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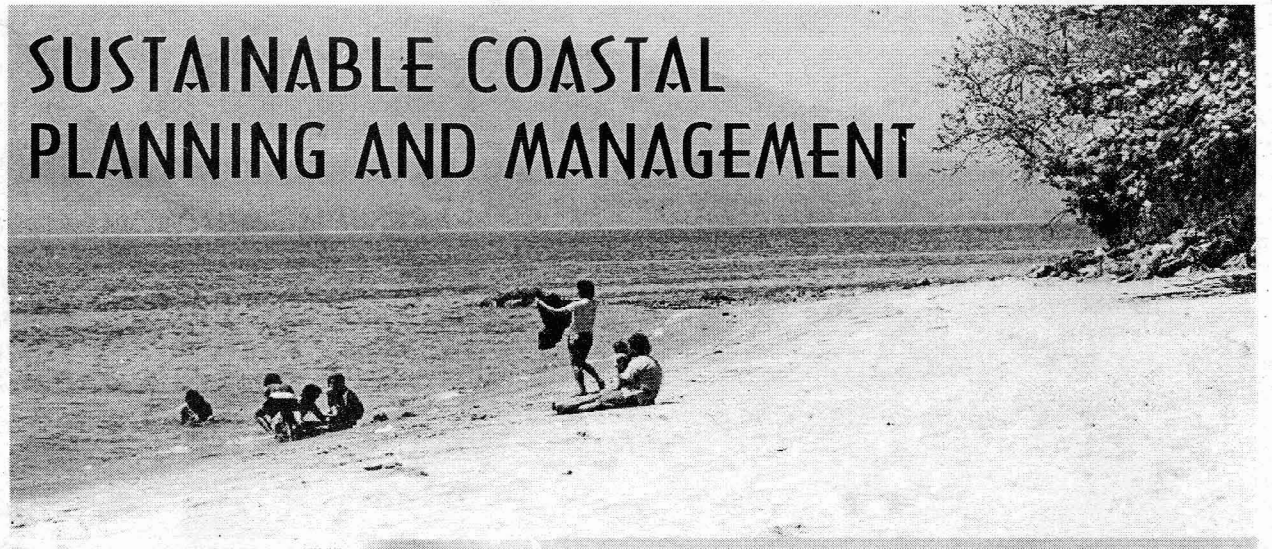
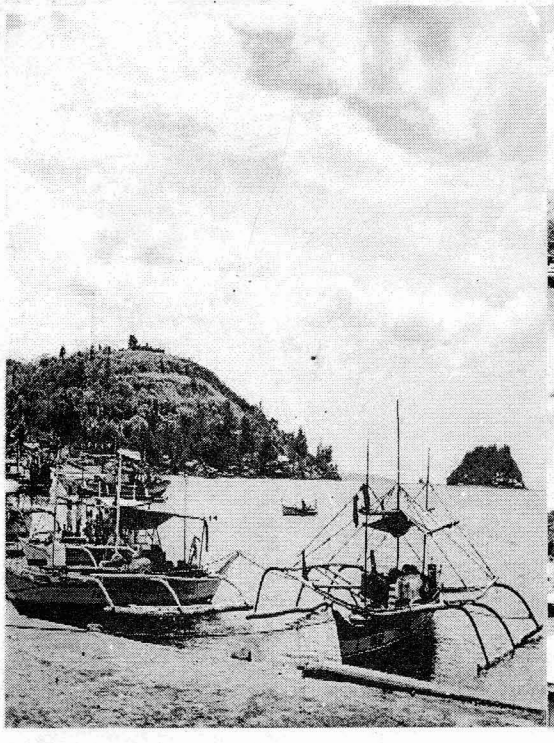
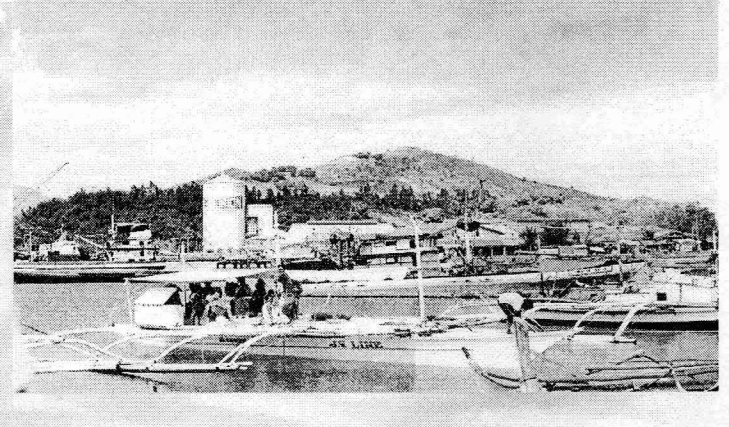
SUSTAINABLE COASTAL PLANNING AND MANAGEMENT







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* Front cover photos by Malou B. Alampay

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EBBING COASTS[1]

Coastal Area Planning

Candido A. Cabrido, Jr.

First, the tide rushes in, plants a kiss to the shore.
Then rolls out into the sea,
and the sea is very still once more.

Jack Jones "Ebb Tide"

COASTAL NOSTALGIA

When one thinks of the coastal panorama, one cannot help feeling romantic and poetic at the same time. The beauty and splendor of the coast continues to inspire generations of songwriters and poets. The coast is one of the most romantic places in our landscape. Its fine beaches, coral reefs, and tropical flora and fauna are a major attraction to tourists. Within the coast, the river and the sea meet at a rendezvous called estuary, which is one of the most productive ecosystems. The coast has not only given us inspiration; its beauty and fertility have provided the economic base for many people. But, like an old song, natural coastal areas are literally beginning to ebb.

The Philippine coastal zone spans to about 11,000 square kilometers in which 59 percent of the country's population resides. Seventeen of the 25 cities with populations in excess of 100,000 are located along the coast. Furthermore, about 70 percent of the 1,525 municipalities including ten of the largest cities are located in the coastal zone.

The coastal zone supports many types of land uses such as aquaculture, industrial and commercial development, housing, tourism and recreation, land reclamation, and waste disposal. Because of the multifarious demand on the use of the coastal zone, it suffers from increasing pressure resulting in its deterioration. Problems and issues related to coastal land and resource use include habitat (i.e. coral reefs, seagrass meadows, mangrove forest) destruction, water pollution coming from domestic, industrial and agricultural wastes, overfishing and destructive fishing, resource use conflicts, incompatible land uses, and rapid population growth.

A typical coastal area profile in the Philippines is illustrated in Figure 1. The illustration also depicts the various coastal ecosystems and their compatible uses.

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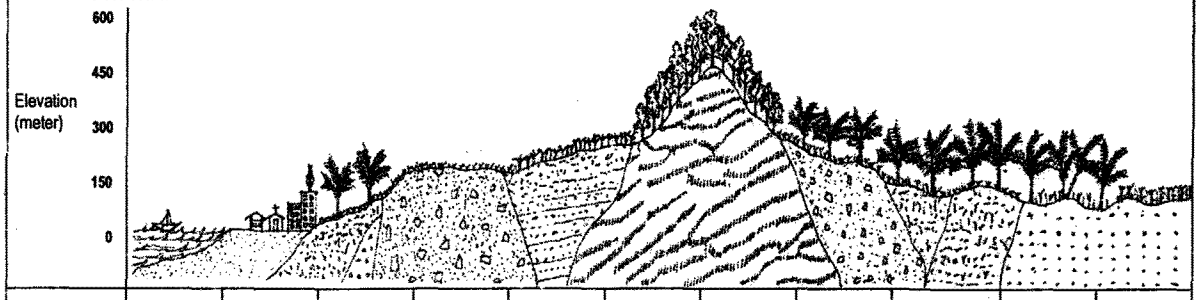
[1] Paper presented at the Philippine Institute of Environmental Planners' (PIEP) Midyear Conference held at Northwind Hotel, Cebu City on August 27-28, 1999.

Figure 1

A SELECTED TRANSECT IN BATANGAS BAY

Land Management Unit		01	67	88	43	88	88	43	88	64	63
Geomorphic Mapping Unit	Coastal Waters	Coastal Land	Volcanic hills	Volcanic Mountain	Sedimentary Hills	Volcanic Mountain	Volcanic Mountain	Sedimentary Hills	Volcanic Mountain	Volcanic hills	Volcanic hills
Schematic Cross Section											
Parent Material	-	Fluvio Marine	Volcanic tuff	Volcanic agglomerate	Shale and Sandstone	Andesite basalt series	Volcanic agglomerate	Shale and sandstone	Metavolcanics/ Metasediments	Quartz-Diorite	Quartz-Diorite
Slope Range (%)	-	0-3	18-30	30-50	18-30	>50	>50	18-30	30-50	30-50	18-30
Soil Depth	-	Moderately deep	Moderately deep	Moderately deep	Moderately deep	Moderately deep	Moderately deep	Moderately deep	Moderately deep	Shallow	Shallow
Texture	-	Heavy	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Soil Drainage (internal)	-	Very poorly drained	Well-drained	Moderately well-drained	Moderately well-drained	Moderately well-drained	Moderately well-drained	Moderately well-drained	Moderately well-drained	Well-drained	Well-drained
Erosion Class	-		Slight	Severe	Slight	Severe	Severe	Slight	Severe	Moderate	Slight
Dominant Land Use/Vegetation	Fisheries Navigation Ports/Harbors	Built-up areas Fishpond	Upland rice Quarrying	Grasses	Shrubs	Secondary forest	Secondary forest	Coconut Shrubs	Grasses Coconut Shrubs	Coconut Shrubs	Shrubs
Associated Land Use	Recreation	Tourism Roads	Sugarcane Coconut	Shrubs Upland Rice	Grasses Upland Rice	Grasses	Grasses	Shrubs	Shrubs Upland Rice	Shrubs	Grasses Upland rice
Land Capability	-	-	De (Fairly good land)	M (Pasture land)	M (Pasture land)	M (Pasture land)	M (Pasture land)	M (Pasture land)	M (Pasture land)	De (Fairly good land)	De (Fairly good land)
Land Limitation	-	Saline Tidal inundation	Slope	Slope erosion	Slope	Slope erosion	Slope erosion	Slope	Slope	Slope Erosion Shallow	Slope Shallow solum
Issues/ Problems	Sedimentation Water pollution Water use Conflict Depleted corals, seagrasses Declining fishery yield Illegal fishing	Coastal erosion Depleted beach vegetation, wildlife Squatters Land use conflict Solid waste pollution Tidal flooding	Quarrying Soil erosion Agricultural wastes Fertilizer and pesticide runoff	Deforestation Soil erosion	Deforestation Soil erosion	Deforestation Soil erosion	Deforestation Soil erosion	Soil erosion Agricultural wastes	Soil erosion Deforestation Agricultural wastes	Soil erosion Deforestation	Soil erosion Deforestation

Prepared by Dr. Cabrido for the "Coastal Environmental Profile of the Batangas Bay Region" under the GEF/UNDP/IMO Regional Programme for the Prevention and Management of Marine Pollution in the East Asian Seas, 1996.

NEED FOR COASTAL AREA PLANNING

The coastal area serves many purposes, which could be categorized into four: *(1)* source of natural resources (fisheries, forestry, minerals, gas and oil and biodiversity); *(2)* site for settlements and infrastructure (transportation, ports and harbors, etc.); *(3)* tourism and recreation; and *(4)* maintenance of ecosystem stability. Planners need to balance and optimize these various demands for the uses of the coastal area in accordance with sustainability principles. Coastal area planning is a preliminary step to attain this goal.

The coastal area planning approach being espoused by foreign funding agencies and widely adopted by government agencies such as the Department of Environment and Natural Resources (DENR) and Department of Agriculture (DA) adopts the coastal zone as the planning unit and is therefore referred to as coastal zone planning and management. Coastal planning involves a mixture or a combination of urban and regional planning, land use planning, and resource conservation and protection planning, among others.

Two types of coastal plans are usually employed in the planning of coastal areas. These are strategic and operational plans. Strategic and operational planning were differentiated by Kay and Adler (1999). Strategic planning is considered as the highest order of planning. It provides the basis and broad directions to guide more detailed planning. Furthermore, it outlines the approaches and strategies on how objectives could be met. However, it does not provide the detailed description of actions that should be undertaken to meet objectives. Strategic plans commonly have a time frame of 20-25 years but are usually reviewed and revised every five years to capture changing medium-term priorities of the government.

On the other hand, operational planning provides the detailed activities to achieve management objectives on the ground. It specifies where and how operations should be carried out. Contents of operational plans include site designs, costing, and schedules of work, among other things. The usual time frame for operational plans is two to five years. The plan is revised and reviewed every year or every two years.

Coastal plans can be prepared at different scales depending on the purpose and focus of the plan. These scales usually conform to administrative units such as region, province, and municipality. Regional and provincial coastal plans address issues and concerns of wide geographic coverage. These issues and problems require coordination and collective decision-making by several Local Government Units (LGUs) and government agencies. Municipal coastal plans are area specific plans and provide more operational details on land use and coastal resources management.

Kay and Adler (1999) also described the difference between planning and management. Planning refers to the charting of future activities while management involves directing the daily activities occurring in coastal lands and waters, including the overall control of the government agencies that oversee these day-to-day activities.

Furthermore, environmental management including coastal resources management is the management of the behavior of users or stakeholders. There will be no resource or environmental problems if the users behave in an environmentally desirable manner. Thus, management involves the use of economic and regulatory instruments to direct the behavior of users or stakeholders in a more desirable manner.

The management of coastal resources should adopt certain principles to attain the goal of sustainable development. It is therefore imperative that our coastal area managers are able to apply the precautionary principle, polluter pays principle, use of proper resource accounting, the principle of transboundary responsibility, and the principle of intergenerational equity in their planning and management of coastal ecosystems and resources.

THE COASTAL ZONE AS A PLANNING UNIT

The Philippine Fisheries Code of 1998 (Republic Act No. 8550) is influenced by the coastal zone concept. It defines the coastal

zone as the area which comprises a setback of one kilometer inshore or could be extended a little bit farther depending on the presence of maritime influences such as swamps, nipa, and mangrove vegetation. Its seaward limit extends to 15 kilometers from the shoreline, which is believed to be the distance that could normally be reached by coastal or municipal fishing boats.

Foreign-assisted programs and projects on coastal area planning and management that include the DENR's Coastal Environment Program (CEP) and Coastal Resources Management Project (CRMP) as well as the DA's Fisheries Program (FSP-Phase I) whose successor project is now titled Fisheries Resources Management and Development Project (FRMDP) adopt the coastal zone as the unit for planning and managing fisheries and coastal resources. The efforts of these programs are focused on the rehabilitation, conservation, and improvement of coastal and marine resources and habitats.

Efforts to manage the coastal resources and habitats were often viewed as partially successful because they were not able to contain many of the basic causes of the problems. A great bulk of these problems is terrestrially based and is usually over-looked in a coastal zone planning and management approach, a concept introduced and popularized by marine scientists. Problems in the coastal zone are far-originating from distantly degraded watersheds, unstable upland agriculture, and chemically intensive lowland agriculture to overly congested urban settlements, pollutive industrial clusters, coastal slums, and unsanitary ports and harbors.

Considering these causative factors, an effective coastal zone planning and management package of interventions has to be designed beyond the traditional architecture of the coastal zone. This package may be difficult to operationalize at this stage because of the sectoral configuration of the government bureaucracy.

Appropriate Approach to Coastal Area Planning

Contemporary coastal area planning has to be holistic in perspective and ecosystem-based in approach. The terrestrial and aquatic continuum cannot be dissociated without causing severe dysfunction. In such a case, the gains of sectoral intervention may be overrun by cascading externalities. An ecosystemically cohesive plan, however, synergizes small and disparate impact currents into large waves of impacts. Integrated ecosystem-based planning binds the loose ends in coastal zone planning and cultivates reciprocity of impacts on human and ecosystem well being.

What is disappointing but revealing at the same time is that the Western model of coastal zone planning and management does not seem to fit an archipelagic and developing country such as the Philippines. Unlike large landmasses in big continents, the country's landmasses are small and fragmented, creating a longer coastline and coastal waters highly vulnerable to terrestrial activities. The country is comprised of 7,100 islands with a coastline exceeding 17,000 kilometers in length and about 28 million hectares of coastal waters. Whatever residues or wastes generated in the terrestrial landscape immediately affect the coastal waters and seascapes. Because of the country's archipelagic configuration, the coastal waters in island provinces and municipalities are virtually waste disposal sinks of terrestrial activities.

It is therefore more appropriate to adopt an integrated coastal area planning or 'bay region' planning for the Philippine coastal zone. Such an approach gives impetus to the sustainability aspects of coastal area development.

BAY REGION PLANNING

The relatively neoteric concept of bay regional planning is a significant deviation from the coastal zone planning presently being adopted by many programs of the Philippine government.

