Chapter 4 Existing Environmental Problems

4.1. Classification of Environmental Problems

Various types of environmental problems have been found in the DIDP Area through analysis on data and information collected, interviews, field reconnaissance and workshop discussions. They include problems related to natural environment, natural resources, living environment and others. Environmental management administration deals with aspect of management system and such as capability, delineation of functions, and environmental education and enlightenment. Findings of environmental problems by provinces and city has been found in the DIDP Area are shown in Table 32.

Environmental problems are classified based on management units as follows:

- watershed and forest management
- coastal environmental management
- living environmental management and urban environmental management
- protected area management
- environmental management administration

4.2. Environmental Management Administration

(1) Lack of implementation and enforcement of laws and regulations

A large number of laws and regulations have been promulgated, related to environmental management. In addition to government agencies related to environmental management such as DENR and LGUs, various task forces, committees and NGOs have been involved in environmental management. Conflicts among related agencies are one reason for persisting environmental problems. The environmental laws and regulations are not properly implemented and enforced (the workshop in November, 1997).

The following reasons may be listed up for lack of implementation and enforcement of laws and regulations:

- limited human resources,
- lack of environmental staff training and awareness to environmental management,
- lack of necessary data and information, and
- limited budgets.

Pursuant to the Local Government Code of 1991, some of DENR's functions have been devolved to LGUs such as provincial and municipal governments. However, both provincial and municipal governments do not have sufficient financial and human resources to conduct environmental management for the functions devolved from DENR. In fact, human resources are not sufficient even at the central level.

Table 32 Preliminary Identification of Environmental Problems in the DIDP Area (1/2)

Components	Davao Province	Davao City	Davao Del Sur	Davao Oriental
Watershed and Forest	- unregulated/illegal cutting of trees and kaingin are expanded in Province - forest are denuded due to inappropriate cutting of trees, encroachment of upland settlers and inappropriate upland farming - soil erosion is caused by inappropriate cutting trees and upland farming (New Corella, Nabunturan etc.) - terrestrial environment is deteriorated by inappropriate mining activities *1 - flooding occurs due to heavy rain	- illegal cutting trees and kaingin (illegal logging: Lampianao) - forest are denuded due to inappropriate cutting of tree, encroachment of upland settlers and inappropriate upland farming - indiscriminate and rapid conversion of forest land, particular watershed area into other land uses such as human settlement, inland farming, kaingin, upland resort *1 - soil erosion is caused by inappropriate cutting of tree and upland farming	- forest are denuded due to illegal /inappropriate cutting of tree, encroachment of upland settlers and inappropriate upland farming - soil erosion is caused by inappropriate cutting tree and upland farming - river beds are sedimented by soil erosion (Kiblawan, Santa Maria, Mararagu) - flash flooding occurs due to heavy rain - river water is polluted from pesticide and herbicides *1	- forest are denuded due to illegal /inappropriate cutting of trees, encroachment of upland settlers and inappropriate upland farming - soil erosion is caused by inappropriate cutting of trees and upland farming - forest disappear because of natural fire - flash flooding occurs - river and stream are sedemented by soil erosion *1 - terrestrial environment is deteriorated due to illegal and improper mining technique *1
Coastal Environment	- coral reefs are degraded due to siltation, dynamite/cyanide fishing, chemical dumping, coral gathering for ornament purpose and uncontrolled resort development and operation *1 - illegal use of foreshore area due to beach resort, shanties, fishpond *1 - mangrove forest is destructed for timber firewood gathering, settlement expansion *1 - over fishing (?)*1 - settlement is expanded along shoreline in the whole province *1 - coastal environment is polluted by mercury contamination due to dumping of mine waste from gold processing industry through Higo and Kingking river *1 - coastal environment is polluted by using chemicals from agro-industry areas such as banana plantation, paddy field etc. *1 - solid waste is dumped on shoreline *1	- sea water is contaminated as indicated by coliform level - coastal environment is deteriorated by thrown garbage from vessels - squatters and settler encroach on shoreline *1 - illegal fishing *1 - extraction of coastal resources *1	- coral reefs are deteriorated by siltation caused by soil erosion, plastic debris (garbage) (Santa Cruz to Santa Maria, Malalag Bay) - coral reefs are damaged by illegal fishing such as cyanide fishing (Santa Maria)	- coastal areas are sedimented by siltation caused by soil erosion (Mati) - coral reef are damaged by illegal fishing using cyanide and electricity - sea water is contaminated indicated by coliform level and occurrence of red tide - illegal occupancy in coastal areas *1

Table 32 Preliminary Identification of Environmental Problems in the DIDP Area (2/2)

Components	Davao Province	Davao City	Davao Del Sur	Davao Oriental
Living Environment and Urban Environment	- existing open dumping site(s) is not suitable because of contamination of surface water and groundwater (?) - flooding occurs by deterioration of forest land - ambient air is polluted by motor vehicles (exhaust gas from vehicles can not be measured because of unavailability of pollution detecting device - mercury and cyanide poison occur because of gold processing plants in Barangay Apokon	- existing open dumping site(s) is not suitable because of contamination of surface water and groundwater ?) - flooding occurs due to heavy rain - ambient air is polluted by motor vehicles and factories - river water is polluted by siltation caused by soil erosion, domestic waste water, poultry farming	- existing open dumping site(s) is not suitable because of contamination of surface water and groundwater ?) - ambient air is polluted by motor vehicles (exhaust gas from vehicles can not be measured because no equipment) - Hagonoy river is polluted by sugar mill and other industry - river water and sea water may be polluted by using sprayed pesticide for banana plantation	- poblacion of Mati is not completely covered with waste collection service (only road sides and market) (Mati) - existing open dumping site(s) is not suitable because of contamination of surface water and odor, and garbage is thrown into any space (Mati) - groundwater is polluted by instruction of salt water *1 - settlement is congested *1 (Magsaysay, Magapo) - noise level is increasing *1
Protected Areas	- conflict between management of Mainit Hot Spring National Park and occupancy by residents	- garbage is thrown into Mt. Apo Protected area by visitors *1	- conflict between management of Mt. Apo National Park and occupancy by residents	- delineation of boundary of Pujada Bay Seascape protected Area and existing land use are mismatched (already developed before establishment of protected area) - squatters and settlers encroach on Protected Area *1
Land Conversion	- on productive land: intrusion into productive agricultural lands by urban uses leading less production of food supply - environmental protective land: some other land conversion which will lead to adverse environmental impact			
Environmental Administration	- lack of implementation and enforcement of laws and regulations *1 - lack of human resources of DENR particularly ecology, coastal environment, pollution control, and EIA experts - lack of human resources of LGUs for environmental management - lack of opportunity of environmental staff training - lack of necessary data and information for environmental management - difficult of monitoring for environmental conditions and projects/programs - conflict in implementation of environmental programs and functions *1 - lack of people's awareness *1			

*1: obtain from Workshop

(2) Limited human resources

The most staff members of DENR (PENRO and CENRO) and LGUs are foresters, agricultural specialists and civil engineers. However, environmental management covers not only forest but also terrestrial and marine ecosystems, pollution control and solid waste management. Also environmental management issues will change connected with urbanization and industrialization in the DIDP Area so that specialists for new fields will be required to deal with new types of environmental problems.

(3) Lack of staff training

PENRO, CENRO and environmental sections of LGU, such as Provincial ENRO and Municipal ENRO do not have opportunities for attending training programs. On-the job-training alone would not be effective so that combination of on-the job-training and off-the job-training is required for environmental staff training. Especially, knowledge of environmental laws should be enhanced for staff members who belong to the environmental sector.

(4) Limited data and information

There is lack of data and information necessary for environmental management. Absence of scientific data on environment makes it difficult to formulate an effective management plan.

There are many on-going environmental projects and programs implemented in the DIDP Area by DENR and LGUs such as forest management. These projects and programs cannot be evaluated due to lack of data and monitoring capability. For example, although reforestation projects can be implemented without detail forest coverage data and monitoring, how much the projects contribute to increasing forestland cannot be estimated.

4.3. Land Related Development Problems

Various land related problems have been identified through the analysis on existing conditions. These problems were discussed by province/City during the workshops conducted in November, 1997. The problems enumerated through this process are summarized in Table 33.

As seen from Table 33, some problems are common to different provinces and/or the City, and thus may be treated more properly within the DIDP framework. More important problems are described below.

(1) Irrational land use

Land resources in the DIDP Area are at present over-used in some areas and under-used in some others as shown earlier. Forest lands have been encroached upon by those seeking livelihood opportunities. Improper farming practices including slash-and-burn are still undertaken in hillyland to highland areas. The rapid population growth is applying increasing pressure on land resources in urban and rural areas. Those activities cause irrational land use in the DIDP Area.

Table 33 Land Development Problems of Provinces/City in the DIDP Area

Province	Problems
Davao Province	- Irrational conversion of prime agricultural land to urban uses, and forest land to other use - Large tract of marginalized upland area - Presence of over-used land area - Degradation of ecosystem caused by pressure of human activities - The acceleration of degradation and desertion brought about by slow-paced reforestation activities - Poor information dissemination of importance of protecting the environment - Lack of livelihood opportunities - Illegal use of forest areas - Continuous influx of migrants in the upland - Destruction of forest and mangroves - Unregulated/illegal mining operation - Insufficient implementation of environment related laws and regulations - Insufficient human resources in both in number and capability - Insufficient and/or conflicting information on land use - Absence of forest land use plan - No updated land resources use data
Davao City	- Encroachment of urban development upon fertile agricultural land - Improper use of lands for agricultural purposes - Rapid depletion of the forest resource - Ineffective control of logging operation - Kaingin activities - Poverty in the upland and lack of livelihood - Proliferation of slum colonies occupying open spaces like shorelines, banks of creeks and rivers, and along road right of ways of major highways - Heavy concentration of population and activities in the poblacion - Urban sprawl from Toril to Panacan results in lower density ratio causing higher serving cost - Lack of strong implementation of zoning plan - Lack of public awareness of sustainable land use - Adverse environmental impact of urban uses, particularly heavy and/or offensive industries in land, air, and water resources - Lack of open spaces especially parks and playgrounds and parking areas in the poblacion, - Lack of baseline data - Insufficient and/or conflicting information on land use - Insufficient implementation of environment related laws, policies and regulations
Davao del Sur	- Large number of people in the protected land areas - Complex tenure arrangement - Presence of a large area of over-used productive land - Encroachment of rural population (both IP and migrants in the upland) - Intrusion of settlement areas within protection lands such as adjacent areas from NIPAS Area or NPAA, including Mt. Apo National Park - Lack of Proper upland farming technology - Lack of dissemination of appropriate technology for CBRM - Insufficient and/or conflicting information on land use - Insufficient implementation of environment related laws and regulations - Lack of comprehensive land use plans at municipality level - Conflict in implementation or environment program/functions
Davao Oriental	- Land conversion of prime agricultural land into urban areas - Lack of economic opportunities at lowland will put pressure on the protection lands in the forest land - Proliferation of squatters and business establishment have endangered the coastal zones and buffer strips in the province, in particular the Pujada Bay area which has been proclaimed as protected seascape - Lack of information and appreciation on the importance of the sustainability of land use - Lack of resources to fund rehabilitation/preservation of environmentally critical areas, and - Soil erosion, droughts and flood that contributed to lower agricultural and marine productions - Insufficient and/or conflicting information on land use - Insufficient implementation of environment related laws and regulations

(2) Lack of local capacities for land resources management

Capability of LGUs is insufficient to manage land resources in planning, monitoring and evaluation. In addition to the LGUs capability itself, the lack of local people's participation in resources management is also a problem. These include lack of base-line data on land resources, lack of awareness of local people for sustainable land use and management, and lack of good coordination with various actors in land resource management. Also, management of land resources that is inherently related to water resources management causes water related problems when it is managed in improper manner.

(3) Inadequate land tenure improvement

Indigenous people have been pushed upward to the upland and they are now trying to be awarded the ancestral domain claim to maintain their right to the land resources. Even though they have gained their right, their livelihood has not been improved yet. At this moment, lack of balance in ensuring the indigenous people's right, creation of their livelihood and sustainable use of forest and land resource in Ancestral Domains is a land development problem. In addition, another land tenure problem is incomplete accomplishment of CARP.

(4) Lack of enforcement of environment related laws, policies and regulations

Aside from the specific problems above, lack of enforcement of laws, policies and regulations related to management of environment and land resources is raised as a problem. Law enforcement is a prerequisite for a proper resource management, which can be attained by proper monitoring and evaluation, which should be based on reliable data and capable human resources. In the DIDP Area, such a system is not working well.

4.4. Forest and Watershed Management

(1) Denudation of forest/soil erosion

Forest has been denuded by the following major reasons:

- illegal and inappropriate cutting of trees,
- kaingin (slash-and-burn),
- inappropriate upland farming,
- encroachment of squatters and settlers, and
- inappropriate mining activities.

Although conflicting views on illegal logging and kaingin are reported (e.g. at the workshops in November) denuded forest areas caused by cutting of trees can be recognized easily in the DIDP Area.

Encroachment by squatters and settlers on upland give rise to degradation of forest land. They practice kaingin, cultivate on the slope, and construct houses on the steep slope or forest land. Denuded land caused by these activities can be found throughout the DIDP Area even within protected areas. Denuded land can generate soil erosion and land slides especially during rainy season. In consequence of forest denudation, river beds and the coasts are sedimented by eroded soil.

Inappropriate exploitation works for mining including disposal of mining tailings and construction of access roads are also responsible for the degradation of forest and soil.

(2) Flooding

The DIDP Area is located in a typhoon free zone. However, many people and land is damaged by flooding as shown in Table 12. For two years, 25 flooding cases were reported in 1996-1997. In Davao City, approximately 4,000 families were affected by flashfloods in May and June 1994 (Provincial Ecological Profile, Davao Del Sur, 1994). Flood prone areas are found in each province and the City. Forest denudation and narrow watershed system are main factors affecting flooding.

(3) Improper land conversion

Hillyland and Highland (higher than 500m elevation and above 18% slope) accounts for 70% of the total DIDP land area. Slope Agricultural Land Technology (SALT) is promoted in land below 18% slope. Hillyland and highland areas are also indiscriminately cultivated and developed so that terrestrial environment has been deteriorated. Decrease in forested land leads to deterioration of water resources and aggravation of flooding.

4.5. Coastal Management

(1) Encroachment on shoreline by squatters and settlers

Some parts along shorelines on Davao Gulf and the east coast of Davao Oriental are occupied by squatters, settlers, fishponds and beach resorts. Illegal occupancy on shoreline was pointed out at workshops excluding Davao del Sur (November 1996). Most structure on shorelines may be illegal. The following activities degrade ecosystems such as mangrove forest, coral reef, and deteriorate sea water quality in the DIDP Area:

- construction of houses and other structures (encroachment on beach, gathering of construction materials etc.), and
- daily activities (discharges of wastewater, generation of waste, gathering firewood etc.).

Major shorelines occupied by squatters and settlers are Mati in Davao Oriental, Panacan, Agdao, Magsaysay, and Santa Ana in Davao City, Panabo, Mabini, and Tagum City in Davao del Norte, and Maco, and Pantukan in Compostela Valley.

