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Factor Analysis of Water-related Disasters in The Philippines

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Factor Analysis of Water-related Disasters in The Philippines

by

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Synopsis:

Vulnerability to disaster differs considerably depending on natural exposure to hazards and social conditions of countries affected. Therefore, it is important to take practical disaster mitigating measures which meet the local vulnerability conditions of the region. Designating The Philippines as a research zone, this research aims to propose measures for strengthening the disaster mitigating system tailored to the region starting from identifying the characteristics of the disaster risk threatening the country. To this end, we identified the country's natural and social characteristics first, and then analyzed the risk challenges and their background as the cause to create and expand the water-related disasters. Furthermore, we also analyzed the system of the socio-economic structure, the evacuation behavior of the affected people and related experience to disasters.

Key Words: water-ralated disaster, risk management, case study, disaster prevention plan

List of Abbreviations

AFP	Armed Forces of Philippines
ARMM	Autonomous Region in Muslim Mindanao
ASEAN	Association of South East Asian Nations
ASG	Abu Sayyaf Group
BDCC	Barangay Disaster Coordinating Council
BRS	Bureau of Research and Standards, DPWH
DCC	Disaster Coordinating Council
DENR	Department of Environment and Natural Resources
DOH	Department of Health
DOST	Department of Science and Technology
DPWH	Department of Public Works and Highways
EBS	Emergency Broadcasting System
EFCOS	Effective Flood Control Operating System
F/S	Feasibility Study
GDP	Gross Domestic Product
GNP	Gross National Product
GOP	Government of the Philippines
IMF	International Monetary Fund
JBIC	Japan Bank for International Cooperation
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
LGU(s)	Local Government Unit(s)
MDCC	Municipal Disaster Coordinating Council
MMDA	Metro Manila Development Authority
MNLF	Moro National Liberation Front
NDCC	National Disaster Coordinating Council
NEDA	National Economic and Development Authority
NGO(s)	Non-Governmental Organization(s)
NIA	National Irrigation Administration
NIEs	Newly Industrializing Economics
NPC	National Power Corporation
NWIN	National Water Information Network
NWRB	National Water Resources Board
OCD	Office of Civil Defense
OECF	Overseas Economic Cooperation Fund 旧 JBIC
OFDA/CRED	Office of Foreign Disaster Assistance / Centre for Research on the Epidemiology of Disasters
PAGASA	Philippine Atmospheric, Geophysical, and Astronomical Services Administration
PDCC	Provincial Disaster Coordinating Council
PHVOLCS	Philippine Institute of Volcanology and Seismology
PNP	Philippine National Police

PTWC	Pacific Tsunami Warning Center
RDCC	Regional Disaster Coordinating Council
UTC	Coordinated Universal Time
WMO	World Meteorological Organization

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1. Outline of the Philippines

1.1 Social Economy (P11, P12, P16)

According to the National Statistics Office, in the government census completed in May 2000 the Philippines had a population of 76.5 million people (the Manila capital area population being 10 million), and a population density of 255 per square kilometer. There are 15.7 million households in total averaging five people per household. Looking at the rate of population increase every five years from 1970, it has slowly dropped from the peak rate of 3.08% in 1970, reaching 2.32% in 1995, with a slight increase to 2.36% in 2000. According to the latest World Bank 2004 Data, the total population is 83 million.
82% of the population are Roman Catholic, 9% Protestant and 5% Muslim. Muslims are common in the western area of Mindanao Island.

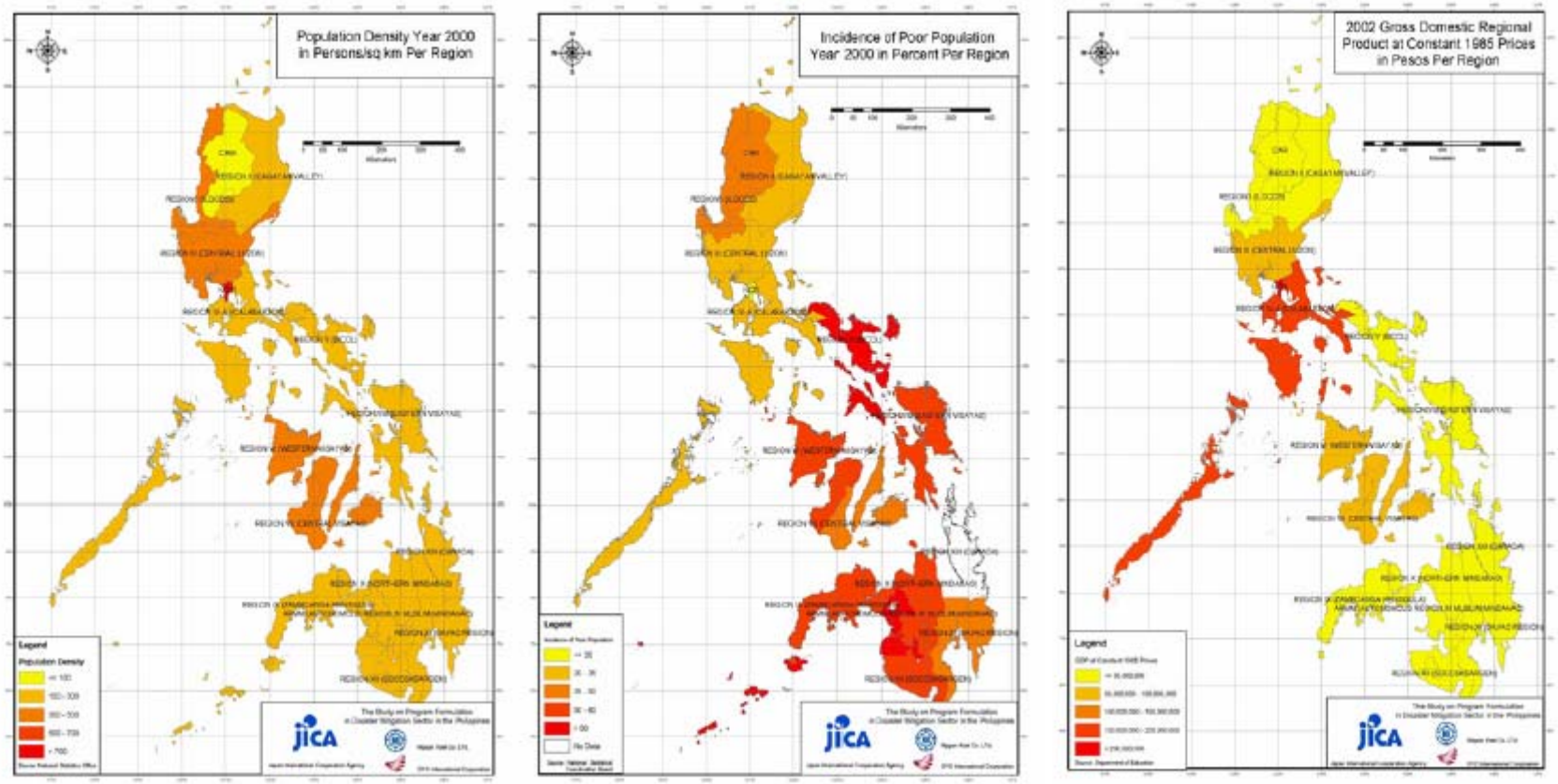
Following the 2001 stepping down of former President Estrada, Vice President Gloria Macapagal-Arroyo became the 14th President of the Philippines. In May 2005 allegations of misconduct in the 2004 elections surfaced and demands for her resignation increased. In February 2006 a plan for a coup was discovered, the President declared a state of emergency and attempted to bring a conclusion to the situation.

Poverty is a major social problem in the Philippines, with extremely large regional differences. The Manila capital region has the lowest rate of 11.4%, the highest being ARMM with 71.3%, each region in Mindanao having high poverty levels. If the population growth rate is high, the GNP per person does not change significantly even if a high growth rate is achieved. Consequently, as one measure to lower the rate of poverty, during the Ramos administration restrictions were placed on population growth (through artificial birth control or the use of contraception), but due to strong opposition from the Catholic Church this had almost no effect. As long as high birth rates remain in place amongst the poor, the poverty ratio will not go down easily.

Table 1 Principal National Indicators

Principal Indicators	Details	Principal Indicators	Details
Land Area	299,404 km^2	GNP per person	45,637 pesos
Independence	July 4 1946	Exports	$38,078 million
Total Population (2006)	76,498,000 (2000 National Census)	Imports	$31, 387 million
Population density	255 people / 1 km^2	Infant mortality rate (1994)	40%
Average lifespan (2006)	Men 67, Women 73	Birth Rate (1994)	3.8%
GNP	3,491,134 million pesos	Literacy (2000)	Overall 94.6%, male 95.0%, female 94.3%

Source: Philippines Mount Pinatubo Western River Basin Floods and Mudslides Control Plan Survey Preliminary Study Findings, February 2002 (P12)



Population Distribution (2000)

Poverty Distribution (2000)

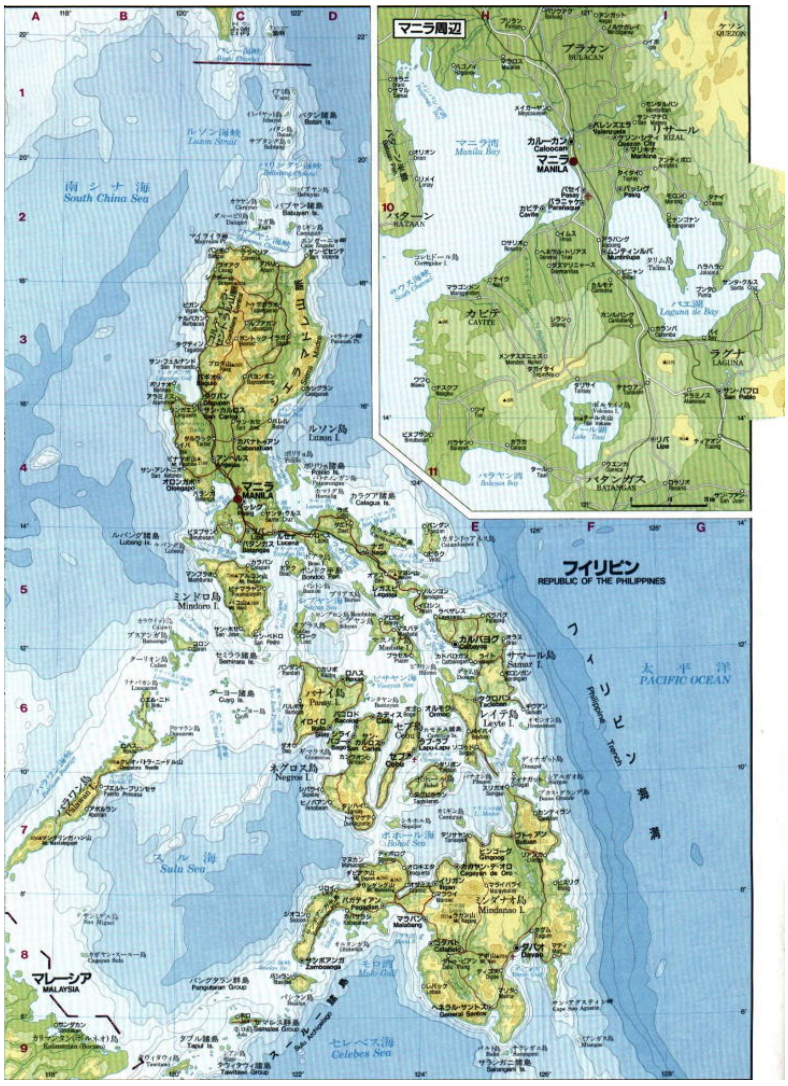
GDP Distribution (1985)

Source: Study Encouraging Disaster Prevention Field Programs in the Philippines
Main Report (P11)

Fig. 1 Economic / Social Information on the Philippines

1.2 Natural Conditions (P9, P11, P12, P18)

The Philippines consists of some 7,100 islands, and is located between 4°23′ to 21°25′ north latitude and 116° to 127° east longitude. Existing in the eastern part of the Asian continent, it is a country where no point is ever very far from the ocean. The archipelago making up the country faces the South China Sea on its west, the Pacific on its east, the Sulu and Celebes Seas to the south and the Balingtang Channel to the north. Its land area of approximately 300,000km^2 is equal to 80% of Japan. 94% of the land area is taken up by the eleven following principal islands: Luzon, Mindanao, Samar, Negros, Palawan, Panay Mindoro, Leyte, Cebu, Bohol and Masbate. Of these Luzon and Mindanao, the first and second largest respectively, make up 65% of the national land area. 2,773 islands have been named, and 1,190 of those are inhabited. The overall land area is divided into the three regions of Luzon, with 141,000 km^2, Visayas with 57,000 km^2, and Mindanao with 102,000 km^2. It also boasts the world's longest coastline of 34,600km.



Source: Inside News of the Philippines (P15)

Fig. 2 Map of the Philippines

The highest peak is Mount Apo, overlooking the suburbs of Davao City at EL. 2,954m, the second being Mount Pulog (El. 2,930m) on Luzon Island. On the west side of the northern area of Luzon Island lie a chain of mountains of around 2,500m centered on Mountain Province. Ranges of mountains run north to south on the northern Luzon Island and the largest southern island of Mindanao, in the islands between few high mountain ranges exist. The mountain highlands offer comfortable living, with many towns being formed in the area.

The mountain city of Baguio in Benguet Province is a cool mountain resort as well as ranking as the second capital of the country, and supplies the Manila capital area with vegetables.

In terms of geological structure, the Philippines Archipelago is formed from two geological zones, one moving and one stable. The moving zone covers most of the archipelago, earthquake epicenters being concentrated in this area. A great many subduction zones exist along the oceanic trench connected to the Philippine Islands due to collision of the Philippine Sea Plate and the Eurasian Plate. There are around 220 volcanoes, those active now or with a history of eruption comprising 22 of these and being designated as active volcanoes. Principal volcanoes are Pinatubo, Taal, Mayon, Bulusan, Canlaon and Apo. Mayon, located in the Bicol region, is famous for having over thirty recorded eruptions since 1616. In June 1991 Mount Pinatubo erupted causing great damage. The volcanoes are located along narrow belts running parallel to their respective neighboring oceanic trench, the epicenter zones having almost the same distribution as those of the volcanoes. The Philippines is famous worldwide both for its many volcanoes and frequent earthquakes.

The Philippines climate is tropical, having both wet and dry seasons, but its topography is affected by monsoon and typhoon routes and varies greatly by region. The climate factor of temperature / humidity is greatly affected by latitude, height above sea level and distance from the sea. Sea level temperatures never fall below 27℃, the temperature varying from 28°C to 36°C and humidity from 70 to 80%. Inland the areas at the edge of the islands have slightly higher temperatures, the mountains lower temperatures. Mean annual rainfall is 2,030mm, being higher on the coastline than on valleys and regions enclosed by mountains. In the rainy season each year from June to October from twenty to thirty typhoons occur. Almost half the annual rainfall is brought by the typhoons. The Visayas and Luzon Island lie directly in the path of the typhoons, and are subjected to heavy damage from torrential rain, storms, floods, and landslides brought about by the typhoons.

With climate conditions such as these, in the low-lying areas tropical rainforests are dominant and in the upland regions coniferous forest can be found. This vegetation has changed greatly due to the economic impact of a long history of colonization. In the low-lying areas large-scale monoculture cultivation was made for the plantations, and in the uplands vast tracts of forest were felled, with some areas remaining untouched. The remaining rainforest is also subject to slash-and-burn agriculture.

The islands also had times of isolation, the flora and fauna both showing natural species distribution. Looking at the fauna, over 200 animal species, 580 bird species, 200 insect species and 100 species of amphibians are believed to inhabit the islands, including among them many valuable species confined to separate islands. For the flora, there are several thousand species of trees, bushes and ferns, the most dominant being pines (found in the northern mountainous region of Luzon Island), palm trees and bamboo.

The effects of felling and slash-and-burn agriculture on trees cannot be overlooked, having brought on natural devastation, and in particular land erosion and desertification as well as climate change. Regardless of the legal limits placed on tree felling in 1989, the lack of sufficient measures continues into the present.

