistical relationships between natural gas demand and climate data/climate outlooks for 30-to-90 days to aid in the decision to reallocate natural gas from warm to cold regions in the country. Another example of the benefits of applied climatology is based on crop yield modeling which is now used worldwide for land use planning (matching the appropriate crop, soil, and climate to mitigate problems in drought-prone areas), examining the effects of soil erosion, determining optimum planting dates, forecasting crop yields, etc. Agricultural meteorology has become very important to both public and private sectors.

If some practices exacerbate vulnerability to disaster, then altering those practices appropriately should contribute to the prevention and mitigation of disaster. Preventive measures can thus be seen as adjustments in the activities of vulnerable people which will increase their resilience and self-reliance. In this sense, disaster preparedness can be promoted by public awareness campaigns, education, and training. Long-range measures to limit the effects of natural phenomena should also include promoting cooperation between specialized agencies, assessing vulnerability, and formulating and implementing regional, national and local community preparedness plans.

Measures to prevent disasters or mitigate their effects should be based on a sound knowledge of their benefits and risks. They should be reliable, realistic and integrated with national development plans. All such measures should reduce vulnerability by reinforcing community self-reliance.

Benefits/Costs of Prevention

Messrs. Jerry Jarrell and James Lewis

James Lewis discussed insurance and compensation schemes in light of the experience of the South Pacific Bureau for Economic Cooperation (SPEC) Disaster Fund. The SPEC region represents the self-governing countries of the South Pacific, and is therefore based more on economic and political affiliation than geographic proximity. A study undertaken for the Fund revealed that commercial disaster insurance is less readily available in less developed countries where the scale of loss from disaster tends to be greatest. Thus, the Fund provides a form of self-help based on regional experience to provide protection that is unavailable from commercial sources. Although the commercial insurance industry could be doing much more to provide disaster insurance, a regional program has the distinct advantage of being able to serve as a catalyst for national and regional preparedness planning and cooperation. Any country with a low level of preparedness is clearly a liability and should be encouraged to implement preparedness activities as a condition of membership in a disaster fund. As part of preparedness planning, steps should be taken to discourage people from living in disaster prone areas and from becoming dependent on disaster relief.

Public and private disaster insurance funds are viable but increased knowledge is needed about damage which is likely to result when disasters occur. Insurance risks are calculated on the basis of specific events of limited impact, the frequencies and consequences of which are known with reasonable certainty (e.g., annual injury from home fires). Disasters, however, may result in extensive damage to many property owners within an entire region. This "catastrophe potential" is as yet undefined and can be quantified only after more historical data has been collected and analyzed.

Mr. Jarrell explained that the ability to determine the probability of an event is fundamental to the range of optimization problems central to hazard analysis, preparedness planning, and forecasting. In the long run, disaster officials are interested in the frequency of disaster events for hazard analysis and planning. If the frequency of those events is great enough, we make contingency plans to respond to the event when it occurs. We may also alter our behavior to mitigate the impact

since the damage from disaster generally far exceeds the cost of prevention. In the short run, we are interested in the immediate forecast probabilities which help us to optimize the execution of our contingency plans. The probability of occurrence of hurricanes has been calculated for extensive portions of the United States' Atlantic and Gulf Coasts and the model has been extended to indicate the probability of the occurrence of severe storm surge. With better models, the same can be accomplished with wind threat and flood potential. This approach also can be used in Southeast Asia if we devote the resources necessary to understand the mechanics of the hazards which threaten the region.

Education as a Prevention Tool

Mr. Hiroshi Higashiura and Dr. Frederick Krimgold

Drawing on the experiences of Sri Lanka, Hiroshi Higashiura underscored the vital role education can play in a disaster situation. Despite the existence of a Red Cross disaster preparedness plan for Sri Lanka and timely warnings from the meteorological service, the cyclone which hit Sri Lanka in November, 1978 exacted a heavy toll. Official figures indicate that the effects of the cyclone were as follows:

killed	915
permanently disabled	60
people rendered homeless	100,000
people affected	1,000,000
homes with extreme damage	96,415
homes seriously damaged	85,000
homes lightly damaged	145,302

In retrospect, it is apparent that the public lacked the training necessary to elicit an effective response to the warnings and instructions to evacuate. The last cyclone of comparable force was in 1907; as a consequence, few residents had any appreciation of the hazards of cyclones or the steps they could take to protect themselves and their property from harm. The heavy losses were also attributed to the public's lack of participation in relief operations. Responsibility for implementation of the disaster preparedness plans rested solely with government agencies and relief organizations. Residents were unprepared to help themselves or organize into small groups to achieve cooperative action. A few senior officials responsible for relief operations had received preparedness training before the cyclone struck, but they did not have the opportunity to prepare the general public to respond effectively and systematically.

The need for educating the public about disasters is recognized in several countries, including the Philippines. In Japan, disaster preparedness education is compulsory in both elementary and secondary schools. These courses include practical work as well as lectures, and encourage students to discuss with their families what to do before, during and after a disaster. Disaster preparedness education can and should also be available in programs for adults in or out of school. For this purpose, the Red Cross Teaching Guide is available.

Other strategies for educating the public include using the mass media, conducting seminars, sponsoring competitions (artistic or scholarly), and distributing publications such as posters and brochures. Another especially effective strategy is to conduct drills to review and test the concepts and procedures contained in the preparedness plan. Drills serve not only to test equipment and procedures in an operational context but also to train personnel at every level and facilitate the organization of small groups to achieve cooperative action for community preparedness.

Specialized disaster education also should be available, Dr. Krimgold concluded. Special courses should be directed toward architects, social scientists, engineers, public officials, bankers and others in the private sector. Supplemented by reference and resource centers, such courses would heighten the consciousness of the individuals who attend and encourage them to promote disaster preparedness activities.

Shelter Concerns and Building Standards

Dr. Frederick Krimgold

The loss of shelter frequently accompanies a large-scale disaster. In many cases, the failure of structures is the main cause of loss of life. Though shelter needs and appropriate responses vary depending upon type of disaster, climate, population, availability of resources, and construction practices, there are some universal principles for dealing with the problem of shelter provision. Dividing his treatment of shelter concerns into three time periods, pre-disaster, disaster, and post-disaster, Dr. Krimgold distinguished between the opportunities and constraints for mitigation and reconstruction before, during and after disasters.

The problems of the "pre-disaster period" are primarily those of identifying and minimizing the effects of potential disaster, using vulnerability analysis and hazard assessment. Attention should be directed toward the reduction of future loss through the application of hazard zonation and land use management and the application of building standards in construction.

The problems of the "disaster period" center around life-saving, caring for the injured and homeless, and re-establishing the social and physical infrastructure. Attention should be directed toward evaluating the damage and providing emergency shelter and infrastructure. Dr. Krimgold cited various strategies for the provision of emergency shelter with the intention of minimizing social and economic discontinuities and facilitating the rapid execution of permanent reconstruction plans. Though emergency housing should provide the best possible standard of living, it should not inhibit long-term reconstruction.

The problems of the "post-disaster period" are mainly those of re-establishing a stable, self-sufficient environment for the disaster stricken population. Although post-disaster reconstruction is typically planned and carried out under severe time constraints, it should recreate these elements of the pre-disaster environment which are critical to social and economic survival. However, it must also respond to the lessons inherent in the disaster by reducing the future vulnerability of shelter to the effects of disasters.

The periods before and after a disaster provide the greatest opportunity to apply building codes to prevent or mitigate disasters. In both pre-disaster mitigation and post-disaster reconstruction, there is a need to implement adequate building standards based on studies of the impact of disasters on buildings.

Afforestation

Dr. Carlos M. Fernandez and Professor Frank Zadroga*

Disaster prevention and mitigation in the ASEAN region is closely linked with proper management of the land and its vegetative cover. Trees and other types of vegetation reduce splash erosion and run-off. Trees form windbreaks, and roots improve the

* Grateful acknowledgement is made of Professor Zadroga's services which were generously provided on short notice by the Escuela de Ciencias Ambientales, Universidad Nacional, Heredia, Costa Rica.

structure and bind the particles of soil. Deforestation and improper management of deforested land, on the other hand, typically lead to erosion, landslides, floods, rapid siltation of dams and irrigation canals, and reduced streamflows during the dry season. When upland watershed areas have been denuded, catastrophic effects of heavy rainfall or melting snow are greatly magnified in lowland areas.

Reforestation (afforestation in extreme cases where the land has been devoid of trees for centuries) is one of several measures to reverse damage to land caused by improper management. Tree species selected for reforestation projects should be fast growing and resistant to disease, insects and browsing by other small animals. The trees should develop a strong, wide root system and produce a large amount of organic matter on the forest floor. Furthermore, trees should provide some short-term as well as long-term economic benefit.

Efforts to reforest should be accompanied by restrictions on slash and burn agriculture and measures to prevent overgrazing. Other conservation measures include terracing, strip cropping and contour cultivation. Measures to conserve the land, however, will be adopted only if they appear to be profitable, to produce short-term benefits such as better yields. Multiple cropping--planting crops among trees--is a measure that has great promise in the tropics.

Integrated watershed management calls for a combination of measures metioned above with structural measures for flood control (dams and dikes, reservoirs, and floodways) and complementary institutional measures (flood warning systems, damage insurance and hazard mapping). Normally a combination of measures suited to local conditions can most effectively protect against the short and long-term impact of environmental degradation.

Dr. Zadroga cited successful efforts to reclaim eroded land. Examples included Nepal's program to promote three different types of forests (individual, contract, and state), Afghanistan's program to establish lines of trees to serve as windbreaks and South American efforts to build obstructions at regular intervals along drainage canals.

Dr. Fernandez approached the problem of deforestation and the improper management of deforested land from a socio-cultural and political perspective. Over the years, the cultural minorities which occupy the Philippine uplands have been displaced by the cultural majority from the lowlands. With the

lowlanders come agricultural technologies that replace the viable system of agriculture the uplander developed. Although the same technologies are of great benefit in the lowlands, they are inappropriate in the uplands. Other problems have resulted from increased pressure from growing populations, and uncontrolled logging and mining. These events are not receiving the attention they deserve partially because it takes years for their impact to become readily apparent. To the ordinary farmer, however, the impact is already apparent and the future is bleak. By the year 2000, the Philippines will have cut 90% of its timber. Most fishing grounds will have been threatened by sedimentation and the destruction of coral reefs; and the pressure on remaining arable land will continue to increase as agricultural land is converted into human settlements.

Nevertheless, some communities are making efforts to manage their resources wisely. In Cavite, for example, intercropping is widely practiced; in Palawan Island communities, the land lies fallow for three of every eight years; and the people of Negros have learned to plant ipil-ipil trees as a source of green fertilizer. In the Philippines, there exist the technical resources, and knowledge of traditional management practices to promote proper management of the land and its vegetative cover. What is needed is inclusion of the uplands in the agrarian reform program and an appropriate organization to help communities adopt crops and agricultural practices that are both highly productive and compatible with the environment.

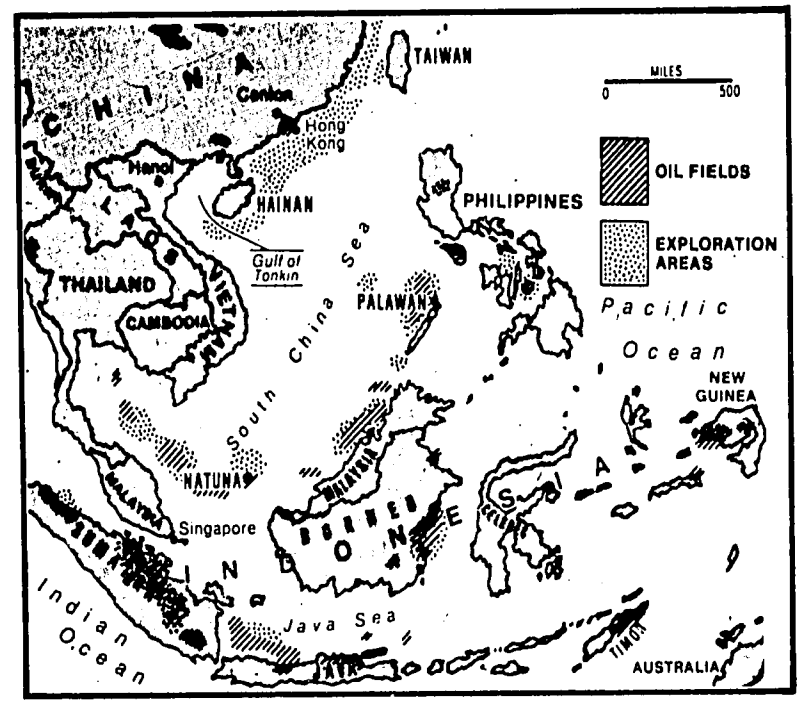
Oil Spills and Environmental Pollution

Dr. Lawrence B. Gratt

Environmental pollution is a term that refers to the ways by which man directly or indirectly causes degradation of the biosphere. It is one of the most serious problems facing mankind today. Air, water and soil are essential to the survival of life, yet they are vulnerable to pollution. Sooner or later polluted air causes illness and death, polluted water kills marine life, and pollution of soil reduces the amount of land available for growing food.