(2) Degradation of coastal ecosystems

The shorelines of the DIDP Area consist of rocky shores, coral reefs, sandy beaches and tidal flat types. Each shoreline has a different ecosystem, which has been degraded to a different degree by human activities. Causes of degradation of coastal ecosystems are illegal activities, inappropriate coastal use, and land-based human activities.

Illegal activities such as destructive fishing give rise to degradation of coastal ecosystems, especially coral reefs. Dynamite fishing is, still practiced although the number of cases are decreasing, and other illegal fishing practices have expanded throughout the DIDP Area.

The coast is faced with the land so that coastal ecosystems can be affected by land-based human activities. This deterioration of coastal ecosystems is brought about by sedimentation on the coast due to soil erosion and landslides caused by deforestation, upland farming, quarrying and other activities. It is difficult to rehabilitate damaged coastal ecosystems caused by sedimentation, especially coral

reefs. More seriously sedimented coasts are found in Santa Cruz ~ Santa Maria, and Malalag Bay in Davao del Sur, and Mati, and Balete Bay in Davao Oriental.

(3) Pollution of sea water

The seawater of the coast is polluted in the DIDP Area directly or through rivers by sedimentation, discharging of domestic wastewater and industrial wastewater, solid wastes dumping and leaks of oil by accidents and others. Coastal areas faced with populated areas are polluted by discharge of untreated wastewater from households, poultry farms, and various industries.

The coast along Davao City, Balete Bay and other populated coast, for example, coliform level of seawater which is indicator of pollution by human activities is comparatively high. The first red tide was identified in Balite Bay and Pujada Bay in 1996. Shellfish was poisoned by red tide plankton containing paralytic shellfish poisons.

It is reported that pesticides used in banana plantations and mercury from gold processing plant flow into the sea (the workshop in November, 1997). No scientific data, however, have been obtained to verify these phenomena.

4.6. Living Environment and Urban Environment Management

(1) Inappropriate solid waste management

At present, municipal governments have responsibilities for waste collection. In the DIDP Area, however, only wastes generated in poblacions are collected by municipal governments, especially at markets and along major roads. According to 1990 Census by NSO, collection coverage rate in Davao City was 21%, while collection rate of other provinces ranges in 1 - 4% (Table 34). Therefore, even some areas in poblacion are not covered due to lack of collection vehicles and lack of disposal sites.

Most wastes are dumped into vacant areas, rivers and valleys by municipal governments and individuals. Capitals of provinces and the City have dumping sites located in mountain or hilly areas in Davao City and Nabunturan in Compostela Valley. For Mati in Davao Oriental, dumping sites are located on shorelines. However, such dumping sites are not properly located from environmental viewpoint. Although there is no water quality data such as surface water and groundwater, they may be polluted by leachate from dumping sites. Leaches containing high organic matters and metals seep out from garbages and flow into rivers and permeate into groundwater. Garbages are scattered around dumping sites. Residents living around disposal sites complain about scattering garbage and odors. For example, a disposal site of Mati is located close to houses. According to the Mati municipal government, the disposal site must be closed as soon as possible due to complaints from residents. Therefore, even existing dumping sites managed by municipal governments are not desirable from hygienic and landscape points of view. Because LGUs do not have middle term solid waste management plan so that their solid waste management is an evasive.

Table 34 Solid Waste Management System in the DIDP Area

(Unit : %)

Solid Waste System	Davao Province	Davao City	Davao del Sur Province	Davao Oriental Province
Picked up by Track	4.3	20.8	1.2	2.3
Dumping in individual	27.1	19.3	13.9	17.8
Burning	53.9	47.9	71.9	63.1
Composting	7.2	3.2	3.4	4.6
Burying	2.6	3.1	4.5	4.2
Feeding to animals	3.2	0.9	3.5	5.0
Others	1.7	4.7	1.6	3.0

Source: 1990 Census of Population and Housing, Davao Province, Davao City, Davao del Sur, Davao Oriental Province, NSO

(2) Air pollution

In the capitals, especially Davao City, traffic volume is increasing rapidly, leading to rising air pollutants (the workshops in November, 1997). Provincial governments can not control smokes from vehicles due to lack of smoke tester. Traveling vehicles also generate noise, and cause traffic congestion on major roads in capitals during commuting times. These urban environmental problems may become serious, as the urbanization proceeds.

(3) River water pollution

River environment in the DIDP Area is deteriorated due to various types of pollution as follows:

- sedimentation due to soil erosion,
- discharges of organic matters, and
- discharges of toxic substance.

River beds are sedimented by soil erosion and landslide. Denuded forests cover the DIDP Area widely. Soil erosion and landslide occur in denuded areas. Eroded soil flows into rivers or the sea directly during rainy season. Mining activities cause sedimentation by tailing; for example, the Monkayo river has been sedimented on foot of Mt. Diwata, Monkayo, Compostela Valley. Sedimentation in river bed gives rise to deterioration not only of environment for river benthos but also of coastal environment.

Organic matters are discharged from domestic wastewater, poultry farming and other industries. The Hagonoy river in Davao del Sur is polluted by sugar mill and others. The Davao river is also polluted by domestic wastewater and leaking of heavy oil from downstreams of Don Isidro to Bankerohan Bridge.

Environmental problems caused by discharges of toxic substances will be described in next sections.

(4) Mercury/cyanide poisoning

Since the early 1970's, small-scale gold mining has been undertaken in the northeast of Mindanao Island. At the beginning, mercury was used exclusively for gold processing. At present, both cyanide and mercury are used for processing.

In Apokon, Tagum City, there are gold processing plants located in residential area. According to toxicological health assessment conducted by the National Poisons

Control and Information Services, University of the Philippines 1996, schoolchildren had been exposed to mercury and cyanide poisoning from the plants. Mercury and cyanide were found at alarming levels in blood and urine samples taken from the schoolchildren. Information obtained on these matters is limited. However, it may be possible that same kinds of problems can be found in other gold rush areas such as in Monkayo, Compostela Valley.

(5) Inappropriate use of pesticide

Pesticides are sprayed in banana plantations by aircraft. According to the Ecological Profile of Davao Province, banana plantations use four or five different types and brands of pesticides twice a month. At present, there are no scientific data related to pesticide effects on residents, river waters and coastal environment. However, the Ecological Profile of Davao Province mentioned that the populace near banana plantations, especially plantation workers, are suspected to various kinds of illness or birth defects due to prolonged contact with spray mists.

4.7. Protected Area Management

(1) Conflict between protected area management and encroachment

There are nine protected areas in the DIDP Area such as Natural Park and protected landscapes/seascapes under NIPAS. In the Mt. Apo Natural Park, Mainit Hotspring Protected Landscape and Pujada Bay Protected Landscape/Seascape under NIPAS, settlers are encroaching on and cultivating in these protected areas. There are approximately 2,000 settlers including 15 tribal communities in the Mainit Hotspring Protected Landscape/seascape. They are cultivating for coffee, coconut, fruit and other cash crops, also exploiting small-scale mining and building houses within the protected area.

As a result, conflicts between settlers and park management occur. It is reported that boundaries of protected area cannot be identified by people due to no land markers (the Davao Oriental Workshop, 1997).

(2) Improper delineation of park boundaries

The Pujada Bay Protected Landscape/Seascape (21,200 ha) was established in 1994 under Proclamation No 431. It covers the whole Pujada Bay, excluding the Pujada Island. This protected area also covers part of poblacion of Mati including the pier under the Philippine Port Authority, dumping site, houses and others that were constructed before the establishment of the protected area.

According to NIPAS, 1992, "Protected Landscapes/Seascapes" are defined as areas of national significance which are characterized by harmonious interactions of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal lifestyle and economic activity of these areas. In principle, a "Protected Area" is identified portion of land and water set aside by reasons of their unique physical and biological significance, managed to enhance biological diversity and protected against destructive human exploitation. Therefore, the present delineation may be inappropriate.

(3) Lack of visitors' environmental awareness

The Mt. Apo Natural Park is a tourism destination for mountain climbing and camping. Garbages are littered by visitors, and scattered around camping sites

within the Park due to lack of environmental awareness. Scattering garbages, especially leftover food may lead to transformation of ecosystem due to increase in specific omnivorous species.

4.8. Mechanism of Environmental Problems

Environmental degradation mechanism in the DIDP Area is shown in Figure 17. Environmental problems are caused by increasing of population pressure, lack of income opportunity and livelihood, lack of implementation and enforcement of laws and regulations, lack of environmental management capability, and lack of environmental data. One environmental problem leads to other problems. Land based environmental problems such as denudation of forest and soil erosion also give rise to marine environmental problems. Inappropriate human activities bring about plural environmental problems.

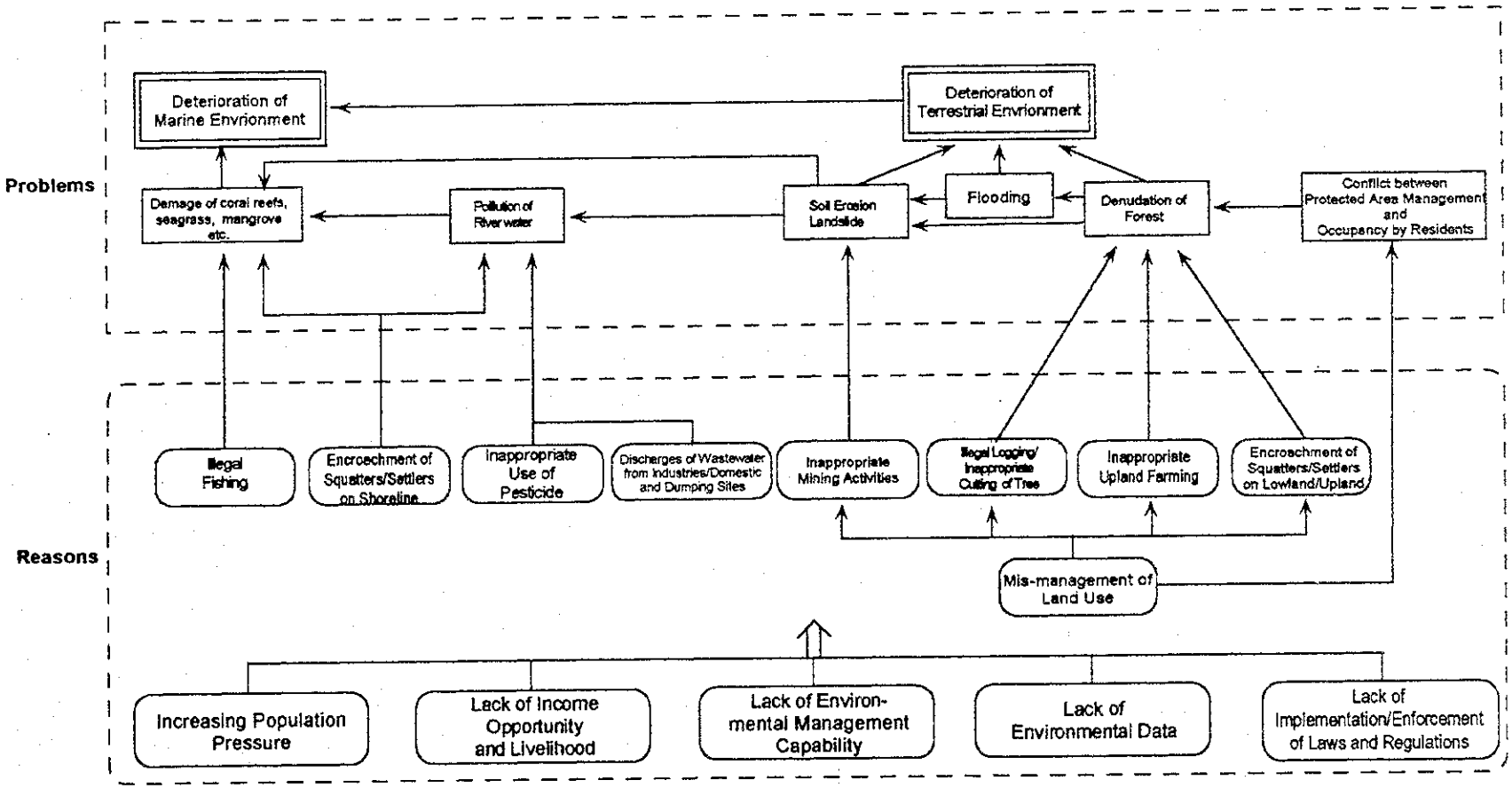


Figure 17 Environmental Degradation Mechanism in the DIDP Area

Chapter 5 Environmental Management Issues and Approach

5.1. Goals of Environmental Management

Rich environment of the DIDP Area needs to be sustained for the next generations, and simultaneously, natural resources are to be used for economic growth, and environment provides for health and safety to our living environment through appropriate land use, appropriate resources use, conservation of ecosystem, pollution control and adequate environmental administration.

5.2. Environmental Management Issues

Environmental problems in the DIDP Area are listed up in Chapter 4. In this chapter, environmental management issues to be addressed in the Environmental Management Plan of the DIDP Master Plan are identified through field reconnaissance, interview surveys and workshops. Linkages between environmental problems and management issues are shown in Figure 18. Management issues are as follows:

- Environmental management capability building,
- Formulation of land use and its implementation,
- Appropriate natural resources use,
- Conservation of terrestrial ecosystem and environment,
- Conservation of coastal ecosystem and environment, and
- Improvement of living environment.

5.3. Environmental Management Policy

Environmental management requires effective conservation of precious ecosystem and environment toward sustainable development. Key players of implementation of environmental management are governments, the private sector and communities.

Management issues shall be handled by several governments. The government initiative, especially of provincial governments, is imperative to ensure the overall viewpoint to be reflected. It is required, however, that the private sector and communities also be involved for implementation of environmental management, because private companies and people's behaviors ultimately determine sustainable development. Therefore, the following approaches should be taken for formulation of environmental management for the DIDP Area (Figure 19).

- Top-down approach: for integrated government initiative for environmental management, and
- Bottom-up approach: for community-based environmental management policies including community-based resource management, community initiative for environmental programs etc.