2. Special Regional Features

(1) Meteorological Features (P11, P12, P48)

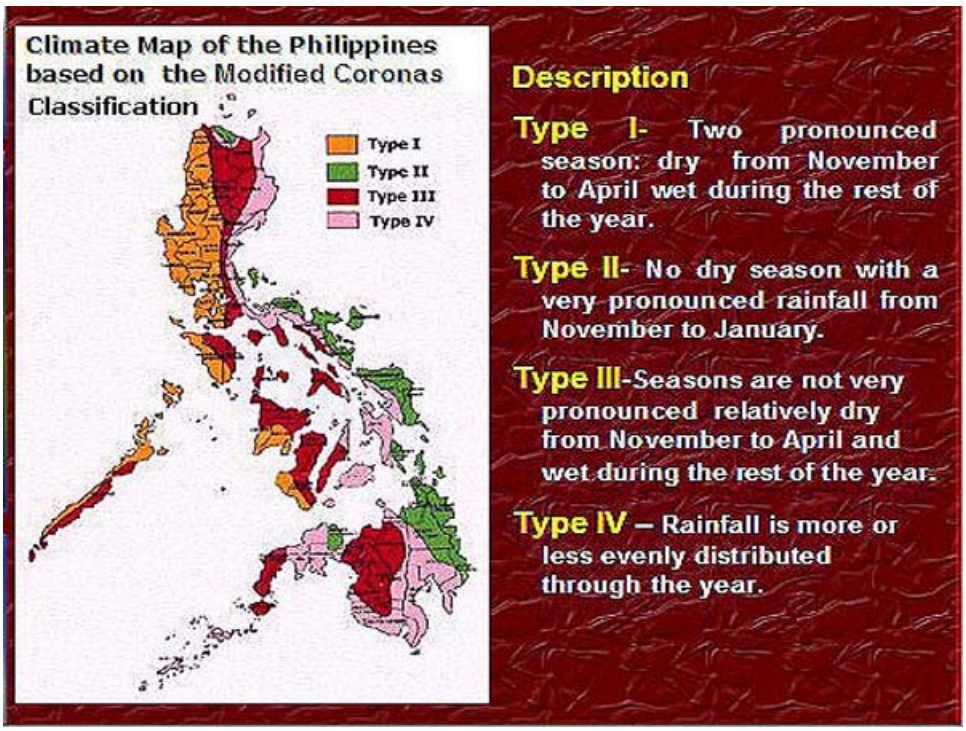
1) Climate Zones

In the Philippines, there are differing rainfall patterns on either side of the mountain ranges running north-south, and the climate conditions and natural environment of the typhoon-affected northern Luzon Island also differ greatly from Mindanao and Palawan Islands, which are off the typhoon course. The central Visayas have no central mountain range and hence have low rainfall throughout the year. A monsoon climate encompasses most of the west of Luzon, Palawan and the Visayas, whereas a rainforest climate covers eastern Luzon, Samar and Mindanao. Generally speaking, the climate of the Philippines can be divided into the following four types of areas based mainly on the quantity of rainfall.

Table 2 Climate Zones and their Features

Zone	Features	Representative Regions
Zone 1	Clear division between dry and wet seasons, dry season from November to April, wet season all other times	Ilocos, Central Luzon, Southern Tagalog (east), Western Visayas (east)
Zone 2	No dry season, heavy rain from November to January	Bicol (west), Eastern Visayas, Southeastern Mindanao
Zone 3	No clear division for the rainy season, general tendency to lower rainfall from November to April	Bicol (east), Western Visayas (west), Central Visayas (east), Northern Mindanao (north), Southwestern Mindanao (east)
Zone 4	No real difference in rainfall throughout the year	Cagayan Valley (west), Bicol (east), Central Visayas, Mindanao (south)

Source: Study Encouraging Disaster Prevention Field Programs in the Philippines Final Report Main Report (P11)

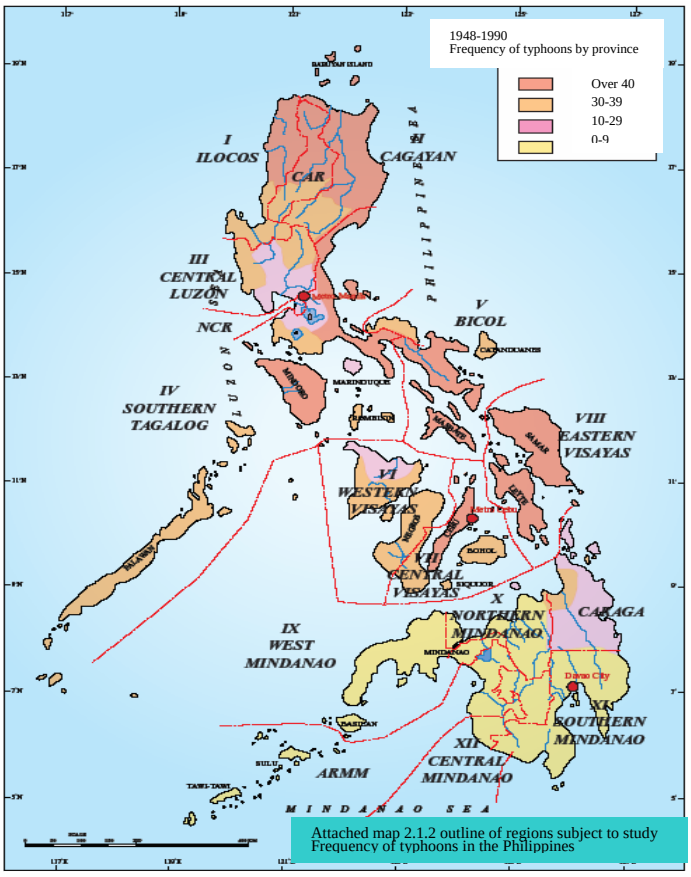


Source: Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA) Data

Figure 3 Climate Map of the Philippines

2) Frequency of Typhoons

Nearly half the annual rainfall is brought by the typhoons. This is because almost all the typhoons formed in the area of the Caroline and Mariana Islands follow a western or northwestern route leading to the Philippines. In particular, the north of the Philippines from Leyte to the Batanes Islands is the most strongly affected by the typhoons. Each year around twenty typhoons pass through these waters, with half of them making landfall. Flood damage is not limited to typhoons but also often occurs due to frontal torrential rain in the rainy season (June to



Source: Study Encouraging Disaster Prevention Field Programs in the Philippines Final Report (P11)

Figure 4 Frequency of Typhoons

November). In Figure 4 typhoon frequency is shown for each region. We can see from this how the area from the Visayas to Luzon Island excluding Mindanao Island is prone to typhoons.

3) El Nino and La Nina

Like the El Nino phenomenon, the La Nina phenomenon has various effects on weather temperature and rainfall. When El Nino occurs in winter, there is a tendency for higher temperatures and rainfall in the Philippines to Indochina Peninsula area. When La Nina occurs in winter the tendency is for higher rainfall. The Philippines government has made its agricultural development program one of its key policies for achieving economic development and independence, and is making an effort to achieve self sufficiency with staple food crops such as rice and corn. However, the difficulties of expanding food production due to the country's low land productivity and natural disasters, such as droughts and floods brought by El Nino mean that, as before, stable production of staple foods is a vital issue.

Table 3 Storm Warning Signals

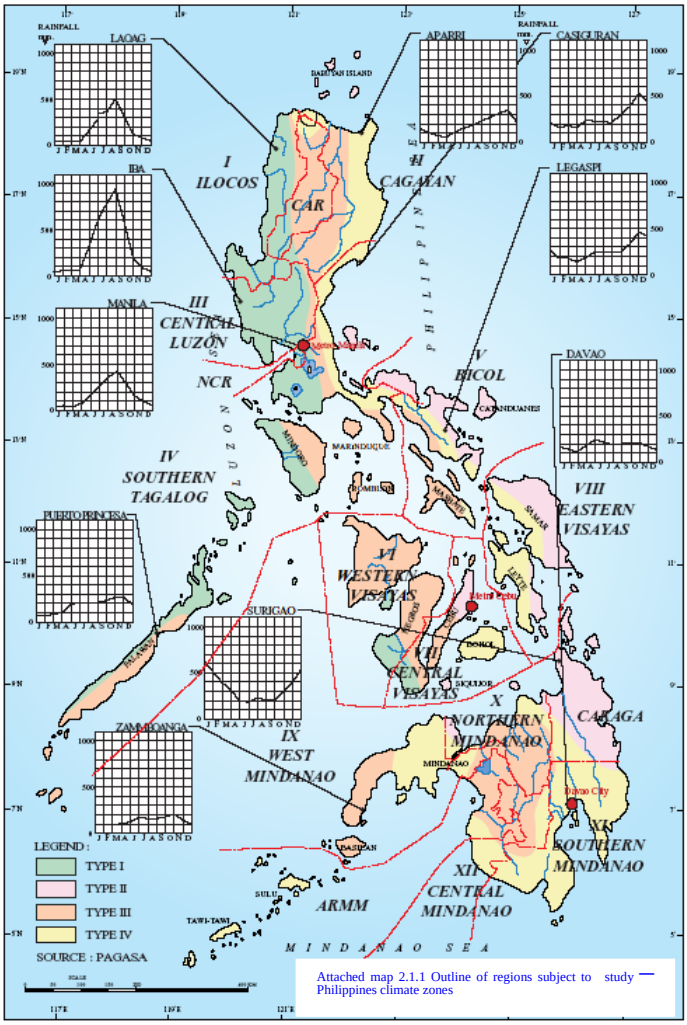
Meteorological Conditions	Wind Intensity	Countermeasures
Signal Number 1 (Areas affected by tropical low pressure systems)		
When wind speeds of 30 to 60 km/h or ongoing rain are predicted within the next 36 hours. (When tropical low pressure systems develop and are extremely close the warning will be given at an early stage) Note: Wind speed is kilometers per hour	Branches on smaller trees will break.	If the force increases and it comes closer then the warning level will be raised.
	Banana trees sometimes lean or fall over.	Coastal waves will gradually become higher.
	Roofs made of light materials like nipa may fly off.	Listening to the Meteorological Office's weather report every six hours will be advised. As long as there are no floods, business can continue as normal.
	If the signal is not given the damage will be small or insignificant.	Damage countermeasures will be prepared in accordance with the alarm status.
	However, at harvest time for rice etc there is the possibility of quite bad damage.	
Signal Number 2 (Areas affected by tropical low pressure systems)		
When wind speeds of 60 to 100 km/h are predicted within the next 24 hours.	Coconut trees may lean or fall over.	The sailing of small boats will become dangerous.
	Some trees may be uprooted.	Special attention must be paid to force, speed, the direction of advance etc.
	Many banana trees will fall.	People using boats and planes must act carefully to avoid unnecessary risks.
	Rice plants and corn will be affected.	Children should not be allowed outside.
	A great many roofs made of light materials like nipa will fly off.	Secure the safety of property before the warning level is raised.
	Decrepit or tin roofs may also fly off.	Disaster reaction institutions should be on standby.
	Light or medium damage will be sustained.	
Signal Number 3 (Areas affected by tropical low pressure systems)		
When wind speeds of 100 to 185 km/h are predicted within the next 18 hours.	Many coconut trees will snap.	Areas affected will be in a state of danger.
	Almost all banana trees will fall over.	All ships will be in danger if sailing.
	Rice plants and corn will suffer bad damage.	Use of ships or planes will involve extremely high dangers.
	Houses made of light materials like nipa will have their roofs fly off and/or collapse. Buildings of up to medium strength will sustain bad damage.	Evacuation to strong buildings and evacuation from low-lying, coastal or areas close to river banks will be advised.
	Large scale blackouts and loss of communications will occur.	Usually attention must be paid to the passage of the eye of the typhoon following the blowing of strong northerly winds.
	Usually, agricultural businesses in particular will suffer heavy damage.	When in the eye of the typhoon strong southerly winds accompanied by the worst of the storm will rage for one to two hours, hence no one is to leave the emergency shelter.
		All schools will be closed and all children will be advised to take cover in strong buildings.
		Disaster reaction institutions will be on emergency status.
Signal Number 4 (Areas affected by strong typhoons)		
When wind speeds of 185 km/h or more are predicted within the next 12 hours.	Coconut farms will suffer wide-scale damage.	A situation of destruction may arise.
	Many large trees will be uprooted.	All travel and outside activities will be curtailed.
	Rice plants and corn will suffer severe damage.	Evacuation at this stage is too late, evacuation must be made at an earlier stage.
	Many residential areas and buildings will suffer bad damage.	As in Signal 3 attention must be paid to the passage of the eye of the typhoon.
	Power supply and communications services will be in chaos.	Reaction institutions such as the Disaster Coordinating Council must be on emergency status or ready to act immediately to a catastrophe.
	Extremely severe damage will be suffered.	

Source: Inside News of the Philippines (P15), Philippine Atmospheric, Geophysical, and Astronomical

(2) Hydrological / Geographical Features (P6, P9, P11, P13)

1) Precipitation

Mean annual rainfall is 2,030mm, being higher on the coastline than on valleys and regions enclosed by mountains. In the western region the wet season is the summer monsoon season lasting from May to November, the dry season being from December to April. In contrast the eastern region has higher rainfall from December to April, though it rains throughout the year and there is no clear dry season. Annual rainfall for the country's ten main cities is shown in the figure to the right.



Source: Study Encouraging Disaster Prevention Field Programs in the Philippines Final Report Main Report (P11)

Fig. 5 Annual Rainfall of the Ten Main Cities

Tropical low pressure systems or typhoons are concentrated from July to October, with around twenty typhoons coming to the Philippines annually. Typhoon damage is concentrated in the east of Luzon Island and the Samar region, with frequent rainstorms or floods occurring.

Climatically speaking, this area comes under a tropical climate with high temperatures and humidity, but in comparison to the representative south with its heavy rain all year round, the variation in rainfall (low from December to April, high from May to November) caused by monsoons and typhoons occurring in the surrounding seas is quite remarkable.

2) Principal River Basin Features

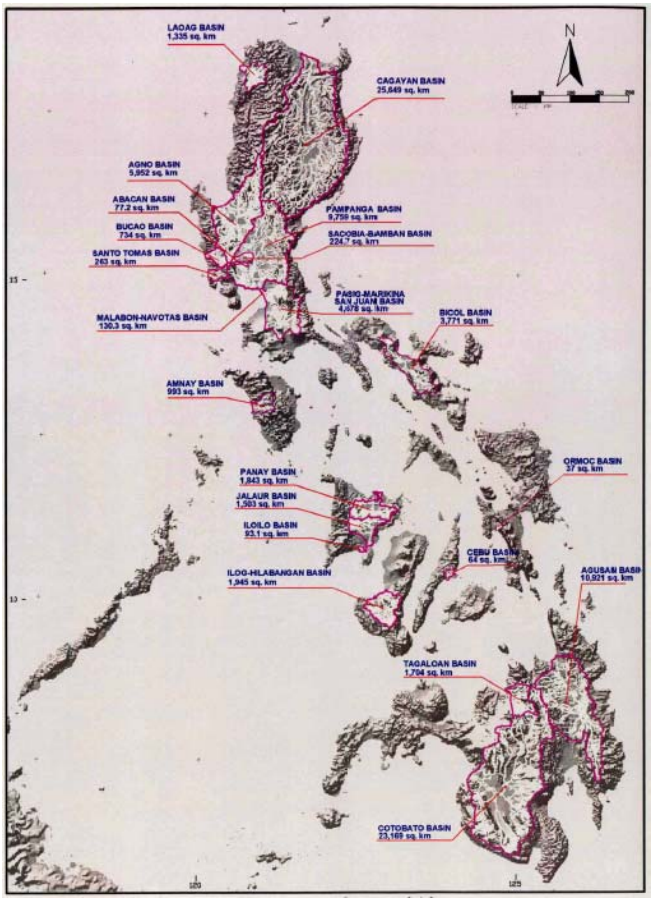
While in the Philippines there are no categories for level one and two rivers as in Japan,

in 1976 the National Water Resources Committee (NWRC, now the NWRB) divided the country into twelve water resource zones. According to the 'Principal River Basins of the Philippines', published in October 1976, there were 421 river basins in the country over 40 km^2. These 421 water systems were designated as Principal River Basins, and those eighteen water systems with basins areas over 1,400 km^2 are called Major River Basins. As can be seen in the following table, the total basin area of all the Major River Basins is 108,678 km^2, 1/3 of the total area of the country.