Coastal resource management (CRM) alone, no matter how successfully implemented, will not effectively stop degradation of the coastal environment if for example, land-based pollution is not addressed properly and simultaneously. Problems like sedimentation and chemical pollution greatly contribute to the destruction of coral reefs, seagrasses, and

other coastal resources. These environmental problems emanate from land-based activities which, oftentimes, are not covered by interventions under CRM programs and projects. Most CRM plans are confined within the limits and concerns of the coastal zone. Neglecting such sources of coastal problems in CRM renders its impacts non-sustainable.

The environmental integrity of a bay is influenced by external factors such as forest cover and land uses in critical watersheds, use of rivers draining into the bay, and the use of coastal and foreshore lands. The bay serves as a sink or receptacle of residual matters coming from terrestrial sources. Watercourses draining into the bay convey sediments and pollutants. Massive soil erosion in denuded watershed causes heavy sedimentation of rivers and coastal waters. Quarrying of hills near the shore also contributes to siltation of coastal waters. Organic and chemical pollutants from households, industries, and agricultural farms located in a catchment basin or watershed also find their way into coastal waters. It is therefore imperative that the watershed is taken into account in CRM planning.

The bay region approach (also referred to as Integrated Coastal Resources Management or ICRM) takes into consideration as major planning parameters the influence and impact zones in a bay, i.e. the watershed, rivers, estuaries, coastal and foreshore lands, coastal and water resources, and small islands within the bay (Cabrido 1996). The influence zone (watershed, rivers, coastal and foreshore lands) and impact zone (estuaries, coastal water, and coastal resources) should be planned in an integrated manner, that is, their ecological interrelationships and interactions should be analyzed in CRM planning. Under the bay region or ICRM planning, land use and water use plans upstream should be made compatible with the coastal land and water use plans downstream. Such integrated land and water use planning should be carried out by synchronizing sectoral plan preparation (i.e., agriculture, forestry, fisheries, and urban planning by the DA, DENR, Bureau of Fisheries and Aquatic Resources, and Housing and Land Use Regulatory Board, respectively) with provincial and municipal plan formulation by LGUs.

In essence, ICRM planning may be considered as a variant of regional planning. However, several types of integration may be considered under ICRM:

1. Integration of resource use and development planning with settlement development planning within the context of the bay region as a planning unit. The spatial and land use aspect of bay region planning is anchored on the principles of ecosystem management. Hence, bay region planning straddles conservation planning and settlements planning.

2. Integration of environmental, social, and economic considerations. Environmental, social, and economic objectives should equally be considered in integrated coastal area planning for sustainability purposes.

3. Ecosystem integration. Upland, lowland, and coastal area plans are integrated. Such integration recognizes the fact that these ecosystems are very much intertwined.

4. Integration of planning and management actions among actors. Sectoral agencies should be able to get their acts together in planning and managing coastal resources. Their actions have to be synchronized for greater effectiveness and impacts.

5. Integration of administrative levels. Plans and programs at the municipal level should be guided and integrated at the provincial level, and similarly, provincial plans and programs should be integrated at the regional level to effectively resolve transboundary issues and problems. Moreover, plans and programs of the national and local governments should be complementary to avoid wastage of scarce resources.

6. Integration of people's organizations and Non-government Organizations (NGOs) in the planning and management process. Participation of local organizations and NGOs is imperative in ensuring the sustainability of development efforts in the locality or bay region.

Bay Region/ICRM Planning Process and Strategies

Briefly, the process of undertaking bay region/ICRM planning should incorporate the following important activities:

1. Delineation and mapping of the bay region indicating the influence zone (e.g. watershed areas) and impact zone (e.g. coastal waters).
2. Assessment of the status of these zones (e.g. forest cover, land use, land development activities, etc.).
3. Inventory of programs and projects undertaken in these zones.
4. Identification of management and development gaps.
5. Development of strategies to integrate these zones (i.e. integrate watershed management with CRM).
6. Formulation of an action plan to address gaps (i.e. issues and problems).
7. Design of implementation mechanisms to integrate upstream and downstream dynamics and concerns.
8. Conduct of stakeholders' consultative meetings and planning sessions or workshops to legitimize ICRM.
9. Drafting of zoning plan, resolution, and ordinance for discussion and approval of provincial and municipal councils.

These aforementioned activities should be properly mainstreamed in the traditional approach to coastal zone planning which involves the following steps as described in the Guidebook for Sustainable Coastal Land Use Planning and Management (IEMSD 1997):

1. Resource inventory and stocktaking. This involves the preparation of a coastal environmental profile.
2. Identification of problems and issues in consultation with stakeholders.
3. Validation of data and results of analysis.
4. Formulation of goals and objectives. This may vary from one community to another depending upon the needs, traditions, and norms of the people residing or working therein.
5. Institutional analysis for resource use management. This will examine the multi-agency implementation of the various components of the plan, the integration of local organizations and NGOs in policy and decision-making, planning, implementation, monitoring, and evaluation.
6. Review of existing policies and formulation of recommendations.
7. Formulation of the coastal land use plan guided by ICRM principles, goals and objectives, and results of analysis of problems, needs and potentials or comparative advantage.
8. Consultation, conflict resolution and consensus building.
9. Finalization of the coastal land use plan and zoning ordinance.
10. Plan adoption by concerned LGUs.
11. Plan implementation.
12. Monitoring and evaluation.

Characteristically, the bay region/ICRM planning is an improvement over CRM fisheries planning since it is more comprehensive in approach, addresses the perennial problems of siltation and pollution plaguing CRM, and ensures that the impacts of CRM interventions to be made are sustainable.

Three major strategies are deemed critical in the successful execution of bay region planning or ICRM approach:

1. The bay's CRM plan should integrate details on the following concerns of ICRM: solid waste management situation and requirements in the bay region, watershed rehabilitation and reforestation needs, pollution monitoring and controls from the coastal area, impacts of tourism and industrial initiatives, upland area management, coastal migration, as well as mangrove reforestation, establishment of marine and fish sanctuaries; and livelihood and community organization initiatives. These plans should have a greater

emphasis on inter-agency coordination to ensure that the integrated approach to CRM planning is implemented.

2. Pollution sources in the watershed area should be determined and assessed. The Bureau of Fisheries and Aquatic Resources (BFAR) should coordinate with the Environmental Management Bureau (EMB) and other government agencies in drawing up a plan and program to clamp down on sources of pollution. Common sources of pollution should be mapped out, such as poultry and piggery, quarries, industries, coastal settlements, ports and harbors, etc. A plan of action to implement pollution control measures in these areas should be drawn and given priority by the agencies concerned. Under this plan, BFAR should concentrate its efforts on CRM monitoring and enforcement of laws while the other agencies like DENR and EMB should commit resources to regulate and control upstream pollution in accordance with their mandates.
3. Planners from government agencies, LGUs, and NGOs should be introduced and trained on the bay region/ICRM planning and management approach.

SOME SELECTED TOOLS AND TECHNIQUES FOR BAY REGION PLANNING

Coastal Ecological Profiling or Environmental Profiling

Preparation of an ecological profile is the first necessary step in coastal area planning. This profile gives us a clearer picture of the existing situation in the coastal area, the issues and problems confronting the population, their goals and objectives in improving their socio-economic well being, and environmental conditions.

An ecological profile normally contains the following information:

1. Population and demographic characteristics (e.g. population, employment, income, education and health).
2. Biophysical characteristics (e.g. location and boundaries, land resources, forest resources, groundwater resources, mineral resources, coastal resources such as fisheries, mangroves, coral reefs, seagrasses, hydrology, climate, natural and geologic hazards).
3. State of environment and natural resources (sources and level of pollution, natural resources depletion/degradation).
4. Land use (e.g. present coastal land use/water use issues and problems).

Modern ecological profiling uses certain techniques such as the three-dimensional profiling and zone of influence and impact mapping (ZOIIM). The first technique employs graphing the typical physical configuration of the coastal area from an actual transect. The graph shows the parts of the coastal landscape (land and water) and characterizes the various coastal subsystems in terms of their physical attributes and socioeconomic features. It also depicts the problems and issues dominant in these coastal ecosystems or part of the landscape and seascape. Examples of such profile are shown in a selected transect in Batangas Bay (Figure 1) and a hypothetical transect of a typical coastal tropical area (Figure 2).

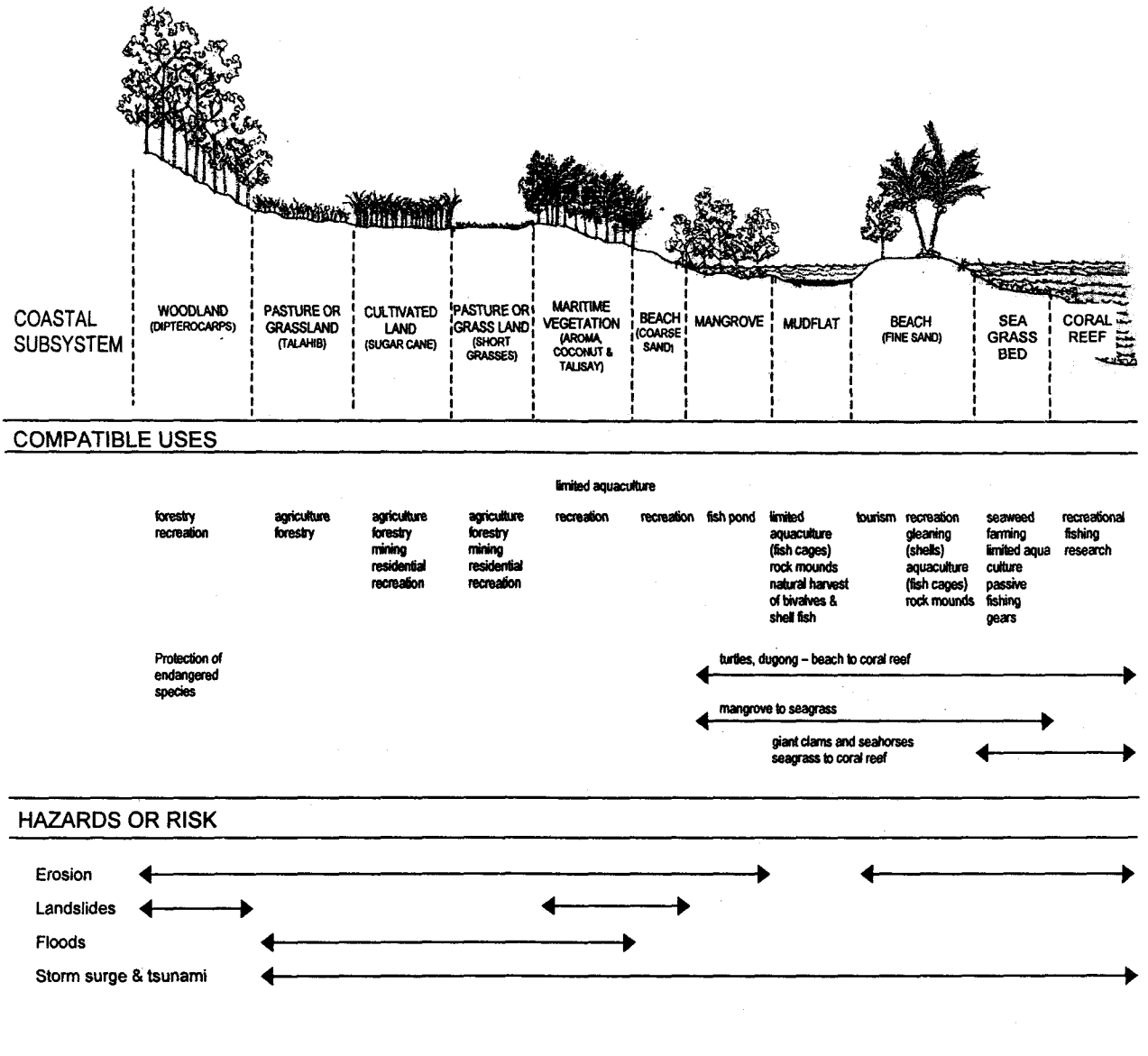
The second technique, called ZOIIM mapping, is an exercise to delineate areas, that influence the quality of coastal environments or ecosystems and their productivity. Mapping influence areas is done to have a better understanding of its problems, magnitude of such problems and how they impact the coastal zone. Areas in the coastal zone which are vulnerable to the influence zone and impacted by them or by any development intervention in the coastal area is also delineated and mapped as the impact zone. This mapping exercise aims to draw the attention of the planners and managers in the interrelated aspects of the coastal continuum so that they will be able to formulate and undertake the necessary measures to resolve them.

Compatibility Mapping Matrix

Another technique useful in analyzing appropriate land uses in the coastal area is the compatibility mapping matrix. An example of this matrix is shown in Figure 3. The matrix

Figure 2

A HYPOTHETICAL TRANSECT OF A TYPICAL COASTAL TROPICAL AREA



Source: Integrated Environmental Management for Sustainable Development (IEMSD) Programme. 1997.

provides a diagrammatic presentation or profile of the coastal area delineating its subsystems. Against this backdrop, the matrix charts the possible or compatible utilization of these coastal subsystems.

This matrix is used in determining permissible uses in the coastal subsystems and their land use planning. The coastal subsystems depicted in the example are woodland (dipterocarps), pasture or grassland, cultivated land, coastal vegetation (mangrove and beach vegetation), beach, mudflat, seagrass bed, and coral reefs. The coastal land uses examined for their compatibility to the coastal subsystems are agriculture, forestry, mining, residential, recreation, commercial, industrial, major infrastructure, waste disposal, navigation, fishing/ gleaning, aquaculture, and seaweed farming (Figure 3).

Community-Based Resource Management (CBRM) Approach

Every ICRM or bay region planning and management should adopt the CBRM approach to enhance its sustainability and ensure successful implementation. The CBRM is considered an appropriate planning and management approach to coastal resources use and development because it strongly espouses stakeholders' participation in all aspects of the ICRM scheme.

The role of stakeholders is considered important for three main reasons: *(1)* for effective management of the coastal resources, their users should also be given the responsibility and accountability to manage them; *(2)* users of coastal resources could be effective managers because they live close to (proximity) and are very familiar (familiarity) with these resources and their livelihood very much depend on them; and, *(3)* arresting the increasing threats and diminishing opportunities of coastal resource would require the adoption of property rights over these critical resources.

The adoption of the CBRM approach is intended to enhance the participation of local communities in the following activities: *(1)* protection and conservation of environmental resources, *(2)* productivity enhancement of environmental resources, *(3)* development of alternative livelihood for marginal communities, *(4)* institutionalization of local community organizations, and *(5)* acquisition of tenure rights over resources.

The LGUs can promote CBRM in their locality by issuing ordinances and regulations to support CBRM efforts such as the establishment of fish sanctuaries and by deputizing local people in the enforcement of fishery laws. The LGUs could also assist the NGOs in the organization of local communities and in the preparation of CRM plans and programs. They can also assist local organizations in sourcing development funds from concerned government agencies. They also play an important role in the resolution of resource use conflicts in the locality.

Pressure-State-Response (PSR) Monitoring Method

The PSR method is an effective method of monitoring changes in coastal land uses and coastal environmental quality. The results of monitoring are reported in a matrix or table, which provides the following information:

1. The coastal subsystem.
2. Problems of the subsystems (***Pressure***).
3. State of the subsystem in quantitative terms (if possible) so that it can be compared to standards or thresholds (***State***).
4. Actions in terms of policies, regulations, programs and projects undertaken by the government as well as the measures being done by civil society and the private sector (***Response***).

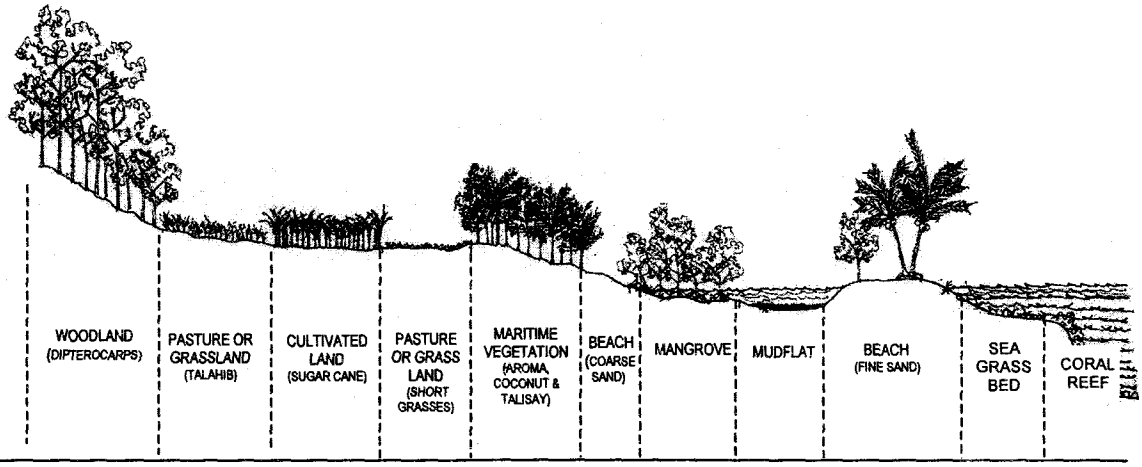
A sample of the PSR matrix is shown in Figure 4. The PSR matrix can also be used in evaluating the level of actions that the concerned entities are undertaking or have undertaken to resolve coastal environmental problems.