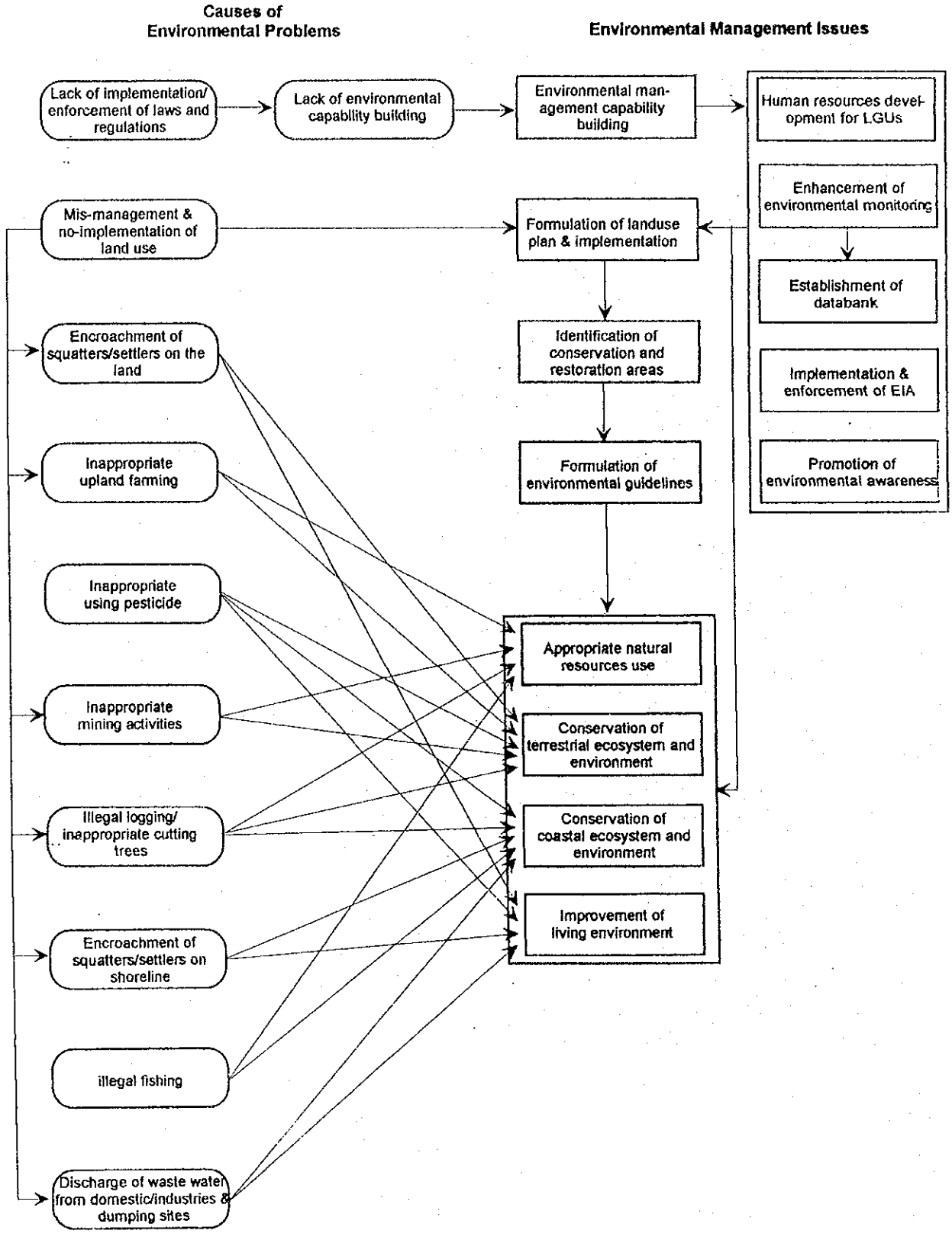
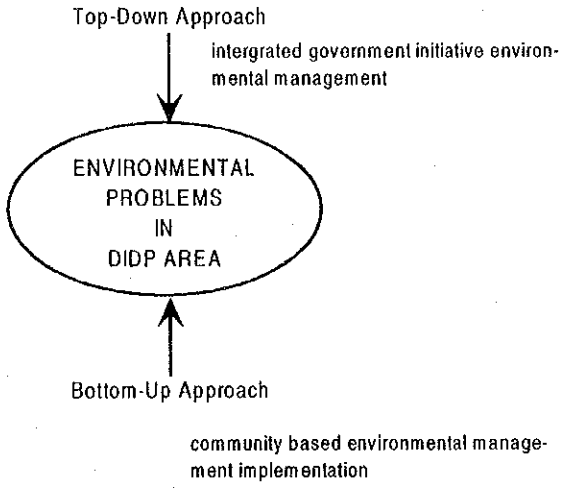


Figure 18 Environmental Problems and Management Issues

Figure 19 Approach for Formulation of Environmental Management Planing



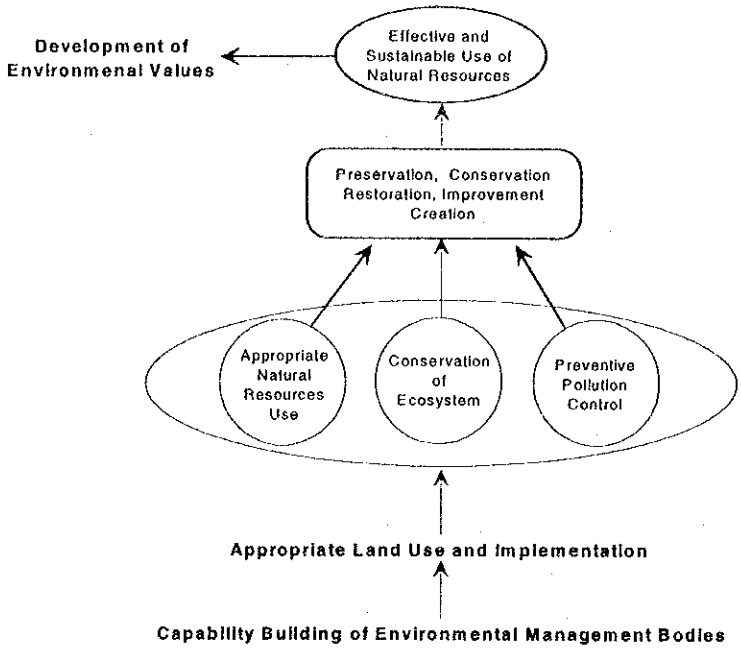
Although the Philippine Government has established various regulations and standards, there are also various environmental problems in the DIDP Area. At present, environmental values have been deteriorated by inappropriate land use and human activities such as illegal logging, inappropriate farming, destructive fishing and others. Structure of environmental management strategy to address to these problems in the DIDP Area is shown in Figure 20.

Environmental administration especially at LGUs should be enhanced for capability building. Existing organizations and facilities should be used effectively. Furthermore, appropriate land use plan should be formulated. However, if they are not implemented, use of natural resources and environment conservation can not be harmonized. Governments should guide and lead appropriate land use by incentives and penalties. Environmental guidelines are required composing of the following three components for achievement of the objectives:

- appropriate natural resources use,
- conservation of ecosystem, and
- pollution control.

The environment of the DIDP Area including natural resources, ecosystem, and living environment requires preservation, conservation, rehabilitation/improvement and creation of environment toward effective and sustainable use of natural resources.

Figure 20 Structure of Environmental Management Strategy for DIDP Area



5.4. Environmental Management Components

Various types of environmental problems have been found in the DIDP Area through analysis on data and information collected, interviews, field reconnaissance and workshop discussions. They include problems related to natural environment, natural resources, living environment and others.

These environmental problems may be classified in different ways. Examples of classification are:

- spatial basis: inland environment, lowland environment, coastal environment etc.;
- ecosystem basis: terrestrial ecosystem, marine ecosystem;
- topic basis: pollution, soil erosion, illegal fishing etc.; and
- management basis: forest management, coastal management, wildlife management etc.

Classification on spatial basis is common. However, the same environmental problems are found in different spatial areas: e.g., river water pollution can be seen in upland and urban areas, and down stream is affected by upper stream. Classification on ecosystem basis focuses on biological aspects. In general, a problem of ecosystem represents broken food chain or energy flow. Effects on human beings and habitat of people to be affected by air pollution, noise, odor and amenity are not usually covered by the ecosystem approach as they relate to how the people feel/perceive the problems. Topic basis is also a common way of classification. However, a large number of topics may be identified, and the classification is not systematic.

It is natural that classification based on management fields is used for management issues, as findings of environmental problems provide a basis for formulating an environmental management plan. Responsibility and implementing agencies can be

clarified by this approach: forest management conducted by the forest sector of DENR and LGUs, protected areas managed basically by DENR, and solid wastes by LGUs.

An environmental problems – solving approach is taken for environmental management in the DIDP Area. In this report, therefore, environmental management components are classified based on fields of management as follows:

- watershed and forest management,
- coastal environmental management,
- living environmental management and urban environmental management
- protected area management.

Environmental management administration is discussed also covering implementing entities and system for environmental management such as capability, delineation of functions, environmental education and enlightenment, and others.

5.5. Environmental Area Management

Environmental management zoning is required for minimizing conflicts between natural resource users and environmental conservation. Environmental management zoning shall be followed as land use planning prepared by LGUs.

The following environmental management areas are proposed:

- preservation area,
- conservation area, and
- rehabilitation area.

Definition of Preservation Area, Conservation Area and Rehabilitation Area are as follows:

Preservation Area

Definition: A Preservation Area is defined as the area where utmost effort are exerted to protect target environment. Some of Preservation Areas can be established as Core Zones in the NIPAS zoning.

The areas to be included are:

- area rich in natural resources and well preserved,
- area with high ecological value including scientific value, and
- area ecologically sensitive especially to human activities.

Conservation Area

Definition: A Conservation Area is defined as the area surrounding a preservation area to function as buffer and reduce the impact of human activities on the preservation areas. Conservation Area aims to use natural environment and resouces sustainably under environmental capacity such as ecotorisum, traditional use rather than strict management area. Intense human activities should be restricted.

Conservation Areas intend to provide and contribute to the following effects:

- serving as physical barriers from human activities,
- rehabilitating the natural environment and expanding wildlife habitat, and
- supporting sustainable use of natural resources.

Rehabilitation

Definition: A Rehabilitation Area is defined as the area requiring rehabilitation from view points of ecosystem and natural landscape, and prevention of natural disaster such as soil erosion and landslides.

Rehabilitation Areas to be included are:

- area where deterioration of environment is feared, and
- area which affects coastal environment.

The following environmental management areas are proposed:

- forest management area,
- slope management area, and
- slope rehabilitation.

(1) Forest management areas

Delineation of forest management aims to conserve forests and forest ecosystems. A forest management map is shown in Figure 21. In general, area with primary forest or closed canopy forest and forest above 1,000 m elevation should be preserved. However, primary forest and secondary forest can not be identified so that forest area includes both categories of forest in existing land use map. In other words, conservation area for forest management area in the DIDP Master Plan Study includes preservation and conservation areas. Therefore, only forest conservation areas are delineated in the Forest Management Area Map. Criteria of forest management are shown in Table 35.

In general, conserved forest and wildlife habitats remain in upper area, and upland forest can be managed comparatively more easily than lowland because of accessibility. It is required that forest of upland area should be conserved, and denuded area in upland should be restored. However, large area of upland has been already developed for agriculture purpose, forest industry and settlements. It is difficult that such developed areas are restored by reforestation from viewpoint of conservation of forest environment. Therefore, denuded area above 1,000 m elevation, and the denuded area within the area of 70% forest cover in a watershed unit above 200 m elevation should be restored.

Fragmented forest areas are connected with other fragmented areas. In Forest Conservation Area, continuity of the forest system should be ensured, and trees of diversified species should be planted. When forest area can be divided into primary forest and secondary forest by a further study, Forest Preservation Area and Conservation Area shall be delineated. Distribution of forest management area is shown in Table 36. Guidelines for forest management area shown in Table 37. Forest management guidelines should be taken as the priority in area where forest management area and slope protection areas are overlapped.

Table 35 Criteria of Forest Management Area

Forest Type / Elevation	Above 1000 m	500 – 1000 m	200 - 500 m
Forest area	Conservation	Conservation	Conservation
No forest area where 70% forest cover in a watershed unit	Restoration	Restoration	Restoration
No forest	Restoration	-	-

Table 36 Distribution of Forest Management Area by City and Provinces

(unit : km²)

Management Area	Davao del Sur	Davao City	Davao del Norte	Compostela Valley	Davao Oriental	Total
Conservation Area	879	711	297	2,047	2,077	6,011
Restoration Area	188	25	43	25	102	382

Table 37 Guidelines for Forest Management Area

Forest Conservation Area	Forest Restoration Area
• logging, agriculture and other any activities which cause decreasing of forest area are prohibited • small scale facilities for tourism environmental education purposes with permission are allowed • recreation and environmentally friendly tourism are allowed • cutting of tree for significant culture, religious, anthropological purposes, and ceremonies and cultural practices for indigenous cultural people are allowed	• variety of indigenous tree specie is planted

(2) Slope management area

Delineation of slope protection areas aims to preserve soil, conserve watershed, and conserve terrestrial ecosystem in hilly area. A slope protection map is proposed in Figure 22. Area with above 30% of slope can be eroded easily so that any development should be prohibited. It is possible that area with above 18 % of slope is eroded by infrastructure and agriculture development without slope protection works. Elevation also should be considered for watershed conservation. Accordingly, criteria of management area are proposed in Table 38. Distribution of slope management area is shown in Table 39. Guidelines for slope management are shown in Table 40.

Table 38 Criteria of Slope Management Area

Elevation / Slope	Above 30%	18 – 29%	8 – 18%
Above 1000 m	Preservation	Preservation	Preservation
500 – 999 m	Preservation	Preservation	Conservation
200 – 499 m	Preservation	Conservation	Conservation

Table 39 Distribution of Slope Management Area by City and Provinces

(unit : km²)

Management Area	Davao del Sur	Davao City	Davao del Norte	Compostela Valley	Davao Oriental	Total
Preservation Area	1,869	1,383	1,015	1,774	2,302	8,344
Conservation Area	536	320	230	585	857	2,529

Table 40 Guidelines for Slope Management Area

Slope Preservation Area	Slope Conservation Area
• any spatial development is prohibited • any construction of road is prohibited • construction of building is prohibited	• any spatial development is prohibited • construction of road and other infrastructure without slope protection and ECC are prohibited • construction of individual house and small size of building are prohibited without permission

(3) Slope rehabilitation

Delineation of slope rehabilitation areas aims to rehabilitate possible eroded areas. A slope rehabilitation area is proposed in Figure 23. This management easily eroded without forest cover. Several erosion areas without forest cover are priority for rehabilitation works. Criteria of slope rehabilitation are proposed in Table 41. Distribution of slope rehabilitation area is shown in Table 42. The following rehabilitation works and their combinations are recommended:

- reforestation,
- slope stability work including bamboo fence, grass planted, and
- soil erosion control work including wire net gabion box, masonry retaining wall

Table 41 Criteria of Slope Rehabilitation Area

Erosion Possibility	No Forest Coverage
Severe Erosion	Highly required slope rehabilitation works
Moderate Erosion	Moderately required slope rehabilitation works
Slight Erosion	Low Highly required slope rehabilitation works

Table 42 Dsitribution of Slope Rehabilitation Area by City and Provinces

(unit : km^2)

Management Area	Davao del Sur	Davao City	Davao del Norte	Compostela Valley	Davao Oriental	Total
Highly require	1,474	245	683	922	376	3,700
Moderate required	197	389	364	582	429	1,962
Low required	272	502	187	116	550	1,628

5.6. Land Management

5.6.1. DIDP issues

Various land related problems and issues have been identified through the analysis on existing conditions. These problems and issues were discussed by province/City during the workshops conducted in November 1997, and more important issues have been clarified that should be addressed in the DIDP Master Planning.

Some issues are common to different provinces and/or the City, and thus may be treated more properly within the DIDP framework. More important issues for the DIDP development are described below, and also future directions are indicated.