Table 4 Outline of Eighteen Principal River Basins of the Philippines

No.	River name	River basin area (km^2)	River length (km)	Water resources region	Water resources region
1	Cagayan	25,649	505	(II)	Cagayan Valley
2	Mindanao	23,169	373	(XI)	South Mindanao
3	Agusan	10,921	350	(X)	North Mindanao
4	Pampanga	9,759	260	(III)	Central Luzon
5	Agno	5,952	206	(III)	Central Luzon
6	Abra	5,125	178	(I)	Ilocos
7	Pasig-Marikina	4,678	78	(IV)	South Tagalog
8	Bicol	3,771	136	(V)	Bicol
9	Abulog	3,372	175	(II)	Cagayan Valley
10	Tagum-Libuganon	3,064	89	(XI)	South Mindanao
11	Ilog-Hilabangan	1,945	124	(VI)	West Visayas
12	Panay	1,843	132	(VI)	West Visayas
13	Tagoloan	1,704	106	(X)	North Mindanao
14	Agus	1,645	36	(XI)	South Mindanao
15	Davao	1,623	150	(XII)	Central Mindanao
16	Cagayan de Oro	1,521	90	(X)	North Mindanao
17	Jalaur	1,503	123	(XI)	West Visayas
18	Buayan-Malungun	1,434	60	(XII)	South Mindanao
	Total	108,678			

Source: "Principal River Basins of the Philippines" National Water Resources Board, October 1976 (P12)



Source: Philippine Flood / Erosion Control Technology Enhancement Project Study to Improve Mid-sized River Works Systems, Main Report (P9)

Figure 6 Eighteen Principal River Basins of the Philippines

The Pasig-Marikina river basin facing onto the China Sea and the Agno and Pampanga river basins belong to climate zone 1, with dry and wet seasons clearly separated. In 1911 Baguio City, located in the Agno river basin, recorded the highest yearly rainfall up to that time of 9,038 mm. Conversely the Cagayan river basin belongs to climate zone 3, with no clear wet season, and its rainfall is low compared to the previous three basins. In contrast to this, the Bicol river basin located on the Pacific coast has no clear dry season and a high mean annual rainfall of 2,300mm, with monthly rainfall of 300mm or more from October to December.

Of the five river basins above, all except the Cagayan river basin are in the area of frequent typhoons and hence are liable to flood from October to November. The Cagayan river basin is not affected by typhoons as frequently as the others, but when typhoons pass through northwestern Luzon floods causing great damage occur.

(3) Meteorological / Hydrological Observation Networks (P9)

Organizations involved in observation and collection of meteorological / hydrological data are as follows:

- Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)
- Bureau of Research and Standards (BRS)
- National Irrigation Administration (NIA)
- National Power Corporation (NPC)

Observation of rainfall and the river flow rate was carried out intermittently and lackadaisically by the Department of Science and Technology (PAGASA-DOST) and the Department of Public Works and Highways (BRS-DPWH), but in recent years (up to 2000) observation was stopped due to budget and personnel cutbacks at the NIA and NPC. The current status of observation by each organization is summarized in the following table.

Table 5 Current Status of Meteorological / Hydrological Observation

Organization	Operational	Abandoned	Total	Notes
A. Rainfall				
Meteorological Office	181	165	346	According to 'Observation Posts Outline' Met. Office 2004
Joint	56	9	68	
Met. / coop. / Rain	96	147	243	2 meteorological observation posts are scrapped
Farmland Climate	26	9	35	2 farmland meteorological observation posts

				are scrapped
NIA	0	157	157	According to NIA Project Development Office
NWRB	0	69	69	Data transferred to NRWB
B. Flow rate				
DPWH Survey Standards Office	272	479	751	From published records
NIA	1	178	179	According to NIA Project Development Office

Source: Philippine Flood / Erosion Control Technology Enhancement Project Study to Improve Mid-sized River Works Systems Main Report (P9)

PAGASA has set up 346 hydro-meteorological observation stations, but 165 of these have been abandoned. Of BRS's 751 river flow observation stations, 272 are operational while the remaining 479 have been abandoned. The NIA set up 157 rainfall observation stations which have all been abandoned. Also, of 179 river flow observation stations, only one is currently in operation. The NPC's rainfall observation stations were all abandoned in 1997.

The Status of Observation

Sufficient rain fall and river flow rate observation data is essential for the hydrological analysis required when planning flood control projects. The absolute minimum necessary numbers of rainfall and river flow observation stations are given in the World Meteorological Organization (WMO)'s guide to meteorology and hydrology. In an area like the Philippines with frequent localized rainfall, the following standards are given by topography.

However, the average figures for rainfall / river flow observation stations currently in operation on the Philippines' major river basins are 2,470 km^2 and 913 km^2 for rainfall and river flow respectively per station, which must be considered as extremely low figures.

Table

Terrain	Rainfall Observation Station Density	Flow Rate Observation Stations
Flat terrain	1 per 400km^2	1 per 500km^2
Hilly / Mountainous	1 per 200km^2	1 per 200km^2
Island over 1,000km^2	1 per 100km^2	

Source: Philippine Flood / Erosion Control Technology Enhancement Project Study to Improve Mid-sized River Works Systems, Main Report (P9)

Meteorological / Hydrological Database

PAGASA's rainfall data is organized into reference charts giving rainfall for the day, month and year and has been put into a database. Data has been accumulated at almost all observation stations from 1951 to the present. For BRS, several observation posts have still not finished organizing their past recorded data. River flow data has been recorded since 1945 onwards but with many gaps, 112 stations have data for over thirty years. The NIA's observation data has been made into a reference chart, and some of this has been entered into the National Water Information Network (NWIN)'s system. Rainfall data from 1972 to 1997 and river flow data from 1974 to 2004 can be viewed. The NPC stopped observation in 1997 and all its data has been transferred to the NWRB.

Lacking in particular is hydrological data on floods, including rainfall (intensity, period, range and movement routes), river levels (flood wave profiles and highest water level) and sediment transport (suspended sediment, bed load); almost no observation has been made on such data.

Problems in Data Collection

Problems that can be cited in current hydrological data collection arrangements are, among others, 1) no information on accurate observation facilities, 2) no arrangements made with other organizations, and 3) regional autonomous bodies are not participating in key data observation.

3. Social Structure

(1) History (P12)

A simplified history of the Philippines since independence is given in the following year chart.

1943	Philippine Republic declared, President Laurel assumes power
1945	The Second World War ends (The Japanese Army surrenders, under US control)
1946	Officially independent of US (President Ramos in power)
1956	Signing of Japan-Philippines Reparations Agreement, relations resumed between the two countries
1965	Senator Marcos wins the elections and becomes President
1970	The Moro National Liberation Front (MNLF) of Islamic rebels is formed, war for the independence of Mindanao intensifies
1972	President Marcos declares martial law (the constitution is suspended so the limit on the term of president is frozen)
1973	President Marcos proclaims a new constitution
1981	President Marcos lifts martial law, takes third term as President by election
1983	Former Senator Benigno Aquino returns from exile in the USA, is assassinated after arriving at Manila airport
1986	Snap presidential elections, congress declares Marcos victorious, on February 25 Corazon Aquino is declared President, citizens gather near an armed forces base for the “People Power Revolution”, on February 26 President Marcos and family leave the country, Aquino takes power and issues an interim constitution
1989	Failed coup d’etat by armed forces rightists, President Aquino declares a state of emergency. Marcos dies in Hawaii
1992	Former Defense Minister Fidel Ramos wins May Presidential elections, legalizes political activities involved with communism
1995	Landslide victory by government party in the Senate and House of Representatives
1996	APEC conference held in Manila, in September signing of peace accord with the MNLF, elections held for governor of the autonomous Muslim region
1998	Presidential election in May, Joseph Estrada becomes thirteenth President
2001	Estrada resigns as President in January, Vice President Gloria Macapagal Arroyo becomes President

2004 Gloria Macapagal Arroyo is elected as President

(2) Political System (P12, P16)

Political System

The Philippines experienced political and economic chaos from the 1986 dissolution of Marcos's political power by "People Power" into the early 1990s, but since then relatively stable democratic politics have been achieved. In particular, under the former Ramos administration national reconciliation through peace negotiations with anti-government forces (military rightists, communist forces and the southern Muslim forces) was strongly promoted, and the stable administration most desired by the Philippines was achieved.

In 1998 the Vice President and former actor Estrada left the other candidates far behind to become President. Expectations that he would be a President for the common people were high, but he appointed cronies from the administration of Marcos, illegally amassed money and repeatedly made bribes, leading in the second half of 2000 to the gambling profits payoff scandal being found and an impeachment trial begun. The citizenry rose in reaction to attempts to engineer his innocence, and People Power 2 came into being. The government party in the Estrada administration succeeded through its control of congress in securing the administrative infrastructure, but due to the suspicion of a scandal Estrada's political support plummeted and the President could not escape being removed from office.

In the 1998 elections Gloria Macapagal Arroyo became Vice-President with an overwhelming level of support. As criticism of Estrada grew, she took a clear adversarial stand with the support of Cardinal Sin, head of the Catholic Church in the Philippines, as well as former Presidents Aquino and Ramos, and became President through People Power 2 after the dissolution of Estrada's administration. After taking power she has gathered wide-ranging support from the army, police and business world, holding her position without difficulty.

The primary goal of the Arroyo administration's policy is the elimination of poverty. Her administration has announced the beginning of major anti-poverty programs involving government organizations and NGOs and is planning measures aimed at the poor. The administration has set itself to oust the corruption that caused the fall of the previous President, and cabinet members and private secretaries have shown visible achievements within a year, and in its preeminent field of economics various economic reform bills have been passed with the aim of rebuilding the economy. Arroyo has also promoted the modernization of the Philippine National Police, announcing funding of 1 billion pesos. There are 110,000 police officers in the Philippines, and their low salary has meant a drop in their quality, many being no better than criminals. The goal is help eliminate such police officers, win back the public's trust, improve public safety and prevent crime.

In May 2005, allegations of misconduct in the 2004 presidential election came to light, and pressure on Arroyo to resign grew. In February 2006 a coup d'etat plan was discovered, and the President declared a state of emergency, hoping to take control of the situation.

Political Organizations

The Philippines is a constitutional republic with the President as head of state. The legislative, administrative and judicial powers of the government are independent. The legislature is a bicameral congress with the Senate and Houses of Representatives, with the power to impeach the President and revoke martial law, and to approve government officials and bureaucrats. The judicial branch of government is headed by the Supreme Court with various other lower courts, the Supreme Court having the power of judicial review. It also decides the official Vice President. The head of government is the directly elected President, having a term of six years with no reelection allowed. The President has the power to pass or veto bills and the power to appoint the Supreme Court. Article 7 of the Constitution gives administrative authority to the President. The President is chosen through a direct election. The President appoints and presides over the cabinet with the agreement of the Senate and House of Representatives, is the head of the armed forces, has the power to declare martial law, conclude treaties, appoint judges and so on.

Independent institutions include the Commission on Elections, the Commission on Public Servants and the Commission of Accounting Auditing as the Constitutional Regulating Commission. The heads and members of each commission are appointed by the President following nomination by the commission. In addition the Ombudsman acts as an observer of the administration to investigate and prosecute illegal acts by public servants, the Offices of the Ombudsman acting as an independent institution.

The House of Representatives consists of up to 250 representatives, 200 from single-seat constituencies and 50 from proportional representation (party list system). The party list system stipulates that half of the representatives on the list must be chosen from farmers, workers, minorities, citizen's groups and so on. The term is for three years with reelection possible for up to three terms.

The Senate is selected from a single nation-wide constituency, its 24 members having terms of six years with reelection possible twice.

Composition of the Government (Cabinet)

The government consists of the following ministries under the President and Vice President.

Office of the President
Department of Foreign Affairs
Department of Finance

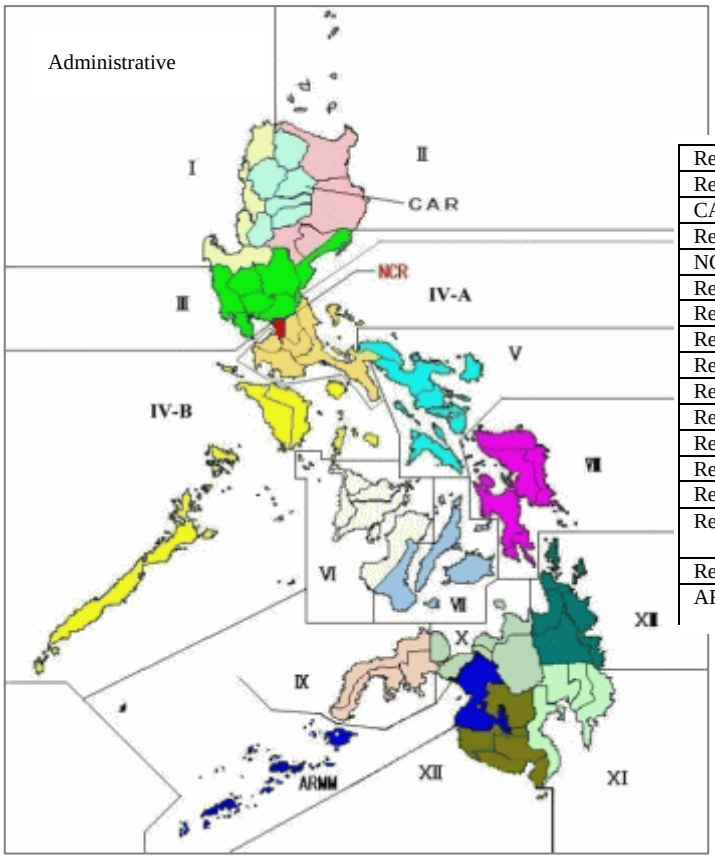
Department of Budget and Management
National Economic and Development Authority
Department of Agrarian Reform
Department of Agriculture
Department of Environment and Natural Resources
Department of Tourism
Department of Trade and Industry
Department of Public Works and Highways
Department of Transportation and Communications
Department of Education, Culture and Sports
Department of Labor and Employment
Department of Health
Department of Social Welfare and Development
Department of National Defense
Department of Science and Technology
Department of Justice
Department of Interior and Local Government

(3) Regional Organizations / Local Governments (P12, P16, P49)

The Structure of Regional Local Governments

The is spread regionally, being made up of legally prescribed and hierarchically arranged Local Governments, with legislative, administrative and judicial structures and tax collecting abilities.

The regional hierarchy has the barangay as its smallest unit, followed by the city, municipality, and finally province. Cities are divided into those independent of their provinces and those not.



Region I	Ilocos
Region II	Cagayan
CAR	Cordillera Administrative Region
Region III	Central Luzon
NCR	National Capital Region
Region IV-A	CALABARZON
Region IV-B	MIMARO
Region V	Bicol
Region VI	Western Visayas
Region VII	Central Visayas
Region VIII	Eastern Visayas
Region IX	Zamboanga Peninsula
Region X	Northern Mindanao
Region XI	Davao
Region XII	SOCCSKSARGEN(Central Mindanao)
Region XIII	Caraga
ARMM	Autonomous Region in Muslim Mindanao

Source: Philippines Inside News (P16)

Fig 7 Map of Philippines Administrative Zones

The smallest national administrative unit is the barangay. There are 40,149 barangays with governmental functions, the selection method of their leaders and members being prescribed by the national law. The barangay is governed by a captain elected from the residents' votes, with a term of office for six years. The barangay captain is the head of the barangay council of six members elected on similar terms, the council deciding on lawmaking, budget approval and the administration of the barangay.

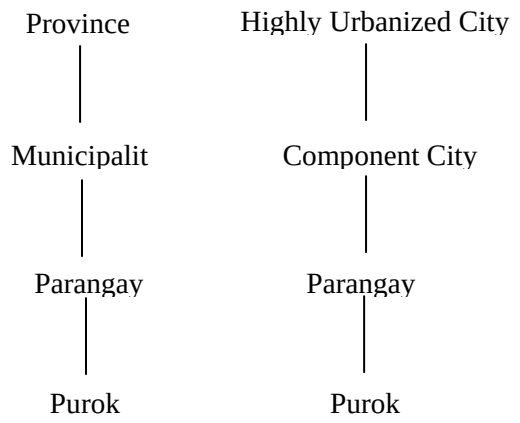
A barangay court is set up from several key figures in the area with the barangay captain as its head, handling petty crime or rule-breaking in the barangay. In addition the practical institutions of the secretary and treasurer are also established. At the barangay office these administrative institutions handle electoral rolls to supervise the residents as well as taxing the residents and issuing various types of certification.

The Japanese system of residential registration is not used in the Philippines. Prior to an election residents are registered on the electoral rolls at the barangay office in a set period of time, and this registration becomes the basic certification for the residents.