Environmental Performance Indices

Environmental performance indices are quantitative measures of the environmental and socioeconomic impacts of development interventions (i.e. coastal development pro-

Figure 3

COMPATIBILITY-MAPPING MATRIX



COASTAL SUBSYSTEM / USES	WOODLAND (DIPTEROCARPS)	PASTURE OR GRASSLAND (TALAHIB)	CULTIVATED LAND (SUGAR CANE)	PASTURE OR GRASS LAND (SHORT GRASSES)	MARITIME VEGETATION (AROMA, COCONUT & TALISAY)	BEACH (COARSE SAND)	MANGROVE	MUDFLAT	BEACH (FINE SAND)	SEA GRASS BED	CORAL REEF
AGRICULTURE	X	O		O	O	X	X	X	(O)	X	X	X
FORESTRY		O	X	O	O	X		X	(O)	X	X	X
MINING	(O)	(O)	X	(O)	X	X	X	X	X	X	X	X
RESIDENTIAL	(O)	X	X	X	X	X	X	X	X	X	X	X
RECREATION	O	X	X	X	(O)	O	O	O	O	(O)	(O)	(O)
COMMERCIAL	X	X	X	X	(O)	(O)	X	(O)	(O)	(O)	(O)	X
INDUSTRIAL												
MAJOR INFRASTRUCTURE	X	X	X	X	(O)	(O)	X	X	X	X	X	X
WASTE DISPOSAL	X	X	X	X	X	X	X	X	X	X	X	X
NAVIGATION	X	X	X	X	X	X	(O)	(O)	(O)	O	O	(O)
FISHING/GLEANING	X	X	X	X	X	X	O	O	O	O	O	O
AQUACULTURE	X	X	X	X	(O)	(O)	O	O	O	O	O	O
SEAWEED FARMING	X	X	X	X	X	X	(O)	O	O	O	O	(O)

LEGEND: X = Not Compatible; O = Permissible Use; (O) = Strict Adherence To Ecological Principles Must Be Observed

Source: Integrated Environmental Management for Sustainable Development (IEMSD) Programme, 1997.

Figure 4

A SAMPLE OF THE PSR MATRIX

COASTAL SUBSYSTEM	PRESSURE	STATE	RESPONSE
Woodlands			
Cultivated lands			
Dunes			
Estuary			
Mineral lands			
Pasture lands			
Swamps			
Tidal flats			
Beaches			
Mangroves			
Beach vegetation			
Seagrass			
Coral reefs			
Small islands or islets			

grams and projects). The five indices now being used include: cost of remediation (COR) index, environmental elasticity (EE) index, extended benefit-cost (EBC) indices such as net present value (NPV), benefit cost-ratio (BCR), and economic internal rate of return (EIRR), environmental effectiveness (EnE) index, and social elasticity (SE) index.

These indices were developed by an expert group from Harvard University in a project study funded by the Asian Development Bank (ADB 1991). The formula and description of the indices are as follows:

COR – the cost of moving the current environmental state to a desirable level or standards.

EE – the percent change in environmental quality divided by the percent change in household income or GDP.

NPV – the net present value of net benefits or incremental benefits over the project lifespan using a given discount factor.

BCR – the ratio of the NPV of benefit and cost streams.

EIRR– is the economic internal rate of return of the project investment.

EnE – cost per unit of environmental improvement, which is measured by dividing the project cost by the amount of environmental improvement.

SE – uses the same formula as EE but employs social indicators for the numerator.

Environment and Natural Resource Accounting (ENRA)

The ENRA is a system of accounting for the cost of environment and natural resources degradation and depletion. The cost of pollution, depletion and degradation of environment and natural resources is monetized and imputed in the computation of GDP. The result of the ENRA is an index called environmentally adjusted GDP or net national product (NNP). The formula for NNP is as follows:

NNP = consumption + net investment in physical capital + the value of the net change in human capital + the value of the net change in stock of natural capital minus the value of current environmental damages.

The National Statistical and Coordination Board (NSCB) is the agency in charge of preparing the ENRA. This specific tool can also be applied to fishery and coastal resources accounting in a bay region. The results indicate whether the development interventions in the area are producing net positive effects to income and environmental quality.

Environmental Impact Assessment (EIA)

The most popular and one of the effective planning and regulatory tools for safeguarding the coastal environment from the negative impacts of development projects is the EIA. Under the EIA law, environmentally critical projects are automatically required to prepare and submit an Environmental Impact Statement (EIS) which is reviewed and evaluated by the EMB and/or DENR. On the other hand, those projects which are not environmentally critical but happen to be located in an environmentally critical area are required to submit an Initial Environmental Examination (IEE) report. If the project is found to have significant impacts, the proponent is required to prepare a full-blown EIA. Those projects with approved EIS are given an Environmental Clearance Certificate (ECC) which contain the conditionalities or necessary environmental safeguards for allowing them to construct and operate.

An EIS essentially contains a detailed description of the project and the characteristics of the environment, an analysis of impacts both positive and negative, and the necessary mitigating or preventive measures to minimize or avoid negative impacts. The EIA remains to be a useful tool in examining the environmental and social soundness of proposed development projects in a coastal area.

EBBING COASTS

The future of our natural coasts remains uncertain. Continuous decimation of our precious coastal resources will leave a permanent scar to our natural heritage. The splendor of our coasts will only be preserved in history books for future generations to read. An old song has a better chance of being revived than our natural coasts.

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PLANNING FOR THE INTEGRATED MANAGEMENT OF PHILIPPINE COASTS

Alan T. White and Tom Bayer

INTRODUCTION

Coastal and marine resources are extremely important to the economic welfare of coastal communities in the Philippines. Almost 60 percent of the Philippine population are located along the coast and depend on coastal fisheries for more than half of the animal protein consumed by the average Filipino. The most productive of the surrounding marine environment are the shallow coastal areas, measuring some 26 million hectares that border the coastline (Surtida 1998). These shallow areas are characterized by rich coral reefs, mangroves, and seagrass habitats. Unfortunately, these are seriously threatened by unsustainable exploitation, pollution, and general environmental degradation.

Over the past 20 years, the Philippines has experienced a rapid decline in coastal and marine resources. Its 18,000 kilometers of coastline are being rapidly developed while the 27,000 square kilometers of coral reefs are severely degraded. Many of the problems stem from a variety of related causes:

1. sedimentation and pollution caused by upland and coastal development,
2. illegal and destructive fishing practices,
3. over-fishing as a result of open-access fishery regimes,
4. increasing poverty in coastal populations,
5. a rapidly growing population,
6. and variable political will to address the problem directly (Courtney et al. 1998).

The contribution of municipal fisheries to total fish production has declined consistently over the last 10 years, dropping from 1,060,878 tons in 1987 to 909,248 in 1996 (Surtida 1998). Increasingly, more catches are composed of juvenile fish. The resulting per capita consumption of fish has shrunk from 37 kilograms to 28 kilograms per year. This is partly due to the fact that only about five percent of all coral reefs are still in excellent condition (Gomez et al. 1994). In addition, mangroves now only cover about 140,000 hectares, down from an original coverage of 450,000 hectares in the 1920s. Decreased coverage not only means less habitat for fish nurseries and spawning grounds, but declines in the production of timber products, animal fodder, and medicines, among other values lost. White and Cruz-Trinidad (1998) estimated that, on the average, US$ 60,000 worth of economic benefits per square kilometer is lost annually when mangroves are converted to other uses.

The coastal water mass that surrounds the Philippine islands is a fluid resource that is not containable or ownable in the usual sense, and affects ***all*** coastal interests. As a result, most of the problems associated with coastal management are due to divergent goals and weaknesses in the capabilities of various agencies tasked to ensure the proper development of the coastal resource base. The difficulty of managing coastal resources results from varied and conflicting economic activities in the coastal area as well as the sectoral management of economic activities by a host of institutions with jurisdiction over coastal resources. The lack of control over almost all development activities in the coastal zone is symptomatic of what is to come if stronger and more effective institutions and procedures for integrated coastal management are not put into place in the near future.

The key to success is involvement of all stakeholders and a demonstration that an ***integrated coastal management*** program is in the long-term interest of as many people as possible (Courtney et al. 1998). Past experiences in the Philippines show that an essential element of successful coastal management is active community participation. This includes fishers, local government, national government, non-government organizations (NGOs), and the private sector.

WHAT IS INTEGRATED COASTAL MANAGEMENT?

Integrated coastal management (ICM) can be defined in various ways, depending upon one's perspective. In general, it must fit within a comprehensive framework, which integrates the range of activities taking place in the coastal zone. The coastal zone is defined by the Department of Environment and Natural Resources or DENR (1997) as that "strip of land and adjacent lake or oceanic space in which land ecology and use affect lake and ocean space ecology, and vice versa." By definition, the coastal zone is vulnerable to changes brought about by both nature and man. Whatever pours from the hinterlands finds its way to the sea, while whatever is in the water column eventually floats towards the shore. Being a fluid border between land and sea, the zone is where typical terrestrial-oriented planning and resource management programs are weak.

From both the environmental and economic points of view, the coastal zone is a broad interface between land and water where production, consumption, and exchange processes occur at high rates of intensity. The range of human activities in the coastal zone must work towards sustainable development. In this context, sustainable development activities mean those which enable current improvement in social welfare without foreclosing options for similar development for future generations (White et al. 1997).

ICM is a process of planning, implementing, and monitoring the sustainable use of coastal resources through participation, collective action, and sound decision-making on the part of coastal stakeholders and users whether individuals or groups of individuals, involved in activities in the coastal zone. It seeks to manage development and conserve natural resources as well while integrating and coordinating individual stakeholders and sectors. Typical functions include (Cicin-Sain and Knecht 1998):

- Area planning.
- Promotion of economic development.
- Stewardship of resources.
- Conflict resolution.
- Protection of public safety.
- Proprietorship of public submerged lands.

The planning process is formulated through a multi-sectoral and interdisciplinary consultative process aimed at identifying and prioritizing resource management issues, fostering consensus, and generating support for the ICM program. To enhance strategic planning, it is important to create a strong inter-agency coordinating mechanism to ensure wide, effective participation on the part of stakeholders. In many cases, the economic survival of stakeholders depends on the continual health and productivity of the coastal zone.

Coastal stakeholders also place a high value on the aesthetic, tourism, and recreational aspects of the coastal zone. Therefore, it is important that stakeholders become intimately involved in the development and implementation of the ICM process. Most of the initiative to begin and momentum to sustain such a process must be derived from the stakeholders. They help to generate the political will that nudges government policymakers into taking action. Typical coastal concerns in the Philippines are natural resource degradation, pollution, land use conflicts, and destruction of life and property by natural hazards.

ICM may vary in approach, scope, focus, and degree of integration. However, integration should occur across user groups or stakeholders, levels of government, disciplines, and across the land-sea interface. Implementable statements on ICM are represented in plans where issues are **crisply analyzed**, objectives **clearly stated**, practical actions **specified**, and the resulting institutional structure **identified**.

This integrated form of coastal management has four distinct advantages over traditional forms of development planning (IWICM 1996). These are:

(1) Promoting the understanding of natural resource systems unique to coastal areas and their sustainability with regard to a wide variety of human activities.

(2) Optimizing the multiple use of coastal resource systems through the integration of ecological, social, and economic information.

(3) Promoting interdisciplinary approaches and intersectoral cooperation and coordination to address complex development issues and formulate integrated strategies for expansion and diversification of economic activities.

(4) Helping government units improve the efficiency and effectiveness of capital investment and natural and human resources in achieving economic, social, and environmental objectives.

The Coastal Resource Management Project (CRMP) for the Philippines, a government-initiated project being implemented by DENR, builds upon the experiences of past management efforts through innovative practices. The CRMP promotes sustainable coastal resource management through the integration of interdisciplinary, multi-sectoral, multi-stage, and participatory processes of planning, implementation, and monitoring in its project areas. These approaches are espoused with a view of minimizing impacts of fishing, aquaculture, and tourism on coastal ecosystems.

Integrated forms of coastal management coordinate the initiatives of various coastal economic sectors toward long-term socio-economic outcomes, including resolution of use conflicts and beneficial trade-offs. The integrated, multi-sectoral approach guides the activities of two or more economic sectors in planning for management. Major goals of ICM are to identify conflicts over coastal land and coastal renewable resources, and allocate and manage uses for optimum long-term benefits.

ICM PLANS

Integrated coastal management is a large set of goals and objectives. ICM includes many activities—often complex ones— which are carefully arranged in plans. An ICM plan specifies actions to solve certain problems such as the degradation of a mangrove forest, or organizes all the required actions to manage the coastal resources of one municipality covering 100 kilometers or more of coastline. The plan also lays out a work schedule for the project team aside from setting out a series of goals, objectives, policies, strategies, and actions involving coastal communities, government agencies, and NGOs. Plans for ICM are inherently variable depending on their overall purpose. They change with time as they evolve. But without a good set of initial plans, ICM cannot easily be implemented.

Sustainable coastal development plans should ensure long term protection of environmental resources and natural production, since short term gains often cause long term losses. This is very evident in the Philippines today with respect to the state of mangrove forests which are not nearly as productive as 50 years ago. One of the coastal management lessons learned in the Philippines is that plans and their time horizon can make a difference in outcome. Regardless of the size, scope, and complexity of an ICM plan, the planning process is crucial. Various programs in the Philippines and abroad can help, through experience, determine what is essential in the planning process to achieve results in both the short and long term.

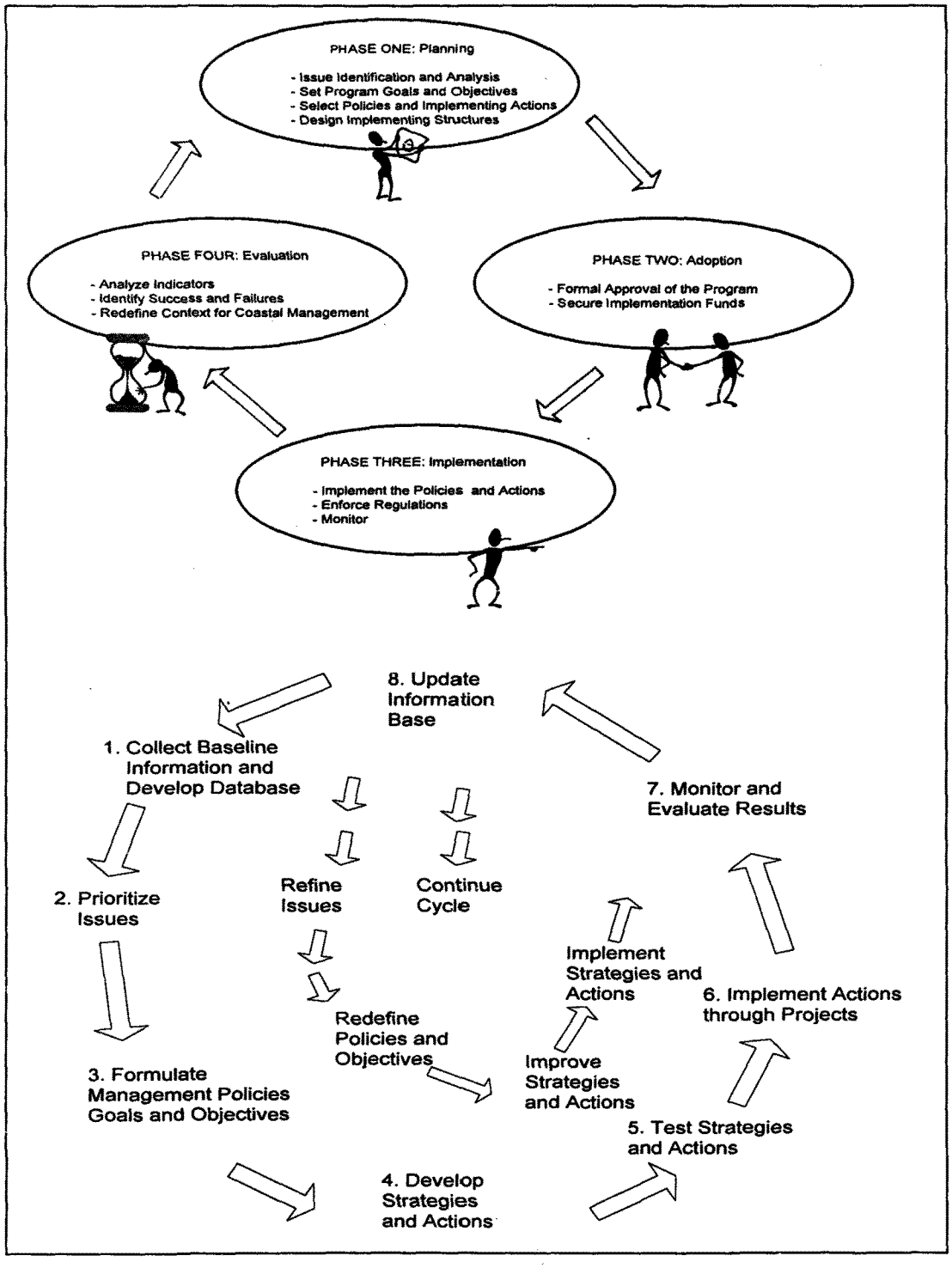
BASIC PROCESS OF ICM PLANNING

There are eight general stages in the ICM planning cycle (Figure 1):

1. Collect baseline information and develop database.
2. Prioritize issues.
3. Formulate management policies, goals and objectives.
4. Develop strategies and actions.
5. Test strategies and actions.
6. Implement actions through projects.
7. Monitor and evaluate results.