There are three major issues specific to land resources: 1) rationalization of land use, 2) enhancement of local capacities for land resources management, and 3) land tenure improvement, and two broader issues, 4) enforcement of environment related laws, policies and regulations and 5) comprehensive watershed management.

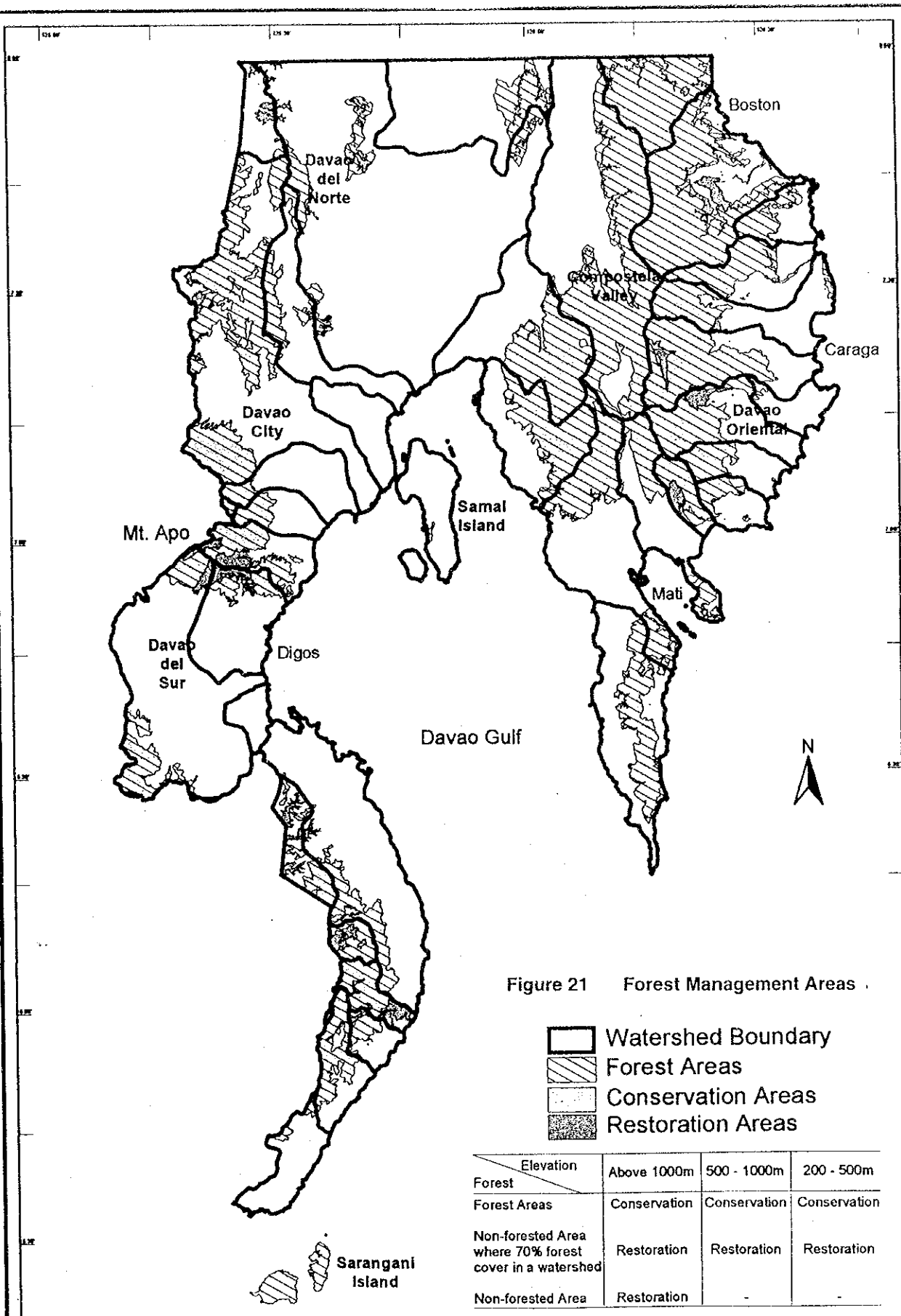


Figure 21 Forest Management Areas

Watershed Boundary
Forest Areas
Conservation Areas
Restoration Areas

Forest \ Elevation	Above 1000m	500 - 1000m	200 - 500m
Forest Areas	Conservation	Conservation	Conservation
Non-forested Area where 70% forest cover in a watershed	Restoration	Restoration	Restoration
Non-forested Area	Restoration	-	-

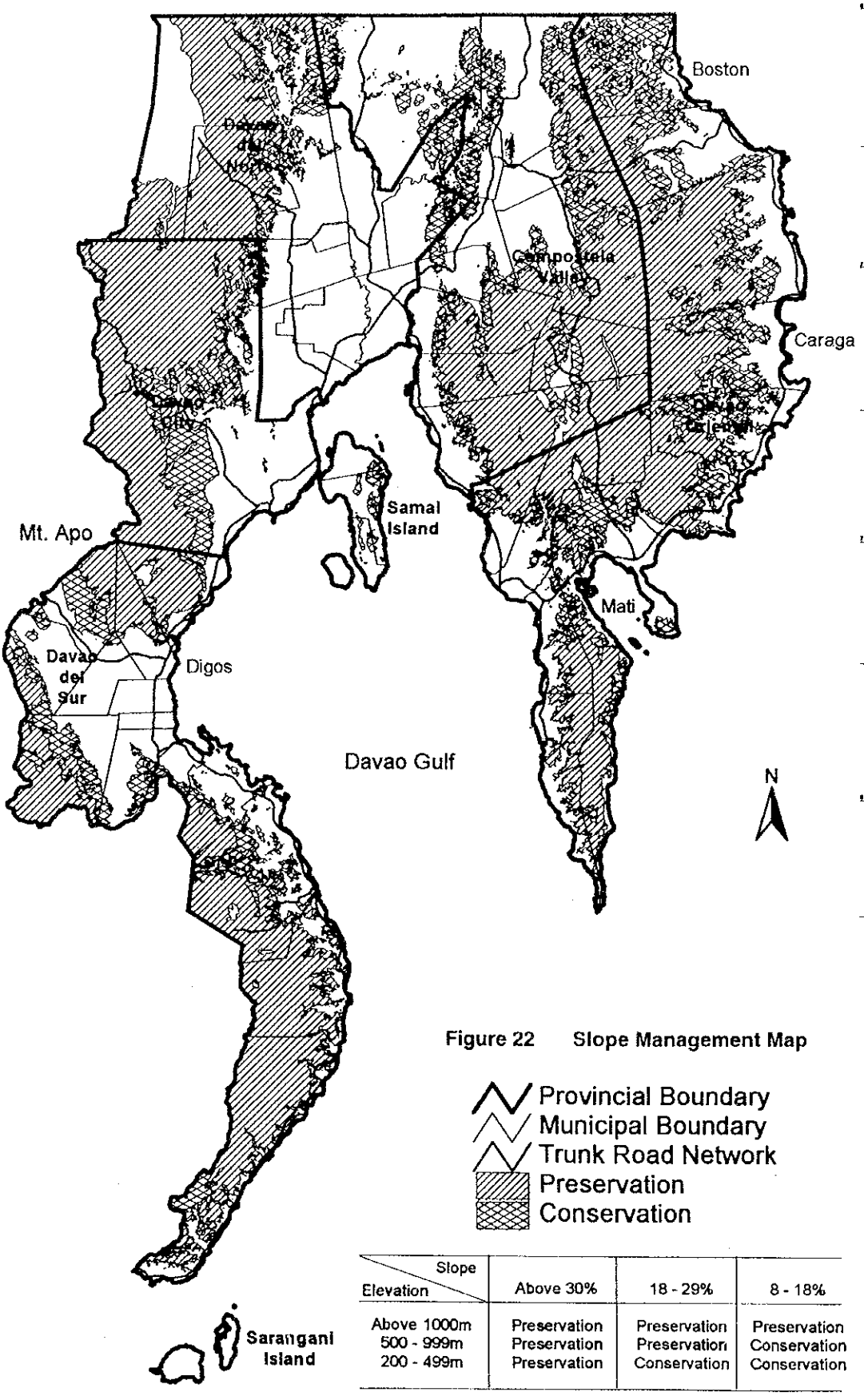


Figure 22 Slope Management Map

Provincial Boundary
Municipal Boundary
Trunk Road Network
Preservation
Conservation

Slope / Elevation	Above 30%	18 - 29%	8 - 18%
Above 1000m	Preservation	Preservation	Preservation
500 - 999m	Preservation	Preservation	Conservation
200 - 499m	Preservation	Conservation	Conservation

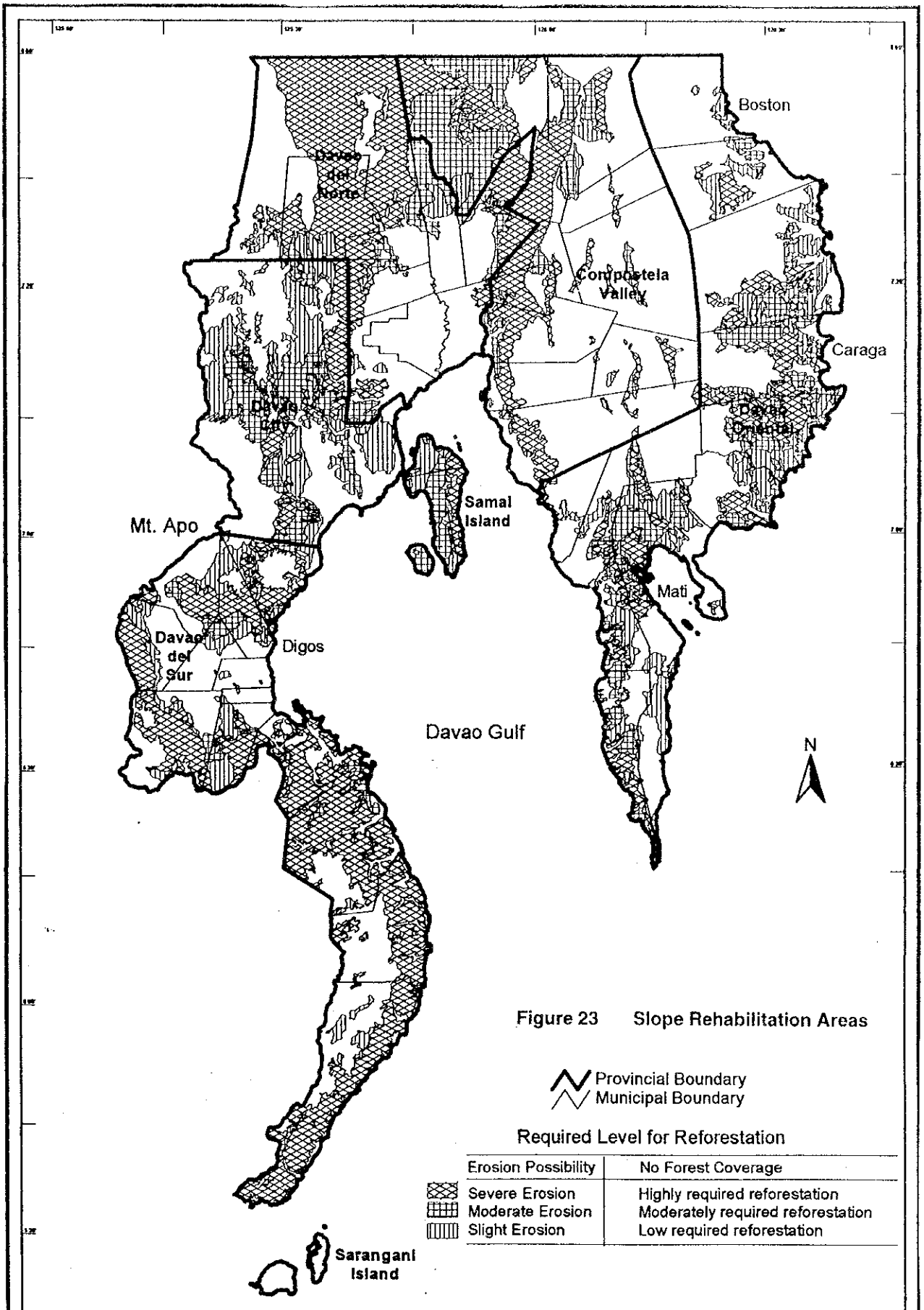


Figure 23 Slope Rehabilitation Areas

Provincial Boundary
Municipal Boundary

Required Level for Reforestation

Erosion Possibility	No Forest Coverage
Severe Erosion	Highly required reforestation
Moderate Erosion	Moderately required reforestation
Slight Erosion	Low required reforestation

(1) Rationalization of land use

Land resources in the DIDP Area are at present over-used in some areas and under-used in some others as shown earlier. Forest lands have been encroached upon by those seeking livelihood opportunities. Improper farming practices including slash and burn are still undertaken in hillyland to highland areas. The rapid population growth is applying increasing pressure on land resources in urban and rural areas. Rationalization of land use is a prerequisite for sustainable development of the DIDP Area.

In particular, the following shall be addressed in the DIDP Master Planning.

a) Re-classification of forest lands for protection, reforestation and limited production uses such as agro-forestry according to land suitability;

b) Resolution of mismatches between land uses and potentials in view of enhancing land productivity and establishing new strategic crops;

c) Establishment of appropriate farming technologies or alternative livelihood opportunities in the upland and hillyland areas;

d) Delineation of environmentally sensitive areas such as areas of severe erosion susceptibility, flood hazards, active fault lines and seismic hazards as well as coastal areas;

e) Prevention of indiscriminate conversion of prime agricultural lands for urban, industrial and property development;

f) Enforcement of urban land use plans particularly for more rapidly urbanization areas; and

g) Formulation and implementation of resettlement plans for squatters and those displaced by calamities or development activities.

(2) Land resources management

Community-based resources management is a viable idea to be applied to the DIDP development. To substantiate the idea, local capacities for land resources management need to be enhanced, involving LGUs, NGOs and POs as well as local people and communities. The following shall be pursued.

a) Establishment of base-line data on land resources,

b) Information and education campaign (IEC) to enhance awareness of local people for sustainable land use and management,

c) Information exchange between various actors involved, and

d) Human resources development to expand local technical expertises necessary for land use and management in general and monitoring/evaluation in particular.

(3) Land tenure improvement

Land tenure situations in the DIDP Area have strong relationships with the existing land use patterns. There exist both large plantations efficiently managed by contract farming arrangements, and successful cooperative schemes with many small holders. At the same time, large under-utilized lands and low agricultural productivity are also common in the DIDP Area, indicating poor management under large absentee land owners or unorganized small holders. Another major factor in the complex land tenure situations in the DIDP Area is the presence of indigenous people (IPs).

The following should be addressed in the DIDP Master Planning related to land tenure improvement.

1) Acceleration of CARP implementation and supports for agrarian reform communities (ARCs) to establish sustainable economic activities;

2) Establishment of alternative systems for land management such as cooperative farming and joint venture property development rather than estate type management; and

3) Certification of ancestral domain claims and supports for CADC communities to establish alternative livelihood opportunities.