Municipalities and cities are anomalous to Japanese municipalities at the regional local government level. There are 1,506 municipalities and 61 cities in the country. Cities are well-developed places with concentrated populations, whereas municipalities are on a smaller scale. They are divided into several ranks based on a financial scale. Even the first class municipalities have a yearly budget of fewer than 100,000 pesos, the larger scale cities start from the fifth class from 100,000 pesos to 500,000 pesos, to the first class cities of over 3 million pesos. The mayors and vice mayors of each local government have terms of three years and can be reelected up to three times, being chosen in local citizen elections. Provinces are administrative units anomalous to Japanese prefectures. However, Metro Manila in the national capital region has a somewhat different system to those of the ordinary provinces. There are currently 73 provinces in the Philippines, divided into five ranks from those with yearly budgets of under 500,000 pesos to those of over 3 million pesos.

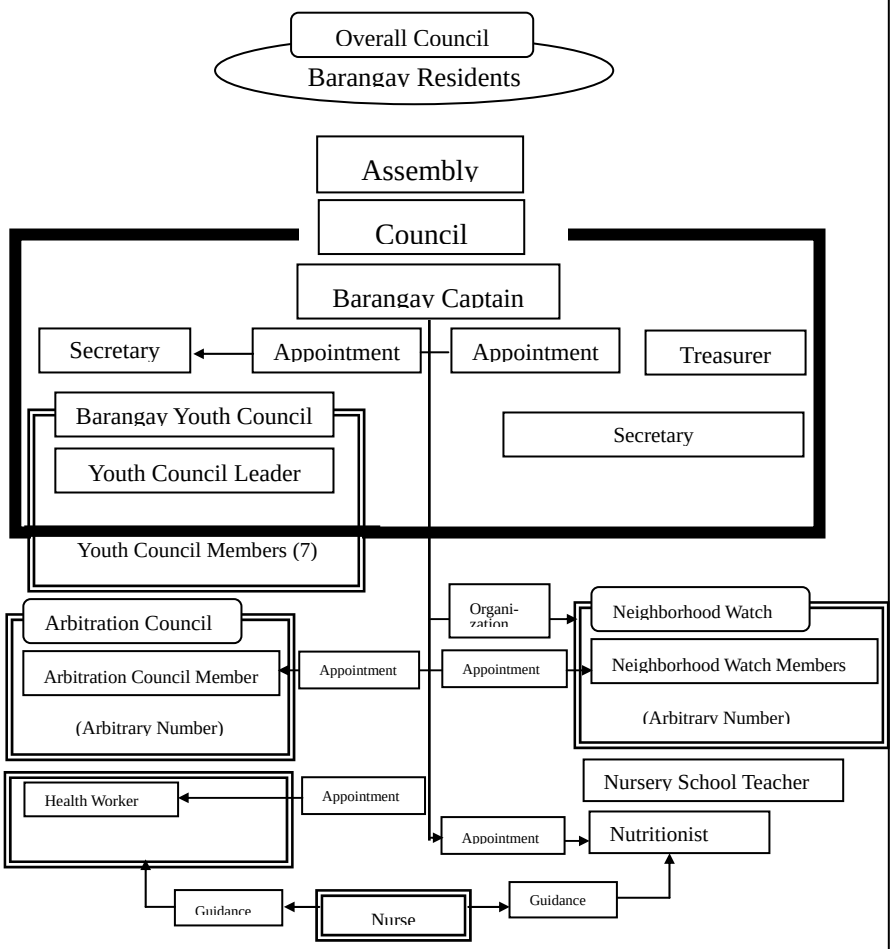
The governors and deputy governors have three year terms allowing election up to three times, and are chosen in local citizen elections, and the provincial officials are decided by the governor and Provincial Board or appointed by the President.

Currently the barangays are ranked at the bottom of the Philippines' public administration (see figure below). Barangays have the following characteristics. 1) They have functions bestriding the areas of administration, lawmaking and justice. 2) They consist of the barangay council (Sangguniang Barangay), arbitration council (Lupong Tagapamayapa), neighborhood watch group (Barangay Tanod), youth council (Sangguniang Kabataan), and the Barangay Assembly, together with Barangay Health Worker / BHW and the Barangay Nutrition Scholar/BNS. The officials do not have only a single function but rather complementary functions. 3) The barangay captain's authority is very powerful. 4) They are voluntary governments.



Source: Philippines Resident Autonomous Organizations / Barangay Functions and Regional Society (P49)

Fig 8 Philippines Local Government Units



Source: Philippines Residents Autonomous Organization / Barangay Functions and Regional

Fig 9 Parangay Organization

(4) Economic Situation (P11, P12, P16)

The Economy

Since the Asian Economic Crisis ended a moderate trend towards recovery can be seen. GDP growth stood at 5.1% in 2005, a slowing down compared to the consumer spending inspired 6.1% of 2004, but still above initial expectations. To maintain ongoing growth in the future, the issue will be the restoration of confidence in the Philippines economy by reforming economic structures, dissolving the financial deficit and the disposing of bad debts.

Over the last ten years, the Philippines economy has shown comparatively firm economic growth. The rate of increase of GDP was 4.5% in 2001, 6.4% in 2003 and 5.1% in 2004. The unemployment rate is 11.4%, inflation was 3.1% in 2003 and 4.1% in the first quarter of 2004. Looking at individual income for 2000, the 300,000 peso figure for the capital area around Manila is reduced to only a third as much for the Visayas and Mindanao. Also, the unemployment rate has shown a tendency to increase nationwide since the 1990s. The Manila capital area has the maximum rate of 17%, the figures for other areas ranging from 6% to 12%.

The Ramos administration actively promoted reforms such as relaxed regulations, privatization, restrictions on monopolies, liberalization of trade and investment, and reform of the tax system, working for the growth of an export led system through the introduction of foreign currency. Through these measures, the Philippines in 995 reached the goal of the Intermediate Development Plan (1993 to 1998) of GNP of US$1,000 per capita.

In July 1997 the Asian Economic Crisis spread to the Philippines, resulting in a huge slide for the peso, worsening financial balance of payments, and exposed sluggish growth in direct investment. As the Philippines had switched to active financial measures, it also led to a further worsening of the financial balance of payments. In addition, the droughts accompanying El Nino caused widespread damage to agricultural production (-6.6% GDP growth in the agricultural sector in 1998), and inflation also rose. The economic climate rapidly worsened as it entered 1998, actual GDP for 1998 being -0.5% (it had been +5.2% in 1997), the lowest GDP since 1991.

Despite this, the shock of the Economic Crisis was not as severe as it was for neighboring countries such as Indonesia. The background factors to this were: (1) Economic development was slow compared to other ASEAN countries, the majority of overseas borrowing was long term borrowing by the public sector, with a low ratio of short term borrowing. (2) During the Aquino and Ramos administrations, circumspect financial policies and financial reform were carried out under the guidance of the IMF and the World Bank. (3) There was a high export ratio to Europe and the US compared to other ASEAN countries. (4) The remittances of Filipinos working overseas became a vital source of foreign currency.

President Estrada followed the previous policy of liberalization, announcing repeatedly that he was putting stress upon poverty alleviation, agricultural development and correcting disparities.

The Philippines government GDP in 1999 was +3.2%, brought about thanks to the recovery of agricultural production and steady expansion of exports. However, the problematic health of the financial sector visible in its bad debts and the problem of cash flow for businesses were causes for alarm.

Recent Economic Trends

The financial deficit continues to be a source of worry in the Arroyo administration. According to Finance Ministry reports, the initial 2001 target of a financial deficit of 62.5 billion pesos had doubled to 136.11 billion pesos due to reduced tax revenues and the privatization of public assets. In addition, the accounts payable of the former Estrada administration amounted to 70 billion pesos, and there were prospects for an increase of the actual financial deficit to 190 billion pesos.

The financial balance of payments had a credit balance prior to the inauguration of the Estrada administration, hence poverty programs should have been easily implemented. However, the new Arroyo administration is forced to continue the poverty programs under a financial deficit, great difficulties can be expected on this point.

After the dissolution of the Marcos administration and the coming to power of President Aquino in 1986, a difficult start was faced with the great debts and financial instability of the previous administration and the economic chaos, but the confidence of overseas countries was successfully gained, investment that had fled the country returned again, and the economic situation had begun a favorable upswing. But due to various factors such as an attempted coup d'etat in 1990 and its after effects, the natural disasters of the Luzon Island earthquake and the eruption of Mount Pinatubo and the sudden rise in oil prices accompanying the Gulf War, as well as the lack of electric power brought about by the failure to construct power stations because of local opposition and the neglected maintenance of the power stations, the rate of economic growth fell in 1991, inflation increased from 14.2% (1990) to 18.7% (1991), forcing the Philippines to ask the IMF for aid.

President Ramos, taking up his administration under extremely severe economic circumstances, followed the liberalization route of the previous administration, engaged in reconstructing the economy and announced a mid-term development plan aiming at becoming one of the Asian NIEs (newly industrializing economies). Specific policies involved flexible financial policies such as setting interest rates taking market mechanisms into account and building financial systems based on the principle of competition, setting up and reforming a new central bank and allowing the entry of foreign banks. The result was an upswing in the

economic growth rate, although it still remained low. Thanks to a greater engagement with economic issues than any other administration heretofore, real results began to manifest themselves visibly with +2% in 1993 and +5% in 1994. The reasons for this were the development of electrical power sources to eliminate the problem of lack of power, leading to a stable political situation which improved the environment for foreign economic investment, as well as firm domestic consumer spending supported by the remittances of Filipinos working overseas.

However, due to the impact of the Asian Currency Crisis, which overlapped with a presidential election, and the stagnation of agriculture, in 1998 once again GNP and GDP recorded negative growth. In 1999 both GNP and GDP recovered around 3%. The Estrada administration followed the economic policies of the Ramos administration, in principle not deviating from the path of economic liberalization and the relaxing of regulations, though the improvement in productivity based on agricultural development may be cited as part of the characteristic policies of this administration to emphasize agriculture and poverty alleviation. At the same time, sound financial measures giving consideration to low interest, restoration of the banking system, the increase of foreign currency exchange reserves and international cooperation for economic stability were advocated as ways to deal with the currency crisis. However, the reduction of government financial expenditure and falling tax revenues are continuing, and with the privatization of government assets, enhancement of tax revenue has become a problem.

Table 6 Economic Indicators for the Philippines

Economic Indicators	2001	2002	2003	2004	2005
Nominal GDP ($100s of millions)	714	771	793	864	(to March) 221
Nominal GNP ($100s of millions)	757	820	852	926	1,052
GNP per capita ($)	978	1,034	1,050	1,100	1,232
Real GDP (%)	3.2	4.6	4.5	6.1	5.1
Real GNP (%)	3.4	5.2	5.6	6.1	(to March) 4.7
Consumer price index increase (mean %)	6.0	3.1	3.1	6.0	7.6
Unemployment ratio (%) (annual mean)	11.1	11.4	11.4	11.8	(to April) 8.3
Balance of trade ($100s of millions)	-9.1	-2.2	-12.8	-7.0	(to April) -3.3
Balance of current accounts ($100s of millions)	3.1	42.0	33.5	20.8	
Overall balance of payments ($100s of millions)	-1.9	6.6	1.1	-2.82	(to June) 19.81

Source: Philippines Government Central Bank, National Institute of Statistics, July 2005 (P16)

(5) Industrial Situation (P12)

Industrial Structures and Principle Industries

For economic structures in the Philippines, a breakdown of industries in terms of GDP gives 20% for the agriculture, forestry and fisheries industries, 35% for manufacturing and construction, and 45% for the service industry including commerce, transportation and communications, with no great change since 1993. Considering each industry in terms of numbers of workers, agriculture, forestry and fisheries take up 40% of overall employment, manufacturing 10%, commerce and so on 50%. The government has promoted an increase of the fraction absorbed in employment in the manufacturing sector through industrialization, but the 1995 rate of 10.2% slipped to 9.7% in 1998, showing no effect.

From the perspective of both GDP and number of workers involved, the agricultural sector is an important one in the Philippines. Hence, issues for the future will be progress with the diversification of industrial and employment structures, improvement of agricultural productivity, improvement of price and quality competitiveness looking toward exporting, and increasing the price competitiveness of non-export items versus imported agricultural products.

The 2005 Philippines unemployment rate was 11.4%. From 2000 to 2005 it has been over 11%, at 11.2%, 11.1%, 11.4%, 11.8% and 11.4%. The figure for 1998 was 10.0% and 1999 9.8%.

Social Conditions

The Existence of Anti-government Forces

Anti-government forces have become weaker through the global retreat of communism and internal bickering, but they remain a block to law and order as before. Among the Muslim anti-government forces, in September 1996 a final peace agreement was signed with the MNLF, and support for the development of southwest Mindanao has come from Japan and other aid agencies. However, the movement of some former MNLF fighters is a latent cause of instability as before. Peace talks have begun with the MILF (Moro Islamic Liberation Front), second only to the MNLF in force, but military clashes are not necessarily over. Also the radical Islamic fundamentalist Abu Sayyaf Group (ASG) is continuing activities in the west of Mindanao Island.

The Problem of Illegal Squatters in the Capital Area

Inside and outside the capital area great numbers of squatters are living concentrated along the river. The Director of the Metropolitan Manila Development Authority, Benjamin Abalos, considers the moving of theses squatters a priority issue and has

ordered the moving of 81,073 families for local governments. He points out that their illegal disposal of garbage into the river could be a major cause of floods around the capital Manila area.

The Problem of Poverty

The percentage of people living in poverty by region in 2000 had great regional variation, the lowest being the Manila capital area at 11.4%, the highest being the Autonomous Region in Muslim Mindanao (ARMM) at 71.3%, with poverty being widespread across each region in Mindanao. On Luzon Island, Bicol stands out with 61.9%.

With a lack of rice thanks to El Nino, 450,000tons were imported from Thailand and Vietnam, the amount imported looking set to rise in the future. At the same time, with the world glut in vegetable oils, there is an excess in supply of coconut oil, affecting the copra farmers engaged in the production of coconut oil. President Arroyo has issued rice to 1,000 households of copra farmers confronted with poverty, and such support of farmers looks set to continue in the future.

According to the Social Weather Station, the poverty ratio has risen to 59% in the first quarter of 2001, and in particular up to 67% in the Visayas area where there are many copra farmers. The percentage of those in starvation is 16%, a record high. There are over 1 million copra farmers throughout the country, and if relief programs could do something to relieve their poverty, this would have a great impact on the poverty ratio overall.

There are over 200,000 homeless street children in the Philippines, described as a social time bomb that will be a major problem in the future. These street children have run away from problem families, and if left to themselves the chance of their becoming criminals are quite high. Half of them are in the Manila capital area, and from poverty almost all of them become beggars, child prostitutes, thieves or drug peddlers. The President is asking the private sector to provide economic assistance to give housing and education to these children.

According to the National Statistics Office, there are over 613,204 underage workers in Cebu Province alone, with 7,697 in Cebu City, and there are reckoned to be 3.5 million children aged 5 to 7 who are working to gain living expenses. In 1999 100,039 children dropped out of primary school, and another 40,308 dropped out of junior high school, the poverty problem having reached become a major social issues endangering children's lives and education.

14.6% (1990 – 2003) of the poorest class of the population earn less than $1 a day.

(6) Culture / Religion / Language (P12, P16)

English and Filipino (with Tagalog as the base) are the official languages. In the central southern area Visayan is the language generally used. Around 80 languages are thought to

be in use, with the main ones shown below. The reason for this multiplicity of languages is the successive waves of people arriving from the Asian mainland or Indonesia, hence the languages belong to the Indonesian (Austronesian) language family.

The 1973 Constitution of the Marcos administration prescribed the development of 'Filipino' as a national language, with the Tagalog-bases 'Pilipino' and English as official languages, but the 1987 Constitution after the February Revolution set 'Filipino' with the addition of English and other provincial languages as the national languages.
English still retains an important position as an official language.

Language Divisions	Speakers	%
Tagalog	20,044,000	29.3
Cebuano	14,486,000	21.2
Ilokano	6,369,000	9.3
Hiligaynon (Honggo)	6,237,000	9.1
Biko (Bikolano)	3,892,000	5.7
Waray-waray	2,610,000	3.8
Kapampangan	2,042,000	3.0
Boholano*	1,435,000	2.1
Other	11,315,000	16.5
Total	68,430,000	1000.0

Source: NSo, 1995 Census of Population (P16)

Education includes elementary school education for six years, four years of secondary education at high school, and four more years of tertiary education at university. Elementary school is compulsory education with an attendance rate of 94%. Attendance at secondary level is 80% and for tertiary 27% (1994). Literacy was 94% in 1994 (for those over ten years old).

The majority of modern-day Filipinos are the descendants of Malays who emigrated there around the beginning of the Christian era. In addition to the primary Filipinos of Malay descent are those of Chinese or Spanish descent, or those of mixed blood, as well as various minorities.