Crowded shipping routes and storage facilities are high risk areas. Oil pollution disrupts the ecosystem, contaminates plants and animals, and reduces food supplies. Oil spills also foul beaches and bodies of water that would otherwise attract tourists, with subsequent economic disruptions that can be devastating.

The problem of transportation-related oil spills has become acute in some areas and worsens each year as the global movement of oil increases, tankers become larger and controls are slack or unenforceable. Such accidents constitute the single largest source of oil pollution in the ocean. Fault-matrices and fracture mechanics are used to identify factors that contribute to a spill and the measures that can be taken to prevent another spill under similar circumstances. Analysis of accidental spills indicates that the risk of frequency and severity of oil spills can be significantly reduced by assuring strict compliance with hull and tank construction standards, training and licensing officers and crews, and equipping tankers with improved navigational aids, collision avoidance systems, oil monitors and alarm systems.

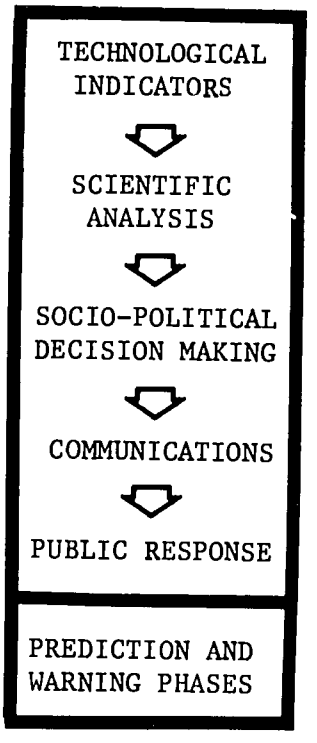


Regional distribution of oil fields and exploration areas vulnerable to oil spill accidents.

Following a spill, the flow of oil must be stopped and the oil must be contained, removed and disposed of properly. Dr. Gratt illustrated methods used for these purposes. He stressed the need to formulate contingency plans for spills of all sizes. The plan should identify areas at risk, areas to receive protection first, local capabilities and deficiencies, the chain of command, limits of authority and procedures for implementing the plan. In the event of major spills, associations are available to supplement regional response capabilities.

Prediction and Warning

There is a logical sequence of events which can provide threatened communities sufficient warning information with which to protect themselves. Technology provides us with indicators of oncoming threats; scientists analyze these indicators and make prognoses. On the basis of this analysis, decision makers must determine the political, social and economic consequences of warning or not warning populations. Radio, sirens, flags, and word of mouth transmit the warning. This complex series of actions does not insure that the threatened population will react in their own interests. Depending on their past conditioning they may choose to totally disregard the warning to their peril. The tools and decision processes of prediction and warning must be improved to the extent that the warning system is credible in the eyes of the public whose lives are at stake.



Prediction Tools and Scientific Analysis

Drs. Ted Algermissen, Bruce Currey, Norton Strommen, Messrs. Neil Helm and Charles Vermillion

Charles Vermillion described the technological advances in monitoring and transmitting environmental data by satellite accomplished during the last decade. Barometric pressure, rainfall, wind direction, volcanic eruptions, and stream flow are among some of the parameters that can be measured by data collection platforms. Satellite telemetry enables these data to be transmitted from ground sensors in real-time to a central recording center, thereby facilitating more timely and accurate forecasts and providing increased lead-time to warn of impending disasters. Neil Helm added that the potential for using communications satellites in disaster operations will significantly increase as ground stations are reduced in size and complexity.

Capabilities and limitations of two types of meteorological satellites, polar orbiting satellites (TIROS-N) and geostationary satellites (GOES) were discussed by Dr. Strommen. Polar orbiting satellites provide a periodic view of all large atmospheric features at least once each 24-hour period, whereas geostationary

satellites provide a continuous view of a specific region of the world. These satellites enable meteorologists to locate and track storm systems, monitor the early or late onset of seasons, locate patches of fog, and monitor potential drought and flood areas. Data from satellites will continue to complement but not replace, current sources of ground data compiled by the World Meteorological Organization.

With regard to predicting earthquakes, Dr. Ted Algermissen cautioned against having high expectations until far more is known about earthquake precursors. Current research in plate tectonics have identified a number of factors that weakly correlate with the occurrence of larger shocks ($M \geq 6.5$ on the Richter scale). Analyses of these factors may eventually lead to some form of probabilistic forecasting. When reasonably reliable predictions can be made, we anticipate significant improvement in the development of disaster preparedness and mitigation measures. To be able to reliably predict earthquakes would undoubtedly be a tremendous scientific achievement, but it should be understood that prediction will not be a panacea for solving the earthquake hazard mitigation problem. That is to say that earthquake predictions in themselves will not appreciably reduce the magnitude or distribution of damage to buildings and loss of life. Predictions that are currently useful in disaster mitigation include delineation of the distribution and magnitude of aftershocks and the modeling of tsunami generation.

Dr. Currey presented his concept of centralized famine early warning systems and stressed the importance of monitoring local indicators. Answers to the following questions are essential to the development of a famine early warning capability.

- From which areas are data collected and from how many collection points?

- Are data collected at the household or district level? Are they collected only from urban areas? Are data sufficiently disaggregated?

- Are the data collected continuously, daily, weekly, monthly or annually?

- Does data collection occur at a particular time of day, week or month?

- How long is the delay between the time the data are collected and the time they are made available to the decision maker?

- Are the data from biased or uninformed sources?
- What are the consequences of failing to predict a famine? What are the consequences of erroneously predicting a famine?
- Do the data indicate the probable intensity of the famine, the population likely to be affected?
- Any data on availability of resources for recovery?
- Who has access to the data?
- Are there sufficient personnel with sufficient knowledge to interpret the data?
- Are the data in a form that will facilitate decision making?

Only if we are sensitive to the inadequacies of the surveillance system which these questions may suggest can we hope to predict famine successfully. See also Dr. Currey's presentation on page 37.

To Warn or Not to Warn

Dr. Ed Arnold, Air Vice-Marshal W. Carter and Mr. Jerry Jarrell

Jerry Jarrell presented a decision model to optimize tradeoff between possible overwarning and underwarning to improve the mitigation of tropical cyclone caused disasters. The model converts weather data, impact predictions and policy information into recommendations for action.

In the model all reasonable variations on cyclone disasters are enumerated. The impact of each of these disaster scenarios would be estimated. Appropriate time sequenced and coordinated actions for any scenario would be delineated as would the estimatewd cost of any combination of inappropriate responses. Government policy is reflected in these cost estimates by a policy model. A policy that is strongly oriented toward saving lives would

assign heavy costs to inappropriate responses that lead to unnecessary life loss. On the other hand the administrator for an overpopulated region with a struggling economic base may assign a relatively low cost to lives lost compared to commercial property damage.

A probability model converts a forecast into the probability of each scenario occurring. Then standard methods are used to select that set of actions which maximizes the attainment of policy objectives.

Interestingly there exists a risk level (acceptable risk) below which public warning should not occur. This is true because if a disaster does not occur after warning, reliance on the warning system is impaired. This lowered credibility translates into poor public response and unnecessary losses in the future.

Another sidelight to this modeling of the problem is that actions should be phased to allow for a maximum of follow-on options. The result of such hierarchical phasing is that irreversible actions can be delayed and still be executed in an orderly fashion.

Issuing warnings based on current state-of-the-art earthquake prediction technology is very risky for decision makers. Dr. Ed Arnold indicated that, whether or not predictions prove accurate, governments are forced to take extraordinary measures to meet impending disasters. Evacuation invariably is costly and may be more disruptive than an earthquake.

With reference to the disaster at Darwin, Australia in 1974 (Cyclone Tracy), Air Vice-Marshal W. Carter discussed a classic example of a belated response to warnings. Despite evidence of a potential threat from a cyclone 48 hours in advance and repeated warnings issued to the public by radio during the 24 hours immediately prior to the disaster, the citizens of Darwin did not take adequate precautions. One of the reasons for the public's disregard of the warnings is the fact that the storm struck on a holiday (Christmas). Despite the existence of a preparedness plan and the issuance of warnings, the Director of Emergency Services ignored the plan and did not call a meeting of the Emergency Committee. Following the disaster, 35,000 citizens were eventually evacuated--25,000 by air and 10,000 by whatever other means they could muster.

Communication and Community Response

Air Vice-Marshal W. Carter, Drs. Mac Marshall and Anthony Oliver-Smith

Although data gathering and information transfer have never been better, Air Vice-Marshal Carter warned against underestimating the difficulties associated with promoting community response. The community is the primary concern of disaster mitigation--especially communities at risk. Attempts to promote effective community response encounter many obstacles including the attitude that "It can't happen here" or "It won't happen here again". The problem is compounded if education authorities are unable or unwilling to incorporate preparedness education in the standard curriculum. It is further compounded if the media does not provide adequate support for government actions or if decision makers and communicators lack credibility.

Communication is a two-way process, involving listening and respect. Community response is conditioned by the beliefs of the inhabitants of those communities; and these belief systems are usually different from those of technicians and decision makers. Populations often have a great deal of disaster preparedness knowledge based upon centuries of experience. And even without official warnings being issued, communities will take precautions based on this experience. When the natural hazard is one which occurs frequently, existing and well-known warning systems can be integrated within the community and acted upon without much encouragement from decision makers. By realizing that communication involves listening and respect, disaster mitigation officials can be more effective in establishing appropriate community response.

Traditional societies have sources of information that combine religion and science, which should be respected and considered as potential resources, noted Dr. Oliver-Smith. In addition, traditional societies undertake disaster preparedness activities within the context of existing organizational structures, and care must be taken to avoid eroding existing forms of risk-taking and self-help. It is unfortunate that modern forms of community response to disasters reveal the disappearance of traditional inter-community pacts and social organizational forms of mutual assistance. An individual's response to a warning or disaster is affected by the constraints of the social, economic and environmental systems in which he lives. To understand the constraints that structure the response of a population to warnings of impending disaster, one should also consider the daily struggle of ordinary people to meet their basic human needs. Choices are never free of conflict; there are frequently very plausible reasons for individuals to accept the risk of a natural hazard rather than respond to evacuation warnings.

Geophysical Prediction

Drs. Ted Algermissen, Ed Arnold and John Lockwood

Dr. Ted Algermissen briefly described several approaches to earthquake prediction currently under investigation. These include analysis of foreshocks, seismic gaps, rock bursts, ground movement, animal behavior and magnetic anomalies. Correlation analyses of these indicators have also been used to determine the statistical probability of the occurrence of imminent earthquakes, but this approach has not been proven to be reliable or practical.

Current approaches to earthquake prediction are as follows:

- Velocity Anomalies
- Ground Movement
- Seismic Gaps
- Inclusion Theory
- Electrical and Magnetic Effects
- Animal Behavior
- Foreshocks
- Bayesian

Volcanoes constitute a major hazard in the ASEAN region because of the proximity of volcanoes to densely populated areas, according to John Lockwood. Of the 200,000 deaths attributed to worldwide volcanic eruptions during the last 200 years, three quarters of the victims were in Indonesia and the Philippines. Mapping of volcanic hazards was first developed in Indonesia in the 1920's and excellent research on volcanoes has continued in the region due to the significant threat. Compilation of past eruptive activity is urgently needed to determine the long-term hazard potential associated with volcanic activity throughout the ASEAN region. Studies of eruptive history and the preparation of hazard maps should incorporate distribution of ashfall and lava. Carbon dating of the burnt wood buried by ashfall and lava will help to determine the periods between eruptions.

For short-term (i.e., days and months) eruptive prediction, geophysical methods are useful tools. Earthquake activity generally precedes volcanic eruptions, and monitoring these small earthquakes by means of a regional seismic network can be critical for early warning. When anomalous activity is noted within the region, portable seismic stations can be placed in the abnormal areas to monitor changes in the frequency, focal depth, and character of microearthquakes.