(4) Enforcement of laws, policies and regulations

A broad issue related to the specific issues described above is how to enforce laws, policies and regulations related to management of environment and land resources. Some policy measures and regulations may be built into specific projects/programs to be formulated through the DIDP Master Planning. Prerequisites to law enforcement are monitoring and evaluation, which in turn should be based on reliable data and capable human resources. Thus, this is substantively part of better land resource management described above.

(5) Watershed management

Management of land resources is inherently related to water resources management. Improper land use and management cause water related problems. A typical case is deforestation and improper mining activities causing water pollution such as high siltation and toxic chemicals and affecting even coastal and off-shore environment. The DIDP Master Plan should incorporate comprehensive watershed management integrating water and land resources from the upstream to the downstream.

5.6.2. Provincial/City issues

The land related issues discussed and identified by provinces and City are as following:

(1) Davao Province

- Rational and well planned land use conversion management
- Rehabilitation of over-used land area and further development of under-used land
- Formulation of comprehensive forest land use development plan
- Implementation of effective IEC program for people's awareness of sustainable land use
- Advocacy for the CBFM
- Improvement of IEC technology transfer on rational land use
- Effective implementation to related laws and policies
- Implementation of integrated coastal environmental management
- Rehabilitation of degraded forest, coral reef, and mangroves
- Generation of livelihood opportunities
- Human resource development in land resource management

- Establishment of better linkages of LGUs, NGOs and POs
- Updating of land resources data

(2) Davao City

- Conservation of productive agricultural lands
- Rehabilitation of the forest resources
- Effective control of logging operation and kaingin
- Formulation of relocation program of slum/squatters
- Rational development control to avoid over-crowdedness or urban sprawl
- Creation of open spaces to enhance the urban amenity
- Updating of land resources data
- Effective implementation of related laws and policies
- Human resource development in land resource management

(3) Davao del Sur

- Simplification of tenure arrangement
- Technology capability building
- Harmonized land use in watershed, protected areas and different tenure arrangements and IPRA (Indigenous People's Right Act)
- Formulation of strategic watershed management plans
- Rehabilitation of a large area of over-used productive land
- Proper control against encroachment of rural population into both already over-used and under-used lands
- Proper protection of lands such as adjacent areas from NIPAS area or NPAA
- Updating of land resource data
- Creation of livelihood opportunities
- Implementation of effective IEC program for people's awareness of sustainable land use
- Effective implementation of related laws and regulations
- Proper monitoring assessment including multi-sectoral monitoring
- Human resource development in land resource management
- Proper delineation of functions among government entities

(4) Davao Oriental

- Conservation of prime agricultural land
- Creation of livelihood for those who would intrude into upland forest
- Proper monitoring and control of squatters and business establishment in coastal zones buffer strips
- Implementation of effective IEC program for people's awareness of sustainable land use

- Updating of land resource data
- Effective implementation of related laws and policies
- Human resources development on land resource management

5.7. Natural Resources Management

Appropriate natural resources management may be expressed as: "competent governments and staff managing natural resources based on scientific data in cooperation with people and the private sector".

The following are specific conditions to realize this.

(1) Clarifying demarcation of management functions among government agencies
Confusion in functional division among government agencies is one of reasons for poor management of environment and natural resources, especially mineral resources. Management functions of the Government should be clearly defined for each agency. Responsibilities of different agencies must be clear and strictly fulfilled.

(2) Coordination of resources management activities
Natural resources should be managed in principle based on ecosystem units. Administrative boundaries do not coincide with them, especially forest and coastal ecosystems. For example, terrestrial environment should be considered based on watershed unit because 1) distribution of habitat is based on river system, and 2) environmental degradation expands within its watershed. Fish can cross administrative boundaries, overexploitation of fishery resources affects not only exploited area but also neighboring sea areas. Therefore, LGUs should coordinate with each other for natural resources management including establishment of protected areas and sanctuaries.

(3) Enhancement of natural resources monitoring
DENR and LGUs make efforts to increase forest resources. However, it is difficult to assess how much forest projects contribute to increasing forest area. The Catch per Unit Effort value has decreased for the past five years. However, the reasons are not clear why and if fishery resources have decreased, number of fisherman is increasing, or fishing methods are not modernized. Scientific data are indispensable for natural resources management. Therefore, natural resources monitoring should be enhanced.

(4) Promotion of community-based natural resources management
As mentioned in Section 7.2, active involvement of communities and the private sector is required for natural resources management.

(5) Promotion of environmental awareness
Promotion of environmental awareness for people and the private sector is mentioned also in Section 7.2.

(6) Information dissemination
Government agencies should provide necessary information, especially regulations and zoning for environmental conservation to people and the private sector.

Chapter 6 Land Development Potentials

6.1. Direction of Future Land Use

A land use plan is to be formulated to guide the promotion of sustainable land use in the DIDP Area. Sustainable use of land resources and protection of critical environmental areas are the ultimate goal of land development. For that, as stated in the respective provincial land use plans, objectives of land development consist of three major pillars as follows:

- to minimize reclassification or conversion of prime agricultural land for urban development,
- to minimize population pressure on protection lands, and
- to minimize population pressure on non-sustainable (over-used) production lands.

To achieve the objectives, the following are set as the criteria for land use in the DIDP Area.

1) Existing protected area should be protected;
2) Preservation area and conservation area should be designated following the proposed environmental management zoning with clear definition of allowable land uses in respective areas in line also with ancestral domains claims;
3) Prime agricultural land in the lowland should be protected unless such land is subject to habitual floods that cannot be controlled in a cost-effective way;
4) Land use in upland/hillyland should be rationalized especially for agriculture with respect to the selection of crops and farming systems, including the extensive grassland/shrubland and over-used land; and
5) Urban and industrial land should be selected based on the criteria established.

For the presentation of the land use plan in the DIDP Area, the following land use categories are used, based on the 1997 "Guidelines for the Formulation/revision of Comprehensive Land Use Plan" by Housing and land Use Regulatory Board.

Agriculture: this category may be shown by specific crops (e.g. paddy rice, orchards, diversified crops, etc.) especially for cities/municipalities with large agricultural uses.

Forest: this land use includes areas proposed as production forests, waterwheds and wildlife sanctuaries. If available, the protection forests may be highlighed as conservation/protection areas.

Settlements/build-up areas: this land includes growth centers, industrial estates, sites for utilities, etc.

Special use: this is unique to the locality and includes mining and quarrying, grasslands/pasture, agro- industrial, tourism, and others.

6.2. Land Related Constraints

Various constraints apply to land development in the DIDP Area. Most constraints related to protection or limited use have legal basis. Other constraints are either physical/natural or caused by human interventions as already seen in the existing land resource conditions.

1) Protected agricultural land

Under the Network of Protected Agricultural Areas or Network of Area for Agricultural Development (NPAA/NAAD), some agricultural lands are protected against any form of irreversible conversion such as urban uses to keep and preserve the highly suitable agricultural land for long-term food security of the Country. The NPAA/NAAD lands consist of the following.

i) All irrigated and potentially irrigable lands

ii) All alluvial plains that are highly suitable for agricultural production and/or can be devoted to food production as determined by BSWM.

iii)All sustainable lands that are traditional sources of food, identified by DA and recorded for reference/information at PPDO.

iv)All crop lands that supports the existing economic scale of production required to sustain the economic viability of existing agricultural infrastructure and agriculture-based enterprises in the province.

v) All productive lands in low calamity-risk areas that are suitable for the production of economic trees and other cash crops.

vi)All agricultural lands that are ecologically fragile and whose conversion will result in severe environmental problem.

On the basis of these definitions, BSWM specified the NPAA/NAAD as consisting of the following categories.

a) Highly restricted conversion: This covers the most efficient agricultural lands which are the traditional sources of food and cash crops. These are the most stable crop lands and they can be grown to a wide range of crops with minimum to moderate levels of farm management requirements. These lands are usually supported by large investments in infrastructure.

b) Moderately restricted conversion: This covers moderately efficient lands planted to agricultural crops but which require high level of farm management inputs. Various characteristics and qualities of these lands limit their use to narrower range of crops, mainly agro-industrial crops. The conversion of these lands to non-agricultural uses will depend on the result of a comparative social benefit-cost analysis.

c) Conditionally restricted conversion: This covers lands which are marginal to agricultural use and more suited to agro forestry projects, fishponds or saltbeds. To sustain production in these areas a high level of farm management is required. The conversion of these lands to non-agricultural use requires an intensive analysis of environmental impact of conversion, particularly on the stability of uplands and adjacent lowlands.

In this study, the protected agricultural land is determined based on the suitability of agricultural use rather that the map of NPAA restricted area.

2) Protection lands

Protection lands comprise NIPAS areas, Non-NIPAS areas including buffer strips and easements along rivers, severely eroded areas, and part of NPAA highly restricted for conversion.

The protected areas, including those proclaimed both under the present NIPAS law and its predecessor, have been already described in sub-section 2.1.4.

3) Other protected lands

Forest reserves

Entries of illegal occupants and introduction of any economic activities shall be banned in forest reserves and other areas identified for protection in order to maintain ecological balance.

For the forest management, the JICA Study Team has determined the forest preservation area, forest conservation area and slope preservation and conservation area, in the environmental management section.

Mangrove areas

Conversion of any mangrove area should be avoided because this will cause adverse effects on fisheries and marine lives.

National parks

Introduction of new economic activities in the national parks will be strictly prohibited while upland agricultural will be controlled and strictly managed and supervised.

Military reserves

There is a military reserve in Sto. Tomas, Davao Province. This area shall be preserved and restricted from any form of conversion.

4) Constraints due to environmental hazards

Flood prone areas

According to GIS computation, the total area with poor drainage and prone to flooding is 90,464 ha in the DIDP Area, or 4.6% of the total DIDP Area. The area is distributed among provinces as follows: 40,726 ha in Davao del Norte, 17,855 ha in Compostela Valley, 6,581 ha in Davao City, 12,748 ha in Davao del Sur, and 16,443 has in Davao Oriental.

Davao del Norte has the largest area of flood area along the Tagum-Libuganon river, particularly in the municipality of Carmen which is suffering from 10,093 ha of flood prone area, that accounts for 47% of the total municipal land. In addition, Davao del Norte and Compostela Valley have a flood prone area along the Agusan river, including the municipalities of Monkayo, Compostela, Sto. Tomas, Asuncion, Tagum and Carmen. Davao del Sur has the largest flood prone area in the Digos area.

Table 43 Flood Prone Area by Municipality

(ha)

Municipality	Flood prone area
Davao del Norte	**36,839**
Asuncion	8,325
Carmen	10,093
Kapalong	2,097
New Corella	4,426
Panabo	3,080
Sto. Tomas	2,374
Tagum	6,445
Compostela Valley	**17,853**
Compostela	4,132
Monkayo	4,755
Montevista	1,583
Nabunturan	1,186
New Bataan	6,198
Pantukan	2,925
San Vicente	962
Davao City	**6,581**
Davao del Sur	**12,748**
Digos	1,123
Don Marcelino	106
Hagonoy	2,021
Jose Abad Santos	340
Kiblawan	169
Magsaysay	552
Malalag	702
Malita	2,257
Matanao	1,250
Padada	307
Sta. Cruz	1,517
Sta. Maria	719
Sulop	1,686
Davao Oriental	**16,443**
Baganga	724
Boston	232
Caraga	1,277
Cateel	3,574
Gov. Generoso	2,921
Lupon	2,108
Manay	1,897
Mati	974
San Isidro	1,392
Tarragona	1,345
DIDP Area	**90,464**

Source: JICA Study Team. GIS computation.

Salt water-intruded areas

Salt water-intruded areas are found along coastal areas which are intensively utilized for fishpond and other aquaculture activities. These areas are located in the coastal municipalities of Davao Oriental, and municipalities between Maco and Panabo in Davao Province. In Davao del Sur, coastal areas from Hagonoy down to Don Marcelino have areas of salt water intrusion.

Observed volcanic fault lines

1) There are many observed fault lines in the DIDP Area. They lie mostly in Davao Oriental, area from Boston to Governor Generoso, northern part of Davao City, and around Mt. Apo area, and throughout Davao del Sur from the Digos area down to Jose Abad Santos, and Sarangani Island.

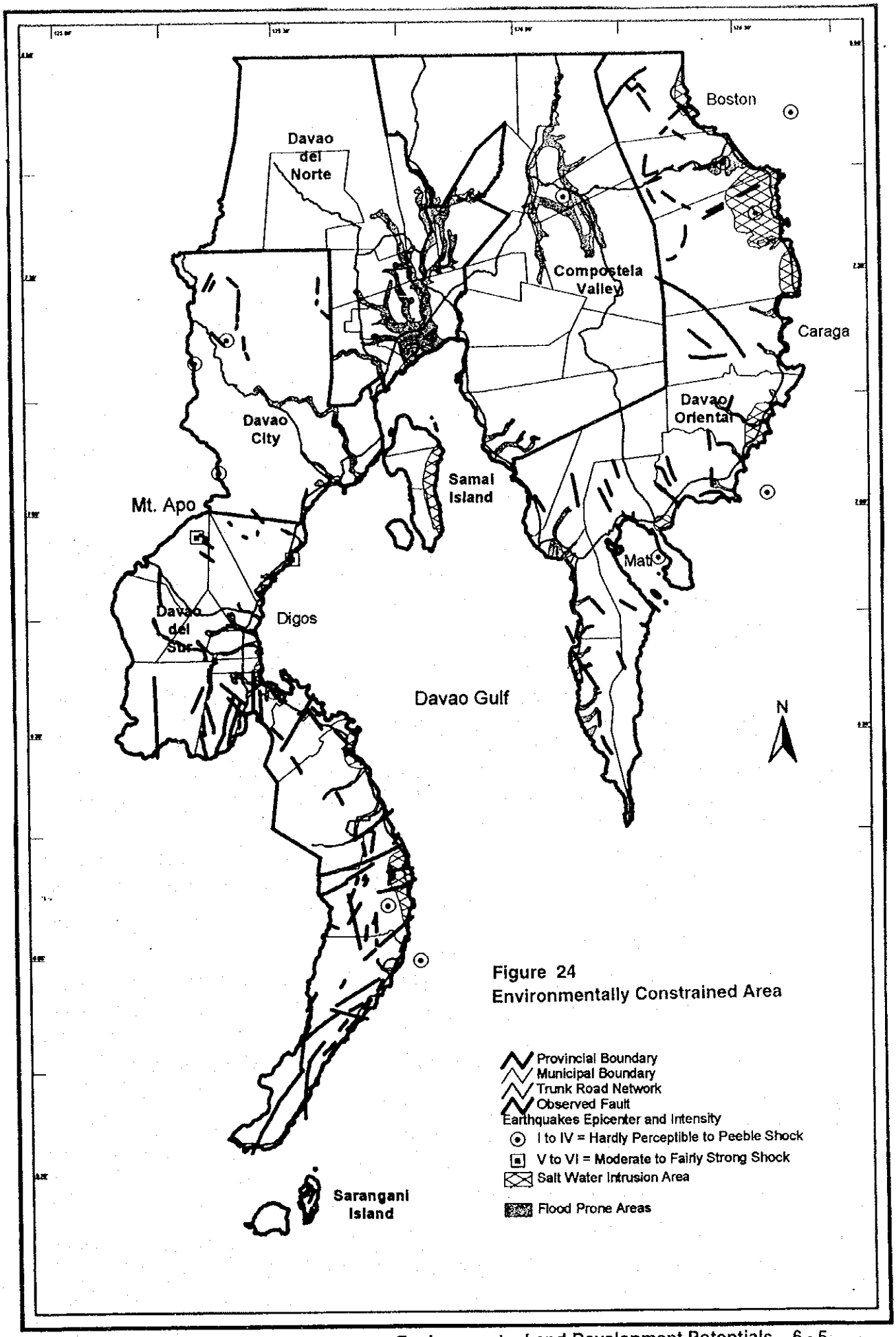


Figure 24
Environmentally Constrained Area

6.3. Land Suitable for Development

6.3.1. Land suitable for urban use

For land use planning, land suitable for urban and industrial development was examined. Lands suitable for urban development are selected based on the criteria below. Basically, suitability is determined first from physical point, and then from social and economic point (closeness to urban center and trunk roads).