In regards to religion, 82% of the population are Roman Catholic, next are Protestants (5.4%) and Muslims (4.6%). Buddhism is at 0.1% (NSO 1990). There are many Muslims in the west of Mindanao Island. The Catholic Church has a powerful voice, and large newly formed religious groups also have political influence.

The characteristic traditional social culture, thinking and values of the Philippines can be seen in the individualism shown in the word 'Kanya-kanya', the high value placed on psychological feelings of loyalty towards a person one is in debt to (Utan na loob), and the tendency towards arbitrary group dominance by socially prominent figures coming from blind

subservience towards superiors (Pakikisama). At the same time there are the traditional values of a spirit of mutual help (Balikatan and Bayanihan).

In the Philippines, the traditional custom called 'Bayanihan' of mutual assistance involving exchanges of labor during agricultural work remains strong in agricultural areas, and even in urban Manila there is a spirit of mutual help in times of difficulty, particularly amongst the poor. A direct translation of 'Utan na loob' is 'inner debt', this debt being one which can never be repaid, an absolute obligation to one's parents or patron. It shows an almost excessively strong feeling of loyalty towards those above you who helped bring you up. 'Pakikisama' is a value taken over from the original inhabitants, meaning subsuming yourself in the group's will or doing well by placing emphasis on the group. This is in opposition to the American ideas which emphasize the individual. Rightly or wrongly, Filipinos who prefer to act alone without cooperativeness are looked upon as discourteous and rude. Source: Homepage, ICAN Manila Blog, International House Osaka Foundation Oriental Heart

(7) Gender (P51)

In the Philippines, not only are literacy and school attendance ratios high for both men and women, there is a lack of gender disparity in these indicators. The percentage of women is higher for tertiary education. However, as can be seen from the gender disparities for wages and the gender bias in specialist fields in tertiary education, problems involving gender remain in existence. On the other hand in the Philippines the mainstreaming of gender is advocated in combining gender development with the country's development policies. Upholding policies for women advanced even on a global standard, these systems are becoming institutionalized.

In the Philippines working women have been treated with respect since long ago. Now it is no longer unusual for women to work in the political world, but the presence of women politicians still gives a feeling of awe.

For example, there have been two women presidents viewed as having a special existence. After the assassination after his return from exile of her husband Benigno C. Aquino, who had opposed the dictatorship of Ferdinand E. Marcos and was the leading candidate, Corazon C. Aquino in an instant took center stage in the political world. After acceding as President in 1986 she reorganized the 'National Committee on Philippines Women Roles' which had so far promoted programs reflecting women's traditional roles, formulating the 'Philippines Women's Development Program' to promote development in consideration of gender. Through this the gender perspective was incorporated into the planning and policy formulation process of all government organizations. The basic rationale of this 'Philippines Women's Development Program' has been inherited by the later 'Philippines Program for Gender-Compatible Development 1995-2025'.

The current President, Gloria Macapagal Arroyo, is the second women president after Aquino. President Arroyo is makes 'poverty programs' key policies, engaging in balanced economic development to create employment, modernize agriculture and correct economic disparities.

Even in regional governments women are leaving a record of achievements as leading officials. There are several cases where women become politicians to carry on the political authority of a husband or father, but the recent trend is for talented women to build reputations as able city mayors.
The activities of women in both the Senate and the House of Representatives are also striking.

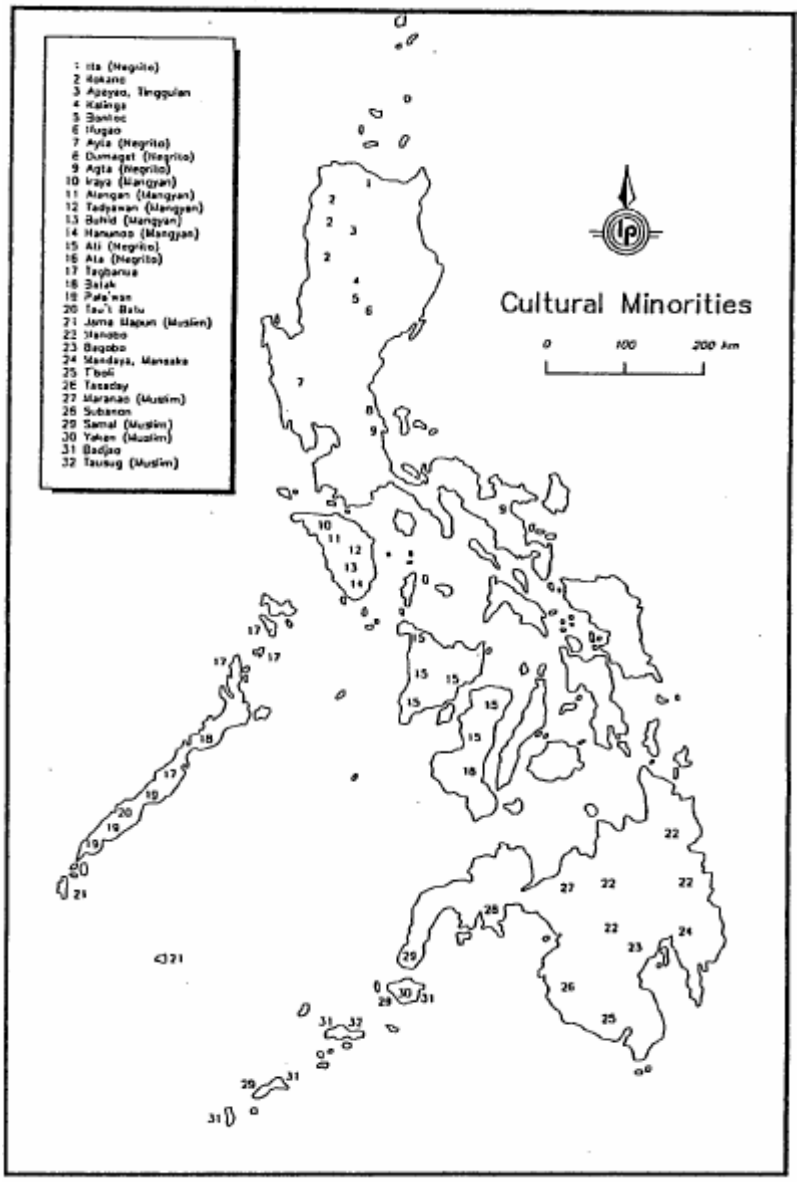
That women in the Philippines have made successes in politics, the most difficult sphere of al, is something no one can deny. Source: Inter-Parliamentary Union "Women in parliaments, 1945-1995" (P50)

(8) Minorities (P12)

There are 55 main different minorities including the Ifugao people and Muslims, making up less than 10% of the overall population. To the west of Mount Pinatubo live many Aeta. Prior to its eruption they lived on the mountain making a living from their traditional

agricultural system of slash-and-burn agriculture, but since the eruption they either live in the areas they were evacuated to with the support of the government and aid agencies, or make a scanty living in areas not covered by volcanic ash as charcoal burners. Most of the minorities are in poverty, with almost no chance of gaining work even if they go to the cities. Currently, it is extremely difficult for these people to leave this region and support themselves, the principal causes being the closure or reduction in size of areas disaster victims are transferred to.

At the same time the government, by reason of its financial difficulties, has transferred these projects from the central government to the local governments. As the local governments have budget constraints, it has become difficult to continue to supply disaster evacuees with the services they have received so far. How local governments can find funds for these evacuees when their tax revenues fail to rise is becoming a major problem.



Source: Lower Cagayan River Area Flood Countermeasure Project Study Advance Study Report (P13)

Fig 10 Distribution of Minorities in the Philippines

4. Outline of Water-Related Disasters in the Philippines

4.1. Outline of Typhoons, Floods and Landslides (P5, P9, P11)

The Philippines is one of the countries which suffers the most natural disasters in the world, the disasters taking diverse forms such as typhoons / storms, floods, volcanic eruptions, earthquakes, droughts, natural fires, slope disasters and tidal waves. Among the more remarkable disasters that occurred since 1980, with a great loss of life (5,101 dead, 3000 missing) was suffered with the November 1991 mudslides in Ormoc (on Leyte Island) caused by the Typhoon Thelma (Pagasa name: Uring), while the most financially damaging (12.2 billion pesos in damages) was the July 1990 central Luzon earthquake. In addition, the 1991 eruption of Mount Pinatubo was a great blow not only to local production but to the national economy, giving a minus figure for overall GDP in this year in comparison to the previous year.

Looking at casualty figures for each type of disaster (in Table 7), we can see that typhoons / storms stand out with 60-70% of the overall dead / injured / affected figures. If earthquakes, volcanic disasters and floods are added to typhoons / storms, 95% of the figures all the indicators are accounted for, showing that dramatic countermeasures and support in these fields are particularly vital amongst overall disaster prevention.

Table 7 Disaster Casualty Statistics (1905 – 2003)

Form of Disaster	Dead	Percentage	Injured	Percentage	Affected	Percentage
Typhoons / Storms	31,738	66%	25,154	62%	67,526,050	78%
Earthquakes	8,728	18%	13,054	32%	2,353,631	3%
Volcanic disasters	2,996	6%	1,188	3%	1,541,518	2%
Floods	2,652	6%	570	1%	10,432,585	12%
Slope disasters	1,453	3%	293	1%	295,968	0%
Infectious diseases	364	1%	0	0%	13,178	0%
Tidal waves	69	0%	0	0%	6,262	0%
Drought	8	0%	0	0%	4,185,050	5%
Fire	2	0%	0	0%	300	0%
Pest disasters	0	0%	0	0%	200	0%
Total	48,010	100%	40,259	100%	86,354,742	100%

Source: The OFDA/CRED International Disaster Data Base (P11)

The affected here are those considered to have been impacted upon by the disaster. It has been calculated principally based on the population of the various cities, municipalities and barangays. The final digits have little significance and the figure should be taken as a

guide.

(1) Flood and Landslide Disasters

1) Floods

Floods, (including flash flooding) are a phenomenon where rivers overflow due to torrential rain at the river basins.

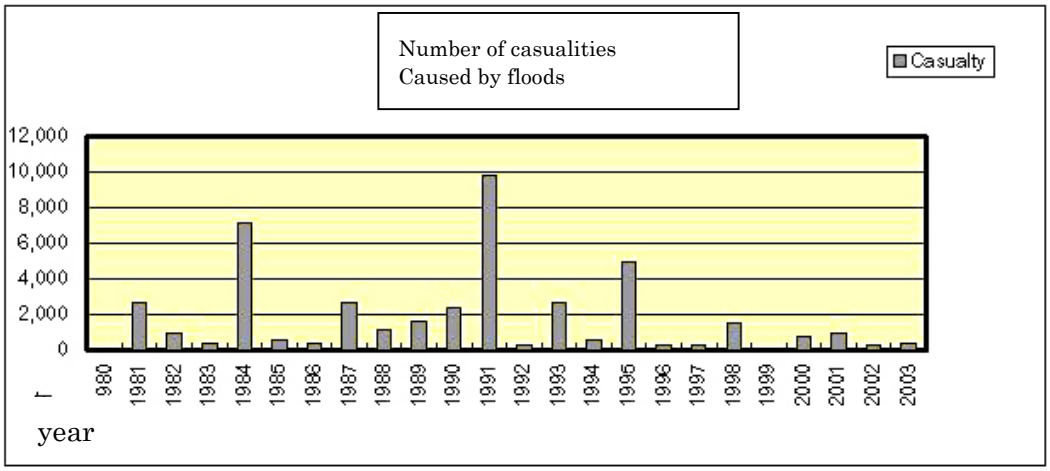
Floods and flash flooding occur due to typhoons, tropical cyclones and localized storms. Farms, villages, towns and cities along rivers on alluvial plains are inundated by floodwater. Another cause of floods in the Philippines involves a lack of sufficient drainage systems in urban areas.

The Philippines experienced an annual average of 3.5 destructive typhoons in the period from 1990 to 2003 alone. The combined damages of these are over 96.57 billion pesos, almost all of this being from flood damage to ordinary property, public buildings and cereal crops. The mean average deaths of 632 people are also equivalent to 7.6 billion pesos. Flood damages are equivalent to 2% of the national budget and double the flood control budget of the DPWH. The following table shows flood damages over the last 24 years.

Table 8 Yearly Average Amount of Flood Damages (Recorded)

Year	Number of victims		Human losses			Number of Houses damaged		Damage amount (millions of pesos)*
	Households	Population	Dead	Missing	Injured	Totally destroyed	Partially destroyed	
1980	248,164	1,666,498	36	4	55	16,510	51,101	1,472
1981	250,325	1,472,417	484	264	1,922	44,994	159,251	1,273
1982	266,476	1,569,017	337	223	347	84,027	97,485	1,754
1983	140,604	747,155	126	168	28	29,892	85,072	523
1984	741,510	4,048,805	1,979	4,426	732	310,646	313,391	416
1985	318,106	1,643,142	211	300	17	8,204	211,151	3
1986	287,240	1,524,301	171	43	155	3,162	14,595	1,838
1987	464,162	2,591,914	1,020	213	1,455	180,550	344,416	8,763
1988	1,173,994	6,081,572	429	195	468	134,344	585,732	8,675
1989	501,682	2,582,822	382	89	1,088	56,473	184,584	4,494
1990	1,265,652	6,661,474	676	262	1,392	223,535	636,742	11,713
1991	150,894	759,335	5,201	4,278	357	15,458	83,664	74
1992	418,964	2,097,693	145	95	51	3,472	8,342	7,359
1993	1,523,250	8,202,118	814	214	1,637	166,004	456,004	25,038
1994	670,078	3,306,783	266	54	260	58,869	226,291	3,401
1995	1,710,619	8,567,666	1,255	669	3,027	294,654	720,502	57,781
1996	260,581	1,254,989	124	49	97	2,690	17,557	10,109
1997	777,997	3,954,175	199	28	66	13,225	53,980	4,842
1998	1,590,905	7,197,953	498	116	873	137,020	406,438	17,823
1999	270,424	1,281,194	56	3	25	144	687	1,555
2000	1,436,965	6,852,826	338	59	370	24,573	195,536	7,217
2001	756,938	3,629,295	431	134	418	14,899	54,422	6,924
2002	538,600	3,546,469	169	33	71	2,980	15,947	829
2003	702,223	3,362,991	139	28	182	12,306	51,579	4,567
Total	15,215,530	77,693,144	15,178	11,886	14,840	1,823,345	4,907,712	183,047

Source: Philippine Flood / Erosion Control Technology Enhancement Project Study to Improve Mid-sized River Works Systems Main Report (P9)



Source: Philippine Flood / Erosion Control Technology Enhancement Project Study to Improve Mid-sized River Works Systems Main Report (P9)

Fig 11 Flood Casualties Over Time

2) Landslides

In addition to the above are basins that cause problems through sediment movement accompanied by water in the form of landslides, mudslides and debris flow. These occur due to large amounts of rain caused by typhoons, tropical cyclones or localized torrential rain in rivers with large amounts of unstable deposits along river basins where sedimentation frequently occurs, often being accompanied by flash flooding.

Also, in the Philippines earth slides occur on slopes in mountainous and hilly areas. These occur because of weakening of the slope's resistance due to torrential rain and earthquakes.

The table below shows particularly remarkable flood landslide disasters since 1990 on.

Table 9 Particularly Remarkable Landslide Disasters

Date of Occurrence	Form of Disaster	Damage Outline
June 1991	Mudslide / debris flow, pyroclastic flow, breaking of the crater lake accompanying eruption of Mount Pinatubo	Three large-scale debris flows post eruption. 850 dead, 10.4 billion pesos total damages
November 2 – 5 1991	Large-scale mudslide at Ormoc River due to Typhoon Thelma (Uring)	Over 8,000 casualties. Afterwards erosion control dam, channel works and bridges were constructed with Japanese grant assistance.
2001	Mount Mayon area mudslides / debris flow	Damage accompanying Mount Mayon eruption
November 6 – 9 2001	Camiguin Island (Misamis Oriental River) mudslides	366 casualties (148 dead) from mudslides and flash flooding caused by Typhoon Lingling (Nanan)
December 16 – 18 2003	Slope failure, mudslides / debris flow at San Francisco, Liloan (Southern Leyte)	Concentrated torrential rains caused by tropical storm cause 244 casualties (200 dead) and total damages of 364 million pesos
August 2004	Floods at the Tarlac River in the central Luzon region	Caused by Typhoon Marce. Right bank dike collapse, totally in 44 places, partial collapse in 52 places. Revealed impounding effect of San Roque Dam and lack of information sharing among ministries.