Local geodetic changes often precede volcanic eruptions. Establishment of survey stations to monitor tilt can provide valuable precursor data on pre-eruptive changes. Significant vertical and horizontal movements can be detected; and variations in the earth's electrical and magnetic field have been recorded near active volcanoes. Geochemical observations of the composition and temperature of volcanic gases can also indicate changes that in some cases are precursors to eruptive activity. The eruption of Mauna Loa, Hawaii, in 1974 was predicted quite accurately with the help of these techniques. From 1950 to 1972, there was a lull in the recording of earth tremors around Mauna Loa. A perceptible increase in tremors was then observed until the eruption in 1974.

Input from local residents can also provide excellent early warning. Many tragic "surprise" eruptions have been preceded by visible signs of change (increased fuming, increased temperatures, rapidly melting snows, felt earthquakes, etc.), but the people who observed these phenomena did not report what they saw to public authorities. People living in hazardous volcanic zones must be educated to recognize and report changes which may forewarn of volcanic activity.

Reliable prediction of impending hazardous eruptions is not yet possible, even at the world's best-monitored volcanoes such as Mauna Loa. Nonetheless with expanding populations in hazardous zones living ever-closer to the threat posed by volcanoes, geophysical monitoring will be increasingly necessary if the threat to these people is to be minimized.

Typhoon and Storm Surge Prediction

Messrs. Jerry Jarrell and Charles Vermillion

Mr. Jarrell presented the unique attributes of the currently operational Tropical Cyclone Strike Probability Program (STRIKP) and Tropical Cyclone Wind Probability Program developed for the Western Pacific Region by the U.S. Naval Environmental Prediction Research Facility (NEPRF). He provided examples of how these predictive models can be used in analyzing typhoon forecast errors and threat probabilities to improve the disaster mitigation decision process. The STRIKP Model has direct application for optimum routing of oceanic cargo ships and military vessels, typhoon early warning of threatened coastlines

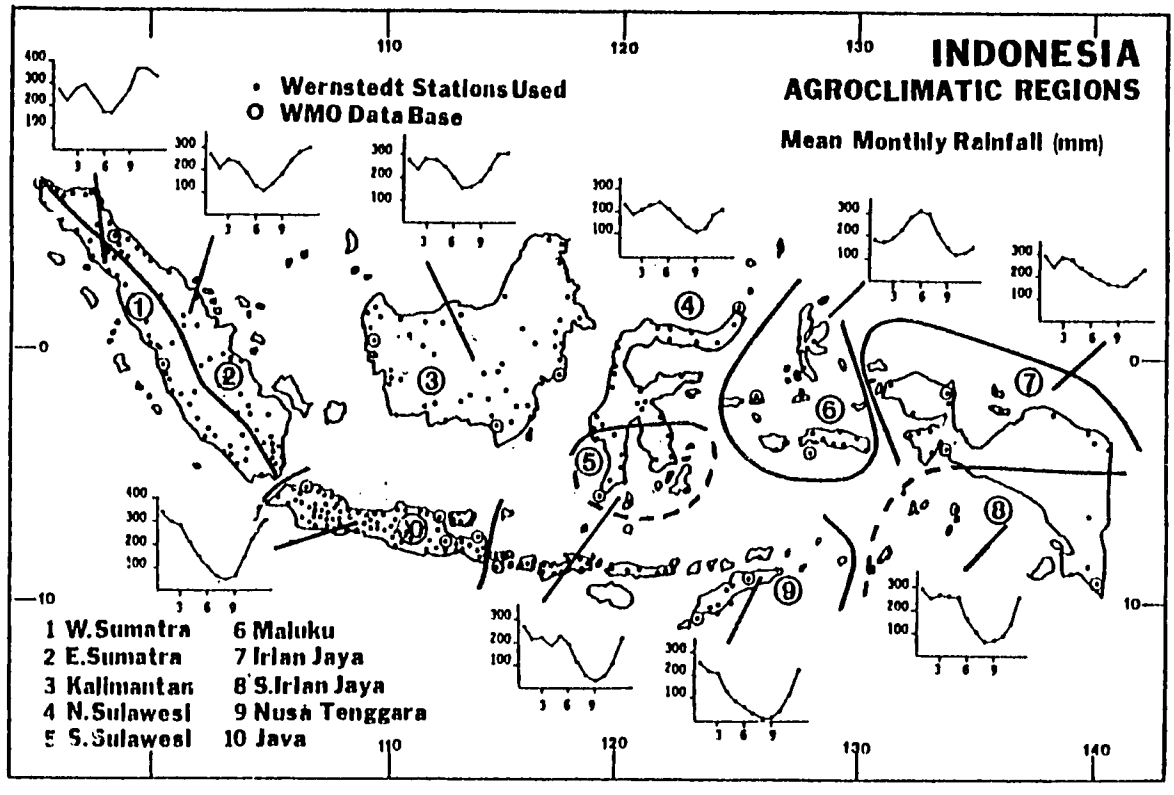
(The Philippines, Japan and Western Pacific Region), and is a factor in storm surge prediction models. Mr. Jarrell briefly discussed current research efforts in the Bay of Bengal region sponsored by A.I.D. to develop cyclone wind threat estimation models and storm surge forecasting models for all possible scenarios including tidal cycles.

The application of geosynchronous satellite synoptic data in producing electronic movie loops for large portions of the earth was briefly discussed by Charles Vermillion. This technique provides animation of severe storms from which storm size, intensity, rate of intensification or abatement and direction and rate of movement can be determined. These and other data can be synthesized and analyzed in conjunction with in-situ measurements from oceanic tidal data collection platforms (buoys) and thereby provide important inputs to storm severity forecasts and surge prediction models.

Drought Assessment

Drs. Louis Steyaert and Norton Strommen

Unlike disasters that occur suddenly, drought is a "creeping disaster". Among the effects of drought are reduced crop yields, food shortages and disruptions to society. Because severe drought has recently occurred in Indonesia, Malaysia, Thailand and other Southeast Asian countries, it is important that decision makers in these countries have ready access to timely drought assessment information. Dr. Strommen described the LACIE and AgRISTARS programs and outlined a real-time, low-cost drought monitoring system which is sufficiently reliable to provide meaningful information prior to the onset of disaster. He and Dr. Steyaert also described the NOAA/OFDA project currently underway in South and Southeast Asia to forecast crop yields using agronomic climatic and precipitation data. The project is to determine agroclimatic regions and corresponding crop response indicators for each specific region and to establish baseline data and devise a system to correlate current data on rainfall, soil types, temperature, crop types and planting dates. Evidence suggests that crop yield forecasts based on these data are significantly more accurate than forecasts based on cumulative precipitation alone.



The importance of an accurate, quantitative forecast of crop yield lies in its potential for early warning of diminished crop yields and resultant food shortages. Crop yield forecast techniques have been used to predict crop shortfall or failure in India (wheat and rice), China (rice), Haiti (corn) and Niger (millet). The forecasts help to avert potential agricultural shortfalls leading to disaster by providing longer lead time for the formulation of contingency plans. Even in the absence of probable drought conditions, crop yield models provide decision makers with useful information on expected market conditions and guidelines for planting and harvesting.

Health Surveillance and Medical Aspects of Disasters

Dr. Gerald A. Faich

Dr. Faich summarized several of the lessons for health care practitioners learned during the 1972 earthquake in Managua, Nicaragua:

- Rapid assessment is crucial to ensure an appropriate response. Inappropriate or belated responses often do more harm than good.

- A central facility point should be established where persons with responsibility and authority can meet to attend to each aspect of emergency assistance. Without coordination, inappropriate supplies and personnel converge upon the disaster area and prevent the arrival of appropriate relief.

- An epidemiologist able to assess need for health care and risk of disease is a crucial part of the disaster-relief team. Careful monitoring by the epidemiologist will assure an appropriate basis for future medical relief and authoritatively dispell rumors of epidemics.

- Post-disaster actions should be based on evidence rather than preconceived notions. Contrary to popular belief, epidemics do not necessarily follow a disaster. The fear of a typhus outbreak in Managua proved to be unfounded since the water reservoir serving the city was not damaged.

- The most frequently treated medical problems after the earthquake were not disaster-related.

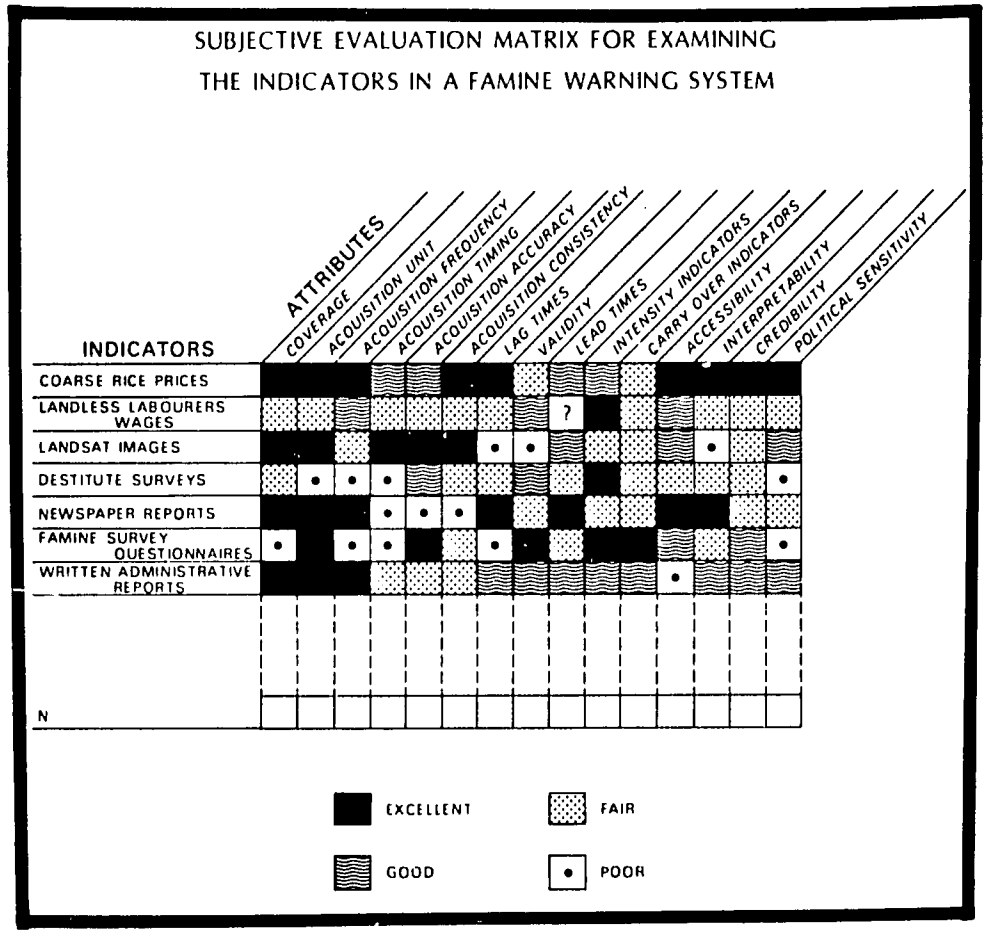
- Only medical teams with appropriate skills, supplies and adequate support should enter the scene. They should be self-sufficient, i.e., provide their own shelter and food.