Steps to class the land in urban and industrial development are as follows:

1) Exclude the land not suitable from physical point of view: slope being over 18%, severe erodability, flood susceptibility or existing land uses being built-up, lowland paddy, forest, wetland, or other special uses (water surface, livestock, mining).

2) Select from the rest land physically suitable for urban use that meets the following criteria: slope 0-8%, no apparent or slight erodibility, not flood prone, and the existing land use not being any of the above.

3) Classify most suitable land, out of the selected land, satisfying socioeconomic criteria: distance from urban centers and trunk roads shown in the table below. The land which meets the both the criteria to be classed most suitable; the land which meets only one of the two criteria classed moderately suitable, and the rest which does not meet either of the two criteria to be classed marginally suitable.

4) Classify the rest of the land not falling in either "not suitable" or "physically suitable" as marginally suitable land.

The result is shown on Figure 25. Table 44 describing the municipality-wise land area which is classed as most and moderately suitable. Most suitable land spreads along the urban corridor: namely, Tagum-Panabo-Davao-St. Cruz-Digos corridor. Moderately suitable land are mostly found around Digos, and coastal areas on Mati, Baganga, Mabini, and Pantukan, and some inland, lowland area around St. Tomas and Nabunturan.

Additional land area required for the future urban use is computed as 40,754 ha in the year of 2016 for residential, industrial, and other uses. The results of the urban land suitability show the urban land demand can be met.

6.3.2. Land capability for agriculture

Land capability for agriculture is illustrated in Figures 26 to 28 for three kinds of agricultural crops based on the agricultural development capability and other protected areas.

Areas to be protected are Protection, Preservation and Conservation Areas as the following:

1) Protection area (NIPAS area),

2) Forest preservation area,

3) Slope protection/preservation area, and

4) Forest conservation area.

For development suitability of the land area classified as follows:

- Highly suitable: class 2 in each crop productivity capability
- Suitable: class 3 in each crop productivity capability

Not suitable: class 4 in each crop productivity capability

Table 44 Urban Development Suitability Criteria for DIDP Area Development

Criteria	Most suitable	Moderately Suitable	Not suitable	Marginally Suitable
Characteristics	Suitable both from Physical and socio-economical points	Physically suitable	Physically not Suitable	The rest of the area
Slope	0-8%		18%-	
Erosion	No apparent, or Slightly		Severe	
Flood	None		Flood prone	
Distance from urban centers	- Davao City (30km) - Tagum (10 km) - Digos (10 km) - Mati (10 km) - Nabuntoran (7.5 km) - Panabo (10 km) - Sto. Tomas (7.5 km) - Sta. Cruz (7.5 km) - Lupon (7.5 km)	- either of the distance from the urban centers or trunk road is met, not both.	-	-
Distance from trunk road	0-10 km		-	-
Present land use	Not - built-up area - lowland paddy field - forest - wetland - other miscellaneous (water surface, livestock, mine)		- built-up area - lowland paddy field - forest - wetland - other miscellaneous (water surface, livestock, mine)	

Table 45 Land Suitable for Urban Use in the DIDP Area

(km²)

Area	Most	Moderate	Total
DAVAO DEL NORTE	**25,920**	**18,579**	**44,499**
ASUNCION	30	2,614	2,644
BABAK	4,189	0	4,189
CARMEN	1,751	3,531	5,282
NEW CORELLA	131	2,282	2,413
PANABO	7,907	3,488	11,395
SAMAL	1,474	0	1,474
STO. TOMAS	2,106	3,261	5,367
TAGUM	7,611	0	7,611
KAPALONG	722	3,403	4,125
COMPOSTELA VALLEY	**2,190**	**22,530**	**24,720**
COMPOSTELA	0	288	288
MABINI	0	2,598	2,598
MACO	1,027	133	1,160
MAWAB	275	1,745	2,020
MONKAYO	0	2,160	2,160
MONTEVISTA	0	65	65
NABUNTURAN	889	477	1,366
NEW BATAAN	0	5,887	5,887
PANTUKAN	0	6,335	6,335
MARAGUSAN	0	496	496
SAN VICENTE	0	2,346	2,346
DAVAO CITY	**26,562**	**516**	**27,077**
TORIL	3,666	0	3,666
BAGUIO	318	0	318
MARILOG	52	446	498
TUGBOK	6,755	0	6,755
CALINAN	4,080	0	4,080
AGDAO	100	0	100
BUNAWAN	3,493	0	3,493
PAQUIBATO	302	69	371
TALOMO	3,849	0	3,849
POBLACION	62	0	62
BUHANGIN	3,886	0	3,886
DAVAO DEL SUR	**9,018**	**41,242**	**50,259**
BANSALAN	0	3,203	3,203
DIGOS	2,846	0	2,846
DON MARCELINO	0	2,137	2,137
HAGONOY	2,473	2,422	4,895
JOSE ABAD SANTOS	0	1,805	1,805
KIBLAWAN	0	1,282	1,282
MAGSAYSAY	0	6,296	6,296
MALALAG	0	1,989	1,989
MALITA	0	3,687	3,687
MATANAO	1,403	7,098	8,501
PADADA	0	3,649	3,649
STA. CRUZ	2,296	0	2,296
STA. MARIA	0	3,918	3,918
SULOP	0	3,758	3,758
DAVAO ORIENTAL	**2,405**	**31,909**	**34,314**
BAGANGA	0	12,296	12,296
BANAY BANAY	204	606	810
BOSTON	0	740	740
CARAGA	0	3,023	3,023
CATEEL	0	3,066	3,066
GOV. GENEROSO	0	1,220	1,220
LUPON	181	132	312
MANAY	0	3,018	3,018
MATI	1,997	5,144	7,141
SAN ISIDRO	24	1,738	1,762
TARAGONA	0	927	927
DIDP	**66,094**	**114,775**	**180,868**

Source: JICA Study Team based on GIS computation

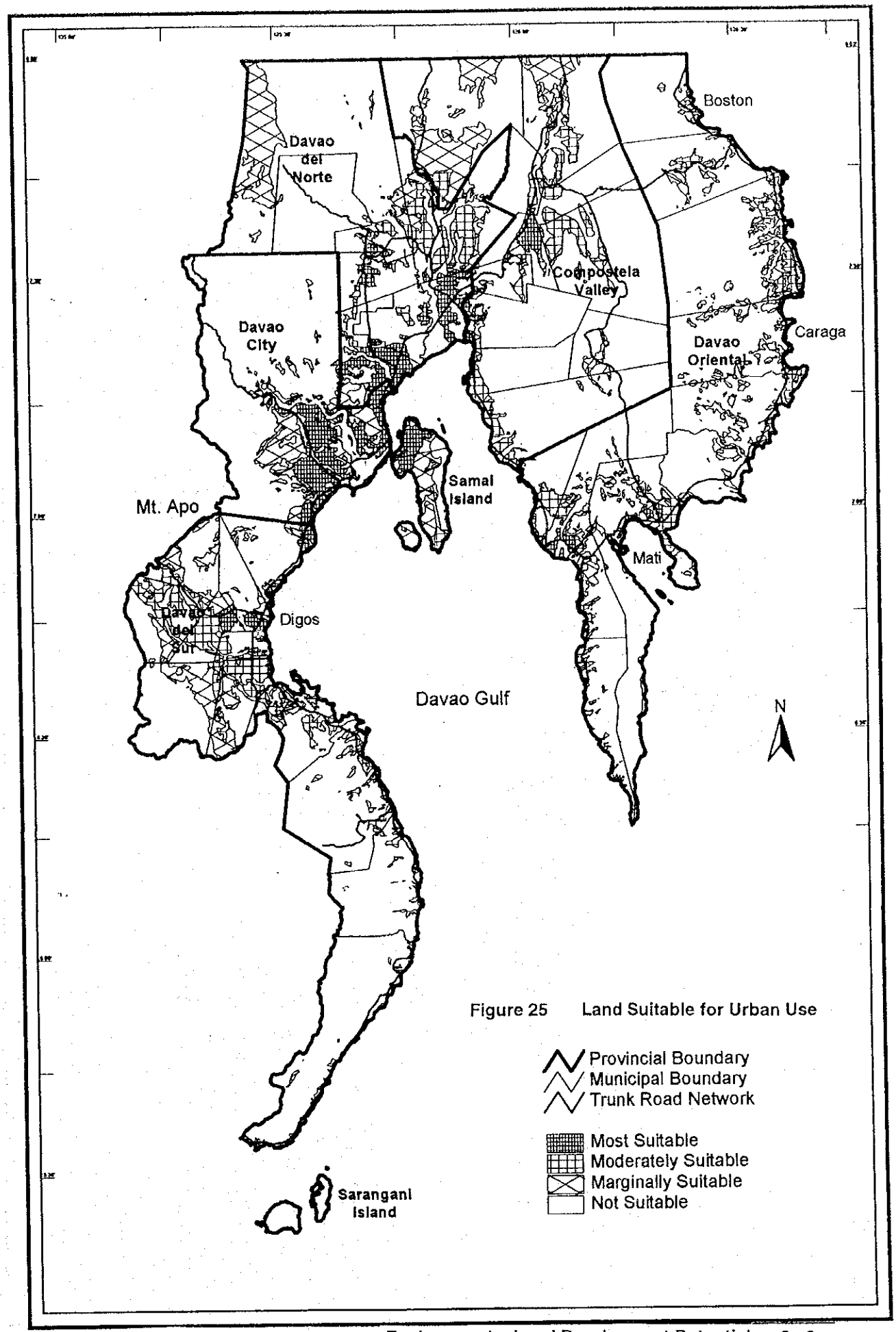


Figure 25 Land Suitable for Urban Use

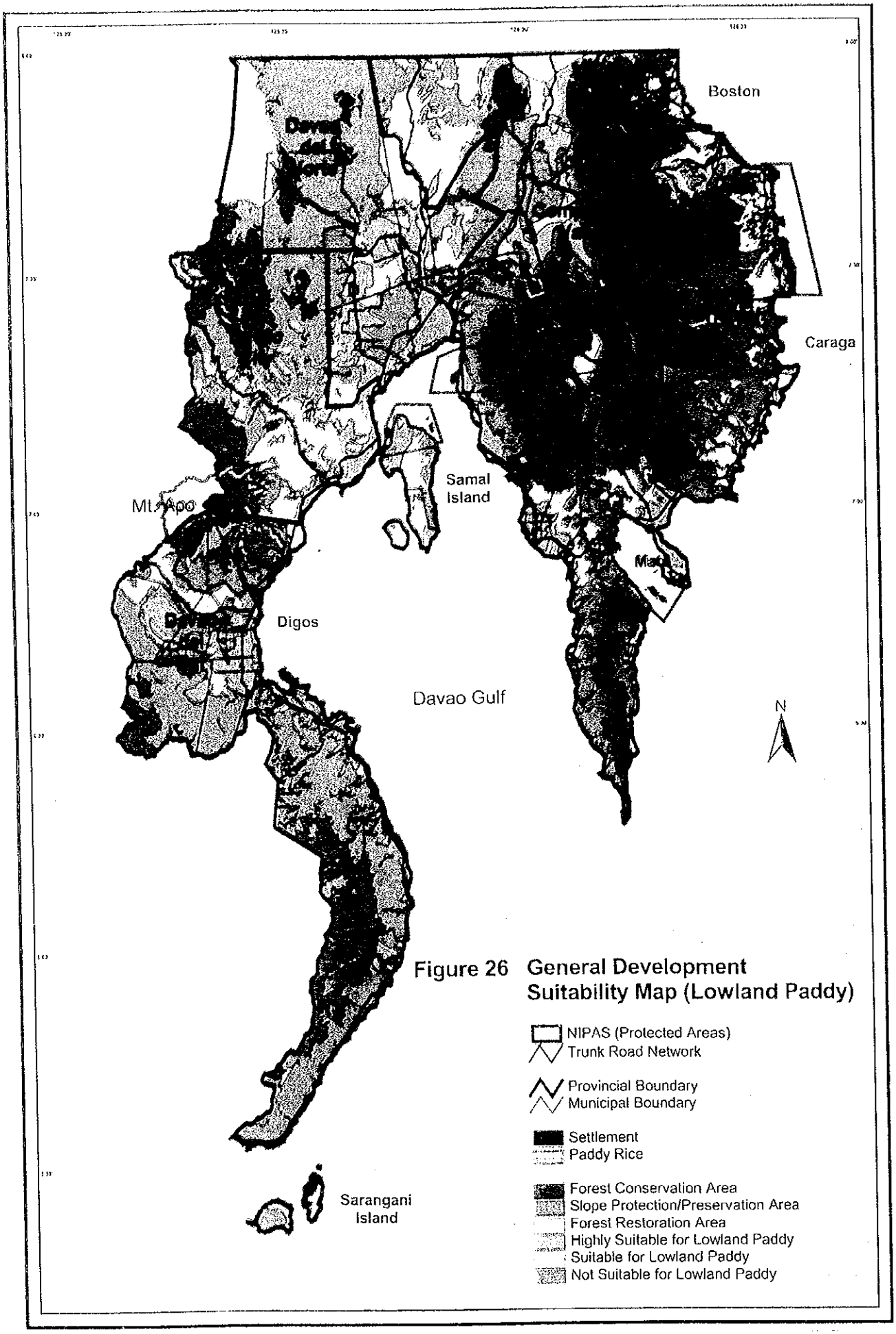


Figure 26 General Development Suitability Map (Lowland Paddy)