Source: Study Encouraging Disaster Prevention Field Programs in the Philippines Final Report Outline (P11)

(2) Typhoon Disasters

In many cases floods (including flash flooding) and landslides (including earth slides) in the Philippines are caused by typhoons in particularly the northeast of Mindanao, the Visayas (Region VI – VIII), Mindolo and all of Luzon Island. In general, floods (including flash flooding) in Mindanao arise from tropical cyclones and localized torrential rain. Furthermore, sometimes typhoons cause tidal waves along the Philippines coast, causing destruction to small villages. However, not enough is known about the tidal waves and their damage because of a lack of observation networks and the difficulty of access to the damaged areas.

Also, due to the strong winds of the typhoon, housing, buildings and electrical wires suffer damage. However, as the wind damages are included along with floods and landslide damage as typhoon damage, it is difficult to distinguish wind damage itself from the NDCC

damage data.

The average number of deaths per year attributable to typhoons from 1970 to 2003 was 544, rising to 1,478 when the missing and injured were added. 550,000 households were affected (2.8 million people), completely destroyed houses being 70,000, partially destroyed houses 160,000, with damages amounting to 4.6 billion pesos. At the rate of around once every six years a typhoon causes over 10 billion pesos of damages (approximately 20 billion yen). One typhoon damages 8 billion pesos of property (16 billion yen), this figure being equal to approximately 2% of the national budget.

1) Frequency of Destructive Typhoons / Floods

Tables 10 (1) ~ (2) show NDCC data on damage by destructive typhoons in each province for the 12 year period of 1991 to 2003 (no data for 1998).

As the majority of damage including floods and landslides is occurring from 1991 onwards, the 13 year period from 1991 is one sample period for studying damage trends for each river.

Almost all damage is caused by floods and typhoons.

The frequency of destructive typhoons is high for northeastern Mindanao, Visayas, Mindolo and Luzon, because they match the typhoon route. The frequency of typhoons in this area (which could also be called the degree of safety) is 0.5 to 2 times a year, with a recurrence interval from 2 years to half a year.

Mindanao (excepting the northeastern part) in general has a low frequency rate, being from 0 to 0.5 times a year on average (recurrence interval of once every two years).

As in many cases typhoons cause floods, the frequency rate and degree of safety can be said to be almost the same as for floods.

Table 10(1) Data on Damage by Destructive Typhoons for the 12 Year Period from 1991 to 2000 for each Province

Province	Region	Affected Times	Casualties				Affected		Damaged Houses			Damaged Properties			
			Dead (pers.)	Injured (pers.)	Missing (pers.)	Total (pers.)	Families (no.)	Persons (pers.)	Totally (no.)	Partially (no.)	Total No. (no.)	Agricult. (Mil. P)	Infra. (Mil. P)	PVT (Mil. P)	Total (Mil. P)
Philippine		**838**	**8,484**	**7,612**	**2,224**	**18,320**	**5,866,641**	**29,845,671**	**547,691**	**1,668,092**	**2,215,783**	**51,233.575**	**26,376.791**	**2,212.709**	**80,485.265**
NCR	NCR	34	63	40	9	112	186,964	1,035,063	1,342	14,860	16,202		87.078		87.078
Abra	CAR	14	23	28	16	67	38,874	199,858	2,092	8,730	10,822	302.974	1,108.195	342.582	1,753.752
Apayao	CAR	17	4	16		20	16,698	88,621	354	3,617	3,971	75.502	134.346		209.848
Benguet	CAR	23	173	196	26	395	26,182	117,275	1,087	2,277	3,364	177.667	1,455.648	97.789	1,731.104
Ifugao	CAR	13	32	6		38	15,111	78,932	1,693	9,758	11,451	192.818	245.056	6.936	444.810
Kalinga	CAR	17	15	17	10	42	31,796	148,636	2,271	11,724	13,995	309.137	307.598	8.017	624.752
Mt. Province	CAR	16	33	11		44	712	4,390	1,238	588	1,826	209.090	1,031.255	7.309	1,247.654
Ilocos Norte	Reg. I	24	15	38	13	66	104,133	364,685	3,100	22,675	25,775	445.266	745.612	0.594	1,191.474
Ilocos Sur	Reg. I	21	49	20	11	80	87,878	436,649	7,935	17,543	25,478	987.144	1,044.976	147.909	2,180.771
La Union	Reg. I	22	27	35	11	73	74,097	341,120	2,447	13,418	15,865	435.436	887.220	83.831	1,407.587
Pangasinan	Reg. I	21	100	107	35	242	567,525	3,166,343	3,631	19,555	23,186	5,135.233	1,144.401		6,347.486
Batanes	Reg. II	12					27,651	159,444				32.604	30.895	110.302	182.579
Cagayan	Reg. II	18	55	22	15	92	244,084	1,210,750	5,335	51,306	56,641	2,899.725	1,051.543	21.083	3,972.351
Isabela	Reg. II	13	108	228	14	350	353,951	1,704,282	41,890	106,971	148,861	3,576.954	262.259	0.033	3,839.246
Nueva Vizcaya	Reg. II	15	36	31	23	90	15,258	71,684	763	3,809	4,572	1,222.145	520.313	7.702	1,750.160
Quirino	Reg. II	12	10	17	1	28	33,911	153,111	955	1,269	2,224	438.727	71.182	0.001	509.910
Bataan	Reg. III	24	13	6	5	24	174,164	1,016,352	1,654	6,215	7,869	170.028	179.533	0.028	400.085
Bulacan	Reg. III	21	37	1	9	47	220,217	1,180,833	155	549	704	808.907	69.486		912.990
Nueva Ecija	Reg. III	21	34	2	4	40	168,309	872,639	471	2,057	2,528	934.289	532.163	11.916	1,543.295
Pampanga	Reg. III	30	85	8	1	94	542,059	2,650,554	1,829	2,539	4,368	1,116.902	123.107		1,429.592
Tarlac	Reg. III	20	15			15	162,810	853,286	1,414	2,999	4,413	784.865	1,085.624		1,962.507
Zambales	Reg. III	26	34	35	22	91	77,889	394,554	411	3,114	3,525	112.225	298.110	0.553	428.652
Aurora	Reg. IV	7	2			2	25,956	124,299	2,579	10,589	13,168	370.183	275.385		645.568
Batangas	Reg. IV	11	19	8	7	34	9,483	44,847	622	2,811	3,433	325.474	48.465	5.130	379.069
Cavite	Reg. IV	13	12	550	97	659	92,973	452,680	8,257	15,333	23,590	238.814	97.936	126.812	463.562
Laguna	Reg. IV	10	49	281	16	346	103,731	497,165	13,622	26,659	40,281	917.527	94.486	255.799	1,267.811
Marinduque	Reg. IV	5	21	16	6	43	27,713	118,664	1,082	11,201	12,283	754.923	925.503	19.950	1,700.375
Occidental Mindoro	Reg. IV	7	4		1	5	4,133	18,514	243	541	784	26.455	50.265	14.800	91.520
Oriental Mindoro	Reg. IV	9	78	12	5	95	117,724	574,262	32,202	21,695	53,897	1,443.882	946.868	44.558	2,435.307
Palawan	Reg. IV	8	78	18	50	146	17,546	105,728	510	5,574	6,084	68.428	3.922	4.240	76.590
Quezon	Reg. IV	10	324	598	95	1,017	225,885	934,953	50,492	165,886	216,378	7,339.865	407.677	18.383	7,765.925
Rizal	Reg. IV	19	33	19	38	90	76,475	396,847	8,172	38,964	47,136	471.670	1,464.501	61.657	2,001.020
Romblon	Reg. IV	7	12	14		26	12,393	29,477	1,356	154,232	155,588	96.928	224.836	65.604	387.367
Albay	Reg. V	15	99	56	28	183	109,303	575,853	19,339	80,726	100,065	201.550	397.225	17.232	616.007
Camarines Norte	Reg. V	11	332	886	57	1,275	131,994	643,874	50,647	79,282	129,929	2,968.797	402.421	50.170	3,421.388
Camarines Sur	Reg. V	7	407	2,332	34	2,773	300,548	1,522,311	106,799	207,352	314,151	2,173.227	846.240	158.516	3,177.983
Catanduanes	Reg. V	9	58	42	14	114	49,613	289,478	26,248	31,086	57,334	731.010	463.006	11.100	1,205.116
Masbate	Reg. V	8	8	10	14	32	9,305	48,051	1,020	8,872	9,892	682.918	230.657	43.744	957.319
Sorsogon	Reg. V	11	25	61	3	89	42,520	214,417	4,371	33,089	37,460	627.486	189.978	94.441	911.904
Aklan	Reg. VI	14	3	4	3	10	160,802	831,028	319	3,695	4,014	281.687	172.859		454.547
Antique	Reg. VI	12	6		3	9	5,866	32,077	902	2,017	2,919	182.197	374.797		562.474
Capiz	Reg. VI	12	42	15	6	63	63,085	354,192	782	4,359	5,141	1,453.638	151.023	7.565	1,612.225
Guimaras	Reg. VI	8	4	2		6	1,902	10,395	181	1,109	1,290	58.068	59.047		117.115
Iloilo	Reg. VI	15	91	42	16	149	225,055	1,188,502	26,931	73,656	100,587	2,686.772	471.447	0.416	3,279.227
Negros Occidental	Reg. VI	21	269	241	59	569	179,312	1,031,393	33,035	71,966	105,001	1,161.429	913.348	2.220	2,082.067

Source: Natural Disaster Risk Management in the Philippines Reducing Vulnerability Follow on Study Final Report (P5)

Table 10(2) Data on Damage by Destructive Typhoons for the 12 Year Period from 1991 to 2000 for each Province

Province	Region	Affected Times	Casualties				Affected		Damaged Houses			Damaged Properties			
			Dead (pers.)	Injured (pers.)	Missing (pers.)	Total (pers.)	Families (no.)	Persons (pers.)	Totally (no.)	Partially (no.)	Total No. (no.)	Agricult. (Mil. P)	Infra. (Mil. P)	PVT (Mil. P)	Total (Mil. P)
Bohol	Reg. VII	10	63	7	7	77	11,413	59,912	7,435	3,486	10,921	227.422	451.759	42.951	722.131
Cebu	Reg. VII	12	91	57	41	189	82,378	401,628	9,316	49,900	59,216	307.806	237.489	38.198	583.493
Negros Oriental	Reg. VII	8	11	4	4	19	1,641	7,944	218	418	636	126.033	21.961	0.887	148.881
Siquijor	Reg. VII	2							2		2	1.346	5.855		7.201
Biliran	Reg. VIII	8		1	2	3	21,816	114,909	567	6,496	7,063	108.951	97.258	1.117	207.325
Eastern Samar	Reg. VIII	6	3	8		11	19,363	116,106	3,499	15,854	19,353	75.864	85.029		160.893
Leyte	Reg. VIII	20	4,984	502	1,244	6,730	246,085	1,170,093	33,040	153,874	186,914	1,607.884	1,464.948	14.535	3,087.366
Northern Samar	Reg. VIII	9	24	568	51	643	65,996	335,118	12,243	24,935	37,178	186.944	352.249	246.831	786.024
Samar	Reg. VIII	8	8		1	9	12,310	66,301	61	9,570	9,631	282.385	19.230		301.615
Southern Leyte	Reg. VIII	9	24	2	4	30	2,557	11,281	557	2,120	2,677	139.604	133.491	2.226	275.321
Basilan	Reg. IX														
Zamboanga del Norte	Reg. IX	2	3	5		8	238	1,236	16	40	56	21.750	5.300		27.050
Zamboanga del Sur	Reg. IX	4	42	101		143	3,342	18,041	241	492	733	237.642	0.109	5.800	243.551
Bukidnon	Reg. X	2	18	7		25			5		5	3.145			3.145
Camiguin	Reg. X	4	148	146	72	366	9,022	53,427	253	568	821	46.763	172.192	0.287	219.242
Misamis Occidental	Reg. X	2	1			1						3.700	0.888	0.145	4.733
Misamis Oriental	Reg. X	4		1		1	1,869	10,174	36	72	108	38.189	59.330		97.519
Compostela Valley	Reg. XI														
Davao	Reg. XI	2	23		1	24	36,377	171,905	220	114	334	141.887	125.425		267.312
Davao del Sur	Reg. XI	2		4		4		1,186	14	52	66	434.750	128.177		562.927
Davao Oriental	Reg. XI	7	16		3	19	4,232	25,295	24	30	54	37.277	39.791	1.673	78.741
Saranggani	Reg. XI	2						236	34	25	59			0.407	0.407
South Cotabato	Reg. XI	1										0.033			0.033
Lanao del Norte	Reg. XII														
North Cotabato	Reg. XII	2										217.464			217.464
Sultan Kudarat	Reg. XII	2					484	860				41.225			41.225
Agusan del Norte	Reg. XIII	5	15	6	3	24	45,196	276,859	493	8,826	9,319	226.910	282.587		509.496
Agusan del Sur	Reg. XIII	1	2	2	2	6	10,423	52,115	63	4	67	31.402	38.467		69.869
Surigao del Norte	Reg. XIII	9	22	116	6	144	70,680	372,175	5,820	21,052	26,872	392.221	542.211	0.080	934.512
Surigao del Sur	Reg. XIII	7	46	4	6	56	55,629	280,802	1,756	13,897	15,653	555.812	485.554	8.652	1,050.018
Lanao del Sur	ARMM	2					2,000	10,000				63.911			63.911
Maguindanao	ARMM	1										35.701			35.701
Sulu	ARMM														
Tawi-Tawi	ARMM	2	3			3						8.990			8.990

Notes: 1) Available damage data of NDCC are 12 year data of 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2002 and 2003.
2) Property damage is re-calculated based on 2003 price level by allping rates of CPI of each year.

Source: Natural Disaster Risk Management in the Philippines Reducing Vulnerability Follow on Study Final Report (P5)

2) Frequency of Flash Flooding Damage

The frequency of flash flooding damage is generally much lower when compared to that for flood damages. The national average frequency does not rise above 0 to 0.5 times a year (recurrence interval of over two years).

Because of cyclones and localized torrential rain, flash flooding occurs not only in the flood-prone zones of Visayas and Mindolo but also in Mindanao.

3) Frequency of landslides / earth slides

The frequency of landslide and earth slide damage is much lower compared to that for flood damages.

4) Damages from floods and landslides

Flood patterns vary depending on the river basin topography, land usage and hydrometeorological conditions. A river basin with flat terrain will experience long term and large scale flooding (i.e., the Cagayan, Agno, Pampanga, Bicol, Panay, and Mindanao river basins).

River basins in precipitous terrain will often have flash flooding and landslide damage (i.e., Laoag river basin, mid-small river basins in the mountainous Pinatubo area, Camiguin Island, Ormoc City).

Furthermore, mudslides and debris flow accompanied by flash flooding occurs at rivers in river basins in the mountainous Pinatubo area, Camiguin Island, and Southern Leyte (Panaon Island).

The degree of damage depends upon the magnitude, flood pattern (including flash flooding), landslides (including earth slides), population distribution, and land usage such as farming.

In consideration of this, the depth of damage of destructive typhoons, including damage from floods and landslides, will be analyzed by the number of people affected and the damage to property.

The number of people affected will include casualties (dead, injured, missing), and will also concern households suffering impact.

Damage to property will include damage to agricultural produce and public and individual property, being concerned with all property damage.

<u>People Affected</u>

The average number of people affected each year by destructive typhoons is almost the same as the number of people affected by floods and landslides (including earth slides).

Among those affected the largest group is the northeastern Luzon area with the Cagayan river basin, the central Luzon area with the Agno and surrounding river basin and the Pampanga river basin, and the southern Luzon area with the Bicol river basin.

Generally the numbers of people affected are in provinces such as Iloilo and Negros Occidental in the Luzon and Panay areas that are in the path of the typhoons and have comparatively larger populations.

Because of the November 1991 flash flooding in Ormoc City where 5,100 people died, the number of people affected in Leyte is in the second highest group.

Property Damage and Property Damage Per Person

Looking at property damage per person, Luzon is generally in the mid to high group (50 million pesos a year or more).

In particular, the Cagayan, Agno and Bicol river basins have taken quite severe damage (both overall and per person).

Other islands, in particular Oriental Mindolo, northeast and south Panay, Leyte and northeast Mindanao (Surigao del Norte and Surigao del Sur) have suffered severe damage (both overall and person).

The Relationship Between Property Damage and Poverty

It cannot be stated for certain that the number of people badly affected by or suffering damage frequently from floods, landslides and typhoons, or areas with property damage in volume, have a high correlation with poverty.