Predicting Food Shortages

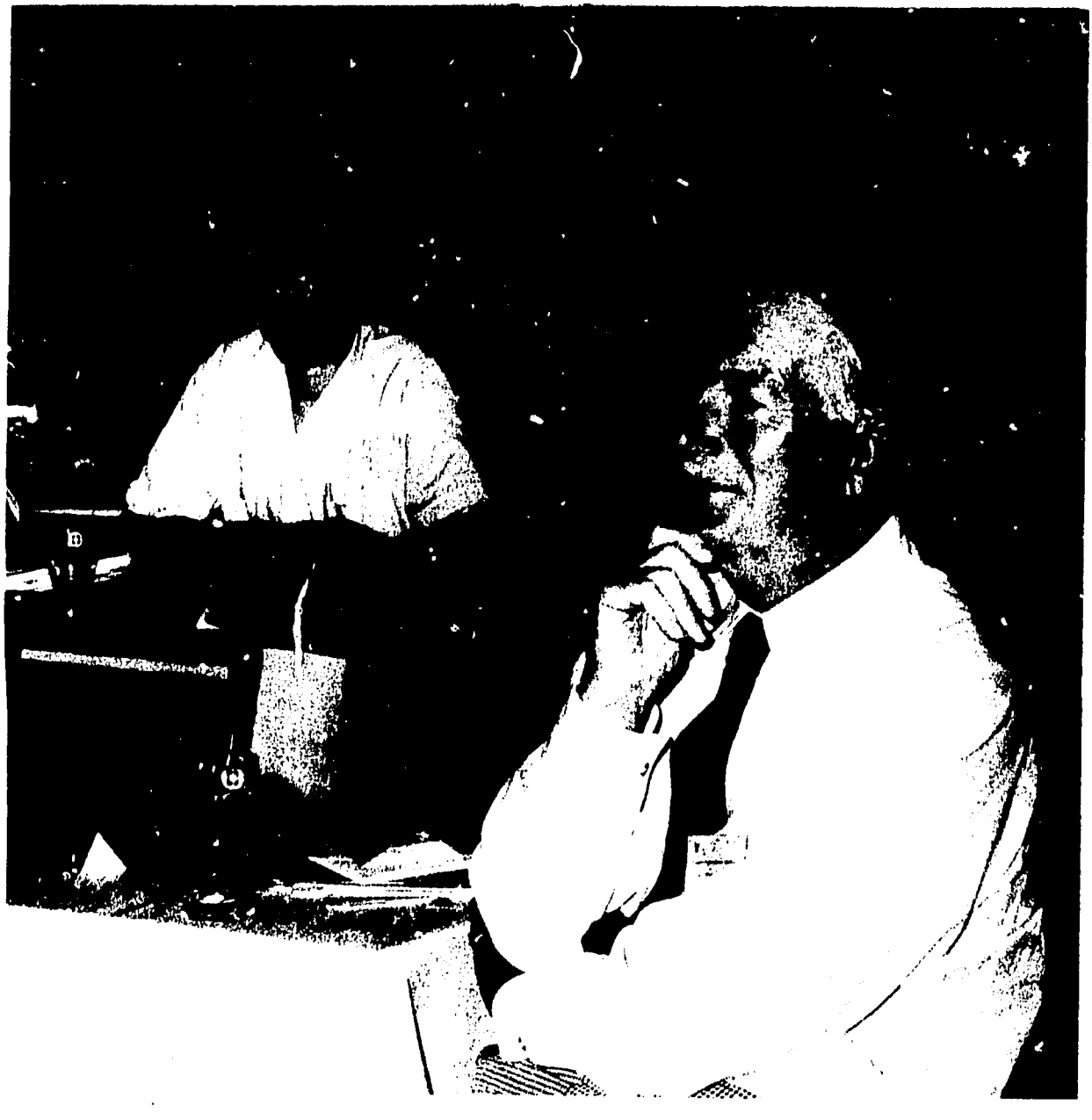
Consensus and Consistency as the Basis of a Pragmatic Strategy for Famine Prediction

Dr. Bruce Currey

Many factors come together at a particular time and place to cause a famine. They usually occur in areas where statistical data bases are poorly developed. Though famines are often euphemistically called food shortages, in many cases there is no actual shortage of food. Dr. Currey offered as an alternative the definition of famine as the sudden inability of a rural community to support its poor members, as associated with sudden increases in starvation deaths or out-migration or both. Illustrations of some of the indicators of approaching famine as they have occurred in Bangladesh were presented. The appropriateness of government interpretations and actions was also analyzed. Governments are in a better position to predict famine if they consider all sources of information--indigenous folk knowledge as well as scientific evaluation of precursors.



Though it may be several decades before a reliable information system will be available to predict famine more accurately, a pragmatic strategy for famine prediction should be adopted in the meantime. There is a need for trained personnel who understand the cultural ecology of specific regions, especially since the indicators and causes of approaching famine can vary from place to place.



Resource persons Professor Frank Zadroga (on the left) and Air Vice-Marshal Nick Carter.

Relief and Rehabilitation

So long as man remains out of tune with nature and does not heed the warnings of destruction, disasters will occur. Disaster relief in itself is a very complex system of interactive components, which could not be fully explored at this seminar. A few of the more perplexing issues were discussed. Accurate assessment of damage and needs was said to be the most critical factor in effective relief operations. Quick mobilization of resources is very desirable. Toward this end, resources should be identified and prepared before a disaster strikes. The range of any country's resources is greater than we may suspect, and includes private as well as public capabilities.

Coordination of these diverse resources is a pressing problem which deserves comprehensive and exacting planning. Communication plays a very important role in this coordination. It was pointed out that "hardware", for all of its potential benefits, is only as useful as the information it transmits makes it.

Assessment of Damage and Needs

Drs. Mac Marshall, Anthony Oliver-Smith and
Mr. William Wilcox

Knowledge of the pre-disaster socio-cultural setting is essential for accurate post-disaster damage and needs assessment. Socio-cultural factors relevant for disaster planning and management include:

Cognitive Orientations

- concepts of time and space;
- values and norms for individual and collective behavior;
- religious and moral beliefs and standards;
- risk perceptions and preparedness attitudes;
- symbolic systems for individual and community integration; and
- knowledge of the environment.

Environmental Factors

- ecological niches;
- settlement patterns;
- land use patterns; and
- natural resources.

Infrastructue and Use Patterns

- transportation systems;
- communication systems;
- water; and
- power.

Social Structure and Organization

- family;
- community;
- patterns of stratification:
  class--ethnicity--religion--race;
- patterns of conflict/cooperation/consensus; and
- position of local population in national social structure.

Economic System

- systems and cycles of natural resources exploitation;
- social organization of production;
- distribution mechanisms; and
- dietary patterns and nutritional levels.

Political Structure

- formal political entities and governing bodies;
- informal political groups;
- leadership patterns;
- legitimacy of power structures; and
- capacity and modes of community mobilization.

In any context, needs should be perceived in light of local resources. If the local resources and conditions are not known, it is very difficult to assess local needs with accuracy. The most effective aid is usually based on a solid understanding of local conditions and needs.

Damage assessment procedures employed in the United States were described by William Wilcox. It is useful to distinguish between assessment before a disaster declaration and assessment after a disaster declaration, the latter being far more extensive and exacting. Damage assessment at FEMA (Federal Emergency Management Agency) has two purposes: 1) To provide information upon which a recommendation can be made to the President in response to a Governor's request for a disaster declaration. In general, the larger the disaster, the smaller the amount of information required for declaration purposes. 2) To provide basic management data to answer questions as to what type of assistance is needed where, when and in what quantity. In this case, the larger the disaster, the greater the amount of information required to identify management requirements. Damage assessments should focus on the impact of the disaster. Figures should be translated into impact which represent hardship, suffering and emergency needs. Damage assessment should continue until all management needs are identified. Ongoing damage assessment is especially valid for larger disasters.

Dr. Mac Marshall suggested that adequate assessment of needs following disaster is possible only if base-line data are available for the following environments:

- natural/physical (e.g., loss of crops, livestock, shelters, threat to health);
- socio-cultural (e.g., disruption of family organization, governmental structure, economic patterns); and
- personal/individual (e.g., injury, anxiety, trauma).

Preparedness activities should incorporate base-line data on an on-going basis. Studies of communities should be undertaken as a matter of policy to facilitate meeting the inevitable need for congruent relief and rehabilitation operations.

Resources of Relief Organizations

Mr. Jacques Brijl, Air Vice-Marshal W. Carter and
Mr. Asbjorn Olsen

The range of resources required for disaster relief operations was outlined by Air Vice-Marshal Carter and guidelines were suggested for insuring their availability and coordinated use. Post-disaster problems can be categorized by their effects on people (injury, death, shock, and isolation); effects on life support systems (loss of food, water, power, medical facilities, and transportation); and effects on the patterns of conduct (disruption of government, loss of order and external communications).

Disaster relief operations require resources to provide health services, food, water, clothing and shelter. Resources are also required to restore power, order and communications. Some sources of resources include:

- local resources and community residents;
- stockpiles;
- government agencies and depositories;
- voluntary organizations;
- armed forces;
- private sector;
- utilities;
- international organizations; and
- foreign donors.

Although there will always be some uncertainty before a disaster occurs as to which resources will be needed, measures must be undertaken to insure that resources are identified well in advance and that they can be mobilized without delay. This requires a high level of effort that should not be underrated. In addition to preparing an inventory of resources, a sound relief plan is essential to assure effective distribution.

The functions of the Office of the United Nations Disaster Relief Coordinator (UNDRO) were described by Jacques Brijl. Before disasters occur, potential donor governments are invited to inform the Disaster Relief Coordinator of facilities and services they might be in a position to provide including relief units, logistical support and means of communication. Resources available from the United Nations include a maximum grant of $30,000 per country per disaster from UNDRO and $20,000 from the U.N. Development Programme for relief purposes. UNICEF and and some governments (e.g., the United States and the United

Kingdom) are also able to provide financial aid, supplies, personnel and transportation. The United States and the League of Red Cross Societies maintain stockpiles at various points around the world, and additional resources are available from international voluntary organizations and scientific facilities such as the Hurricane Warning Center in Miami.

All parties engaged in disaster relief and rehabilitation operations are encouraged to maintain a dialogue so that resources will promote development of the country and be managed efficiently. It was emphasized by Mr. Olsen that delays in relief provision can be minimized by issuance of clear and specific appeals for assistance, implementing regulations and procedures to expedite the transportation of resources, and improving the exchange of information between the agencies of government and voluntary organizations.

Fire, Search and Rescue

Major Remigio A. de la Cruz

Industrialization and urbanization have increased vulnerability to a variety of hazards, one of which is fire. In the Philippines, fire results in an annual loss of hundreds of millions of pesos worth of property and hundreds of human lives. In addition to causing losses from heat, smoke and water, fires disrupt families, production and business. In general, little progress has been made to minimize losses from fire.

Procedures and techniques for search and rescue were summarized; they apply not only to fire but to all kinds of disasters, natural or man-made. Recommendations include:

- determine immediately if human life is in danger;
- formulate a definite course of action; allocate personnel and equipment accordingly;
- use simple procedures that can be explained at the scene to volunteers;
- consider all victims as being alive until they are officially pronounced dead;
- first rescue all victims that can be seen or heard;
- require all workers to work in pairs; and
- permit only trained persons to conduct search and rescue inside damaged buildings.

Communications

Mr. Neil Helm

According to Neil Helm, based on his experience in post-disaster relief operations, a good emergency communication system will pay for itself during a disaster by minimizing delay and confusion. Such a system typically consists of the following:

- equipment to provide local communications within ten kilometers of the disaster site. This requirement can be met using hand-held units which are far more reliable and less expensive than they were only a few years ago. Units of this type cost from US $100 - US $200. Battery life in these units has also improved significantly in recent years; and usually the batteries are rechargeable.

- equipment to provide communications from the immediate disaster area to the regional staging area or national emergency operations center. This requirement can be met using mobile units with a range of approximately 40 kilometers. Mobile units cost US $300 - US $500 when purchased by governments in quantity.

- equipment to serve as the base station to provide communications with other countries and international agencies. Depending on the sophistication of the equipment, the base station costs US $500 - US $700. Similar units are used by radio amateurs (who are generally as well organized as any unit in the field and can be a great asset during a disaster).

Mr. Helm also described switching equipment that permits communication with any working telephone in the world. For this purpose, there is a commercial U.H.F. mobile unit available in the United States. It has an antenna that extends approximately 30 meters above the unit which, if placed on a hill, establishes communication with a telephone switching center up to 90 kilometers away. The equipment is bulky but invaluable when linkage with the public telephone system is required. If available, military communications equipment is also extremely valuable to disaster relief units. Unfortunately, such equipment is usually confined to government warehouses during extended peacetime periods.

As satellites become more powerful and earth stations become smaller and less expensive, use of satellite communications for disaster relief operations will become more commonplace. Satellite technology already underlies the communication systems of 102 nations and has demonstrated that small mobile earth stations can provide high-quality communications from nearly any location on the globe. The INTELSAT system--of which all ASEAN countries are members--has reserve capacity available, and its global coverage and multinational membership make it a prime candidate for a disaster communications network. The MARISAT system has features which also qualify it as a good candidate. Maritime frequencies lend themselves to emergency operations; the equipment is highly reliable, relatively small and commercially available. Satellite technology has been proven, is growing in usage by 20-30% every year, and is not likely to be supplanted by another technology in the foreseeable future.