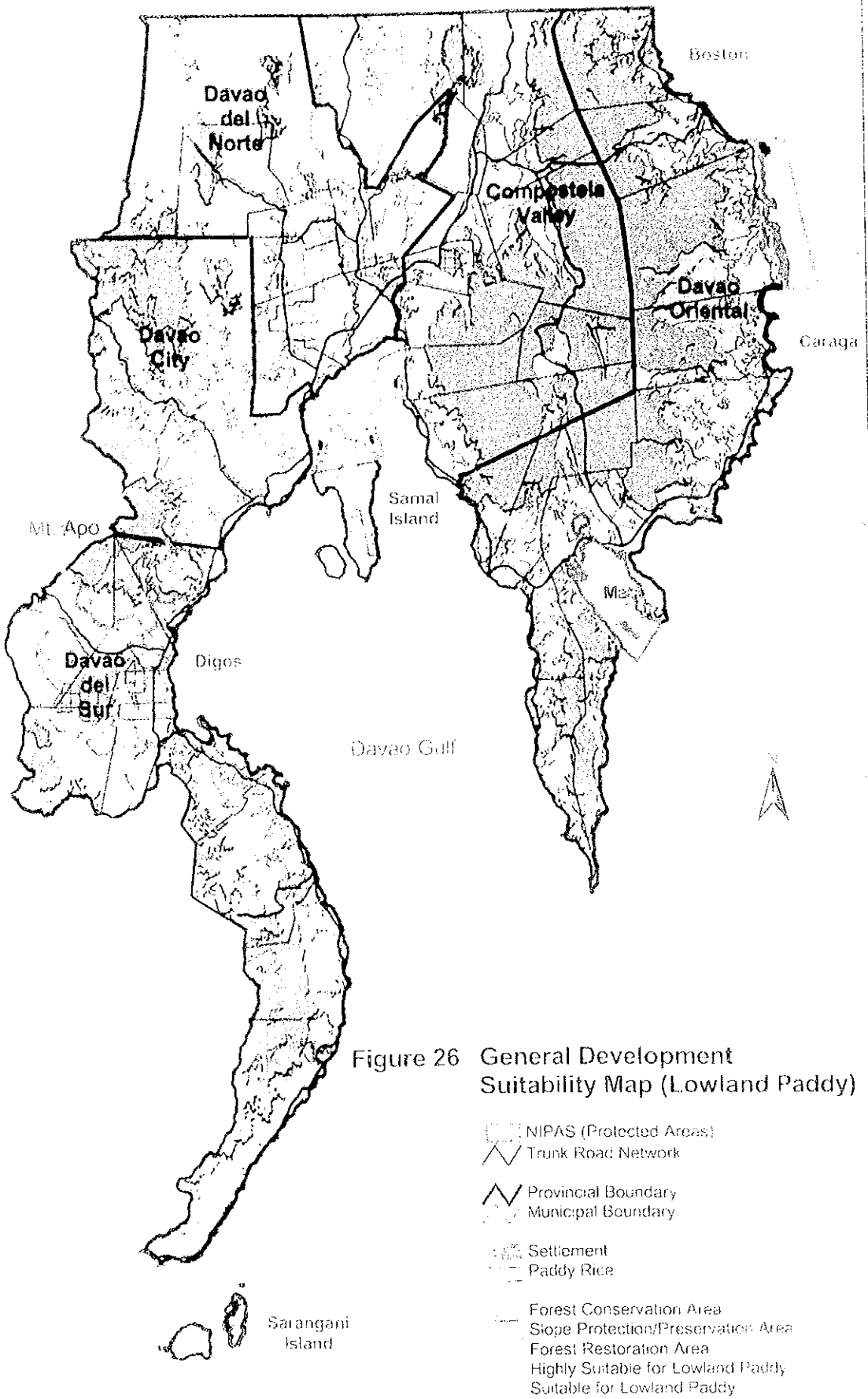


Figure 26 General Development Suitability Map (Lowland Paddy)

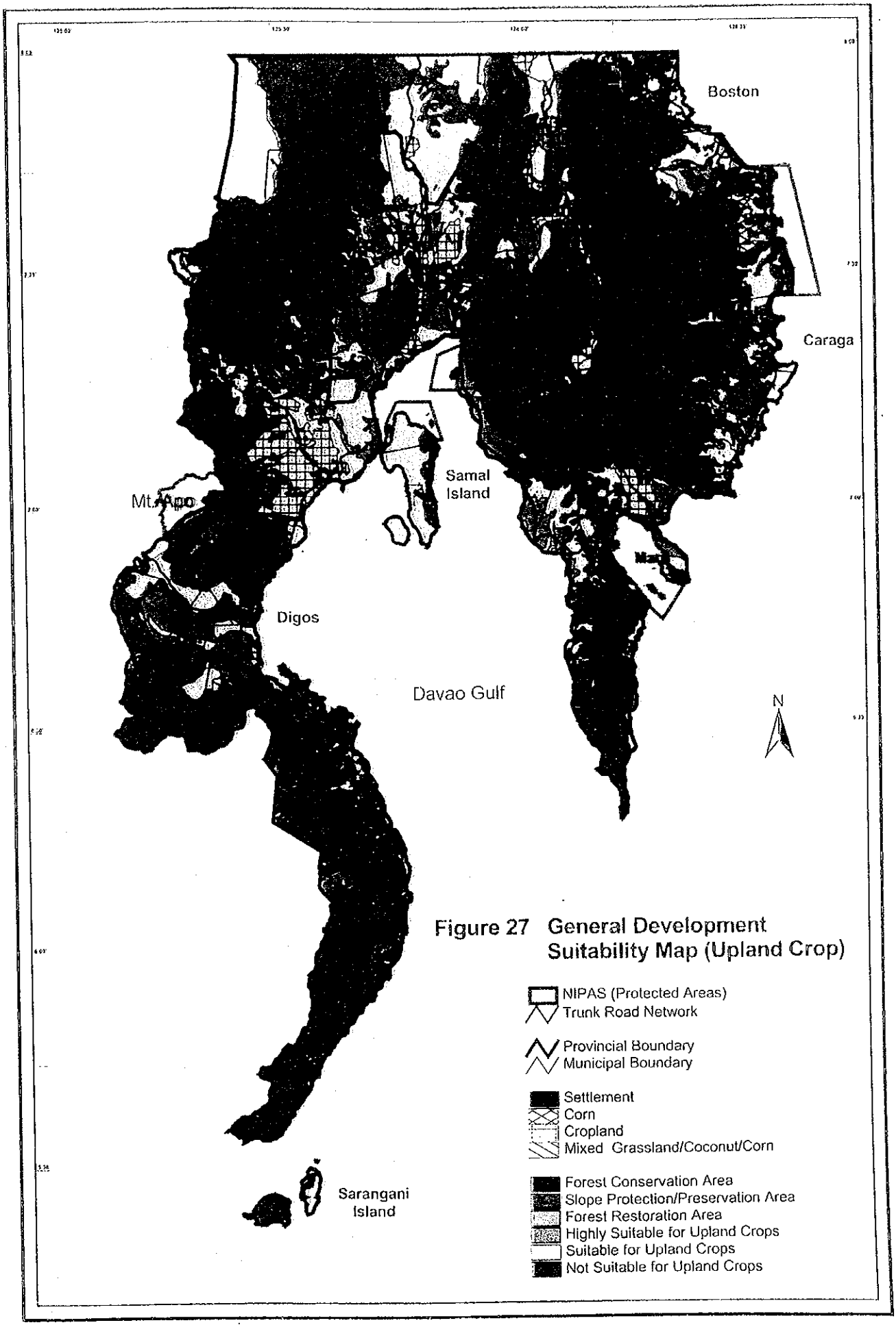


Figure 27 General Development Suitability Map (Upland Crop)

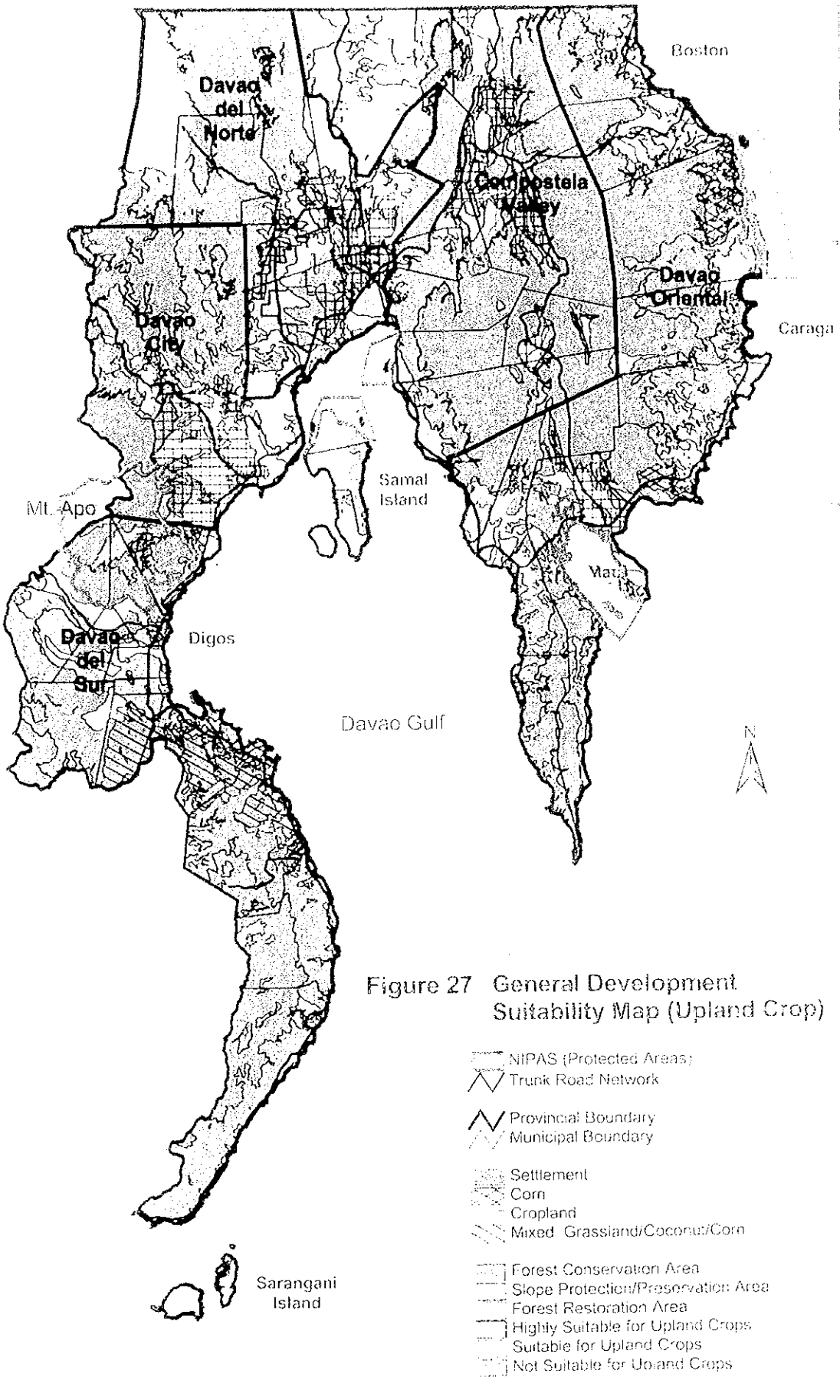


Figure 27 General Development Suitability Map (Upland Crop)

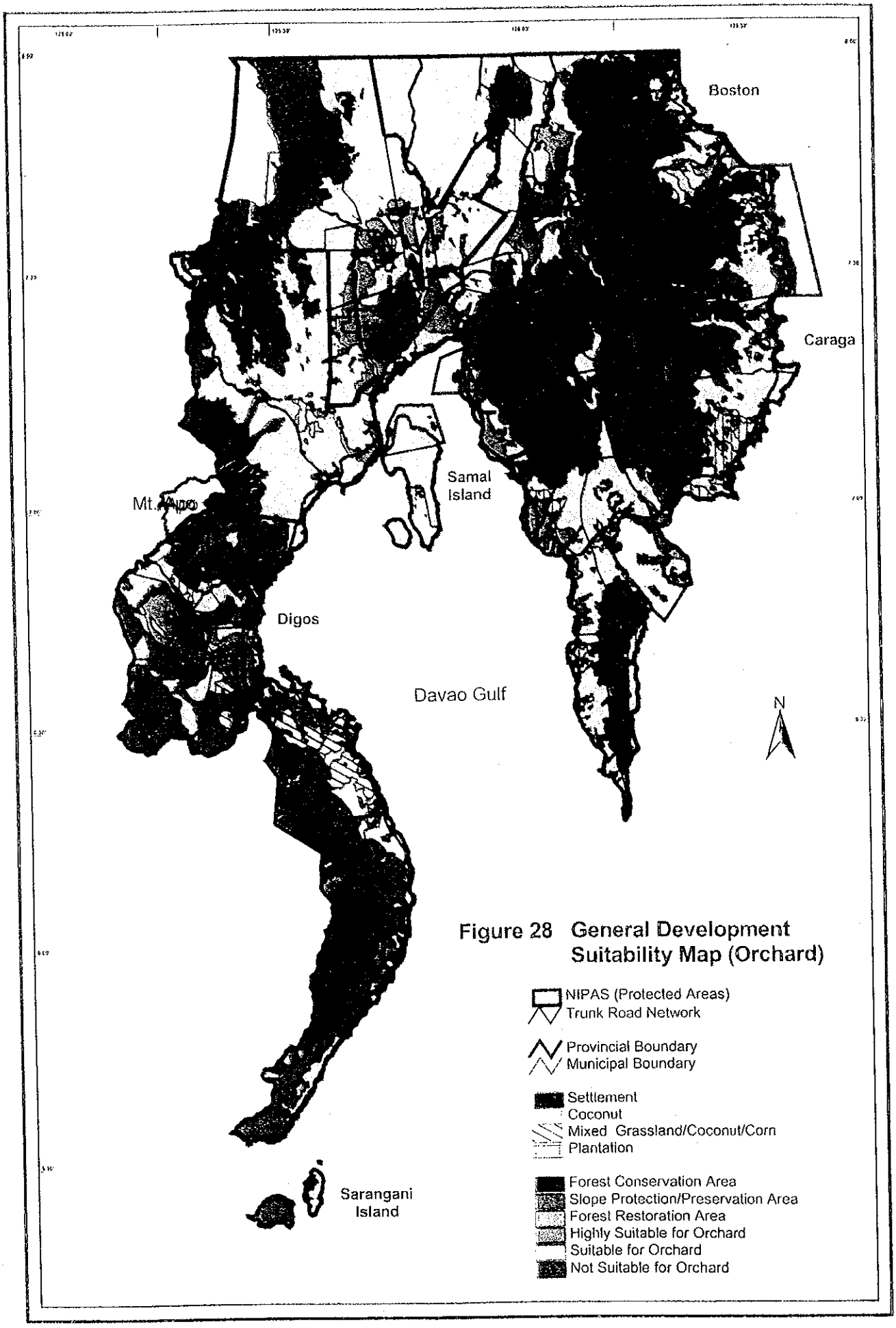


Figure 28 General Development Suitability Map (Orchard)