However, in Cagayan, Bicol river basin, Oriental Mindolo, northeast Panay and Panay river basin, Leyte and northeast Mindanao (Surigao del Norte and Surigao del Sur), a clear relationship between property damage and poverty conditions is visible.

Among these areas, those of the Cagayan river basin, Bicol river basin, Leyte and northeast Mindanao are characterized by the high numbers of people affected no less than the high frequency of destructive typhoons and amount of property damage (overall and per person).

The Panay river basin and Oriental Mindolo are characterized by high property damage (overall and per person).

Damage from floods, landslides and typhoons are primary reasons for the poverty of these regions.

(3) Tidal Wave Disasters

Tidal waves are a phenomenon where the sea level becomes abnormally high due to the effect of cyclones or tropical cyclones (including typhoons) on wind and direction and coastal topography. They may be accompanied by tsunamis.

When tidal waves occur, usually the towns and villages along the coast suffer damage including the death of people.

In the Philippines tidal waves occur less frequently than floods, but they are sometimes recorded. However, the damaged areas are usually distant areas with no observing equipment, such as tide gauges, in the area, and even from PAGASA's study of the damaged areas little is known about the tidal waves or their damage.

Table 11 shows the places where tidal waves have been reported from 1897 to 2002, though several tidal waves have not been recorded due to the difficulties of studies and data

collection.

Table 11 Tidal Waves Recorded from 1897 to 2002

Date	Tropical Cyclone	Place of Max. Sea Water Level		Max. Sea Water Level above MSL (m)
		Province/Area	Place	
Oct. 12, 1897	TY Samar & Leyte	Samar	Hernani	7.3
Oct. 13, 1908	TY Aparri	Cebu	Consolacion	9.1
Oct. 11-15, 1970	TY Sening	Luzon	West coast	3.6
Jan. 25-31, 1975	TY Auring	Surigao Sur	Tandag	2.4
Jan. 25-31, 1975	TY Anding	Aurora	Sabang	4.8
July 11-16, 1983	TY Bebeng	Sorsogon	Bulabog	3.4
Aug. 31-Sep. 4, 1984	TY Nitang	Cebu	San Fernando	3.3
Aug. 10-14, 1987	TY Herming	Oriental Mindoro	Naiyan	2.6
Nov. 23-27, 1987	TY Sisang	Albay	Tiwi	
Dec. 1, 1990		Cebu	Bgy. Mataas	3.3
Nov. 1-3, 1995	TY Rosing	Lopez	Pansol	2.3
Dec. 1995	TY Naning	Dact	Bagasbas	2.6
Sep. 1998	TS Gading	Pangasinan	Dagupan	0.9
Oct. 1998	TY Loleng	Calauag	Kagtalaba	3.4
July 2-5, 2001	TY Feria	Ilocos	Santa	3.3
Nov. 6-10, 2001	TY Nanang	Cebu and Bohol		
Mar. 19-22, 2002	TY Caloy	Cebu	Talisay	2.7

MSL: Mean sea level

Source: Natural Disaster Risk Management in the Philippines Reducing Vulnerability Follow on Study Final Report (P5)

(5) Countermeasures

1) Structural Countermeasures

a) Preexisting Flood / Landslide Countermeasures

The Department of Public Works and Highways (DPWH) is the organization in charge of flood and landslide (including earth slides) control. Structural countermeasures in the Philippines for floods and landslides are only carried out in several of the main river basins. In other river basins only minor countermeasures are taken, limited to maintaining dikes and embankments. Table 12 shows the preexisting projects and structural countermeasures in the main river basins.

b) Preexisting Flood Control / Multipurpose Dams

There are 36 large-sized dams over 15 meters in height in the Philippines. The majority of these are for hydroelectric power generation, irrigation or drinking water, and several have flood control capabilities. Out of these 36 dams 7 are principal dams over 150m in height, as outlined in Table 13.

Table 12 DPWH Principal Flood / Landslide Defense Projects

River	Project	Framework Plan	Master Plan (M/P)	Feasibility Study (F/S)	Implementation
1. Major Rivers					
Laoag	Flood control Sediment control	GOP & OECF (1982)*	JICA (1997)	JICA (1997)	GOP & JBIC (from 2001, D/D 2003)
Abra		-	-	-	-
Cagayan	Flood control Water resources develp.	GOP & OECF (1982)*	JICA (1987)	JICA (2002)	-
Abulog		-	-	-	-
Agno	Flood control	GOP & OECF (1982)*	JICA (1991)	JICA (1991)	GOP & JBIC (OECF) (from 1995)
Pampanga	Flood control	GOP & OECF (1982)*		JICA (1982)	GOP & OECF (1990-2003)
Pasig-Laguna Bay	Flood control Drainage improvement	GOP (1954)	JICA (1990)	JICA (1990)	GOP (1970s) GOP & JBIC (OECF) (from 1973 for several projects)
Bicol	Flood control	GOP & OECF (1982)*	WB (water shed management project on-going)	BRDBDP (1983)	BRDBDP (D/D, 1992) GOP (1973-1991, partially)
Amnay-Patric	Flood control Sediment control Water resources develop.	GOP & OECF (1982)*		DPWH (Pre-F/S, 1984)	-
Panay	Flood control Water resources develop.	GOP & OECF (1982)*	JICA (1985)	JETRO (2002)	-
Jalaur	Flood control	GOP & OECF (1982)*	-	-	-
Ilog-Hilabangan	Flood control	GOP & OECF (1982)*	JICA (1991)	-	-
Agusan	Flood control	GOP & OECF (1982)*	-	-	GOP & OECF (1985, 1988-1999)
Tagoloan	Flood control	GOP & OECF (1982)*	-	-	-
Cagayan (Mindanao)	Flood control Environmental improve.	-	LGU (1999)	-	-
Tagum-Libuganon	Flood control Irrigation develop.	-	-	NIA & DPWH	NIA (completed) DPWH (on-going)
Davao	Drainage improvement	-	Davao City (1998)	Davao City (1998)	-
Buayan-Malungun		-	-	-	-
Agus		-	-	-	-
Mindanao	Flood control Watershed management	GOP & OECF (1982)*	-	-	-
2. Other Rivers					
Pinatubo Pasig-Potrero Sacobia-Bamban West side rivers	Lahar control		JICA (1978) - JICA (2003)	- JICA (1995) JICA (2003)	JBIC (from 2000) OECF (1997) -
Mayon Volcano	Mud flow control		JICA (1981 & 83)	JICA (2000)	Italia (Community level pilot project: 1989-1992) DPWH (after 1983)
Ormoc City FC	Flashflood control		JICA (1995)	JICA (1995)	GOJ Grant (1998-2001)
Iloilo City FC	Flood control		JICA (1995)	JICA (1995)	GOP & JBIC (D/D 2001-2002)

Note: * DPWH, Nationwide Flood Control Plan and River Dredging Program.
Source: JICA; "Water & Floods", 2003

Source: Natural Disaster Risk Management in the Philippines Reducing Vulnerability Follow on Study Final Report (P5)

Table 13 Principal Dams in the Philippines (Over 150m in height)

Dam	Agency	Purpose	Province	River Basin	Catchment Area (km^2)	Dam Type	Dam Height (m)	Gross Storage (mil. m^3)	Active storage (mil. m^3)
Angat	NIA / NPC	Hydropower Water supply Irrigation Flood control	Bulakan	Angat	568	Rockfill	131	1,075	850
Magat	NIA / NPC	Hydropower Water supply Irrigation Flood control	Isabela	Cagayan	4,143	Rockfill / Concrete Gravity	114	1,254	969
Pantabangan	NIA / NPC	Hydropower Water supply Irrigation Flood control	Nueva Ecija	Pampanga	853	Earthfill	107	2,310	1,973
Ambuklao	NPC	Hydropower	Benguet	Agno	612	Rockfill	129	327	258
Binga	NPC	Hydropower	Benguet	Agno	854	Rockfill	107	91	33
San Roque	NIA / NPC	Hydropower Water supply Irrigation Flood control	Pangasinan	Agno	1,235	Rockfill	200	850	530
Pulangi IV	NPC	Hydropower	Bukidnon	Pulangi	3,633	Concrete Gravity	115	287	-

Data sources: 1) JICA; "Water & Floods", 2003
2) JICA; "Master Plan Study on Water Resources Management, Final Report, Vol. IV Data Book", 1998

Source: Natural Disaster Risk Management in the Philippines Reducing Vulnerability Follow on Study Final Report (P5)

2) Existing Flood Warning Systems as Nonstructural Countermeasures (P5)

Flood warning in the Philippines is one of the tasks entrusted to PAGASA. PAGASA has flood warning systems in four river basins (Cagayan, Agno, Pampanga and Bicol, all in Luzon).

PAGASA's flood warning systems were built with financial and technical cooperation from Japan. There are four flood warning systems for dam operations in the Cagayan, Agno and Pampanga river basins, these are administered by the NPC and NIA and are connected to the PAGASA flood warning systems. These systems are in use, but due to maintenance problems several of the water-stage recorders and alarm stations are not working.

The DPWH has a flood warning system called the Effective Flood Control Operating System (EFCOS) on the Metro Manila and Parsig Marikina river basins, its control being transferred to the Metro Manila Development Authority (MMDA). EFCOS is in good condition and diverts Marikina River (Parsig River upstream tributary) floods into the Laguna de Bay, proving useful in reducing and preventing floods in central Metro Manila. Observation data is sent to PAGASA.

Areas where floods, landslides and typhoons happen with high frequency are currently only covered to a limited extent, though the area to be covered is quite wide.

Furthermore, PAGASA is principally transmitting typhoon information dependent on wind speed via the media and the Disaster Coordinating Council (DCC) network, but on the local government unit (LGU) and barangay level there is insufficient information to allow judgments on evacuation and DCC warnings. More information on rising river levels due

to torrential rain and floodwater flow is necessary.

Part of the purpose of the above five flood warning systems is to give information on the possibility of floods to residents via the DCC and LGU.

However, the regions that can be covered by this are limited inside the county.

A list of flood control projects in the principal river basins and other river basins is shown in Table 14.

Table 14 Flood Control Projects in the Eighteen Principal River Basins and Structural / Non-Structural Countermeasures

No.	Name of River Basin	Project	Structural Countermeasure	Nonstructural countermeasure
1	Cagayan	Multipurpose dam project, NIA/NPC (P5)	Magat dam (P5)	Flood Warning System (P40)
				Cagayan Flood Warning System (P40)
2	Mindanao	Flood control Dredging Project (OECF: 1974-) (Cotabato river basin) (P5)		
3	Agusan	Flood control (GOP & OECF: 1985, 1988-1999) (P5)	Embankment	
4	Pampangan	The Pampanga Delta Development Project (OECF, 1990-2003) (P7)	Diversion channel, dredging, closing dyke	
		Flood Forecasting and Warning System in Pampanga River Basin (GOJ: 1972), PAGASA (P5)		Flood Warning System
		Flood control Dredging Project (OECF: 1975-) (P5)		
		Multipurpose dam project, NIA/NPC	Pantabangan dam, Angat dam (P5)	
		Dam Flood Warning Control System Construction Project (1986-1994) (P40)		Pantabangan dam, Angat dam Flood Warning System
5	Agno	The Agno River Flood Control Projects (GOP & JBIC: 1995-) (P7)		
		Phase I: Agno & Allied Rivers Urgent Rehabilitation Project (JBIC, 1995-2003)	Cut-off channel, revetment, dyke bank raising	
		Phase II: Agno River Flood Control Project (JBIC, 1998-2006)	Diversion channel, dyke bank raising, revetment, spur dike, other	
		Multipurpose dam project, NIA/NPC, JBIC/Private (P5, P42)	San Roque dam	
				Flood Warning System (P40)
6	Abra			
7	Pasig-Marikina-Laguna Bay	KAMANAVA Flood Control & Drainage Improvement Project (JBIC, 2002-2007) (P7)	River improvement, circle levee (8km), dyke bank raising (4.4km), drainage channel (1.8km), lock gates, diversion channel gates (8), pumping stations (7)	
		Pasig River Rehabilitation Project (JBIC, 1999-2004)	Revetment, earth banks, breastworks, control gates	
		West of Mangahan Floodway Project (JBIC, 1999-2006) (North Laguna Flood Control) (P7)	Lakeshore levee (8.5km), balancing reservoir (15.5ha), breastworks (5.8km), spillway gate (8)	
		The Mangahan Flood way (JBIC, 1984), Pasig-Marikina River Channel Improvement (2003-2008)	Diversion channel improvement	
		The Napindan Flood Gate (ADB, 1983) (P7)	Flood adjustment gates etc	
		Manila and Suburbs Flood Control and Drainage Project (OECF:1971-) (P5)		

No.	Name of River Basin	Project	Structural Countermeasure	Nonstructural countermeasure
		Metro Manila Flood Control Project (II) (OECF: 1987-) (P5)	Pumping stations (3) (Vitas, Balut, San Andres) (P7)	
		Metro Manila Pumping Stations (1973-1997), OECF	Pumping stations (12)	
		Pasig River Flood Warning System Project（1983-1993) (P39)		Flood Warning System (EFCOS)
		Pasig-River Flood Control Project (1975-) (P5)		
8	Bicol	Flood control (GOP: 1973-1991, partially), DPWH (P5)	Cut-off channel / diversion channel	
				Flood Warning System (P40)
9	Abulog			
10	Tagum-Libuganon	Flood control, Irrigation develop. (NIA &DPWH) (P5)	Embankment	
11	Ilog-Hilabangan			
12	Panay			
13	Tagoloan			
14	Agus			
15	Davao			
16	Cagayan de Oro			
17	Jalaur			
18	Buayan-Malangun			
	(Others)			
19	Pinatubo	The Pinatubo Hazard Urgent Mitigation Project (P5)		
		Phase I: Urgent Works for the Sacobia-Bamban River Stretch (OECF, 1997-2001) (P7)	Training dyke, gabion / erosion control dam (12), water channel works, Maskup Dam, bridges	
		Phase II: Urgent Works for the Pasig-Potrero River Stretch (JBIC, 2000-2005) (P7)	Training dyke, megadyke, erosion control dam, groin	
20	Ormoc City	Ormoc City Flood Mitigation Project (P7)		
		Project Works of Phase I (GOJ)	Bridges (4), slit dam (3) (P44)	
		Project Works of Phase II (GOJ)	Revetment (7.45km), drops (8 places), drainage improvement, bridges, other (P44)	
21	Laoag	The three-year Laog river basin flood control and sabo dam project (JBIC:-2008) (P5)	Erosion control dam (5), embankments (total extension 87km) (P43)	
22	Iloilo	Iloilo Flood Control Project (OECF:1997-) (P5)		
23	Mayon Volcano	Mudflow control Italia (Community Level pilot project: 1989-1992), DPWH (after 1983) (P5)	Mudflow control facilities	

（Sources: P5, P7, P39, P40, P42, P43, P44）

4.2 Outline of Earthquake Tsunami Disasters (P11)

The Philippines is on the circum-Pacific earthquake belt, being a region of active volcanic and earthquake activity where earthquakes occur frequently. The July 16 1990 central Luzon earthquake struck urban areas to leave a toll of 1000 dead and caused widespread damage. Tsunamis also frequently occur, such as the particularly destructive one of August 16 1976 that struck the Mindanao area leaving over 8,000 dead or wounded. Representative damages for earthquakes and tsunamis are given in Table 15. It is clear

what severe damage can happen if an earthquake occurs without sufficient preparations being made.

Table 15 Principal Earthquake Disasters and Amounts of Damage

Earthquake Date	Deaths	Injured	Affected households	Damages (Billion PhP)
August 1976, Moro Gulf Earthquake (Tsunami Damage)	3,700	8,000	12,000	0.276
July 1990 Luzon Earthquake	1,283	2,786	227,918	12.226
November 1994 Mindoro Earthquake	83	430	22,452	0.515

Source: Study Encouraging Disaster Prevention Field Programs in the Philippines Final Report Main Report (P11)

Note: Damage estimates vary according to different sources. The figures given here are those officially announced by the Philippines government.

5. Analysis of Damage

This section will analyze the damages caused by representative disasters. For volcanic mudslide disasters, the landslide damage caused by the 1991 Mount Pinatubo eruption, the largest of its kind in the twentieth century, will be used. For flood / landslide disasters, a cause of death analysis and an analysis of the social background will be made for the comparatively well documented flood damage in Capiz Province in December 2000, where onsite studies of the disaster area have been made, and the December 2003 Southern Leyte Province landslide damages.

For tsunami damage, the great damage brought about by the Moro Gulf Tsunami in 1976, caused by the M=7.9 earthquake occurring in southern Mindanao, will be used.