Figure 1

ICM Planning and Implementation Cycle



8. Update information base (followed by the refinement of issues, strategies and actions, etc.).

Planning and management require an information base. The better quality the information has, the more realistic the plan becomes. Plans based on hearsay are unreliable and might even cause damage. Thus, obtaining reliable information is the first step in planning. The question of how much information and what sources should be utilized then arises.

In ICM planning, it usually starts with secondary information followed by field assessments and interviews with community members to collect primary data. The CRMP uses the Participatory Coastal Resource Assessment (PCRA) approach. Through this approach, the CRMP assists coastal stakeholders in developing ICM plans by preparing a coastal environmental profile. The profile and resulting socio-economic and ecological assessments are important in identifying and evaluating potential management options.

The project seeks to identify local organizations and individuals who potentially can play key roles in the planning and management process; develop coastal environmental profiles through local participation and collaboration with local institutions; implement PCRA and mapping exercises with barangay groups; and, promote barangay, municipal, and project area-wide participatory planning.

Once good information is available, plan formulation may commence. An ICM plan needs a focus so that it does not attempt to solve too many problems at once. Attempts to address every issue will only result in a weak ICM program. ICM programs must generate tangible results in terms of sustainable uses and ecosystem conditions within several years. The plan must therefore focus on selected issues important to the resource users in order to maintain interest and support of the stakeholders.

Thus, identifying management issues and deciding on their level of importance are essential steps in determining what should come first. Issue analysis and prioritization by the community helps decide where to start. For example, if coral reef is being blasted to pieces, and it is the major resource of a coastal community, the issue of blast fishing may be prioritized.

In analyzing the contributing causes to blast fishing, one may realize that the task is not as simple as it appears. Blast fishers may come from afar, which highlights the need for local law enforcement. However, blast fishers may come from the community and may claim poverty and no alternative sources of income. In this case, the solution may include new jobs, education, peer pressure, and other interventions, all of which complicate plan formulation. Nevertheless, one objective can still be to stop blast fishing, but various strategies and actions may be more than simple law enforcement. The planning process helps sort out the actions needed, their timing, level of support, and implementing bodies.

Once ICM objectives are formulated, policies, strategies, and actions are then specified. Objectives should be translated into meaningful actions. Some strategies may include: setting up a marine protected area, zoning of the resource area, organizing management committees, and educating a community group, among many other possibilities. Actions are particular steps necessary to implement a given strategy. Actions, once decided, require people, money, time, organization, and communication to implement. Thus, the need for a detailed and logical action plan that addresses the needs of the stakeholders.

A good ICM plan makes implementation easier. Plans evolve over time through experience, testing, trials, and improvements which work in the field. The sooner implementation starts during the planning process, the more likely that the plan will be practical and acceptable. A high level of participation on the part of stakeholders is crucial for ICM plans. This participation is not only in the planning stages but in implementation as well. The sooner and more effectively the two merge, the better the plan.

This leads to the stage of monitoring and evaluation. All efforts are ultimately tested in the field with real people and actions. Therefore, there must be constant monitoring of the results to see if these efforts are

effective. Monitoring and evaluation of the effectiveness of the plan and its implementation are conducted to know if changes are made through the most efficient means. The findings of monitoring then feed back into the cycle whether in the data base and profiling stage, objectives setting stage, or even in refining the strategies and actions.

ICM PLANNING OUTPUTS AND RESPONSIBILITIES

Another way of understanding the planning process is by looking at the activities involved in each phase, the concomitant outputs, and responsible party. Figure 2 breaks the planning cycle down into eight phases with associated activities and roles of various actors.

Responsible individuals, groups, or organizations formulate and implement plans. It is essential to be clear who is responsible for what action. In a developing country like the Philippines, ICM is typically driven by external organizations which provide technical assistance and support in various forms to local government units, community groups, non-government organizations, and private organizations.

The dichotomy between external technical assistance groups, which often include the national government, and the community level stakeholders needs to remain transparent and clearly stated in ICM plans. It is unlikely for ICM to develop effectively without some outside facilitation; however, local government units and communities should begin to take control at some point during the planning and implementation process for a sustainable ICM.

In order to facilitate the complete takeover of coastal management by local stakeholders, the CRMP conducts various trainings throughout its areas of operation. Some of these trainings include community-level PCRA workshops and a 10-day ICM training course for mid-level decision-makers. It is hoped that these and other trainings can catalyze local coastal resource-users and policy-makers to effectively and conscientiously manage their future. Actual coastal stakeholders must take responsibility and continue the planning and implementation process. This is the ultimate test of success of any ICM program.

In conclusion, the Philippines still has the opportunity to sustainably use its coastal resources to attain its economic development goals. Adoption of ICM programs is an effective way to achieve this goal while still conserving its rich marine resources. For this to occur, there must be a coalition of stakeholders at both the national and local levels to support and implement the integrated management of the coastal zone.

Lastly, while planning in an integrated fashion for successful coastal management is flexible, there are five general characteristics of successful ICM plans (CRMP 1997). These are:

- Issue-based.
- Realistic management actions.
- Definite criteria for decision-making.
- Supported by factual data.
- Participatory and popular.

Planning for ICM is a rational process that has the potential to ensure a sustainable future for Philippine coastal communities. Without it, one runs the risk of degrading the coastal resources into extinction.

Figure 2
Phases, Activities and Participant Roles in a Coastal Management Planning Process

Phase	Activities and Outputs	Technical Assistance Roles of Non-Government Organizations, Academe, Donors and National Government	Roles of Community, Local Government and Stakeholders
1. Program preparation	• Determine boundaries and scope • Make workplans/ budgets • Assign personnel • Secure consensus on overall approach	• Prepare workplans • Formulate working agreements • Contract staff • Train staff • Facilitate consensus on design	• Enter into memoranda of agreement • Participate in discussion • Communicate needs and potential roles
2. Secondary information gathering	• Compile existing maps, reports, data • Interview information sources • Compile existing laws, agreements, plans • Review other sources of information	• Locate sources of information • Compile information in useful form • Coordinate activities	• Provide information • Assist to compile information • Begin developing information storage and retrieval system
3. Field assessment/ study: Participatory Coastal Resource Assessment (PCRA) and other research	• Train practitioners • Conduct PCRA mapping and data collection • Contract special research studies on fish stock assessment, habitat condition, water quality, enterprise and others	• Train practitioners • Facilitate PCRA • Conduct specialized research • Analyze research data • Make results available	• Conduct PCRA with technical assistance • Participate in special research and data collection • Assist in analyzing data • Provide inputs to mapping
4. Database and profile development	• Set up data storage and retrieval system • Compile coastal environmental profile • Use profile as planning base • Refine boundaries and further research needs	• Determine data storage site, personnel • Write profile • Distribute profile • Facilitate discussions on boundaries and research needs	• Provide information • Assist with profile analysis • Use profile for planning • Decide on boundary demarcation
5. Prioritize issues and analyze causes	• Conduct community and municipal-based planning sessions • Develop issue tree • Prioritize issues for management • Determine causes of issues	• Facilitate process • Interject outside perspectives, research findings, policies, etc. • Help translate issues into causes	• Provide basic policies • Provide major inputs to plan • Build consensus among communities • LGU support to planning process
6. Policy and plan formulation	• Conduct planning workshops to determine objectives, strategies and actions • Determine goals, objectives and indicators • Interagency coordination • Determine composition of management body • Initiate preliminary plan implementation	• Facilitate planning process • Provide technical guidance • Assist to set up management bodies	• Provide basic policies • Provide major inputs to plan • Build consensus among communities • LGU support to planning process
7. Plan/project implementation	• Design pilot projects • Test projects • Formalize and set up management council • Secure support as required • Increase implementation effort	• Facilitate initial implementation • Provide seed funding • Provide technical guidance • Conduct training course as required	• Take full responsibility • Participate in implementation • Provide local personnel
8. Monitoring and evaluation	• Train monitoring and evaluation team • Monitor environment and ICM process and feedback to database and plan • Evaluate program results and feedback to plan	• Assist to train LGU personnel • Assist to analyze data • Assist to set up sustainable system	• Collect data • Use data to refine plan and update database • Participate in process • Take responsibility

Legend: ← **- feedback process**

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MARINE PROTECTED AREAS

The Case of Twin Rocks Marine Sanctuary

Bernadette F. San Juan

BACKGROUND

The Philippine Fisheries Code of 1998 is predicated on the assumption that the country's coastal resources are in a degraded state. The new law banners adherence to sustainable development as a distinguishing feature. To demonstrate the progressive stance of the government in this aspect, the Code specifies that local government units (LGUs) shall allocate, where applicable, at least 15 percent of its municipal water as fish sanctuaries. Section 81 of the code stipulates this particular provision as follows:

> *That in municipal waters, the concerned LGU in consultation with the FARMCs may establish fishery refuge and sanctuaries: Provided, further, that at least fifteen percent (15 percent) where applicable of the total coastal areas in each municipality shall be identified, based on the best available scientific data and in consultation with the Department, and automatically designated as fish sanctuaries by the LGUs in consultation with the concerned FARMCs (R.A. 8550).*

In addition to this progressive provision of the Code for environmental protection, the government had also enacted the National Integrated Protected Areas System (NIPAS) Act of 1992 or R.A. 7586 in support of natural resource conservation efforts in the country. Marine sanctuaries or reserves that have been proclaimed through the NIPAS process are managed by designated national or special government agencies.

Yet, the establishment of fish sanctuaries is not merely an exercise of identifying a particular area of the coastal water. More than the challenge of identifying a bio-physically suitable site, the problem of maintenance and sustainability of the initiative is proving to be greater than what has been initially expected. Information from the survey of marine protected areas in the country conducted by Haribon Foundation in 1997 illustrates the challenge in marine protected area (MPA) management. Out of 439 surveyed programs, only 71 or about 16 percent indicated that their programs were not strictly enforced (Haribon Foundation 1997).

The path to sustainable development has been identified as one toward decentralization and distribution of economic wealth (Miller 1995). In giving the power over the resources to the people who depend on them, it is logically assumed that externalities in the economic undertaking are minimized due to the greater concern and knowledge of the people who directly benefit and literally live on the resources. In the fisheries sector, this refers to empowering the municipal fishers. Therefore, in supporting any community-based resource management initiative, there is logic in the promotion of village-based marine protected areas. If managed at the village-level, the rules, regulations, and components of marine protected area programs are assumed to have considered the plight of municipal fishers, who possess very few economic alternatives due to social, political, and economic limitations.

This study presents the challenges faced by village-based MPA programs in the Philippines. The case of Twin Rocks Marine Sanctuary is presented to illustrate the situation of village-based MPA programs in the

country. Specific action areas for the enhancement of these programs are identified from the case analysis.

OBJECTIVES OF THE STUDY

This study aimed to provide answers to the following questions:

1. What are the challenges faced by village-based marine protected area programs?
2. What are the issues confronting municipal fishers?
3. What are the barriers to the fishers' collective action?
4. What forms of interventions will have greater multiplier effects?
5. How can village-based marine protected area programs be improved?

Statement of Objectives

General Objective:

To identify specific action areas to improve village-based marine protected area programs in the Philippines.

Specific Objectives:

- To illustrate the experiences and situation of village-based marine protected area programs in the country using the case of Twin Rocks Marine Sanctuary.
- To trace the causes of the success and failures of village-based marine protected area programs.

MARINE PROTECTED AREA PROGRAMS

History, Definition, and Purposes

The establishment of marine protected areas (MPAs) trailed their terrestrial counterpart by almost a century. This is attributed to two reasons. First, the degradation of coastal resources occurred at a later time compared to that of terrestrial resources. Second, the realization of the degraded state of coastal resources also came at a much later time. The relative difficulty of accessing coastal resources, both in the aspects of utilization and monitoring, compared to terrestrial resources is a main factor that led to this situation.

The first MPAs were declared as such because of the resources of the coastal land rather than of the coastal waters. Initially, the protection of the coastal waters of MPAs was only incidental to the purpose of protecting a particularly valuable coastal land area. In the Philippines, for example, this is the case of the Hundred Islands National Park. The main focus of protection is the islands themselves and not the surrounding coastal waters. The protection of the coastal waters of Alaminos, Pangasinan, where the Hundred Islands are located, came primarily out of the efforts to protect the forest area in the islands.

The purposes for which MPAs are established vary. In the earlier period, aesthetic and tourism reasons prevailed. In the latter years, however, ecological considerations have overtaken aesthetic reasons for the establishment of MPAs. This is indicative of the alarming rate of coastal degradation. In many developing countries, ecological considerations in MPA programs are further stressed to improve fishery productivity, especially in village-based MPA programs. Thus, MPAs are categorized depending on the goals for which they were established. In an attempt to standardize the system of classifying MPAs, the International Union for the Conservation of Nature and Natural Resources (IUCN) came up with six categories of MPAs based on management objectives. Below is the IUCN classification of MPAs:

I. Strict protection (i.e. strict nature reserve/ wilderness area)
II. Ecosystem conservation and recreation (i.e. national park)
III. Conservation of natural features (i.e. natural monument)
IV. Conservation through active management (i.e. habitat/species management area)
V. Landscape/seascape conservation and recreation (i.e. protected landscape/seascape)
VI. Sustainable use of natural ecosystem (i.e. managed resource-protected area)

Following the IUCN classification, MPAs in the Philippines are similarly categorized. In the list of the Protected Area and Wildlife Bureau of the Department of Environment and Natural Resources (PAWB-DENR) are some 116 MPAs

under various categories, to wit (Blasique, pers. Comm.):

- National Marine Park - 1
- National Marine Reserve - 1
- Marine Turtle Sanctuary - 1
- Tourist Zone and Marine Reserve - 58
- Wilderness Area - 16
- Mangrove Swamp Forest Reserve - 27
- Protected Landscape/Seascape - 11
- National Seashore Park - 1

This list excludes countless fish sanctuaries that are juridically under individual LGUs. In rare circumstances, there still exist de facto marine sanctuaries due to cultural or religious reasons (Haribon Foundation 1997).

Given the varying objectives of MPAs, no single definition of MPAs exists. However, an international definition of MPA was developed at the 4th World Wilderness Congress and adopted by the IUCN at its 17th General Assembly in 1988 as follows (Gubbay 1995):

> *Any area of intertidal or subtidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means, to part of all of the enclosed environment.*

Village-based MPAs in the Philippines

Village-based MPAs are MPA programs directly managed at the barangay or barrio level. Thus, they constitute part of the countless fish sanctuaries scattered throughout the country. They are primarily run either by a people's organization (POs) or by a barangay council. The involvement of the municipal government is also heavily felt in several cases. Likewise, assistance from NGOs and the academe are visible in some cases.

Village-based MPAs in the country are still in a relatively young stage of development, with barely two and half decades of existence. Started in 1974, the Sumilon Island experience appears to be the pioneer in village-based MPAs. It was initiated by the Marine Conservation and Development Program of Silliman University.

Majority of MPAs were established in the late 1980s up to the present. These programs sprang either from coastal area programs undertaken by NGOs, special government and donor projects as well as by the extension activities of academic institutions. Existing village-based MPAs in the country could be traced from the following efforts:

- Central Visayas Resource Conservation Program (CVRP) and Fisheries Sector Program (FSP) of the Bureau of Fisheries and Aquatic Resources (DA-BFAR),
- Coastal Environment Program (CEP) of the Department of Environment and Natural Resources,
- Coastal Resources Management Program (CRMP) of the United States Agency for International Development (USAID),

as well as through the programs of non-government organizations, such as

- Haribon Foundation,
- Community Extension for Research and Development (CERD),
- Guian Development Foundation (BIDEF),
- Philippine Rural Reconstruction Movement (PRRM),
- Philippine Business for Social Progress (PBSP),
- Philippine Partnership for the Development of Human Resources in Rural Areas (PhilDHRRA),
- OXFAM;
- PIPULI Foundation, and

the extension activities of academic institutions such as

- University of the Philippines (UP),
- Visayas State College (VISCA),
- Bicol University (BU), and
- Silliman University.

As expected, the improvement of fisheries productivity is the main objective of the establishment of MPAs by fishing villages. Other direct objectives of village-based MPAs include the following (Haribon Foundation 1999):

1. to develop a sense of community among the community residents,
2. to restore, maintain, and enhance the coastal resources (may be referring to ecological processes and biodiversity),

3. for the equitable distribution of the benefits of the sanctuary and coastal resources,
4. to stop illegal fishing,
5. to promote the sustainable use of coastal resources, and
6. as protection of small fishers from commercial fishers.