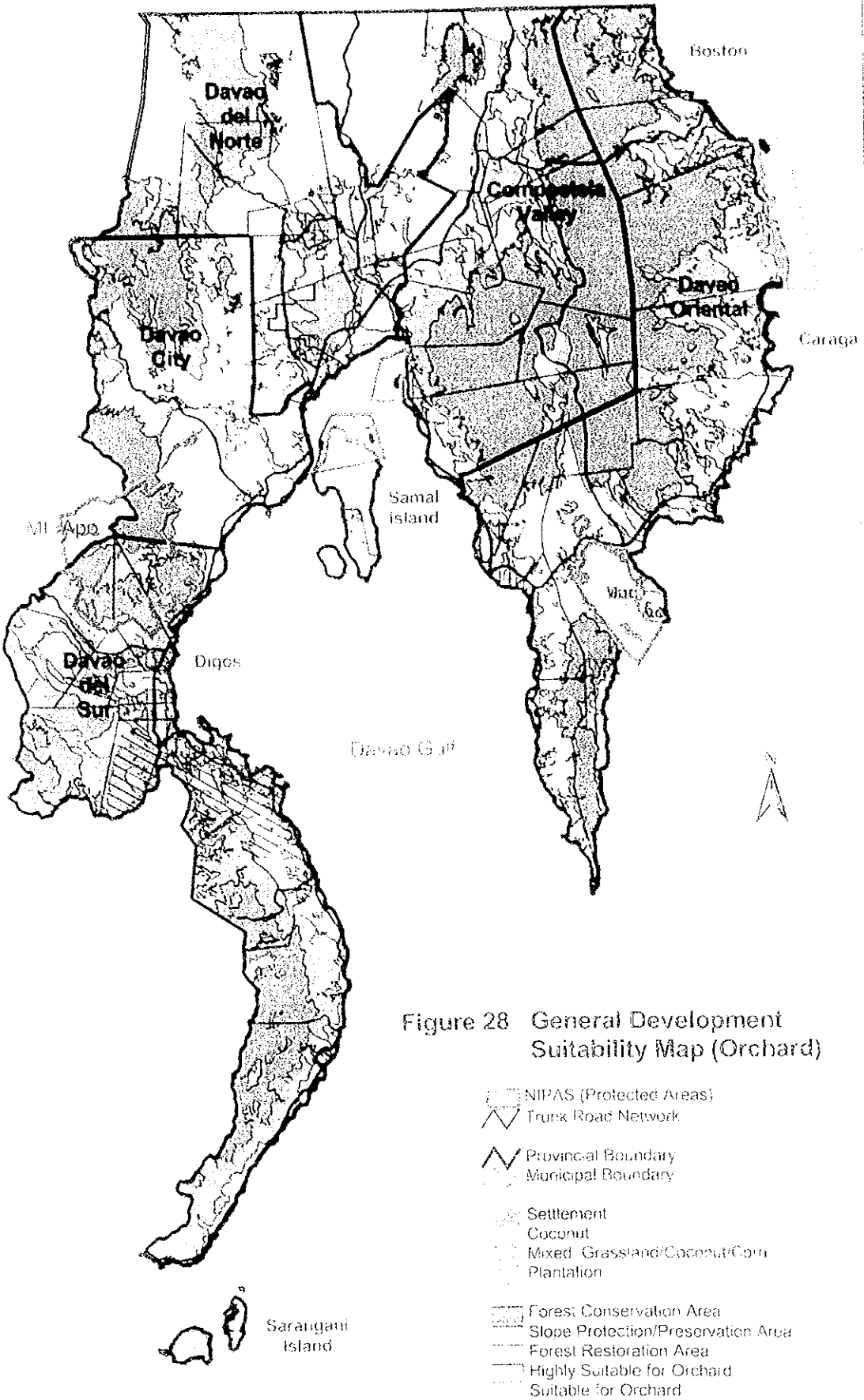


Figure 28 General Development Suitability Map (Orchard)

Chapter 7 Environmental Management Strategies

In this chapter, the DIDP strategy is discussed in the context of environmental management. Environmental management components are discussed in Chapter 4. Strategies of each environmental management component are established in this chapter. Environmental management components are:

- watershed and forest management,
- coastal environmental management,
- living environmental management and urban environmental management, and
- protected area management.

Environmental management capability building is addressed also in this environmental management strategies.

7.1. DIDP Strategy in Environmental Management

Major environmental management issues are identified as follows:

a) How to improve the management of watershed areas that have been degrading due to fast depletion of forest resources, encroachment into protected areas by upland communities, improper land use and management especially in upland/ hillyland, and inappropriate mining activities. These results in more serious soil erosion and land slides, more frequent and significant flooding, and larger amount of sediment yields.

b) How to protect and improve coastal and marine resources that have been degraded due to increased sediments from upper watersheds, pollution by wastewater discharges and solid waste dumping, and illegal fishing activities. Encroachment of coastal areas by squatters with illegal structure and activities is another major factor. Sea water is also increasingly polluted.

c) How to prevent urban pollution in larger urban centers in the face of population pressure and rapid urbanization, including solid waste dumping and littering, traffic congestion and noise pollution, air pollution, poor drainage and degrading quality of surface water and groundwater.

d) How to reduce the risk of environmental health hazards, represented by mercury/ cyanide poisoning of mining communities and their neighbors, and chemical spraying at banana plantations.

e) How to increase the resources to be allocated to, and enhance the capacity for, environmental management. This will include human resources development, promotion of environmental awareness, increased participation of local communities, and establishment of environmental database.

The DIDP Strategy is to combine three strategies: Internal Integration, Globalization Drive, and High Tech – High Services. The Internal Integration strategy, being a sort of survival strategy, is supported by the improved watershed management and the protection of coastal and marine resources, which would restore the healthy resources base for sustainable development. Promotion of environmental awareness and increased participation of local communities in environmental management are in line with the Internal Integration strategy.

Under the Globalization Drive strategy, the issue of soil erosion and degradation needs to be addressed particularly related to expansion of area under export and

other industrial crops. The strategy will have to address also the issue of environmental health hazards and pollution associated with resource-based industries.

Urban pollution is an issue to be addressed under both the Globalization Drive and the High Tech – High Services strategy. As socioeconomic activities diversify under the Globalization Drive and further under the High Tech – High Services strategy, environmental staff will need to be trained in a wider range of fields. Exchange of environmental information will become increasingly more important and far reaching as the DIDP Area development is pursued under the High Tech – High Services strategy. A regional or sub-regional center may be established in the DIDP Area for an international environmental databanking and network.

7.2. Environmental Management Capability Building

Although a large number of laws and regulations have been promulgated related to environmental management, there are lots of problems due to lack of both environmental management capability and necessary environmental data.

The following issues are pointed for environmental capability building:

- human resources development for LGUs,
- community and private sector organizing,
- enhancement of environmental monitoring and construction of data base,
- implementation of EIA, and
- promotion of environmental awareness.

(1) Human resources development for LGUs

After the devolution under Local Government Code of 1991, some of DENR's functions were transferred to LGUs, so that LGUs are very important key players for environmental management in the Philippines. However, LGUs do not have sufficient competent staff for implementation of environmental management.

The following tasks are proposed:

- establishment of Municipal ENRO
- development of Provincial ENRO's capability
- staff training of LGUs

a. Establishment of municipal ENRO

Municipal governments have responsibilities of administrative roles for people such as public services including solid waste management, water supply and others. They face people on a daily basis, so that their functions are very important for environmental management.

Municipal governments can establish Municipal Environment and Natural Resources Officer (municipal ENRO) by the Local Government Code of 1991. However, municipal ENRO has never been established in the DIDP Area. Establishment of municipal ENROs is proposed for strengthening environmental management at the municipal level. Major tasks of municipal ENRO are extracted from Manual of Operations for Devolved General Management Functions, DENR, as follows:

- establish, maintain, protect and preserve communal forest, watersheds, tree parks, mangrove, greenbelts, communal forest and similar forest projects like industrial tree farms and agro-forestry projects, and
- coordinate with government agencies and non government organization in the implementation of measures to prevent and control land, air and water pollution with the assistance of DENR.

b. Development of provincial ENRO's capability

LGUs of the DIDP Area have established provincial ENROs belonging to the respective provincial governments. The most staff members are foresters. In the new future, however, environmental problems of the DIDP Area may be changed into new types of problems such as air and water pollution, ecosystem conservation, especially coastal environment, generation of hazardous and toxic waste, and amenities. It is recommended that some DENR specialists be transferred to provincial ENROs.

c. Government staff training

Although roles of LGUs are very important for environmental management, environmental administrative capability of LGUs is not enough. Capability building of environmental officers is the most important issue. However, DENR and LGUs officers who belong to environmental section do not have opportunities for training, especially in LGUs offices. Therefore, LGUs officers require training. Training for LGUs officers consists of on-the job-training and off-the job-training. Both of two types of training are used based on objectives of training.

<u>On the job training</u>

One-the job-training for environmental officers is already practiced. It can be proposed, however, that an interchange of personnel between DENR and LGUs should be promoted.

<u>Off the job training</u>

Off-the job-training includes seminar, training courses and symposium. DILG has Institute for Local Government Administration (ILGA) as training arms for LGUs. Establishment of ILGA is based on decentralization approach to the implementation of Integrated Capability Building Program (ICBP) by DILG. In the DIDP Area, however, Provincial ILGA was established only in Davao Oriental and Davao del Sur supported by academe. Therefore, establishment of Regional ILGA is proposed at University of Southern Mindanao, capitalizing on facilities and human resources.

ILGA aims to:

- serve as mechanism to complement the existing delivery system of ICBP interventions,
- optimally utilize existing local resources in combination with outside inputs for ICBP service delivery, and
- provide the local institution with an avenue for more relevant and active involvement in the capability building efforts of the locality.

ILGA implements the following courses:

- management system,
- local financial administration,
- development planning,
- local legislation, and
- community mobilization.

According to ILGA Briefing Folio, 1994, environmental management can be implemented because it is one of the demand-driven modules of ICBP. Curriculum should include field work and laboratory work. Participants of the ILGA training program are the following:

- local officials and functionaries,
- members of NGOs/POs/Cooperative involved in local governance, particularly member of local special bodies,
- member of the local learning institutions,
- DILG and other NGA personnel, and
- Barangay Environmental Managers (proposed below).

(2) Promotion of community and private sector organizing

In general, environmental management, especially natural resources management, should be carried out by governments for the following reasons:

- Environment can not be managed under marketing mechanism, because environment is public resources;
- It is difficult that individuals manage environment; and
- It is required that environmental use reflects regional characteristics.

However, environmental management requires understanding and supporting from communities and the private sector, for the following reasons:

- Management capability of government is lacking at present; and
- Major resources users are people and the private sector.

Therefore, community and private sector organizing or community based environmental management are proposed as well as government initiative management. It is recommended that resources users and illegal loggers, farmers and fishermen be involved in environmental management through the following.

- Sharing environmental management and patrol among communities, the private sector and governments.

  For example, in case of environmental monitoring and patrol around resorts, resort owner has the obligation under the conditions of permission for establishment of the resort.

- Establishment of community-initiative environmental management

  Barangay Environmental Managers function as an interface between communities and governments (refer to next paragraphs).

- Leasing fishery ground to fisherman group with monitoring and patrol against illegal activities.

(3) Barangay Environmental Manager System

A Barangay Environmental Manager (BEM) is a volunteer to be appointed by the Barangay Captain from the community for promotion of community participation and community-based environmental management at the barangay level. Information flow of Barangay Environmental Manager System is shown in Figure 30. BEMs monitor environment conditions in their barangay and report to the municipal government. BEMs are also expected to disseminate environmental information to people from the viewpoint of environmental conservation and suggest ways for the improvement of living environment. BEMs have also a function as an interface between the government and communities. Therefore, BEMs contributes to the government, communities and the private sector sharing common information on environmental problems and necessity of environmental conservation. Provincial and municipal governments and Barangay Offices share allowance of BEMs.

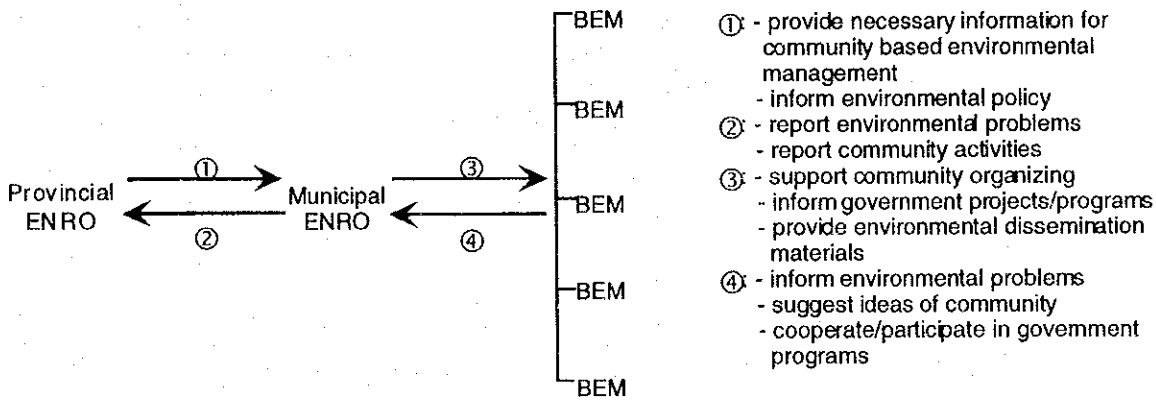


Figure 29 Information Flow of Barangay Environmental Manager System

(4) Enhancement of environmental monitoring and development of database

Environment should be managed based on scientific data. However, environmental data and information lack in the DIDP Area.

Development of an environmental database is urgently necessary including terrestrial environment and coastal environment. Environmental database may be operated and maintained by DENR and the upgraded DIDP PMO office, and should be accessed by LGUs. Environmental monitoring is also required. An Environmental Information Center is proposed. The Center has the following functions:

- to survey and monitor environmental conditions,
- to develop environmental database, and
- to provide environmental data and information to LGUs for environmental management.

(5) Implementation of EIA

Environmental Impact Assessment (EIA) is a very effective and important tool for environmental management. The Philippine Government has the established EIA system. However, it is not functional at present due to:

- lack of number of staff for review of EIA reports, and
- lack of knowledge and understanding of the private sector regarding to regulations

The following should be undertaken to enhance the implementation of EIA:

- to reinforce EIA experts of DENR,
- to provide updated information to PENRO and LGUs regarding the EIA system, and
- to disseminate the purposes of EIA to LGUs and the private sector.

(6) Promotion of environmental awareness

It is required for environmental management that people and the private sector understand environmental policy and cooperate with governments. Information on environmental problems and necessary actions should be shared by governments, the private sector and people. Flow of proper environmental information should be ensured to the private sector and people from governments. These will be ensured through:

- having common environmental information and existing problems,
- strengthening for community participation,
- promotion of environmental education, and
- ensuring of environmental information flow from government to people.

The following should be enhanced for environmental awareness:

- education for students,
- dissemination and enlightenment for community and private sector, and
- dissemination and enlightenment for government staff.

The targets and emphasized points are shown in Table 46.

Table 46 Targets and Emphasized Points for Promotion of Environmental Awareness

Targets	Approach	Emphasized Points
Students	• school education	⇒ to understand the necessary of protection and conservation of environment ⇒ to seize an opportunity for participation of environmental programs
Community Private Sector	• mass media • seminar/workshop • distribution of printed matters • campaign/event	⇒ to understand environmental policy and regulations ⇒ to understand the necessity of protection and conservation of environment ⇒ to recognize environmental problems and issues ⇒ to seize an opportunity for participating in environmental programs
Government Officers	• seminar/workshop • distribution of printed matters	⇒ to have pride ⇒ to understand environmental policy and regulations