COMPARISON OF TWO-WAY RADIO SYSTEMS

TYPE OF SYSTEM	TYPICAL RANGE	CHARACTERISTICS	COST
Single Sideband Citizen's Band 27 MHz 10 watts	10-20 km	• essentially line of sight • ground plane vertical is the most practical antenna • battery operation is feasible • 24-hour system dependent upon co-channel interference problems • commercial equipment is available	$100-175 Antenna adds $25-50
VHF-FM 140-165 MHz 10-25 watts	10-20 km	• essentially line of sight • ground plane antenna is minimum requirement ... directional antenna is desirable • battery operation is feasible • repeater with antenna 200 m above ground level yields 60 km range • a modest repeater requires reliable electric power • maintenance requirements increase with repeater • commercial equipment is available	$200-400 Repeater costs $1500 plus antenna and tower
Single Sideband 4-7 MHz 10-25 watts	30-300 km	• simple(dipole) antenna required • battery operation is feasible • powerful base station is desirable to coordinate village units • not a 24-hour system: extremely variable nighttime range • commercial equipment available	$400-800
Communication Satellite	8000+ km	• helical antenna for VHF or 3 m dish for microwave • acquisition of satellite channel capacity at minimum cost is <u>most important</u> • battery operation is not realistic • ground station requires maintenance • 24-hour system • equipment increasingly available	$5000-6000 for ground station equipment including 3 m dish

Reconstruction and Development

The world is increasingly aware of the strong linkages between disasters and development. It has long been evident that disasters retard development and development can be a most effective tool in mitigating disasters. Only recently have we begun to understand the true dimensions of the problem in terms of productive human life, scarce material resources and even more scarce stability of the human condition. Although we may shy from the notion, it is potentially valuable to view disasters as opportunities following which the human condition can be improved and better protected. Certainly, we are only defeating ourselves if we fail to learn from the lessons which disasters present.

Disaster as Opportunity

Mr. James Lewis, Drs. Mac Marshall and Anthony Oliver-Smith

Disasters are not always unmitigated disasters; they can also be opportunities to affect constructive change. The introduction of improved crop varieties, more relevant education curricula and safer building standards are among the changes that may result. Disasters provide opportunities for new leaders to emerge and aid in the development of previously untapped human resources. They can open new channels of communication and cooperation, unlock institutional paralysis, and perhaps create a climate favorable to social progress. The disruption caused by a disaster may provide an opportunity to discontinue certain deleterious social institutions. Often a damage and needs assessment will highlight social and material problems which had not been fully appreciated under normal conditions and may stimulate public and private agencies to take immediate action in areas that had previously been ignored or relegated to secondary importance. Since most major disasters affect whole regions rather than discreet populations, they tend to stimulate heavy government investments in material improvements, particularly in regional infrastructure. Disasters also stimulate local efforts to improve conditions over pre-disaster levels and may improve communications between the people and their government.

Although the relief and reconstruction efforts which follow a disaster present opportunities for change, the potential for beneficial change is much greater with prior planning. In order to capitalize on the opportunities presented by a disaster, projects and programs should be pre-identified; it is not necessary or wise to wait for the disaster for such planning to take place. Environmental hazards can be identified, and their impact quantified to some degree; the role of socio-economic changes can be assessed; and measures can be taken to revert to practices more in tune with the environment. What is needed is realism in both long-term development planning and preparedness and the integration of relief planning.

The aim of post-disaster planning must be to stimulate and invigorate national development goals by taking advantage of the positive long-term opportunities disasters can provide for building a stronger and more just society. Long-term research is needed to understand the importance of emergency management and recognize its potential role in meeting the development needs of a particular community so that better systems than those which existed before can be built.

Regional Response Capabilities

Chiefs of Delegations

Each delegation recapped its country's disaster preparedness status and reiterated support for the spirit and areas agreed upon in the 1976 Asean Declaration for Mutual Assistance on Natural Disasters.

Indonesia

Indonesia's most significant threat is from volcanic eruptions. The country has an annual rate of three volcanic eruptions from the 38 active volcanoes out of a total of 120 including dormant ones. Indonesia has 30 volcano observation centers and seismic stations and it hopes to put up more in the near future to improve chances of predicting eruptions. Assistance was requested from the international community in obtaining training grants in seismology, volcanology and geology.

Indonesia suffers from chronic drought especially in the eastern islands. Many people are faced with droughts eight months of the year. An afforestation program is being carried out but its effects will be felt only after an extended period of time. Assistance was requested to provide a hydrological survey to determine possible ways of improving the water supply.

Malaysia

Malaysia's preparedness plan is considered adequate to meet flood disasters, the only natural disaster with which it has to contend. In the spirit of brotherhood and cooperation, and in accordance with the understanding reached at the ASEAN Disaster Experts Meeting in Yogyakarta in October 1979, it commits itself to continue to extend assistance to the ASEAN members, especially in the field of training. Malaysia is willing to continue the exchange of information on disaster relief, preparedness and prevention; provide limited material and medical assistance; and train volunteer organizations on a regional basis. It is seeking assistance for the professional training of meteorologists and medical practitioners.

The Philippines

This country's disaster preparedness plan does not include a provision for regional response. It is planned, however, to institutionalize the Philippines' response to the ASEAN Declaration by devoting national funds to improve regional commmunications capabilities, using perhaps the meteorological teletype system and civil aeronautics communication network for this purpose. The Philippines agreed to the exchange of technical expertise in typhoon forecasting, agrometeorology, storm surge forecasting, management of relief operations, the resettlement of disaster victims and earthquake engineering. Training in meteorology, seismology and oceanography is available. It is hoped that the Philippine National Disaster Research Center will become a reality and with it a venue for regional training and expertise.

Singapore

Singapore's experience with natural disasters is limited to occasional floods during the monsoon season. An extensive drainage system has, to some extent, mitigated the effects of these floods. Singapore is outside the volcano belt but is planning construction of a seismological station, to be operational within a few years. When data from this station

are available, they will be shared with member ASEAN countries. Singapore wants to facilitate the acquisition and dissemination of information on disasters. Specifically, it proposes to work on standardization of terminology, identification and classification of the disasters that affect each country within the region, standardization of data collection and transmission procedures, and the exchange of experiences in order to promote effective emergency management practices.

Thailand

Thailand is occasionally threatened by flooding and beset by fires and the refugee problem. It affirmed the areas of cooperation contained in the ASEAN Declaration referred to earlier and recommended the following steps to implement the Declaration:

- improve communication channels among ASEAN countries for weather forecasts and disaster warnings--using WMO procedures;

- encourage the exchange of experts on disaster training, research and management--among ASEAN member countries or with the assistance of third countries or international organizations;

- exchange information and documents on disaster prevention and preparedness projects and other activities relating to natural disasters--through the ASEAN National Secretariat of each country;

- disseminate medical supplies, services and relief assistance--pre-arrangements should be made with relevant authorities in the transit or destination country to facilitate quick distribution;

- establish national and regional coordinating centers on natural disasters. On the national level, Thailand has designated the Department of Local Administration, Ministry of Interior, as its internal coordinating body to gather, collate and exchange data pertaining to natural disasters and to be responsible for implementing cooperation in this field. On the regional level, Thailand supports the establishment of an ASEAN Natural Disaster Center to coordinate activities among the national centers. One of the ASEAN national centers should act as the regional body. The ASEAN Experts on Natural Disasters have recommended that the regional center be located in the Philippines subject to the approval of the member governments and the ASEAN Standing Committee;

- rather than modify existing national plans to accommodate goals of mutual assistance, focus on the need for effective internal administrative arrangements and coordination with relevant authorities so that regional cooperation and assistance can be carried out successfully;

- undertake joint research and training in artificial rain-making to help relieve drought and in cloud-dispersion projects to help prevent flooding in the region;

- promote afforestation in the areas where it is lacking. Other effective methods of flood control should be identified and encouraged;

- consider establishing stockpiles of relief materials for relief operations throughout the ASEAN region. Assistance in this regard by third world countries or international organization is welcomed.

Thailand offers training in weather modification and hydrology to other ASEAN member countries.

How Can ASEAN Disaster Planning Be Strengthened To Achieve Goals of Mutual Assistance?

Chiefs of Delegations

Delegates from the five ASEAN member countries identified features of their national plans and preparedness activities that promote implementation of the Asean Declaration for Mutual Assistance on Natural Disasters. The following list of sugggestions is a composite of steps that were proposed by one or more delegates to further promote implementation of the Declaration:

- review national plans and planning efforts to determine if they are comprehensive and up-to-date;

- revise/expand national plans as necessary;

- introduce or amend emergency legislation as necessary;

- assure reasonable level of funding of preparedness activities;

- improve coordination among administrative and logistical support agencies responsible for relief operations;
- prepare inventories of local resources and expertise;
- encourage use of indigenous supplies and personnel, promote community awareness and self-reliance;
- develop and exchange regional expertise;
- promote the proposed Disaster Research and Training Center;
- prepare hazard maps;
- install/improve warning systems;
- conduct simulation exercises to increase readiness;
- evaluate relief operations to identify strengths and weaknesses and make changes accordingly;
- improve/expand stockpiles;
- survey water resources; and
- promote crop diversification.

The Chiefs of Delegation, from left to right: Drs. A. Harun Alrasjid, Indonesia; Abdul Malek Bin Abdul Aziz, Malaysia; Col. Victor R. Pagulayan, the Philippines; Pratuang Saiyapant, Thailand; and Dr. Chew Chin Hin, Singapore.

RECOMMENDATIONS OF THE ASEAN DISASTER PREPAREDNESS SEMINAR

ASEAN Projects for Mutual Assistance

Chiefs of Delegations

The ASEAN Declaration for Mutual Assistance on Natural Disasters done in Manila on the twenty-sixth day of June 1976 declares, "The Member Countries shall within their respective capabilities, cooperate in the:

a. improvement of communication channels among themselves as regards disaster warning;

b. exchange of experts and trainees;

c. exchange of information and documents; and

d. dissemination of medical supplies, services and relief assistance."

A review of the capabilities of each ASEAN country along these four areas of cooperation indicates the following:

a. There is an existing communication system within each ASEAN country to meet internal communication requirements. There is also an existing communication system which can be used to warn other countries of an impending disaster or advise them that a disaster has already occurred.

b. There is an impressive supply of experts within ASEAN in various disaster preparedness related fields to satisfy most needs of member countries. On a limited scale and for a short time, ASEAN nations can send experts to provide assistance to other countries.

c. Training courses to which foreign trainees can be accepted are already being conducted in some countries.

d. Relevant information and documents are available in various forms (for example, disaster reports and research findings) and can be shared within ASEAN.

e. Most ASEAN countries already have experience providing assistance to neighboring countries in distress on a limited basis and remain capable of doing so, particularly if resources are improved.

The concensus is that there is a need to strengthen the resources among ASEAN countries for a regional response. To this end, the ASEAN delegates proposed undertaking projects to further explore utilization of the Civil Aeronautics Administration Communication System, the meteorological teletype system and if possible the U.S. State Department Communications Network for disaster warnings and other requirements. Such systems can readily be used between and among Singapore, Malaysia, Indonesia and Thailand. Intervening stations located in Tokyo and Hong Kong posed a little difficulty for the Philippines. However, if agreement can be reached through proper coordination, priority can be given to facilitate the transmission of warnings and disaster related messages. Guidelines and regulations of WMO regarding weather forecast and disaster warning should be followed as much as possible.

The following areas of expertise were suggested as a basis for exchange:

Indonesia	--	Volcanology Seismology Earthquake Engineering Agricultural Meteorology Search and Rescue for all disasters Medical Assistance
Malaysia	--	Meteorology River Flood Forecasting Seismology
Thailand	--	Weather Modification
Singapore	--	(Under Consideration)
Philippines	--	Typhoon Forecasting Agrometeorology Storm Surges Hydrometeorology Seismology Disaster Preparedness Geology Disaster First Aid and Nursing Resettlement

There is a need to further develop and expand expert capabilities in case of disaster, however, a limited amount of expert assistance can already be provided. The following training courses are available in the ASEAN countries:

Country		Field
Indonesia	--	Volcanology Meteorology Seismology Earthquake Engineering Search and Rescue Geology
Malaysia	--	River Flood Forecasting Disaster Relief
Thailand	--	Weather Modification
Singapore	--	(Under Consideration)
Philippines	--	Meteorologist Training Course Meteorological Observer's Course Seismological Observer's Training Course Agrometeorological Observer's Training Course Graduate Course Meteorology Disaster First Aid and Nursing Geology Disaster Preparedness and Prevention at different levels particularly at the grassroot level Earthquake Engineering

AFTERWORD

The primary objective in formulating the ASEAN Disaster Preparedness Seminar was to provide a forum in which the wealth of disaster experience that the nations of Southeast Asia hold could be shared. Additionally, we wanted to stress the desirability of disaster-prone nations maintaining independence from outside assistance, while recognizing the economics to be derived from regional cooperation and coordination of resources. Stressing the importance of planning and the benefit of disaster preparedness and prevention was obviously a high priority objective. We viewed the seminar as an opportunity to increase each participant's awareness of the scope and importance of his or her role in protecting people whose lives, health and property are threatened by disaster. Finally, we hoped to demonstrate that the potential for disaster mitigation is available to all, regardless of limitations on resources.