THE CASE OF TWIN ROCKS MARINE SANCTUARY

Location and Area

Located in Maricaban Strait (part of Balayan Bay in Western Batangas), Twin Rocks Marine Sanctuary is part of a series of small sanctuaries established in Mabini, Batangas in 1991 through a municipal ordinance. Situated in Sitio Balanoy, Barangay San Teodoro, Mabini, Batangas, it runs from the western boundary of Sitio Balanoy to about 300 meters beyond Twin Rocks and extends 500 meters offshore. This constitutes about 15 hectares. The other two sanctuaries in the area are Arthur's Rock and Cathedral Rock which are situated in Barangay Bagalangit in the same town. A marine reserve area connects the three sanctuaries and covers the entire shoreline up to 700 meters offshore of Barangays San Teodoro and Bagalangit. Individually, all three sanctuaries can be classified as small compared to the standard size of village-based marine sanctuaries in the Philippines of 10 to 50 hectares (Hermes 1997).

Coastal Land Uses

Maricaban Strait, where Twin Rocks Marine Sanctuary is located, is open to common human disturbances, e.g. fishing, tourism, industrial and domestic pollution (Salamanca, et al. undated). The extent of pressures that are applied in the coastal waters reach the northwestern coastal barangays of Bauan in Balayan Bay on the northeast to the southeastern coastal barangays of Mabini in the east. On the south, the communities on the northern coasts of Maricaban Island also exert pressures on the coastal waters of Twin Rocks Marine Sanctuary.

Along the coasts of Maricaban Island, many small to medium-sized villages can be found. Fishing and domestic pollution are the dominant pressures from this area. Except for a few fishing villages located intermittently, the western coast of the Calumpan Peninsula is dotted with several dive and beach resorts. Among the fishing villages in this area, Barangays Anilao, San Jose, Ligaya, and Bagalangit are dotted with small to large resorts. Diving and other tourism-related pressures, i.e. anchoring and pollution from resorts establishments as well as siltation due to coastal land development predominate in this area. Industrial pollution and pollution from ships in Batangas City reach the sanctuary due to ocean current circulation. Steeper slopes and light vegetation in the hills of the peninsula also aggravate the siltation problem in the coastal area. Vegetation includes nipa, bamboo and cogonal grasses (Salamanca et. al. undated).

Overall, there is a shift of intensity of pressures from fishing to tourism. However, it is expected that as Batangas City, as well as Mabini, become more industrialized, industrial and domestic pollution will overtake tourism as the major source of pressure in the sanctuary. While industrial pollution and garbage from ships are indirect pressures in the sanctuary, direct pressures are derived from fishing activities and tourism-related activities such as anchoring and diving. Although fishing in the sanctuary is curtailed, fishing violations, that is, fishing using prohibited gears such as net and spears, in the marine reserve zone is still rampant.

History of MPA Establishment

Conservation and management of certain reef areas in Anilao had been initiated by the government in the late 1970s. The Ministry of Natural Resources Special Order No. 61 of May 3, 1977 created the Marine Parks/Reserve Development Inter-Agency Task Force under the Natural Resources Management Center of the Ministry of Natural Resources. This group conducted studies on Sombrero Island and evolved a master plan for marine parks and reserve management. Presidential Decree No. 1801 of 1978 declared the whole Batangas coastline and the islands of Fortune, Maricaban, Caban, Sombrero, Ligpo, Malahibong Manok, and Verde as Tourist Zones and Marine Reserves (TZMR). As such, these islands were placed under the administration and control of the Philippine Tourism Authority

(PTA). Out of these initial conservation and management efforts, several other conservation programs and studies followed (Salamanca, et al. undated).

The establishment of the marine sanctuaries and reserve area in Maricaban Strait was an offshoot of the organizing effort undertaken by Haribon Foundation in 1990 to 1991 in the area, particularly in Sitio Balanoy, Barangay San Teodoro. Maricaban Strait was chosen by Haribon Foundation based on the findings of several studies showing the ecological importance of the area in the entire Balayan Bay and Batangas Bay ecosystems. The extensive coral reef system in Maricaban Strait serves as a nursery for many pelagic and reef fishes that feed the fisheries in both bays. The destruction of this ecosystem would result to the collapse of fisheries in the area and would bring economic disaster to the communities dependent on fishing and water recreation industry. To help counter the worsening ecological problems in the area, Haribon Foundation, through the Debt-for-Nature Swap Program, initiated the Mabini Marine Conservation Project (Arciaga 1998). While the initial efforts to conserve Maricaban Strait and the coastal reef system of Balayan Bay were primarily for tourism purposes, the involvement of Haribon Foundation is primarily due to ecological reasons, as well as humanitarian concern for the fishing communities in the area.

Objectives for Establishment

The overt objectives of the sanctuary establishment are expressed in the ordinance declaring the establishment of the marine sanctuary and marine reserve in the coastal waters of Mabini. The Mabini Marine Conservation Project aims to rehabilitate and maintain the coastal resources for the sustainable utilization and benefit of the present and future generation.

Improving fishery productivity for tourism and food security purposes are the twin objectives of the marine sanctuary and marine reserve establishment in the town of Mabini. Yet, the complementation of these two related objectives proved to be not so easy after all. Among the controversial issues in the sanctuaries is the perceived inequitable benefit of the sanctuary establishment accruing to the tourism industry in contrast to the fishing communities. Thus, while the establishment of the three sanctuaries is covered by a single ordinance, the objectives of each of the sectors involved in the sanctuary program do not necessarily coincide. For example, there is a widespread sentiment that water recreation activities in the sanctuaries negate the fishery productivity efforts. This is so because while scuba and snorkeling activities are prohibited in the sanctuaries, this does not happen. Therefore, while tourism flourishes because of the sanctuary establishment, fishery does not improve as fast because of scuba diving and other tourism-related disturbances.

Minor and indirect objectives such as the development of a sense of community and the contribution to poverty alleviation efforts through livelihood development are also among the concerns of the sanctuary program. These objectives, however, are felt more by the fishing communities rather than by other stakeholders.

Management Strategies

The designated body to manage the Mabini marine sanctuaries and reserve is the Resource Executive Committee (REC). It is composed of the municipal mayor as chairman, two other municipal officials, the municipal agricultural officer, the barangay chairpersons of San Teodoro and Bagalangit, and marine experts from Haribon Foundation and Bureau of Fisheries and Aquatic Resources (BFAR) who act as consultants.

On the ground, however, the resorts or communities fronting the sanctuaries are the ones managing (i.e. setting and implementing the rules) the sanctuaries on their own. While these stakeholders are part of the resource management committee created by the REC to assist in the implementation of the ordinance, the inactivity of the REC makes these groups de facto managers of the sanctuaries. In the case of Twin Rocks Marine Sanctuary, the management is being undertaken by Samahang Pangkaunlaran ng San Teodoro, Inc. (SPSTI), a people's organization that came out of Haribon's organizing effort in the area. For Arthur's Rock and Cathedral Rock, they are managed by Arthur's Place Resort and Dive 7000 Resort, respectively. Thus, there are

discrepancies in the management of each sanctuary.

This situation is also influenced by conditions in the area before these were proclaimed as sanctuaries. For example, in the case of Cathedral Rock Marine Sanctuary, fishing in the area has been prohibited since 1985 while the ordinance declaring it as a marine sanctuary came about only in 1991 (Sevilla 1999). Logistics, as well as commitment to the cause of the marine conservation program are also contributory to the situation.

Compared to the other two sanctuaries in the area, the management of Twin Rocks is quite different. While the management of the first two sanctuaries fronting resort establishments focus on reactive enforcement, management strategies applied in Twin Rocks are more diverse by employing zoning, biophysical monitoring, information dissemination, patrolling and enforcement, recruitment of volunteers, networking, and livelihood development.

Management Results

The improved productivity of the coastal area due to the sanctuary establishment is evident from the attested improvement in the fish catch of many artisanal and subsistence fishers in Sitio Balanoy. However, biophysical monitoring activities undertaken by various institutions revealed an inconsistent pattern of coral cover development. This indicates continued disturbances and pressures on the sanctuary area.

While SPSTI employed more diverse management strategies as compared to the resort establishments managing Arthur's Rock and Cathedral Rock, many of the management strategies of SPSTI have not been sustained. Information dissemination is limited to the barangay where the sanctuary is located. Other barangays are not sufficiently informed about the ordinance. Insufficient information dissemination and community organizing efforts also resulted to a loss of the community's sense of ownership. This lack of sense of ownership of the MPA program, in turn, hindered the enforcement of the rules and regulations of the sanctuaries. Logistical problems likewise contributed to inadequate enforcement and patrolling activities.

Recruitment of volunteers and networking are also not sufficient. This is indicative of poor organizational skills and limited connections typical of SPSTI. Initiatives on livelihood development have not progressed in the area. A key issue in this aspect is a perception of the leaders' lack of credibility on handling funds. This is in addition to the lack of business acumen of the leaders of SPSTI. Fishers, like farmers, are generally production and not marketing oriented. Since the key in business is marketing, limitations in marketing skills pose an obstacle to business success.

The case of Twin Rocks Marine Sanctuary depicts the multifaceted challenges being faced by village-based MPAs in the Philippines. These problems include logistical, cultural, political, project administration skills, and technical knowledge limitations. These stem partly from low educational attainment of municipal fishers, lack of livelihood opportunities, and inaccessibility of basic services. Without social services, especially education, municipal fishers cannot improve their skills and economic situation. Without skills, fishers' will find it difficult to engage in livelihood opportunities other than fishing. Without supplementary livelihood opportunities, fishers cannot afford to send their children to school. Without alternative sources of livelihood, the fishers will use coastal resources to their limits. The resultant degraded state of coastal resources would then contribute to the impoverished situation of municipal fishers. Hence, the cycle of poverty in the area continues.

An MPA program aims to counter this vicious cycle of poverty and resource degradation. Yet, conservation efforts that rely heavily on prohibitions and enforcement cannot be sustainable. Complementary economic, social, and political programs must be undertaken to improve the effectivity of marine conservation programs. These include livelihood skills training and access to capital to provide the fishers with supplementary, if not alternative, livelihood sources as well as constituency building.

In developing an MPA intervention program, three years is not enough for the program to be effective. Any institution that decides to engage in MPA establishment must gear up for a period of intervention of at least

five years. If funding for long-term programs is not available from one donor agency, component activities such as livelihood development, information and education campaign (IEC), training and education, resource assessment and monitoring, resource studies, acquisition of equipment, may be packaged separately to be supported by other donors or allied institutions.

While community-based management is ideal, sheer community-based efforts would be insufficient. Technical and financial assistance from allied sectors is critical to sustain community initiatives. Cooperation from other allied sectors such as academic, civic, research, local government, and national government institutions are necessary given the knowledge, skills, time, and resource limitations of municipal fishers.

RECOMMENDATIONS

Bio-Physical Monitoring

Institutions conducting bio-physical monitoring on behalf of the communities must give a timely and graphic feedback to the communities on the status of their resources. Moreover, these information must be translated into economic or monetary terms (economic valuation) to provide a quantitative basis to maintain the MPA program. This information could likewise be used to generate formulas of the appropriate size of the MPA and in site selection.

Resource Studies

Resource studies would yield information needed to formulate appropriate rules and regulations to effectively protect particular species and improve the productivity of the MPA. This need is borne out of the recognition of the stock and flow aspects of the coastal ecosystem. This means that the surrounding environment of the MPA has to be thoroughly studied as well. Apart from the knowledge of the species' biology and ecology (including migration patterns) which are derived from resource studies, factors such as ocean currents, existing land uses, fishing regulations and fishing practices have to be considered in policy development of the MPA program.

While this activity may be too complicated for municipal fishers, allied institutions may assist or even take the lead in this component. This complicated component of MPA management may however be broken down into segments and distributed among different municipal fishers to undertake. Nevertheless, the expertise of development workers and academicians need to come in.

Livelihood Development

Given the current degraded state of nearshore fisheries, an alternative livelihood component is a prerequisite for an effective MPA program. To give nearshore resource the time to rejuvenate, some fishers need to be weaned away from the sea. As the central problem of poverty among municipal fishers is due to lack of livelihood opportunities, this aspect has to be sufficiently addressed to minimize their economic dependence on coastal resources.

Livelihood options may include the development of post harvest facilities, i.e. ice manufacturing, simple food preservation such as smoking or drying, canning, and related livelihood options such as tourism services. The enterprises or income-generating projects the communities would take must not cause any environmental damage. Otherwise, the gains of protection would be negated by environmental damages brought about by the operation of the enterprises.

Many potential livelihood opportunities that complement fishery production such as ice manufacturing and fish preservation require large financial capital. The only way that municipal fishers could engage into such enterprises is by group effort. The formation of a fishers' cooperative is therefore more logical. Developing young, educated, credible, civic oriented, and entrepreneurial local leaders provides better chances of a more effective management of the cooperative enterprises.

Constituency Building

Constituency building must be broadened to include various stakeholders, especially those who put impacts on the resources. In the case of Twin Rocks Marine Sanctuary, scuba

divers and other tourists must be given special focus in the constituency building efforts. Furthermore, constituency building from the local populace must be extended to include other barangays near the MPA. It should be noted that assertion of authority to enforce rules impinges on the issues of ownership and territoriality. Depending on the prevailing social and political culture in the area, reactive and authority based enforcement could work. However, sustainable enforcement of the rules and regulations of village-based MPA programs can come about only through the voluntary submission of the affected stakeholders of the program. In this regard, the proactive enforcement is the solution which can be done through a constituency building strategy. This may mean extending the geographical scope of organizational membership of the PO managing the MPA. Forming a federation of the people's organizations in the area, who will be tasked to manage all three sanctuaries, could also be done.

The constituency building strategy consists of several components including networking, information dissemination, recruitment of volunteers and members, and training of community members. Yet, mastering support for the program from the different stakeholders is not an easy task. Among the sensitive issues involved is the perception of the equitable distribution of program benefits. If some stakeholders perceive that other stakeholders reap more benefits, the open access outlook on the resources is the most likely result. It is important that program benefits reach the adjacent barangays and towns.

Training and Education

Constituency building must give emphasis on values formation and leadership training. One of the perennial problems of the grassroots sector is a lack of leaders who would remain loyal to the interests of the sector whom they represent. Volunteers and staff of marine sanctuary programs have to be educated to stand by the rules and regulations of the program even if it would mean going against their relatives and friends.

Advocacy and Networking

Advocacy efforts complementing marine sanctuary programs include the banning of commercial fishing vessels and other efficient gears within the 15 kilometer limit for municipal waters. These efforts should also include security of land tenure, moratorium on conversion of environmentally critical coastal land, and provision of social services for municipal fishers. The NGOs for Fisheries Reform (NFR) (1998) cited the advantages for the 15-km provision limits of municipal waters reserved for municipal fishers. First, the 15-km limit of municipal waters reserved for municipal fishers would provide bigger fishing ground for small fisherfolk and improve their catch. Second, a wider area reserved for municipal fishers will improve the chances of habitat rehabilitation/ conservation, especially considering that much of the country's coastal and marine resources, have been destroyed. Being a rich source of fishery and aquatic products, the low technology used by small fishers in this area will be enough to optimize the catch in the continental shelf. Use of highly extractive fishing gears commonly used by commercial fishers will push the resource to its limits (NFR 1998).

Siltation has been identified as the number one cause of the degradation of coastal resources. This emanates from the removal of vegetation due to logging and reckless development of critical coastal land. Coastal land uses that dump excessive and toxic wastes into the coastal waters such as mine tailings from mining and chemicals from golf courses, agriculture, and industries must be regulated.

Lack of security in land tenure and social services are two other major issues that confront municipal fishers. Lack of security in land tenure causes worries that affect the focus on livelihood of municipal fishers. Moreover, this lack of security in land tenure takes away the incentive to take care of coastal resources as the thoughts these resources would not be available to them in the future discourages concern for the resources.

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COMMUNITY MOBILIZATION FOR EARLY WARNING[1]

Zenaida G. Delica

INTRODUCTION

The early communication of warning to the population at risk from a certain hazard could save lives and mitigate damage, but only when it reaches them in time, and if the people heed the warning before the hazard occurs. What happens if the warning fails to reach the vulnerable communities? How should the people respond to impending threat?

This paper is about how a community in the Mt. Pinatubo affected areas managed to survive in the midst of lahar threats through community-based approaches to disaster preparedness. It deals with the people's capacity to take responsibility by monitoring hazards and issuing early warnings to save their communities from disaster. This paper emphasizes that early warning would be more effective if the threatened population is aware of the hazards they face and if community-based approaches in disaster preparedness are in place.

As demonstrated by the Mt. Pinatubo eruption, the aftermath could be even more threatening and devastating than the eruption itself. Victims of the eruption acknowledged the necessity of disaster preparedness, particularly an early warning system for lahars. Residents of two communities in the towns of Porac and Bacolor, both in the province of Pampanga, were saved by a timely warning issued by their people's organizations (POs). The PO leaders and members, who were earlier trained by non-government organizations (NGOs), alerted the residents to evacuate before the most critical time. After an hour, large portions of the two villages were completely buried under lahar. There was no casualty. The early warning saved the people.

Information used in this paper came from reports of NGOs and government agencies directly involved in Mt. Pinatubo. Non-structured interviews were conducted with affected residents and NGO staff members who assisted them.

TODAY'S IMPERATIVE: EFFECTIVE WARNING SYSTEM

Disasters associated with natural phenomena are major human and development issues. For the past 20 years, the United Nations Educational Scientific and Cultural Organization (UNESCO) (1993) estimated that up to three million people have been killed and about one million people have been affected by these disasters. Consequently, tragedies have resulted to incalculable human sufferings and reversal of the gains of development. Therefore, there is a pressing need to understand natural hazards, reduce their devastating effects, and mitigate disasters. Early warning has a significant role in disaster reduction. In this regard, vulnerable groups play a crucial role in understanding early warning to save their lives and possessions necessary for survival.

Early warning is an important activity within the general scope of disaster preparedness. It is issued only after analysis of a hazard based on geological, meteorological, and atmospheric interactions and processes. Moni-

[1] This paper was presented at the Early Warning Conference in Potsdam, Germany held on September 7-11, 1998.

toring and predicting hazards involves scientific and technical skills, knowledge, and expertise. Issuing alerts, on the other hand, involves communicating the forecast by translating scientific findings into terms understandable to the general public.

Purpose of Early Warning

The purpose of early warning is to alert the population at risk or vulnerable sector to an impending threat and bring about appropriate responses that could minimize their exposure to hazards. Appropriate response is possible only if the target population is prepared and has the capacity to take timely actions. Early warning is useful not only to the vulnerable population but also for the government and NGOs whose mandates fall under disaster management.

Early warning is an opportunity to educate people about hazards, their causes, and consequences. In Mt. Pinatubo affected areas, the authorities have two types of warning: *(1)* lahar hazard maps that serve as an intermediate or long term warning issued weeks, months, or even years ahead; and *(2)* short term lahar alerts intended to warn endangered communities hours to minutes before hazardous lahar (Tayag, et al. 1993). The long term warning, which explains the areas to be affected by lahar flows and floods, can be used by concerned agencies to create risk scenarios. It then guides them in formulating their disaster preparedness plan. From the NGOs' perspective, this long term warning can also be considered early warning.

Early warning also serves as an entry point for disaster response NGOs to pursue their mandate of assisting vulnerable communities. It gives them an occasion to conduct training on disaster preparedness and organize target communities. It then becomes a learning opportunity both for the NGOs and the communities.

Though most disasters are natural in origin, it is also an acknowledged fact that disasters occur because of the vulnerability factors such as physical environment and socio-economic conditions. In this regard, early warning can be considered another opportunity to undertake development interventions that will reduce current and prevent future vulnerabilities.

Early Warning System (EWS)

The Early Warning System (EWS) consists of several processes: monitoring hazard, forecasting events, and communicating information through warning and alerts. *"While hazard monitoring consists of measuring the probability of a hazardous event with determined attributes, occurring in a given place within a given period of time, hazard forecasting involves in addition, predicting or warning that an event with given parameters may actually occur"* (Maskrey and Sato et al. 1997). In the Philippines, official monitoring and forecasting related to weather disturbance and volcanic activity is the responsibility of the Philippine Atmospheric, Geophysical, Astronomical and Services Administration (PAGASA) and the Philippine Institute of Volcanology and Seismology (PHIVOLCS), respectively. Both are national government agencies. Their messages are relayed to the public through the mass media, government agencies, and NGOs which have access to them.

The progress in modern communication technology has made sending a warning message easier. Properly and correctly communicating the warning can help the concerned agencies in activating its counter disaster plan and contribute to overall risk reduction. However, most of the people in the developing countries, who are the most probable victims of disasters, do not have access to sophisticated communication technologies. Thus, a community-based timely warning system should be in place. It does not mean that local people should be knowledgeable of the scientific and technical aspects of monitoring and prediction. It means that local residents should be informed, of the probable disasters that may happen in their respective areas based on present geophysical, environmental, and economic vulnerabilities as well as historical and experiential information on hazards that normally occur in their villages. From this information, the community can draw a hazard map, formulate a counter disaster plan, and set up its own organization for disaster preparedness. The system should be practical, relevant, and useful to the most vulnerable groups.

Effectiveness of Early Warning

The effectiveness of the EWS highly depends on the people's perception of the coming danger, level of understanding of the hazard type, and acceptance of the warning issued to them. Equally important is the credibility of the agency whose reliability in alerting the public is measured according to its track record in prediction and warning. Moreover, *"the usefulness of an early warning system is judged not on whether warnings are issued per se but rather on whether warning facilities (are) appropriate and timely decision-making (are made) by those at risk"* (Maskrey and Sato 1997).

Smooth information flow to and from the warning authority can contribute greatly to the effectiveness of EWS. Through the information flow in the communication system, data can be validated or corroborated at the local level as in the case of a tropical cyclone in India (See Box 1). Information about threat could also come from the threatened people themselves as in the case of the Mt. Pinatubo eruption (see Box 2). A disaster information system should be active all the time prior to any disaster event.

Likewise, since all disasters are local, the effectiveness of EWS is determined by how local authorities and residents respond to the warning of impending threat. Due to their experience, residents of disaster- prone communities become familiar with the hazards that usually hit their locality. They have developed a disaster culture, which could be either an advantage or a disadvantage to them. If they become watchful of the danger that looms before them, they could be prepared when the alert is issued. However, if they are complacent either because of their doubts as to the accuracy of forecast or because of their 'expertise' in dealing with hazards, they could be in danger of becoming victims.

Long term or early warning message is a part of the public information system that should include the following: timely information about the hazard; action that should be taken to reduce loss of life, injury, and property damage; and consequences of not heeding the *immediate* warning (NDO 1992). There are two problems that hinder the effectiveness of communicating the warning. One is the failure of the short term or immediate warning to reach the target population and the other is failure of the population to heed the warning. Both entail a huge responsibility for the authority issuing warning. On the one hand, warning the threatened population alone without projecting risks may not encourage them to heed the warning. On the other hand, if the projected risks do not happen, they may consider the warning as false alarm and not at all valid. To ensure that the forecast is accurate and early warning reaches the population on time are a huge informational and communication task.

BOX 1
EXPERIENCE OF CASA, INDIA

The first forecast (early warning) of the 1990 cyclone (4th of May) immediately set off warning signals in the organization. The director called for a meeting of the senior staff to work out CASA's tentative response. Most decisions were immediately executed on the phone to meet the demands of the potential emergency situation. Reports from staff in the likely disaster areas started streaming in and they corroborated the cyclone forecast. It became clear that they were in for a major disaster. Vulnerable people from the shoreline and low lying areas in Madras and Machlipatnam started to evacuate. CASA's emergency response machinery was all set. The field staff actively participated in evacuating and feeding the 7000 potential victims.

Source: Fitzpatrick, 1994

BOX 2
HOW THE ERUPTION WAS PREDICTED

As Mount Pinatubo was considered dormant before it erupted in 1991, it was not covered by the regular monitoring network of PHIVOLCS. Consequently, the initial signs of restiveness which the volcano manifested in April 1991 might have been overlooked had these not been promptly reported to the PHIVOLCS by Sister Emma of LAKAS Foundation, a local-based NGO. On April 4, Sister Emma traveled all the way from Zambales (around 129 km away) to the PHIVOLCS office to report the explosion which occurred at Pinatubo's crater on 02 April 1991. According to her, the explosion was accompanied by rumbling sounds and steam and ash ejections. The PHIVOLCS immediately dispatched a Quick Response Team to conduct ocular and aerial observation. On 05 April, a temporary seismic station was installed at about 12 km west-northwest of Pinatubo.

Source: PHIVOLCS, 1996

Every disaster prone community should have a counter disaster plan or community preparedness plan that includes risk scenarios and early detection of hazards that may possibly come their way. This becomes more relevant when the official warning, for some reason or another, does not reach their area. Local hazard maps that include all types of risks that threaten the community should also be drawn. Finally, a structure or organization that will see to it that all tasks and responsibilities in the counter disaster plan are carried out should be put in place. These will facilitate the effective and appropriate response at the local level and should be practiced in Mt. Pinatubo where lahar flow is a repetitive cycle, and to a large extent, predictable as well as other areas.

PHILIPPINES: WORLD'S MOST DISASTER PRONE COUNTRY

A study conducted in 1992 by the Center for the Epidemiology of Disasters (CRED) based in Brussels, Belgium revealed that the Philippines is on top of the list of the world's most disaster prone countries from 1900-1991 with a total of 701 incidents. India ranked second with 369 incidents. In 1997 alone, more than 11.5 million Filipinos were affected by various types of natural and manmade disasters (Table 1). The country therefore needs to reassess its various strategies in disaster reduction.

The result of the CRED's study is not surprising considering the country's geographical location and physical attributes. As the country is located on the western rim of the Pacific Ocean where 50 percent of the world's typhoons originate, the occurrence of a tropical cyclone is normal. An average of 19 typhoons, most of which are destructive, visit the country every year.

Situated along the Pacific Ring of Fire, the country experiences volcanic eruptions and earthquakes, which could lead to several hazardous phenomena such as ground shaking, ground rupture, liquifaction, lateral spreading, landslides, and tsunamis. According to Punongbayan (1993), considering the fact that the big towns and cities of the country are located within the seismogenic zones, it is certain that in the near future some densely populated areas shall be struck with an earthquake of 7.5 magnitude or higher.

The country has 220 volcanoes, 21 of which are active. The most destructive eruption so far has been the Mt. Pinatubo explosion in June 1991, which covered a radius of 20-30 kilometers. Total damage was between 400-600 million dollars. The total population affec-

Table 1

DISASTERS IN THE PHILIPPINES, 1997

DISASTER	FREQUENCY	AFFECTED		CASUALTY		
		FAMILIES	PERSONS	DEAD	INJURED/ AFFLICTED	MISSING
Nature Triggered Disasters						
Landslide	2	29	150	6	10	1
Tornado	2	1,627	8,623	3	---	---
Red Tide	3	32,553	172,554	3	91	---
Epidemic	36	---	15,868	1,029	14,934	---
Infestation	13	46,869	248,406	---	---	---
Volcanic Activity	1	76	401	1	400	---
Tropical Cyclone	6	460,541	2,301,740	88	40	8
Flood/ Flashflood	7	204,591	1,043,559	42	6	6
Drought	1	1,396,251	7,400,223	---	---	---
Fishkill	2	3,100	16,430	---	7	---
Sub-total	73	2,145,637	11,207,944	1,172	15,488	15
Human-Made Disasters:						
Dev't. Aggression	47	26,426	141,286	10	39	---
Labor Repression	24	6,583	34,889	---	---	---
Militarization	9	27,388	158,652	206	23	---
Mining	2	---	11	80	---	---
Sub-total	**82**	**334,838**	**334,838**	**296**	**62**	**---**
TOTAL	**155**	**2,206,034**	**11,542,782**	**1,468**	**15,550**	**15**

Source: CDRC

ted reached 1.4 million or about 22.5 percent of Central Luzon's population (MPC 1994).

MT. PINATUBO: ERUPTION OF THE CENTURY

The Mt. Pinatubo eruption is considered one of the largest volcanic eruptions of this century (US Army Corps of Engineers 1994). When Mt. Pinatubo exploded in 1991, it emitted about 6.6 cubic kilometers of pyroclastic materials that were deposited on the volcano's slopes and in river basins surrounding the mountain. These materials have served as the main sediment source of lahar. Most lahar flows were triggered by rainfall. For the years 1991-1995, the most destructive lahars were generated during prolonged monsoon rains that were intensified by the typhoons. In 1994, some 1.583 million cubic meters of lahar source materials still remained on the slopes (DPWH 1995). Lahar generated by heavy rain falling on erodible deposits posed continuing and grave danger to human lives and property in the low-lying areas.

The eruption made a significant alteration to the surrounding eight river basins as they were not able to hold massive amounts of volcanic ash and debris within their banks. As

a result, when the rivers overflowed due to heavy rains, nearby communities and farmlands became heavily flooded, which further devastated vast tracts of agricultural lands, destroyed bridges and roads, buried homes, and disrupted livelihoods. Widespread impacts continued to occur with each rainy season as tens of thousands of residents were forced to leave their homes.

Pasig-Potrero River, one of the eight river basins, was an active lahar channel. Thus, towns within its immediate vicinity were threatened, *"Because of their high densities, twice that of water, lahar tends to erode channel floors and may lift large boulders, rock filled gabions, vehicles, concrete bridges and even buildings. A single lahar (flow that) typically moves at 8 meters per second or 30 km per hour, is generally very erosive"* (MPC 1994).

AN ENDANGERED COMMUNITY'S RESPONSE

As Mt. Pinatubo has vividly demonstrated, volcanoes can still pose a grave threat even after their eruptive phase. Having witnessed the destructive effects of dangerous lahar and mudflows in the aftermath of an eruption, the population's awareness about the possibility of becoming victims once more was heightened. The displacement of people, destruction, loss of housing and agricultural land caused by lahar flows and flooding have been predicted by PHIVOLCS in some detail. In this sense, the situation in Mt. Pinatubo affected areas provides a unique opportunity for effective disaster preparedness.

Since 1991, during the annual rainy season, lahar deposited in the mountain slopes cascaded down to the low-lying communities and silted rivers and creeks. The ensuing flood caused the destruction of houses, infrastructures, and the community's resource base. One by one, the villages of the municipalities of Porac and Bacolor succumbed to the pressure of lahar. These two towns were the most affected in Pampanga. Between 1991 and the early part of 1995, 19 villages in these towns were submerged in lahar. Hundreds of people perished. These villages are now deserted (NSO 1996).

In 1994 alone, due to continued heavy rains, a total of 147,674 families suffered from lahar and floods. Total villages affected reached 504 in 41 towns of the seven provinces of Central Luzon. Barangays[2] Manibaug-Pasig and Mancatian are two of the villages that were entirely buried after lahar flow struck on the evening of September 22. (Concern 1995).

In 1995, there were 11 rain-induced lahar that affected the Pasig-Potrero river system. An intense and prolonged rainfall caused by the passage of several typhoons triggered the worst lahar flows and floods. A total area of 25 square kilometers was buried beneath 0.5 to 6.0 meters of sediments with an estimated volume of 50 million cubic meters (PHIVOLCS 1996). Again, villages were completely destroyed and lives were lost. However, in two of the ruined barrios not one resident was hurt. Everybody was able to escape and bring some belongings with them. These villages were Manibaug-Libutad and Talba.

The Saga of Manibaug-Libutad

The town of Porac in Pampanga province has 29 villages. In 1994, when lahar cascaded from Mt. Pinatubo breaching the Pasig-Potrero earthdike, lahar rushed towards the Gugu Creek, which had a low, earthen dike of around two meters already constructed to protect the villages lying along the left embankment downstream. However, the lahar carried by the floods breached the dike in many places and buried the barrios of Manibaug-Pasig and Mancatian which lay west of the creek. Many lives were lost. To prevent further destruction of other villages, one of which was Manibaug-Libutad, it was decided that the dike be repaired and strengthened.

The Gugu Dike

The Gugu Creek, about five meters wide, was a tributary of the Pasig-Potrero River. A levee dike ran along both sides of the creek. Still earthen, the dike was raised to around eight meters by dumping volcanic materials on top of the original dike. The levee was about 21 kilometers long and traversed the towns of

[2] Barangay or barrio is the basic political unit in the country. This is equivalent to a village.

Porac and Bacolor with an upstream portion towards Delta 5 Watchpoint of the Mt. Pinatubo Warning System. The proposed strengthening called for the cementing of the inner portion of the Gugu Dike. The lack of funds from the national treasury and other sources did not allow this plan to materialize (DPWH 1995).

It was assumed that the strengthened dike could withstand the onslaught of lahar. Therefore, the villages would be safe. Some doubts, however, were expressed by residents who thought otherwise since the dike was still made of earth and that other similar dikes had been destroyed by lahar.

Manibaug-Libutad

This barangay or village was situated on a gentle slope which started a few meters above the creek and rose to 15 meters to a plateau. Most of the houses were located along the lower portion of the slope where the farms were. Separated by the creek, the villages relied on a bridge to reach the town proper. The bridge was destroyed by the 1994 mudflow. A temporary bailey bridge was constructed for pedestrians and light vehicles only. During rainy times, a circuitous route was the only alternative for the villagers to reach the town hall. Other daring residents would wade through waist-high waters holding up a dry set of clothes into which they would change when they reach the other side of the creek.

There were about 771 households or 3,722 people in Manibaug-Libutad. Most were farmers cultivating sugar cane, rice, cassava, various vegetables, and fruit trees of guavas and sour sop. Others worked as carpenters, laundry women, or ambulant vendors. Some residents found employment as contractual or temporary factory workers in the nearby city of Angeles, about 30 minutes away by public conveyance.