The degree to which the objectives of the seminar are realized must be viewed in the perspective of our overall goal: to provide the people of Southeast Asia better means of protecting themselves from disaster's effects. The seminar suggested various means. It is up to the participating countries now to demonstrate their continued interest in the pressing humanitarian concerns presented by disasters. This can be done only by reinforcing viable programs within the public and private sectors. The seminar was a beginning, not an end in itself.

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ASEAN DECLARATION FOR MUTUAL ASSISTANCE ON NATURAL DISASTERS

The Foreign Ministers of the Republic of Indonesia, Malaysia, the Republic of the Philippines, the Repuhlic of Singapore and the Kingdom of Thailand:

REPRESENTING the Member Countries of the Association of Southeast Asian Nations (hereinafter referred to as ASEAN);

DESIRING to accelerate and intensify the implementation of the aims and purposes of the Association as embodied in the Bangkok Declaration of 1967 and the Declaration of ASEAN Concord of 1976;

AWARE of the serious consequences of natural disasters on the economic and social development of countries especially those of the region;

CONSIDERING that the capacity of Each Member may be inadequate to provide relief in calamities of major magnitude;

BEARING IN MIND that there may arise an urgent need for mutual assistance in the mitigation of the effects of natural disasters and for speedy action for the rescue and relief of victims of natural disasters;

AND INVOKING the ASEAN spirit of mutual help and cooperation:

DO HEREBY DECLARE THAT:

The Member Countries shall, within their respective capabilities, cooperate in the:

a. improvement of communication channels among themselves as regards disaster warnings;
b. exchange of experts and trainees;
c. exchange of information and documents; and
d. dissemination of medical supplies, services and relief assistance.

II

Each Member Country shall designate a national government agency to be its internal coordinating body which will gather, collate and exchange data pertaining to natural disasters, and that these agencies will be principally responsible for implementing the cooperation envisioned above.

III

Each Member Country shall:

a. in cases of calamities of major magnitude, upon the request from an affected Member Country, within its capability extend such assistance as may be needed;
b. on prior notification, undertake immediate internal arrangements to facilitate the transit, through their respective territories, of vessels, aircraft, authorized personnel, supplies and equipment bound for the territory of a distressed Member Country, subject to compliance of such requirements or formalities as may be prescribed by its law;

IV

A Member Country requesting assistance shall undertake internal administrative arrangements necessary to facilitate the entry of necessary vessels, aircraft, authorized personnel, supplies and equipment free from government taxes and any other duties or charges for the purpose of rescue and relief.

DONE in Manila on the twenty-sixth day of June, 1976.

For the Government of the Republic of Indonesia:	ADAM MALIK
For the Government of Malaysia:	AHMAD RITHAUDEEN
For the Government of the Republic of the Philippines:	CARLOS P. ROMULO
For the Government of the Republic of Singapore:	S. RAJARATNAM
For the Government of the Kingdom of Thailand:	BHICHAI RATTAKUL

Disaster Universe

ORGANIZATIONS

GOVERNMENT

- Disaster Center
- Chief of State
- Ministries:
  - Social Affairs
  - Defense
  - Home Affairs
  - Education
  - External Affairs
  - Agriculture
  - Finance
  - Health
  - Planning
  - Communications
  - Transportation
  - Public Works
  - Water Resources
  - Housing
  - Labor
- Scientific Agencies
- Legislature

PRIVATE SECTOR

- Red Cross
- Voluntary Agencies
- Scientific Institutions
- Commercial Enterprises

INTERNATIONAL ORGANIZATIONS

UNDRO	WHO
UNDP	FAO
UNEP	WMO
UNHCR	ESCAP
IGU	ASEAN
ITU	LORCS
IBRD	ICRC

BILATERAL DEVELOPMENT

REGIONAL ORGANIZATIONS

DISASTER TYPES

METEOROLOGICAL

Cyclone
Storm Surge
Tornado
Storm
Heat Wave

GEOLOGICAL

Earthquake
Landslide
Avalanche
Volcano

MAN-MADE

Civil Strife
Fire
Accident
Famine

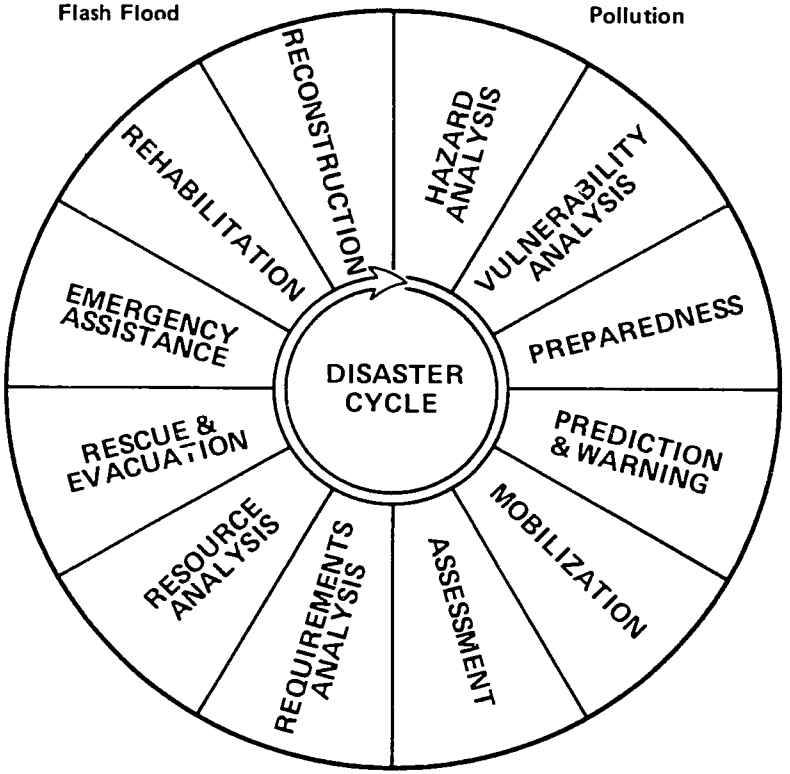
HYDROLOGICAL

Drought
Flood
Flash Flood

EPIDEMIC

ENVIRONMENTAL

Deforestation
Blight
Pollution



TECHNOLOGY

Satellites	Information Systems	Food/Water
Aircraft Reconnaissance	Transportation	Packaging
Earth Stations	Medical Systems	Storage
Ground Sensors	Delivery Systems	"Appropriate"
Communications	Shelter	

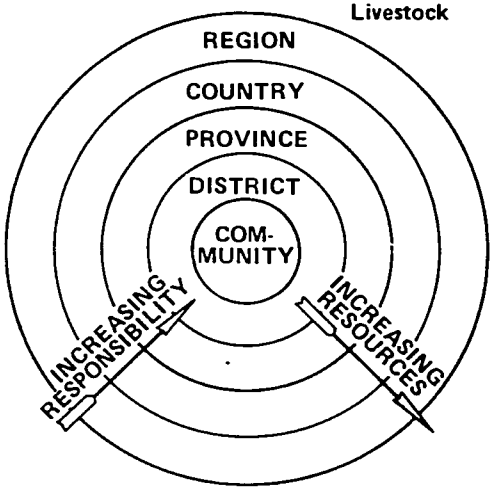
DISCIPLINES

PHYSICAL SCIENCES

- GEOGRAPHY
  - Macrozoning
  - Microzoning
  - Cartography
  - Demography
- GEOLOGY
  - Seismology
  - Volcanology
  - Geomorphology
- HYDROLOGY
  - Ground Water
  - Flood Control
- METEOROLOGY
  - Climatology
  - Weather Modification
- OCEANOGRAPHY

APPLIED SCIENCES

- ARCHITECTURE
- ENGINEERING
  - Seismic
  - Construction
- REMOTE SENSING
- MANAGEMENT
  - Budgeting
  - Accounting
  - Personnel
  - Information Mgmt.
- ANTHROPOLOGY
- EDUCATION
  - Training
- TECHNOLOGY TRANSFER
- ECONOMICS
- POLITICAL SCIENCE
- CIVIL SYSTEMS
  - Search & Rescue
  - Fire
- COMMUNICATIONS
- LOGISTICS
  - Transportation
  - Packaging
  - Distribution
- HEALTH
  - Epidemiology
  - Medicine
  - Nutrition
  - Pharmacology
  - Sanitation
- AGRICULTURE
  - Crops
  - Livestock



GEOGRAPHIC CONCERNS

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PHASES OF THE DISASTER CYCLE

PHASE	RESPONSIBILITY AREA	FUNCTIONS
HAZARD ANALYSIS	Scientific Community	Analysis of mechanics of natural and man-made disaster in terms of causes and effects and with reference to temporal and aereal probability of incidence.
VULNERABILITY ANALYSIS	Geographic Communities Scientific	Estimation of where and when natural hazards will strike populations.
PREPAREDNESS	Disaster Planners Civil Defense Scientific Community Legislators Institutions/Media	Mitigation Programs Organizational Development Physical Adjustments Education and Training Legislation Logistics and Communications
PREDICTION AND WARNING	Government Officials Scientific Community Disaster Managers Communications/Media Civil Defense	Monitor Precursor Events Recognize Dangerous Phenomena Analyze Potential Threat Assess Political Consequences Alert Public
MOBILIZATION	Disaster Managers	Alert Responsible Officials Activate Funding Mechanisms Requisition Emergency Resources Manage Relief Organization

ASSESSMENT	Disaster Managers Scientific Community Military/Civil Defense Red Cross	Determine Damage Determine Causes/ Effects Determine Resource Deficits
REQUIREMENTS ANALYSIS	Disaster Managers	Estimate Resources in Community Estimate Outstanding Needs Identify Unmet Requirements Priorities Requirements
RESOURCE ANALYSIS	Disaster Managers Procurement Specialist Logistics Specialists	Define Requirements Determine Least Time/ Least Cost Source
RESCUE AND EVACUATION	Civil Authorities Military Red Cross	Insure Survivors Safety
EMERGENCY ASSISTANCE	Disaster Managers Civil Authorities Military Red Cross Private Sector Other Donors	Monitor Situation Analyze Continuing Needs Recquisition and Procure Transport and Deliver Provide Life-Sustenance, Health and Comfort
REHABILITATION	Disaster Managers Civil Authorities Military	Bring Stricken Community to State of Normality
RECONSTRUCTION	Development Experts Disaster Managers Scientific Community Private Sector	Bring About Higher Quality of Life/ Security against Disasters

TECHNOLOGIES

TECHNOLOGY	PURPOSES
SATELLITES	Planning, Prediction, Monitoring, Assessment
AIRCRAFT RECONNAISSANCE	Planning, Assessment
EARTH STATIONS	Communications, Data Receiving
GROUND STATIONS	Prediction, Monitoring, Assessment
COMMUNICATIONS	Warning, Administration
INFORMATION SYSTEMS	Planning, Communications, Hazards Analysis, Administration
TRANSPORTATION	Assessment, Relief
MEDICAL SYSTEMS	Surveillance, Assessment, Relief
DELIVERY SYSTEMS	Planning, Relief, Reconstruction
SHELTER	Planning, Relief, Reconstruction
FOOD/WATER	Relief, Reconstruction
STORAGE	Planning, Preparedness, Relief, Reconstruction
MITIGATION	Planning, Preparedness, Prediction, Monitoring, Reconstruction
"APPROPRIATE"	Planning, Relief

DISASTER TYPES

PRECURSOR EVENTS	DISASTER	SUCCESSOR EVENTS
	METEOROLOGICAL	
Weather Anomaly	CYCLONE	Flood, Wind Damage
Cyclone	STORM SURGE	Flood
Weather Anomaly	TORNADO	Wind Damage
Weather Anomaly	STORM	Flood, Lightening, Snow
Climatic Anomaly	HEAT WAVE	Drought
Climatic Anomaly	COLD WAVE	Freezing, Crop Failure
	HYDROLOGICAL	
Ground Water Depletion	DROUGHT	Crop Failure, Blight
Cyclone, Storm, Storm Surge, Snow Melt	FLOOD FLASH FLOOD	Crop Failure, Erosion, Siltation
	GEOLOGICAL	
Seismicity Gap	EARTHQUAKE	Landslide, Avalanche, Liquifaction
Hurricane, Storm, Flood, Earthquake	LANDSLIDE	Stream Interdiction, Crop Failure, Deforestation
Storm, Earthquake, Tremor	AVALANCHE	Deforestation

ENVIRONMENTAL

Overpopulation, Firewood, Exploitation, Grazing	DEFORESTATION	Erosion, Flooding, Siltation, Climatic Anomalies
"7 Year...", Climate	BLIGHT	Crop Failure
Overpopulation, Mechanization, Fossil/Nuclear Fuels		Environmental Degradation

MAN-MADE

War, Incursion, Riot	CIVIL STRIFE	Migration, Famine, Epidemic
Accident, Storm	FIRE	Deforestation
Transportation, Industry	ACCIDENT	Pollution, Fire
Drought, Endemic Disease, Pollution	EPIDEMIC	Epidemic
Drought, Flood, Civil Strife	CIVIL STRIFE	Migration, Epidemic

Geological Hazards

(Earthquakes)

Aftershock: An earthquake which follows a larger earthquake or main shock and originates at or near the focus of the larger earthquake. Generally, major earthquakes are followed by a large number of aftershocks, decreasing in frequency with time.