The village had constructed a barrio elementary school and a public market on the plateau. About one-third of the houses of the barangay were also situated on the upper part of Manibaug-Libutad. When the heavy rains would come and lahar would rampage from the mountain slopes of Pinatubo through Gugu Creek, the people of Manibaug-Libutad knew that they would become isolated from their town officials, that they were on their own.

The Warning System

The people of Manibaug-Libutad rely on a warning system involving both national and local institutions. This system is centered on the Mt. Pinatubo watchpoint, where rain gauges and lahar censors are kept and operated by PHIVOLCS, an institute that monitors volcanoes. Any development regarding Mt. Pinatubo and the lahar are first relayed by PHIVOLCS and the Regional Development Coordinating Committee (RDCC) to the municipal officials who, in turn, inform the village officials usually by two-way radios. The village officials transmit the warning or alert to the residents by various means such as use of whistles and firecrackers. The RDCC has developed the Mt. Pinatubo Warning System (See Table 2).

The system counts on the local officials to carry on their duties as expected. Thus, it is assumed that a 24-hour watch on movements in the Pinatubo Volcano is kept by concerned agencies. Miscalculation or any unintended slippage by these agencies could spell disaster for the communities. The NGOs working in the area are well aware of this possibility.

The CONCERN Training

In 1991, when Mt. Pinatubo erupted and after the first mudflow, CONCERN was already involved in the delivery of relief goods, education and training of the victims and potential victims of lahar, and the promotion of community-based disaster response approaches.

Based on the 1994 Pinatubo hazard map, Manibaug-Libutad was considered one of the high-risk villages. CONCERN organized meetings and related activities and conceptualized possible risk-scenarios with the residents. The village officials were receptive to the proposal of CONCERN and agreed to undertake a disaster preparedness training seminar. Twenty-five volunteered for the training. Among them were three barangay officials including the person responsible for disaster, the officials of homeowners' associations, farmers' coo-

Table 2

Lahar Warning Signals Used in Pinatubo

WARNING	MEANING AND APPROPRIATE ACTION
1 READY	Rain is falling at Mt. Pinatubo volcano and vicinity. No need to evacuate at this stage. People residing near river channels and low-lying areas at the foot slopes of the volcano should pack basic items and belongings and be ready for any eventualities. They should tune in to their local radio station for further announcements. At night, it is important that at least one member of the family should stay awake to be able to monitor warning signals.
2 GET SET	Rain continues for at least 30 minutes and rainfall intensity and duration are approaching critical level or threshold value. People will be informed whether or not the rainfall can trigger a lahar.
3 GO	Detection of lahar. Residents at risk should transfer to higher grounds.

Source: PHIVOLCS

peratives, and officers of women and youth organizations.

On July 23, 1995, a three-day training was carried out. The course contents were: Capacity and Vulnerability Analysis, Disaster Response Management (including Hazard Monitoring), Hazard Mapping, Damage-Needs-Capacities Assessment, Evacuation Drill, Counter Disaster Planning, and the Citizenry-Based Development Oriented Disaster Management (Table 3).

During the training, the community was able to identify where they planned to evacuate; whom to tap in case there will be an evacuation i.e., people and agencies who have cars, trucks, and communication facilities and how the information will flow, especially with regard to the warning system.

The training participants also set up their Barangay Disaster Response Organization (BDRO) and elected a chairman. The organization established several committees to carry out the different responsibilities relating to disaster preparedness. These were the Evacuation Committee, Warning Committee, Health Committee, Information and Education Committee, and Relief and Rehabilitation Committee. The Warning Committee was tasked to monitor the lahar situation and warn the people of impending disaster.

Each committee immediately started recruiting volunteer members from the village residents and familiarized them in their responsibilities. In particular, the Warning Committee recruited volunteers for monitoring mudflow movement at the designated points along the dike.

The 1995 Disaster

On July 28, three days before the village fiesta, the villagers were busy cleaning and decorating their houses, checking the utensils and stocking up for the affair. It was still monsoon season; and there was news of a coming typhoon.

Dark clouds were now approaching the village. At 4:00 p.m., a light drizzle started to fall. The BDRO Warning Committee had posted men along the dike to keep watch on the rising mudflow. Other barangay officials were glued to their two-way radios, waiting for the signal to leave the area. No word came from the municipal authorities. The BDRO Warning Committee informed the residents that the creek was rising.

Table 3

Course Module

TOPIC	CONTENT	METHODOLOGY
Framework	Vulnerability and Disaster, Philippine Vulnerable Situation, Disaster Update	Workshop, lecture, discussion, visual aids
Capacity and Vulnerability Analysis	Objectives and Aspects	Workshop, discussion, visual aids
Disaster Response Management	Definition and Objectives, Types of Responses, Changing Concepts	Role playing, lecture, discussion, visual aids
Hazard Mapping	Definition, Objectives, Methods	Workshop, discussion, visual aids
Disaster Need Capacity Assessment (DNCA)	Definition, Objectives, Methods	Role playing, lecture, discussion, visual aids
Evacuation	Definition, Objectives, Methods	Role playing, lecture, discussion, visual aids
Counter Disaster Plan	Objectives, Guidelines/Format, Planning	Workshop, discussion
Citizen-Based Development Oriented Disaster Management	Concepts, BDROffice/Committee framework	Lecture, discussion, open forum

Source: CONCERN/PDRN

At about 6 p.m., heavy rains fell. Rampaging mudflow mingled with the rising waters of Gugu Creek. Upstream portions of the dike started to erode. The BRDO Chairman gave the word to the Warning Committee: evacuate! The BDRO volunteers blew their whistles and at once mobilized the foot patrols, which went house to house, informing the occupants to leave their homes and run to the marketplace or the schoolhouse, which were identified in the training as a pick-up point for evacuation. Those who had vehicles could proceed to the CABCOM which assigned an area for use by evacuees. The others would be ferried by trucks and buses to the CABCOM. The village chief arrived and also joined in the warning action.

The condition in the area deteriorated so fast from level 1 to level 3 in less than two hours. By 7:00 p.m., about one kilometer of the dike collapsed. One foot of lahar was sweeping through the northernmost houses but the residents were already on high grounds. Only some BDRO officials and some volunteers of the Warning Committee were left behind surrounded by almost two-feet deep of smoking, very hot lahar. They would be the last to evacuate. They had made sure no resident was inadvertently left behind. A truck, returning from CABCOM, had arrived in time to evacuate the volunteers.

At 8:00 p.m., more than one meter of lahar covered the upstream houses, while more than two meters covered the downstream residences of the Manibaug-Libutad Village. Not one villager was killed, not one was even hurt. They had reached the evacuation area safely. The community depended on their strength and capability; had they waited for the official announcement, they could have been killed.

The Aftermath

In the following morning, residents of Manibaug-Libutad returned to their homes, partly buried in lahar, to salvage whatever could be saved. Using picks and shovels, they dug through sand and mud left by the lahar. Were it not for the coming fiesta, they should

not have lost so much, yet all were glad none had perished.

On August 23, 1995, about one month after the first lahar intrusion into Manibaug-Libutad, a stronger typhoon crossed the area bringing with it more rains and stronger lahar. More than two-thirds of the village was covered by lahar and buried beneath six meters of sand. The Gugu Creek, silted with sand which raised its level by more than seven meters, disappeared.

In a similar event, in the village of Cabalantian in the next town of Bacolor, many people died when Typhoon Mameng lashed its fury. This was on October 1, 1995 when the typhoon triggered the release of tons of lahar that breached the same dike and drowned those unprepared or unwilling to move away because of their full trust in the dike.

In the meantime, most of the residents of Manibaug-Libutad had settled in Clark Air Base as their temporary evacuation site for three years. They reminisced the past success with thanksgiving and yet also said that if they had moved much earlier, they would have been able to save more than the shirts on their backs. Others are now relocated to different resettlement sites of Pampanga province such as Sta. Lucia in Magalang and Madapdap in Mabalacat municipality.

This experience of maximizing the early warning is not limited to Manibaug-Libutad. A similar story happened to the residents of a bigger village of Talba in Bacolor municipality, where a training and organizing effort was undertaken by another NGO, the Pampanga Disaster Response Network (PDRN). All of the 771 families or more than 5,000 individuals were saved; not one died although the village was submerged in lahar in 1995.

Mt. Pinatubo remains a threat. Considering the huge volume of remaining lahar sediment source, lahar hazards are still expected to have significant impact on the region surrounding Pinatubo Volcano in the next decade or two. The lahar hazard maps issued yearly by PHIVOLCS will always be treated by the people of Central Luzon as Early Warning.

CONCLUSIONS AND RECOMMENDATIONS

The aftermath of the Mt. Pinatubo eruption provided both a dangerous threat and a rare opportunity for the affected populace. While they were always on their toes to escape disasters, they also took advantage of the situation as an opportunity to learn, to plan and to organize. People's initiatives along this line should be encouraged and supported. Community-based disaster management approaches derive lessons from the people's experiences.

Early warning in the form of lahar hazard maps issued by a government agency long before the impending threat provided a unique occasion for disaster preparedness. The interventions of the NGOs helped the community to understand and interpret the maps, which encouraged them to participate in the training, draw their specific community hazard map and formulate counter disaster plans. Cooperation among the community-at-risk, government agency and NGOs is a must. Resource and information sharing is crucial at all times especially in high risk communities. Information flow to and from the community is important.

Disaster preparedness training gave the participants the knowledge and skills to assess the gravity of the threat; to identify the pick up points for evacuation; to enlist the support of others who have resources that can be used during emergency situation; to ensure information is sent and received; and, to lead and be responsible for evacuation in an organized manner. Efforts on community-based disaster preparedness should be supported by the concerned authority. Early warning should not be treated apart from disaster preparedness as let alone, it would not be effective. Financial resources should be allocated to defray expenses for disaster preparedness activities.

Every village has a particular story to tell and lessons to share about its experience. Yet, there were no documents to speak about their cases. Usually reports talk about the NGO's or GO's narration of their activities. Oral testimonies abound, but no written paper was published about their experiences, be it on early warning or on emergency response. Documentation of people's initiatives and case stu-

dies of their best practice should be done for references and for learning purposes.

People were living in very high risk areas. The study has shown that people were constantly threatened requiring them to be watchful every minute. They saved themselves but they were forced to leave their belongings, which were necessary for their survival. It took them extra efforts to salvage even a few of their materials. To avoid this disastrous effect, no one should be allowed to stay in highly threatened villages. In this connection, a relocation site in a safe ground should be prepared for the population-at-risk before the lahar flows. Relocation sites should also ensure alternative livelihood opportunities to encourage them to move out.

Community organizations such as the Barangay Disaster Response Organizations were very helpful during the most critical time. They have an important role in monitoring hazards that threatened their villages and in issuing timely warnings to the residents. The residents were mobilized to warn their neighbors about the impending lahar flow. The experience showed that these organizations were reliable back-ups to the official and institutional arrangement for early warning. Cooperation and coordination between the BDROs and the village council should be encouraged and strengthened. This is one of the prerequisites for an effective disaster management.

Evacuation or fleeing from a disaster situation proved to be a positive coping strategy. The fact that the residents helped each other in evacuating prior to the lahar rampage demonstrated that people's coping is high during emergencies. This is another capacity that should be enhanced. Community's role in warning, both for long term and short term, should be recognized. Their participation and mobilization is crucial for their safety.

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VOLCANIC HAZARDS AND HUMAN SETTLEMENTS IN THE PHILIPPINES

Ma. Mylene L. Martinez

INTRODUCTION

Majority of high risk volcanoes are in developing countries. The cause for more concern, however, is that most well-known active volcanoes are surrounded by populated communities. From written records and ever since man can remember, densely populated and economically successful ancient settlements were either destroyed or obliterated by volcanic eruptions such as Vesuvius, Italy in 79 AD and Krakatau, Indonesia in 1883. Driven by curiosity and partly by the desire to gain knowledge that will help in formulating solutions to problems brought about by destructive volcanic eruptions, volcanologists have strived to understand the hazardous, often life-threatening, phenomena associated with volcanic eruptions. Studying volcanoes is important because it provides information necessary to undertake disaster preparedness measures to avoid loss of life and property. The recognition of volcanic hazards and proper delineation of settlements that are potentially at risk to such hazards are the ultimate uses of volcanological studies.

VOLCANIC CENTERS IN THE PHILIPPINES

The Philippines, because of its island arc setting, has approximately 200 named and unnamed volcanic centers scattered all over the archipelago. Twenty-two of these volcanoes are classified as active (Table 1). An active volcano means that the volcano has had historical eruptions, or recent geological studies suggest that the volcano has experienced an eruptive activity in the last 10,000 years based on radiometric dating of volcanic deposits. Six out of the 22 listed active volcanoes, namely, Hibok-hibok, Mayon, Taal, Bulusan, Canlaon, and Pinatubo, are considered 'most active', because of their very recent eruptive activities (Figure 1). A volcano is said to be 'inactive' if it has not erupted nor shown signs of activity within historic times. The probability for future eruptions is greater from active volcanoes. Because of the relatively short span of recorded history (approximately 600 years for the Philippines), some volcanoes which are presently classified as 'inactive' may be reclassified as 'active' if future geologic studies of their deposits indicate an age of less than 10,000 years.

In the Philippines, historical eruptions of Mayon, Taal, Hibok-hibok, and more recently, Pinatubo, have clearly displayed the adverse physical, social, and economic effects created by a volcano's activity. One common factor that is noticeable is that these volcanoes are surrounded by large communities that were directly affected during volcanic crises. As population growth continues, the growth of settlements around volcanic centers would likewise continue. For densely populated areas, volcanic hazards would have greater damage potential in terms of human casualties and economic loss (Tilling 1989).

VOLCANIC AND RELATED HAZARDS

Volcanic hazards are phenomena associated with volcanic eruptions that pose potential threat or cause negative impact to man, property, and to the environment in a given period of time (Tilling 1989; Blong 1996). Various types of hazards arising from volcanic eruptions have been identified. This

Table 1
List of Active Volcanoes of the Philippines

Name of Volcano	No. of Eruptions/ Eruptive Periods	Date of Last Eruption/ Last Reported Activity	Location
1. Mayon	45	1993	Legaspi City, Albay
2. Taal	33	1977	Talisay, Batangas
3. Canlaon	26	1996	Negros Oriental
4. Bulusan	15	1994-95	Irosin, Sorsogon
5. Ragang	9	1915	Cotabato
6. Smith	8	1924	Babuyan Island
7. Hibok-hibok	6	1953	Mambajao, Camiguin Island
8. Didicas	5	1978	Babuyan Island Group
9. Babuyan Claro	1	1913	Babuyan Island
10. Camiguin de Babuyanes	1	1957	Babuyan Island Group
11. Cagua	1	1860	Cagayan
12. Banahaw	1	1780	Lucena City
13. Calayo	1	1886	Valencia, Bukidnon
14. Iraya	?	1464	Batanes
15. Pinatubo	1	1991	Zambales
16. Iriga	?	1641?	Iriga, Camarines Sur
17. Biliran	?	1939	Biliran Island, Leyte
18. Bud Dajo	?	1897	Jolo Island
19. Matutum	?	1911	South Cotabato
20. Parker	1?	1641*	South Cotabato
21. Kalatungan	?	-	Bukidnon
21. Makaturing	?	-	Lanao, Mindanao

Source: PHIVOLCS 1995
* Delfin, F.G. and others, (1997). Geological, ^{14}C, and Historical Evidence for a 17th Century Eruption of Parker Volcano, Mindanao, Philippines. Journal of the Geological Society of the Philippines, 52 (1): 25-42.

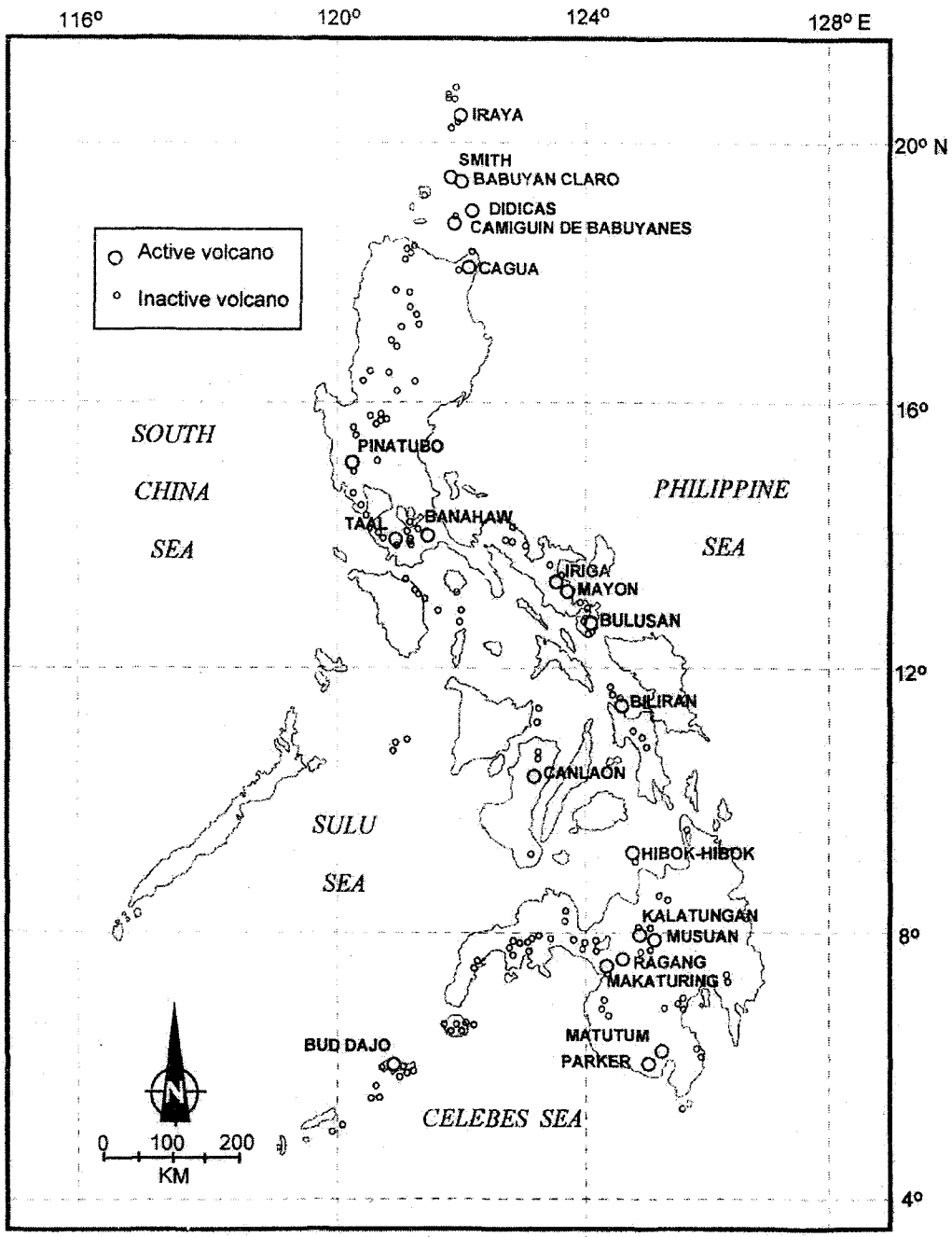
discussion will focus on the most common ones, namely: *(1)* pyroclastic flows, *(2)* lava flows, *(3)* tephra or ash fall, *(4)* lahar, and *(5)* volcanic earthquakes.

Pyroclastic flows are ground-hugging, hot mixtures of gases, ash, and rock fragments that rapidly cascade down the slope of a volcano. They are considered the most destructive volcanic hazard because of their high velocity (33 meters per second to 100 meters per second) which can impact and bury a particular area in a split second. Moreover, their high temperature (300-800 degrees Centigrade) can burn anything across their path. The 1991 eruption of Pinatubo volcano ejected about five (5) cubic kilometers of pyroclastic flow materials that filled river valleys radiating from it. Although the Mayon 1993 eruption ejected a smaller volume of pyroclastic materials, their higher temperature caused the death of approximately 70 people and more economic damage to the affected areas (Arboleda and Martinez, in press).

Lava flows are hot, incandescent molten volcanic materials that are quietly effused from the vent of a volcano. Although lava flows can cause permanent damage to areas by burial, they seldom pose direct threat to human life. Unlike pyroclastic flows, with their high velocities, lava flows are very slow moving (3 kilometers per day). There are several historical lava flow effusions at Mayon (e.g., 1984, 1993) and Taal (e.g., 1968). These lava flows from Taal and Mayon are the type that are less resistant to flowage, or less viscuous, because of their more mafic composition. Because of the content, they develop long flows. Lavas which are more viscuous because

Figure 1

DISTRIBUTION OF ACTIVE AND INACTIVE VOLCANOES IN THE PHILIPPINES



Source: PHIVOLCS 1995

they have more silicic composition develop short flows that pile up to form 'domes'. These growing lava domes on the summit or flank of a volcano are more unstable and have a tendency to collapse. When lava domes collapse, they can generate more dangerous pyroclastic flows. A very good example of this type of phenomena is the 4 December 1951 eruption of Hibok-hibok Volcano in Camiguin Island. A summit lava dome that had been growing for days collapsed without warning. This generated a hot avalanche of gases, ash, fragmented materials, and solid rock that cascaded down-slope of Hibok-hibok (MacDonald and Alcaraz 1956) and resulted to the death of 500 people.

Tephra fall or *ashfall* consists of fragmented or pulverized rock and lava materials that are ejected upward into the atmosphere during an explosive eruption. These materials are dispersed laterally by subsequent wind activity and deposited on the ground by free fall (by gravity) after the initial ejection. Tephra fall can endanger life and property by *(a)* the impact of falling rock fragments, *(b)* burial which can damage and kill vegetation, *(c)* roof collapse of buildings due to heavy accumulation of ash, and *(d)* suspension of fine-grained particles in the air which could damage aircrafts, break up power/communication lines, and pose health hazards. Thick ashfall was experienced during the Taal eruptions (e.g. 1754, 1911) and Pinatubo eruptions (1991). Minor ash ejections affecting areas proximal to the vent (within a 2-5 kilometer-radius around the vent) are common at Bulusan Volcano in Sorsogon and Canlaon Volcano in Negros Oriental.

Lahars are mixtures of water, mud, and rock, forming a slurry similar to cement, that flow down the gullies of volcanoes. Lahars usually derive their sediments from loose unconsolidated pyroclastic materials on the slopes of a volcano. Runoff after heavy rainfall remobilizes these sediments. Lahars destroy properties by burying large areas around the volcano under thick volcanic debris. Lahars are one of the more serious volcanic hazards to occur long after an eruption has ended. At Pinatubo, lahars continued to threaten and damage the communities downstream three years after the climatic eruption in 1991. The threat of lahars is still ongoing, particularly during every rainy season, and will continue until the slopes have stabilized and source sediments have been depleted.

Volcanic earthquakes are locally strong earthquakes that sometimes accompany a volcanic activity. These earthquakes result when magma rises towards the surface and form cracks or fissures as it intrudes along the conduit to the vent. Ground shaking from these localized earthquakes can damage or destroy structures located within the immediate vicinity of an erupting volcano.

DISASTERS FROM HISTORICAL VOLCANIC ERUPTIONS IN THE PHILIPPINES

Hibok-hibok, Mayon, Taal, and Pinatubo volcanoes have had their share of historical eruptions that resulted to deaths and disruption of livelihood. In most of these disastrous volcanic events, one common factor stands out—all are surrounded by major settlements (Table 2).

A pyroclastic flow generated from the collapse of a lava dome devastated the town of Mambajao, Camiguin Island on 4 December 1951. Prior to this fatal event, small pyroclastic flows were generated for several weeks. Unknowingly, the lava dome had been growing for days at the summit of Hibok-hibok. Hence, inspite of the pyroclastic flow occurrences, the people did not expect this deadly phenomenon. This can be explained by two things:

(a) The earlier pyroclastic flow events were confined in areas proximal to the growing dome. Thus, the people underestimated the speed and extent these flows could travel.
(b) Events such as the pyroclastic flows from erupting volcanoes were unfamiliar phenomena to the people around the volcano and were still not fully understood in those days. Unfortunately, the small pyroclastic flows gradually filled the valley until succeeding pyroclastic flows became large enough to ran over the town of Mambajao in the morning of 4 December. This catastrophe paved the way for the creation of the Commission on Volcanology (COMVOL) in 1952, which became Philippine Volcanology (PHIVOLC) in 1982, then finally, Philippine Volcanology and Seismology (PHIVOLCS) in 1986.

Table 2
List of Major Cities and Municipalities Around Some Active Volcanoes.

Name of Volcano	Total Population*	Major cities that may be directly or indirectly affected	Municipalities
1. Pinatubo	~60,000?	Angeles City Olongapo City	Zambales: Botolan, Cabangan, San Felipe, San Narciso, San Antonio, San Marcelino, Castillejos Tarlac: Tarlac, Capas, Concepcion, Bamban Pampanga: Mabalacat, Magalang, Porac, Floridablanca, Sta. Rita, Guagua, Sasmuan, Bacolor, Mexico
2. Taal	~200,000?	Tagaytay City Batangas City Lipa City	Batangas: Agoncillo, Alitagtag, Talisay, Tanauan, Balete, Calaca Cavite: Indang, Silang, Amadeo, Magallanes, Mendez-Nunez, Alfonso, Carmona, Maragondon, Dasmariñas, General Trias, Imus
3. Mayon	579,743	Legaspi City	Albay: Sto. Domingo, Bacacay, Malilipot, Tabacco, Ligao, Guinobatan, Camalig, Daraga
4. Hibok-hibok	64,247		Camiguin: Mambajao, Catarman, Guinsiliban, Mahinog, Sagay

* Population data from NCSO, 1995

One proof of Mayon's devastating impacts during its past eruptions is the famous ruins of the town of Cagsawa. The town was buried by lahars immediately after the eruption of Mayon in 1814. At present, the steeple of the old church is the only reminder of this event. Several Mayon eruptions have since occurred, the most recent of which was on 2 February 1993, when the volcano suddenly erupted. A small pyroclastic flow was generated and covered a triangular shaped area known as the Bonga pyroclastic flow fan on the southeast sector of the volcano. This same area was the site of the pyroclastic flow deposition of Mayon's 1984 eruptive phase. During the 2 February 1993 event, people working on their farmlands within the 6-kilometer danger zone were caught unaware and were instantly killed (Table 3). Communities farther downslope were promptly evacuated as later pyroclastic

flow events were expected to follow within weeks of the initial outburst. As expected, on the third week of March, Mayon went into the height of her eruptive phase by generating several pyroclastic flows which lasted until the first week of April. The activity culminated with the extrusion of lava flows which traveled more than 6 kilometers downslope. The people were able to go back safely to their lands after several months.

Among Taal's numerous historical eruptions, three are remembered for their devastating impacts—1754, 1911, and 1965. As a result of the 1754 eruptions, towns such as Taal Town, Tanauan, Bauan, and Lipa, which used to sit right on the lakeshore of Taal had to move to newer sites (Hargrove 1991). During the 1911 and 1965 eruptions, *base surges* (a type of pyroclastic flow that radiates away from vents by expansion as a result of explosive contact of hot magma with lakewater) that originated from the volcano island reached the lakeshore and devastated the towns on the mainland. At least 1,335 people and 235 people died respectively (Table 3).

Pinatubo has no recorded historical activity prior to 1991. The huge June 1991 eruption immediately devastated areas within the 23-kilometer radius from the Pinatubo summit and displaced the Aetas from their ancestral home. The lowland communities situated more than 25 kilometers away were not spared as people were put in the path of danger, initially from ashfall at the height of the paroxysmal eruption and then from lahars that were generated as soon as the pyroclastic flow materials that were emplaced on the slopes were remobilized by rains. The enormous volume that was ejected during Pinatubo's climactic eruption burdened nearby towns with a lingering lahar problem. Entire towns were displaced and livelihoods severely affected by the lahars.

A summary of some major volcanic eruptions in the Philippines and their impacts is presented in Table 3.

APPROACHES AND TECHNIQUES IN HAZARDS MITIGATION

Volcanic hazards mitigation involves the identification of high-risk volcanoes and a study of their detailed geology for the purpose of hazards assessment and zonation. Mitigation also involves the establishment of a volcano monitoring network for eruption forecasting and prediction and volcanic emergency management plans. Ideally, a comprehensive understanding of eruptive phenomena and eruption frequency of a volcano is a starting point for volcanic hazards mitigation (Tilling 1989). Volcanic hazards mitigation should be based on fundamental research on volcanoes from which past eruptive behavior can be deciphered and future volcanic events may be forecasted.

Volcanic hazards mapping involves the identification of deposits that were produced by eruptions and related phenomena. Recognition of volcanic deposits in the field is necessary to determine the nature of a volcano's past eruptive activity. *Volcanic hazards vulnerability assessment* involves the study and consideration of the consequences of a volcanic eruption to people, their economic activity, and infrastructure (Blong 1996).

A conventional volcano-geological mapping involves determining the lateral distribution of deposits which would indicate how far specific volcanic products and their associated hazards could reach. As the extent of distribution of volcanic products is best represented on maps, the distribution of deposits from past eruptions becomes the basis for hazards zonation and assessment.

With mapping, geologists try to establish the eruptive history of a volcano by correlating products of eruptive episodes and assessing the volume of materials that were erupted per episode or activity. If eruptive history is established, there is a better chance for more accurate prediction of a volcano's behavior in case of renewed activity. But, these scientific data and interpretation must be translated into an information package that local government authorities and urban planners will readily understand. Hazards zonation maps which show volcanic hazards and vulnerable areas for each type of hazard can be used in planning future urban developments.

For an effective disaster management, massive information dissemination campaign supported by proper facilities for public aware-

Table 3
Examples of Major Volcanic Eruptions in the Philippines and their Impacts

VOLCANO	Year of Eruption	CASUALTIES	IMPACTS*			
			1	2	3	4
Taal	1754	12	x	x	x	x
	1911	1335	x	x	x	x
	1965	235	x	x	x	x
Mayon	1814	1200	x	x		x
	1897	150	x		x	
	1984	0		x		x
	1993	~70+	x		x	
Hibok-hibok	1951	500	x	x	x	
Pinatubo	1991	200-300++	x	x	x	x

Modified from Punongbayan, 1987

\+ PHIVOLCS Annual Report 1993
++ Punongbayan, R.S. et al. 1996

*IMPACTS
1. Loss of agricultural lands through burial by volcanic ejecta.
2. Destruction of infrastructure and built up areas by volcanic ejecta and/or ensuing mudflows.
3. Reduction in agricultural activities through vegetation singeing and foliage smothering by settling volcanic ash, pumice, and cinder bombs and death of farm animals.
4. Dislocation or displacement of people or township.

ness is crucial to raise the public's interest about volcanoes and their attendant hazards as well as to raise disaster consciousness. The media plays a key role in information dissemination efforts which in turn will make hazard management programs and practices more effective.

Another approach to hazards mitigation is volcano monitoring. Traditional volcano monitoring techniques such as *(a)* establishing networks of seismic detecting instruments, *(b)* regular geochemical and temperature monitoring, and *(c)* visual observations for any changes that may be manifested by volcanoes are a must in any volcanological station. The PHIVOLCS has established manned volcanological stations at the six most active volcanoes equipped with monitoring instruments that operate 24 hours a day.

The combination of all these above-mentioned activities leads to a more effective and successful disaster mitigation campaign.

VOLCANOES AND LAND USE PLANNING

Built-up areas near volcanoes continue to urbanize. Urbanization is accompanied by an increase in the population and expansion of settlements. This means more and more people will be endangered by future volcanic activity (Tilling 1989).

There is a need to plan for the growth and development of urban areas away from paths of volcanoes. This, however, is easier said than done. In most cases, the growth of communities near a volcano often times precede the understanding of the eruptive phenomena of the volcano. It is worthy to note that during a volcanic eruption, people temporarily vacate their place but come back again as soon as the unrest dies down. One reason is that volcanic deposits make the soil highly fertile and agriculturally productive. This is true in the case of Mayon and slopes of

other active volcanoes which have always been utilized for farming.

Comprehensive land use plans must start to integrate the aim of mitigating future disasters due to eruptive phenomena (Rosi 1996). This is to regulate and minimize, if possible, the development of areas that are identified to be in the direct path of hazards from volcanoes. Realistically, 'regulation' would only be possible for areas that are yet to grow and develop, and if thorough geologic studies have been undertaken. Built-up areas that are already developed and are still growing may face serious problems in case of future volcanic activity. This is because economic and political considerations, factors which are beyond the expertise of volcanologists, also need to be incorporated in the decision-making process in urban planning and development (Tilling 1989). Furthermore, there is still an enormous amount of scientific information on the known active volcanoes that remains to be established before any 'strict' policies for non-development of certain areas can become acceptable.

In anticipation of future eruptions that will affect areas that are urbanized and developed, urban planning must include the development of good road networks such that alternative routes are available and an effective disaster management program in place. These are just some of the basic approaches that can be a part of a long-term plan.

The examples of disasters discussed earlier are just a few of the volcanic events in the Philippines which occurred in the last 50 years. It must be noted that 50 years is a very short span of time compared with the geologic time scale of hundreds or thousands of years which the lives of volcanoes can extend to. Less studied volcanoes, which may have the potential to erupt in the near future, are not included in the discussion because of inadequate data.

Like in all other volcanic centers around the world, the growth of scientific knowledge on each volcano is being rapidly overtaken by urbanization, rapid population growth, and economic development. Planners, for their part, should consider existing basic volcano-geological studies mentioned earlier in formulating long-term land use and urban development plans, while volcanologists must design a program that will pave the way for doing detailed studies of lesser known volcanoes.

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