Amplitude: Theoretically the maximum displacement from zero-level in any wave such as seismic wave.

Array: An ordered arrangement of seismometers/geophones, the data from which feeds into a central receiver.

Arrival: The appearance of seismic energy on a seismic record.

Arrival time: The time at which a particular wave phase arrives at a detector.

Aseismic: Not associated with an earthquake.

A-value: The value of A in the equation describing the relation between the number of earthquakes 'N' at any given magnitude level 'M': log N = A-bM, where 'b' is a constant (see below).

Attenuation: Decrease in energy as the wave propagates.

Acceleration: In earthquake hazard expressed as a fraction of 'g', the acceleration due to gravity.

ASRO: Modified high-gain, long-period, seismic observatory operated world-wide by the U.S. Geological Survey.

Benioff seismic zone: A plane beneath the trenches of the circum-Pacific belt, dipping toward the continents at an angle of about 45°, along which earthquake foci cluster. According to plate tectonics, lithospheric plates sink into the mantle through this zone.

Body wave: A seismic wave that travels through the interior of the earth and is not related to a boundary surface.

b-value: The value of 'b' in the equation describing the relation between the number of earthquakes 'N' at any magnitude level 'M': log N = A-bM, where 'A' is a constant (see above).

Building code: Set of rules developed to use earthquake information in building earthquake-safe structures.

Dynamic response: The response of a structure subjected to dynamic earthquake forces.

Earthquake prediction: Forecasting the time, place, and magnitude of earthquakes.

Earthquake swarm: A series of minor earthquakes, none of which may be identified as the main shock, occurring in a limited area and time.

Elastic wave: A wave that is propagated by some kind of elastic deformation, that is, a deformation that disappears when the forces are removed. A seismic wave is a type of elastic wave.

Epicenter: That point on the Earth's surface directly above the hypocenter of an earthquake.

First arrival: The first recorded signal attributable to seismic wave travel from a known source.

Focus: That point within the Earth from which originates the first motion of an earthquake and its elastic waves.

Focal zone: The rupture zone of an earthquake. In the case of a great earthquake, the focal zone may extend several hundred kilometers in length.

Foreshock: A small tremor that commonly precedes a larger earthquake or main shock by seconds to weeks and that originates at or near the focus of the larger earthquake.

Frequency: The repetition rate in waves expressed in cycles per second.

Global/Plate tectonics: The concept that the Earth's surface is made up of several large plates which move around and are continually created on one side and destroyed on another side.

Hypocenter: The calculated location of the focus of an earthquake.

Intensity: A measure of the effects of an earthquake at a particular place on humans and (or) structures. The intensity at a point depends not only upon the strength of the earthquake (magnitude) but also upon the distance from the earthquake to the epicenter and the local geology at that point.

Induced seismicity: Earthquake activity caused by man-made activities.

Isoseismal line: A line connecting points on the Earth's surface at which earthquake intensity is the same. It is usually a closed curve around the epicenter.

Love wave: A major type of surface wave having a horizontal motion that is shear or transverse to the direction of propagation. It is named after A.E.H. Love, the English mathematician who discovered it.

Low-velocity zone: Any layer in the Earth in which seismic wave velocities are lower than in the layers above and below.

Magnitude: A measure of the strength of an earthquake or the strain energy released by it, as determined by seismographic observations. The local body- and surface-wave magnitudes will have approximately the same numerical value.

Major earthquake: An earthquake having a magnitude of 7 or greater on the Richter scale.

Microearthquake: An earthquake having a magnitude of 2 or less on the Richter scale.

Microseism: A more or less continuous motion in the Earth that is unrelated to an earthquake and that has a period of 1.0 to 9.0 seconds. It is caused by a variety of natural and artificial agents.

Microseismicity: Small earthquake activity.

Microzonation: Subdivision of a region into zones that have exposure to similar earthquake-related effects.

M M scale: Mercalli scale modified for North American conditions.

Mohorovicic discontinuity: The boundary surface or sharp seismic-velocity discontinuity that separates the Earth's crust from the underlying mantle.

NOAA: National Oceanic and Atmospheric Administration of the Department of Commerce, U.S. Government.

Period: Reciprocal of frequency. Time it takes to complete one wave cycle.

Phase: The onset of a displacement or oscillation on a seismogram indicating the arrival of a different type of seismic wave.

P-wave: Longitudinal, irrotational, push, pressure, dilatational, primary, compressional, push-pull wave.

Rayleigh wave: A type of surface wave having a retrograde, elliptical motion at the free surface. It is named after Lord Rayleight, the English physicist who predicted its existence.

Seiche: A free or standing wave oscillation of the surface of water in an enclosed basin that is initiated by local atmospheric changes, tidal currents, or earthquakes.

Seismic belt: An elongate earthquake zone, for example, circum-Pacific, Mediterranean, Rocky Mountain.

Seismic hazard/risk maps: Maps showing extent of various earthquake effects.

Geological Hazards

(Landslides)

Creep (mass move): The slow gradual, more or less continuous, nonrecoverable (permanent) deformation sustained by ice, soil, and rock materials under gravitational body stresses.

Debris avalanche: The very rapid and usually sudden sliding and flowage of masses of initially incoherent, unsorted mixtures of soil and rock material.

Debris flow: A mass movement involving rapid flowage of debris of various kinds under various conditions; specifically a high-density mudflow containing abundant coarse-grained materials and resulting almost invariably from an unusually heavy rain.

Earthflow: A mass-movement landform and process characterized by downslope translation of soil and weathered rock over a discrete basal shear surface (landslide) within well defined lateral boundaries. The basal shear surface is more or less parallel with the ground surface in the downslope portion of the flow, which terminates in lobelike forms.

Fall (mass move): A very rapid downward movement of a mass of rock or earth that travels mostly through the air by free fall, leaping, bounding, or rolling with little or no interaction between one moving unit and another.

Flow (mass move): A mass movement of unconsolidated material that exhibits a continuity of motion and a plastic or semifluid behavior resembling that of a viscous fluid; e.g. creep, solifluction, earthflow, mudflow, debris avalanche. Water is usually required for most types of flow movement.

Landslide: A general term covering a wide variety of mass-movement landforms and processes involving the moderately rapid to rapid (on the order of one foot per year or greater) downslope transport by means of gravitational body stresses, of soil and rock material en masse. Usually, but not always, the displaced material moves over a relatively confined zone or surface of shear. The wide range in site variables, structure, and in the material properties affecting resistance to shear, as well as in the factors affecting the driving forces, results in a great range in landslide morphology, rates, and patterns of movement, and in scale. Landsliding is usually preceded, accompanied by, and followed by perceptible creep deformation, along the surface of sliding and/or within the slide mass. Terminology designating particular landslide types generally refers to the landform as well as the process responsible for the landform, e.g., rockfall, talus, translational slide, rockslide, block glide, debris slide, avalanche, earthflow, mudflow, quick clay slide, liquefaction slide, slump, rotational slide, etc. Syn: landsliding, slide.

Mass Wasting: A general term for the dislodgement and downslope transport of soil and rock material under the direct application of gravitational body stresses. In contrast to other erosion processes, the debris removed by mass wasting processes is not carried within, on, or under another medium possessing contrasting properties. The mass strength properties of the material being transported depend on the interaction of the soil and rock particles with each other. It includes slow displacements such as creep and solifluction and rapid movements such as earthflows, rockslides, avalanches, and falls. Cf: mass erosion. Syn: mass movement.

Mudflow (mass move): A general term for a mass-movement landform and a process characterized by a flowing mass of predominantly fine-grained earth material possessing a high degree of fluidity during movement. The degree of fluid is revealed by the observed rate of movement or by the distribution and morphology of the resulting deposit. If more than half of the solid fraction of such a mass consists of material larger than sand size, the term debris flow is preferable (Sharp & Nobles, 1953: Varnes: 1958). Mudflows are intermediate members of a gradational series of processes characterized by varying proportions of water, clay, and rock debris. The water content of mudflows may range up to 60%. The degree of water bonding, determined by the clay content and minerology, critically affects the viscosity of the matrix and the velocity and morphology of the flow. With increasing fluidity, mudflows grade into loaded and clear streams, with a decreased fluidity, they grade into earthflows. Also spelled: mud flow.

Rockfall: The relatively free falling or precipitous movement of a newly detached segment of bedrock (usually massive homogeneous, or jointed of any size from a clift or other very steep slope: it is the fastest-moving landslide and is most frequent in mountain areas and during spring when there is repeated freezing and thawing. Movement may be straight down, or a series of leaps and bounds down the slope.

Rockslide: (a) A landslide involving a downward and usually sudden and rapid movement of newly detached segments of bedrock sliding or slipping over an inclined surface of weakness, as a surface of bedding, jointing, or faulting, or other preexisting structural feature. The moving mass is greatly deformed and usually breaks up into many small independent units. Rockslides frequently occur in high mountain ranges, as the Alps or Canadian Rocky Mountains. (b) The mass of rock moving in or moved by a rockslide. Also spelled: rock slide. Syn: rock slip.

Rockslide avalanche: A large rockslide that has turned into a flow.

Slump (mass move): (a) A landslide characterized by a shearing and rotary movement of a generally independent mass of rock or earth along a curved slip surface (concave upward) and about an axis parallel to the slope from which it descends, and by backward tilting of the mass with respect to that slope so that the slump surface often exhibits a reversed slope facing uphill. (b) The sliding down of a mass of sediment shortly after its deposition on an underwater.

Soil creep: The gradual and steady downhill movement of soil and loose rock material on a slope that may be very gentle but is usually steep. Syn: surficial creep.

Translational slide: A major landslide classifiction group involving the downslope displacement of soil rock material on a surface which is roughly parallel to the general ground surface, in contrast to rockfalls and rotational landslides. The term includes such diverse landslide types as rock slides, block glides, slab or flake slides, debris slides, mudflows, earthflows, and rapid-flow failures such as liquefaction slides, including loess flows and quick clay slides.

Meteorology/Hydrology

Agroclimatic region: Delineated area selected on the basis of climate, physical features and crop type which is useful in determining crop calendars, forecasting crop yields and conducting drought assessments. A long-term monthly rainfall "normal" (mean) is determined for each agroclimatic region from an aggregation of meteorological station means.

Agrometeorology: The science of agricultural meteorology. The study and application of meteorology and climatology to specific problems in agriculture such as crop yield modelling and forecasting.

Analogue modeling: Technique used to estimate crop yields on basis of climatic data, crop calendar and Crop Moisture Ratio (CMR) formulas. Used where historic data unavailable.

Beaufort Wind Scale: Classifies wind and wave conditions from 0 - 12, when the sea is calm like a mirror to hurricane strength when the air is filled with foam and spray, sea is completely white with driving spray and visibility is seriously effected.

Climatology: That branch of meteorology concerned with the mean physical state of the atmosphere together with its statistical variations in both space and time, as reflected in the totality of weather behavior over a period of many years. Climatology encompasses not only the description of climate but also the physical origins and the wide-ranging practical consequences of climate and of climatic change.

Crop calendar: A list of the standard crops of a region in the form of a calendar giving the dates of sowing and various stages of their growth in years of normal weather.

Crop moisture index (CMI): A modified Palmer Index for representing those aspects of soil moisture which affect vegetation and field operations.

Crop moisture ratio: The ratio of precipitation to potential evapotranspiration (PET) for key stages of crop development. It is a measure of water supply to demand under rain-fed conditions for successive growth stages of specific crops.

Crop phenology: Successive growth stages of crops: planting, vegetative, reproductive (flowering) and late (maturity).

Cumulative precipitation: A simple procedure for equating meteorological and agricultural drought by relating drought stages to percentage of normal cumulative precipitation. The only terms considered are actual and normal monthly preciptation.

Cyclone See Tropical cyclone

The unqualified term cyclone is used by meteorologists to designate atmospheric disturbances of considerable size in tropical, middle, or high latitudes.

Doppler radar see Radar

Drought: An extended period of insufficient precipitation which adversely affects soil conditions.

Evapotranspiration: The combined loss of water from a given area and during a specific period of time by evaporation from the soil surface and by transpiration from plants.

FAO: Food and Agricultural Organization of the United Nations located in Rome.

Floodplain: An area subject to high water during predictable, periodic flood conditions.

GTS: Global Telecommunications System operated by the WMO for near real-time transmission of weather data to users worldwide.

Hydrology: The science that treats the waters of the earth, their occurrence, circulation, and distribution; their chemical and physical properties; and their reaction with their environment, including their relation to living things. The domain of hydrology embraces the full life history of water on the earth.

Hydrometeorology: The study of the occurrence, movement, and changes in the state of water in the atmosphere. The term is also used in a more restricted sense, especially by hydrologists, to mean the study of the exchange of water between the atmosphere and continental surfaces. This includes the processes of precipitation and direct condensation, and of evaporation and transpiration from natural surfaces. Considerable emphasis is placed on the statistics of precipitation as a function of area and time for given locations or geographic regions.

Hurricane: A tropical cyclone in which maximum sustained winds are 64 knots or greater, or Beaufort Scale 12. Hurricane stage of a tropical cyclone is known by different names in various parts of the world: Australia: willy-willy, typhoon, hurricane
North Indian Ocean: cyclone
Philippines: baguio (baruio)
Western Pacific: hurricane
Haiti: taino
Eastern Pacific, North Atlantic, Carribean Gulf of Mexico: hurricane
Mexico: hurricane (cordonazo).

Isobar: An imaginary line or a line on a map or chart connecting or marking places on the surface of the earth where the height of the barometer reduced to sea level is the same either at a given time or for a certain period.

LACIE: Large Area Crop Inventory Experiment conducted cooperatively among NOAA, USDA, and NASA to determine if satellite crop monitoring and meteorological observations could be used with climate/crop-yield models to make timely and accurate estimates of crop production in the major wheat producing countries of the world.

LANDSAT: Orbiting, earth resource sensing satellite used for mapping, environmental change detection and damage assessment.

Meteorology: The science concerned with the atmosphere and its phenomena. The meteorologist observes the atmosphere--its temperature, density, winds, clouds, precipitation, and so on--and aims to account for its observed structure and evolution (weather, in part) in terms of external influence and the basic laws of physics.

Microclimate: The fine climatic structure of the air space that extends from the very surface of the earth to a height at which the effects of the immediate character of the underlying surface no longer can be distinguished from the general local climate (mesoclimate or macroclimate).

Monsoon: Seasonal wind followed by heavy rain particularly in the Indian Ocean and South Asia areas--changes direction with seasons. (From the Arabic word Mausim: season.)

Palmer Index: A mathematical representation of "meteorological drought" for evaluating the scope, severity and frequency of prolonged periods of abnormal weather. Terms include: available water capacity of the soil, evapotranspiration, moisture loss from surface and underlying soil layers, average and normal precipitation and temperature, and runoff.

Potential evapotranspiration (PET): The amount of moisture that, if available, would be removed from a given land area by evapotranspiration.

R-index: A measure of plant water supply in relation to plant water requirements of the ratio of actual to potential evapotranspiration.

Radar: Instrument used for detection and ranging of distant objects. Doppler weather radar determines velocity of a storm by measuring the frequency change in the transmitted pulse caused by the target's motion.

Remote sensing satellite: Earth-orbiting spacecraft carrying a variety of instruments for measuring visible and invisible radiation from the Earth and its atmosphere.

Runoff: The portion of the precipitation on an area which is discharged from the area through stream channels.

SMS/GOES: Earth Synchronous Meteorological Satellites/Global-Observing Environmental Satellites provide images in the visible and infrared portions of the spectrum for the same area every 30 minutes with a resolution of about 1 km (visible) and 8 km (thermal I.R.). The satellites can collect and distribute environmental data from remote unattended data collection platforms (DCP's) on land, in water, or in the atmosphere and quickly retransmit these data to ground receiving stations.

Soil map: A map showing the distribution of soil types or other soil mapping units in relation to the prominent physical features of the earth.

Soil moisture: Moisture in the soil within zone of aeration, including water vapor (also part of the soil air) present in soil pores. In some cases this refers strictly to moisture within root zone of plants.

Storm surge: A gradual rise of sea along a shore as result of the winds of a storm, sometimes called storm tide, storm wave, tidal wave.

Tropical cyclone: Closed circulation with respect to pressure system (isobars). Winds cross the isobars, spiralling inwards toward the center. Clouds also show spiralling effect. Of tropical oceanic origin, the tropical cyclone has no weather fronts per se, derives most of its energy from a complex system, dependent to a great extent on warm sea surface temperatures (usually greater than 26°C or 80°F). Most commonly observed in the Northern hemisphere from May to November and in the Southern hemisphere from December to June. In the North winds spin counterclockwise around a warm center core. In the South the rotation is clockwise.

Tropical depression: Definite closed circulation (in the sense of a closed Isobar) with maximum sustained wind speed below 34 knots.

Tropical disturbance: Formative stage from which a hurricane or typhoon may develop. Forms only in low altitudes over oceans with warm surface temperature characterized by slow fall of barometric pressure. Strongest winds develop to the North and East of the developing vorrex in the Northern hemisphere. In the Southern hemisphere tnese develop South and East of the developing center. The surface pressure drops to the neighborhood of 1010-1000 millibars (29.82-29.53 inches).

Typhoon see Hurricane, Tropical Cyclone

Typhoon Committee: In 1968 the Economic and Social Commission for Asia and the Pacific (ESCAP) and the World Meteorological Organization (WMO) jointly sponsored the establishment of an intergovernmental Typhoon Committee with responsibilities for promoting and coordinating the planning and implementation of measures required for minimizing typhoon damage in the ESCAP region. The Committee's program included meteorological and hydrological activities, disaster prevention and preparedness and also training and research.

Velocity: Wind speed.

Vortex: The eye of a cyclone.

Watershed management See Glossary on Natural Resource Management and Watershed Protection.

Weather modification: Changing of natural weather phenomena by man to effect fog dispersal, cloud modification, rain making, hail and lightning suppression. Modification of severe storms still in infancy. Inadvertent weather modification (pollution) effects ecology and society.

WEFAX: Weather Facsimile Communications System used with SMG/GOES meteorological satellites.

World Meteorological Organization (WMO), Geneva: A specialized agency of the UN, created to provide international cooperation in establishing a network of meteorological stations, to provi uniform standards and dissemination of information, and to encourage research and training in meteorology. See also Typhoon Committee.

Natural Resource Management and Watershed Protection

Afforestation: Establishment of a tree crop on an area from which it has always, or very long, been absent.

Agro-forestry: The growing of crops and trees together or the use of trees to supplement or complement normal field crops.

Biomass: The total quantity, at a given time, of living organisms of one or more species per unit area or of all the species in a community.

Buffer strip: (Also called "filter strip") A strip of trees or vegetation left intact along streams to protect streams against erosion or sediment or to keep runoff from washing sediment or debris into streams.

Canopy: The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees and other woody growth.

Carrying capacity: The number or weight of organisms of a given species and quality that can survive in, without causing deterioration of, a given ecosystem. A more narrow usage is the maximum stocking possible on a given range or wildlife area without diminishing the forage yields or damaging the watershed.

Clear cutting: Clean felling or complete cutting which removes the entire standing crop of trees.

Coppice: The sprouting of a new tree from a stump.

Cultural operations: A general term for operations undertaken to assist or complete existing tree regeneration, to promote the development of a forest crop, and to minimize damage caused by felling and removal of the forest crop.

Debris: Loose material in streams, such as rocks, logs, branches or other materials.

Deforestation: The clearing of an area, other than purely temporarily, of forest. While man is the main deforester, natural agencies such as volcanic eruption and landslides, may also contribute. Clear cutting, if shortly followed by reforestation, is not deforesting.

Degradation: Variously applied to effects of erosion, reduced infiltration and nutrient loss, e.g., after fire, overgrazing or poor cultivation practices, as well as to long-term changes.

Direct seeding: The sowing of seed to regenerate forest cover.

Ecology: The study of plants and animals in relation to their environment.

Ecosystem: Any complex of living organisms with their environment that we isolate mentally for purposes of study.

Establishment: The process of developing a forest crop to the stage at which the young trees may be considered established, i.e. safe from normal adverse influences such as frost, browsing, and no longer in need of special protection or special tending.

Exploitation cutting: Removal of trees for immediate market returns, with little or no regard to silvicultural or reforestation needs.

Floodplain zoning: Setting up a plan to define the main zones of potential floods. Usually accompanied by housing restrictions or other recommendations.

Forest cover: Organic debris and humus on the ground surface of forest soils.

Forest protection: The prevention and control of damage to forests from fire, grazing, browsing, felling, fumes and smoke, insect pests, disease, storms, frost and other climatic elements.

Forestation: The establishment of forest, naturally or artificially, on an area, whether previously carrying forest or not.

Forestry: The science, art and practice of managing and using for human benefit, the natural resources that occur on and in association with forest lands.

Greenbelt: An area of trees and other natural vegetation, or: an area of general conservation works, including tree planting.

Land degradation: Refers generally to erosion and other damages to land, usually caused by land mis-use.

Landslide: A general term describing rapid or moderately rapid movement downhill of soil and rock.

Nursery: An area set aside for the raising of young trees, mainly for planting out.

Plantation: An artificial forest stand, a man-made forest raised by the sowing of seed or by planting.

Protection forest: An area wholly or partly covered with woody growth, managed primarily to regulate stream flow, maintain water quality, minimize erosion, stabilize drifting sand or exert any other beneficial forest influences.

Range: All land, including forest land, that produces native forage in contrast to land cultivated for agricultural crops or carry dense forest.

Range management: The art and science of planning and directing range utilization so as to secure sustained maximum production of livestock, milk, and/or cut forage, consistent with other uses and the conservation of natural resources.

Reforestation: Reestablishment of a tree crop on forest land.

Renewable natural resources: Resources that can be restored and improved to produce the things man needs such as trees, grass and agricultural crops.

Runoff: The rainwater running over the land surface during or following a storm.

Sand dune stabilization: The stopping of moving dunes by use of mechanical or vegetative means. May include afforestation.

Sedimentation: The filling of reservoirs or other areas with sediment (also referred to generally as "silt"). Sedimentation is used synonymously with "siltation".

Selection cutting: The annual or periodic removal of trees (particularly the mature), individually or in small groups, to realize a wood yield and to establish a new crop.

Shelterbelt: A strip of trees along a farm field used to protect fields or crops against wind. Also called a "field windbreak."

Shifting cultivation: Sometimes called shifting agriculture. A primitive, more or less unregulated method of cyclical cultivation, still widely practiced in the tropics, whereby cultivators cut some or all of the tree crop, burn it, and raise agricultural crops for one or more years before moving on to another site and repeating the process.

Siltation: See Sedimentation.

Silviculture: The science and art of cultivating (growing and tending) forest crops, based on a knowledge of the life history and general characteristics of forest trees and stands, with particular reference to locality factors.

Species conversion: The change from one vegetation species or set of taxa to another.

Terracing: Horizontal cuts, benches or embankments made along hillsides to reduce erosion, improve cropping, hold back runoff, improve infiltration of rain or carry out some other function of conservation.

Thinning: Removing some of the trees in a forest so as to gain the wood and also allow the remaining trees to grow more rapidly.

Torrent control: Structures (rock or other materials) built in torrential stream channels to halt the channel erosion.

Tree seed orchard: A plantation of superior trees intensively managed to produce frequent, abundant and easily harvestable seed crops.

Village forest: Forest constituted and managed for the supply of forest produce to a village.

Watershed: All land and water within the confines of a drainage divide. The same as a "catchment", "basin", or "drainage basin", that is, an area of land where runoff flows into the same stream.

Watershed management: The practice of conservation and the management of land within a watershed area so as to minimize flooding, erosion, sedimentation and other resource problems.

Windbreak: A barrier, such as strip of trees, used to protect houses, crops or animals against wind damages.