5.1 Analysis of Damage from Floods and Landslides

(1) Landslide caused by Eruption of Mount Pinatubo(P6)

1) Outline of the landslide damaged caused by the Mount Pinatubo eruption

Mount Pinatubo (1,745m above sea level), located in central Luzon gave vent to the greatest eruption of the twentieth century on June 20 1991, giving forth large pyroclastic flows which then deposited. Four years after the eruption, the volcanic activity itself had calmed down, but concentrated wet season torrential rain on the slopes of the mountain caused an ash deposit mudslide (locally called lahars) to fall into the river basin below and deposited itself, making for severe landslide damage involving loss of life.

According to the estimates of the Philippine Institute of Volcanology and Seismology (PHILVOLCS), the total volcanic ash deposits measured 6.7 billion m^3, of which 2.2 billion m^3 has as mudslides fallen downstream and deposited itself. The mudslides involve huge amounts of sediment which are eroding the river banks and flowing

downstream, causing continuing sediment deposition along the river course and raising the river bed along the gentle gradient of the downstream course. As this continues repeatedly for year after year the effects spread further downstream, with mudslide damage still continuing in 1995. According to the Philippines government tallies, the direct damages caused by the deposit of pyroclastic flows at the time of the eruptions and the secondary damages caused by falling mudslides can be seen in Table 16.

Table 16 Mount Pinatubo Eruption Damage Announced by the Philippines Government

Damages	1991	1992	1993	1994	1995	Total
Human Damage						
Dead	934	18	11	21	50	1,034
Missing	23	1	4	2	0	30
Injured	184	7	0	3	2	196
Human Damage Totals	**1,141**	**26**	**15**	**26**	**52**	**1,270**
Housing Damage						
Completely Destroyed	41,979	3,140	1,684	264	1,722	48,789
Partially Damaged	70,257	3,072	3,498	1,502	2,008	80,337
Damaged Housing Totals	**112,236**	**6,212**	**5,182**	**1,766**	**3,730**	**129,126**
Damages (millions of pesos)	**10,570**	**581**	**486**	**159**	**354**	**12,150**

Source: FY 2005 Construction Technology Transfer Policy Formulation Study (Overseas Flood / Landslide Disaster Warning) Report (P6)

2) Analysis of Causes of Death of Victims

The causes of death in the mudslide deposition given above can be considered from the factor analysis of figure 14 to be:

(1) Failure by the government to communicate mudslide warning evacuation information at the time of disaster (nonstructural countermeasures)

(2) Lack of mudslide observation systems (structural countermeasures)

This will be considered now.

① Government communications failure with the mudslide warning evacuation announcements

The 1991 deaths were not caused by pyroclastic flow deposition directly after the eruption but by mudslide deposition afterwards. At first glance the numbers killed in mudslides from 1992 onwards would seem to be greatly reduced from those immediately after the eruption in 1991. However, these figures are after all officially confirmed ones, according to local information sources there is a tendency for residents to go back to the damaged areas after the announcement of evacuation instructions for the mudslides.

In the Philippines the barangay (the smallest administrative unit) captain has existed from long ago to allow information to be easily spread to local residents. This is how the radio announcements from RDCC III warning people to evacuate

from the mudslide could be communicated swiftly and accurately to the people, and as was stated before at the time of the Pinatubo eruption the evacuation was carried out smoothly, making one reason why there were no direct deaths from ash or pyroclastic flow deposits.

However, the residents immediately returned to the damaged area after evacuation, and did not evacuate though knowing later warnings to evacuate because of mudslides, leading to deaths and serious damage. The main reasons were a slackened sense of danger accompanying the prolonged order to evacuate because of mudslides, and the desire to return to protect their property from theft during the time of evacuation, showing the urgent need to educate the people on the significance of mudslide warning evacuation announcements and to spread knowledge of the range of dangers associated with landslides.

The numbers of people killed in the four years from 1992 to 1995 as a result of dissuading the evacuation warnings is said to be several thousands, though as of yet no work has been made to verify the bodies.

② **Failure of government mudslide observation systems**

As can be seen in Table 17, the evacuation system while the Pinatubo mudslides were in progress was controlled by the Region III Regional Disaster Coordinating Council (or RDCC III for short). The council is composed in the main of police and the armed forces, with members seconded from 21 government organizations, the following council members gathering through faxes and a special wireless general meteorological data and information on rainfall and volcanic activity to ascertain the occurrence of mudslides.

Table 17 Mount Pinatubo Mudslide Monitoring System

Observation	Observation Members	Council Contact Method
River mudflow runoff status	Armed Forces of the Philippines (AFP) / Philippines National Police (PNP)	Wireless
Rain / river basin landslide occurrence status	Office of Civil Defense (OCD)	Telemeter
Volcanic activity	Philippine Institute of Volcanology and Seismology (PHILVOLCS)	Wireless
General meteorological status	Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA)	Fax

The river's mudflow runoff status is observed by placing watching points along the river. The watching point furthest upstream is at a dangerous spot within 10km of the top of Mount Pinatubo, in the rainy season ten soldiers are stationed there on rotation for two weeks. RDC III monitors the mudflow runoff status by keeping in touch with the watching posts through a small wireless. The OCD is in charge of monitoring the status of rainfall and landslide occurrences in the river

basin using instruments provided by Japanese grant aid in August 1991. The instruments are as follows (refer to figure 11).

- Telemeter rain gauge : 8 items
- Telemeter debris flow sensor : 5
- Relay station : 2
- Central monitoring station : 2

Furthermore PHILVOLCS uses its own volcanic activity monitoring system including the following equipment and reports observation results to the RDCC III (See figure 12)

- Seismic instrument : 5
- Telemeter rain gauge : 6
- Telemeter debris flow sensor : 5

Based on the above observation data, the RDCC III notifies the residents by radio on mudslide occurrences, damage status, and evacuation warnings (see fig 12).

This information communication by radio is extremely effective, as can be seen in the smooth evacuation operation mentioned previously where no one died directly as a result of the eruption or the pyroclastic flow.

Problems with these mudslide warning systems are as follows.

i) Reform of Landslide Danger Zone Maps

Danger zone maps for debris flow / mudslides are created by government organizations like PHILVOLCS and the National Economic and Development Authority and used to direct the evacuation of local people. However, there are insufficient records of the range of past landslides and detailed topographic maps which form the basis for these landslide danger zone maps, causing serious unease towards their accuracy. In the future this essential information must be fully collated.

ii) Maintenance of the Observation Equipment

The debris flow sensors currently in place require the wire sensor to be replaced each time debris flow occurs, failure to this is disrupting monitoring. When new equipment such as these debris flow sensors is introduced in the future, consideration must be made to avoid selecting equipment requiring either great numbers of or difficult to procure consumable supplies which are difficult to sufficiently supply. One example would be the use of seismometers to recognize the vibrations caused by debris flow.

iii) Forming Unified Monitoring Networks

Currently, PAGASA and PHILVOLCS are in charge of monitoring rainfall in relation to Mount Pinatubo mudslide warnings, but as the observation data of PAGASA and PHILVOLCS comes to RDCC III separately, an overall grasp of the rainfall status is extremely difficult. Unification of the rainfall monitoring network is needed to make the mudslide warning work rationally.

iv) Developing Landslide Prediction Methods

Currently, prediction of Mount Pinatubo landslides is limited to regularly declaring landslide warnings in the downriver landslide danger zone from the observed rain intensity and mudflow runoff status, with no quantitative landslide prediction (mudflow rate, time of concentration etc) being carried out. This is because of the severe lack of essential mudflow observation data and topographical information; progress with accumulation of essential observation data and the formation of a database and exploration of landslide prediction methods are necessary.

3) Contributing Factors from the Damaged Area's Socioeconomic Structure

The native Aeta minority were the most severely afflicted by the Mount Pinatubo mudslides. Many villages were wiped out by the pyroclastic flow and the volcanic debris deposition, ending their chances of returning to their former way of life.

The Aeta are people who fled from the lowlands to the mountains when Spain conquered the Philippines in 1565 (P24).

From this historical background they have a strong distrust of lowlanders, and few opportunities for education.

- Distrust of the government
- Distrust of medicine
- Low educational level

Because of these factors, awareness of evacuation information and medical treatment for the evacuees are limited, bringing about more casualties.

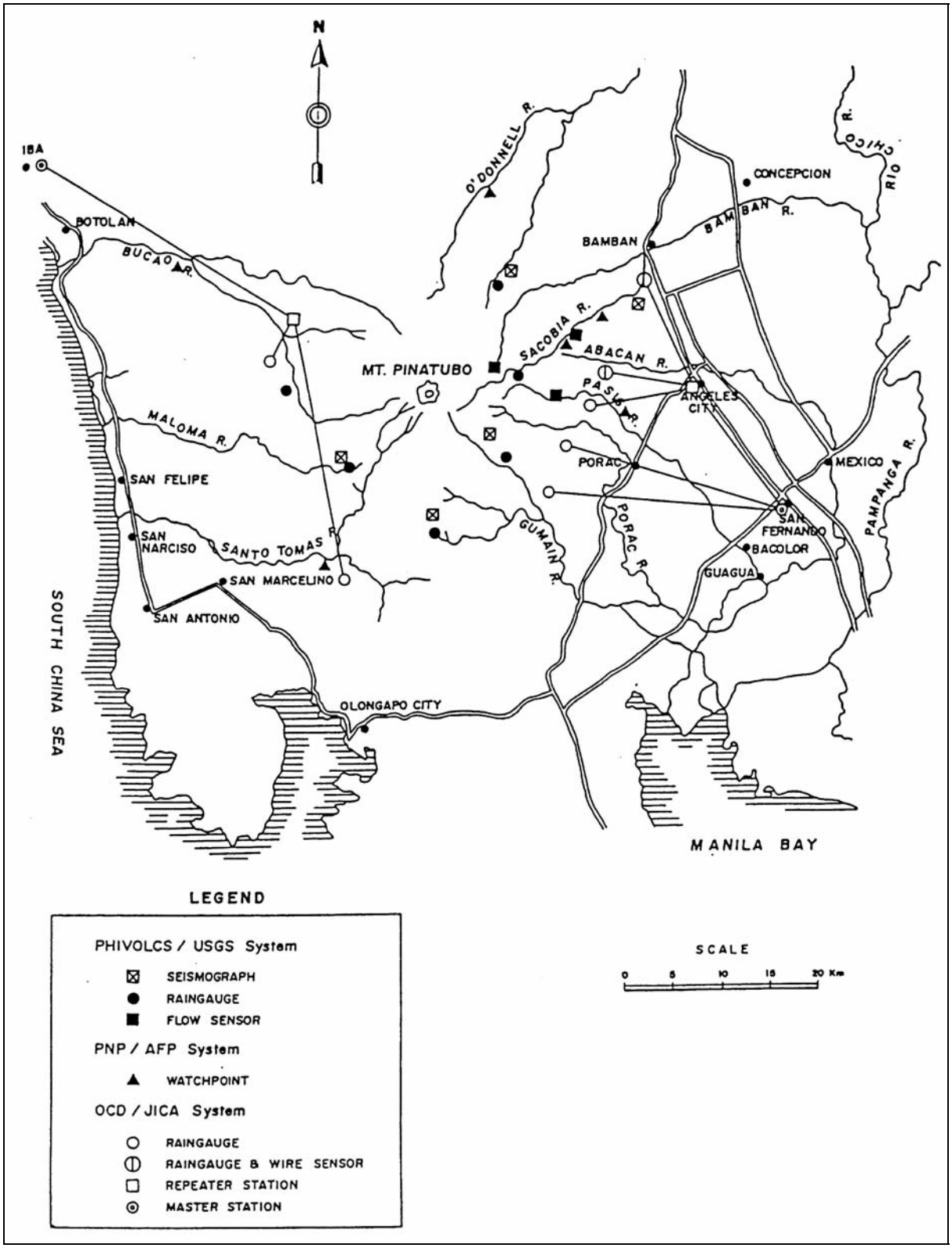


Fig 12 Location of Mount Pinatubo Mudslide Monitoring Facilities

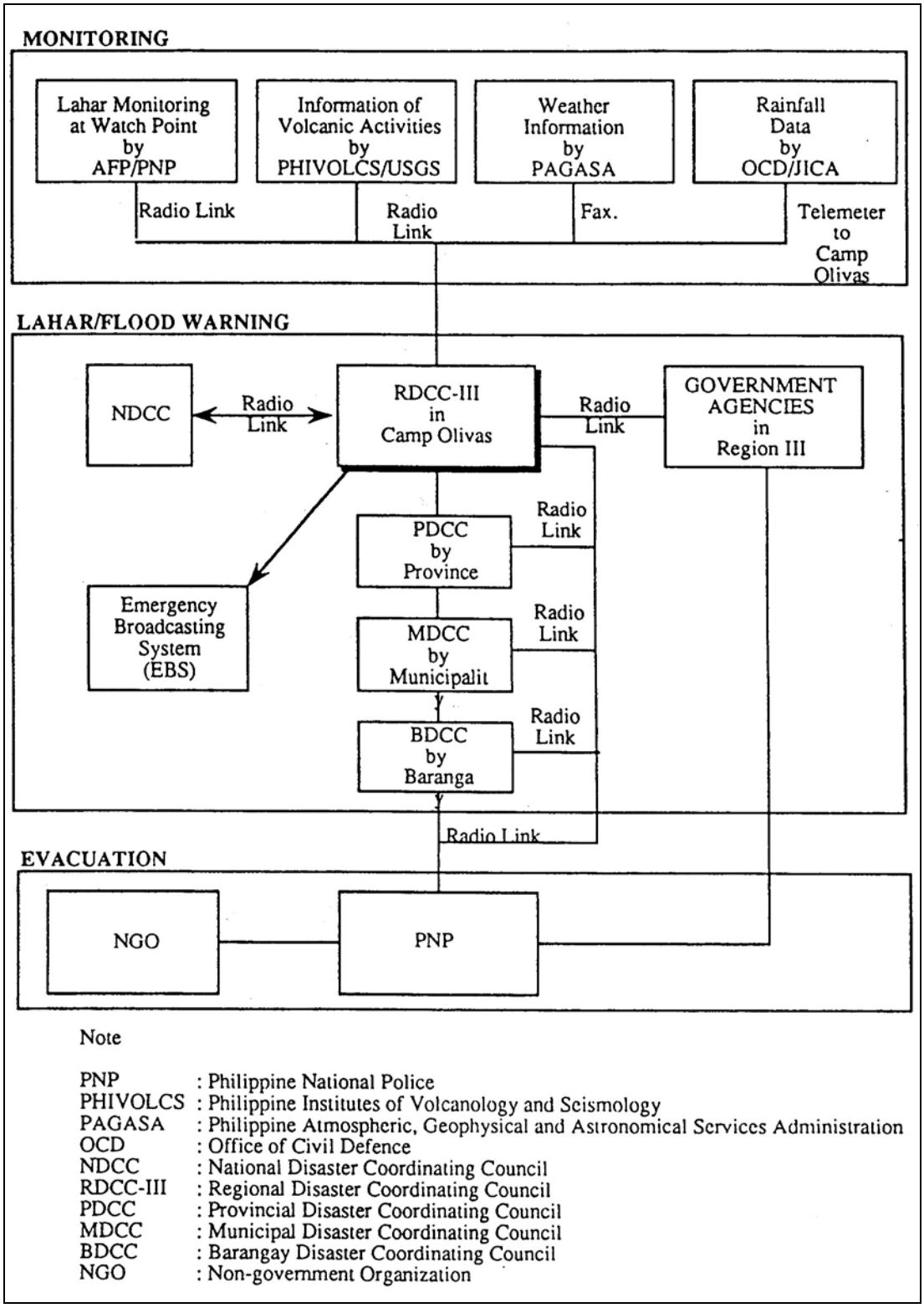


Fig 13 Mount Pinatubo Landslide Early Warning System

Natural Environment of the Mount Pinatubo Region
- Several large eruptions since the formation of Mount Pinatubo in the geologic age
  Last major eruption 500 years prior to 1991 (P24)
- Covered in dense tropical rain forest (P24)
- Typhoons pass every wet season
- 6.7 billion m^3 volcanic ash deposited from the eruption, typhoon 9105 (Yunta) appears

- 200m deposition in upstream Parsig River
Torrential wet season typhoon rain causes the deposited material to become a mudflow

Silting up of the sloping river
Sedimentation along the river's

◆ Countermeasures (Flood control/evacuation facilities): ■Blue

◆Response (evacuation status etc): ■green
◆Damages
Human: ■Red continuous line
Material: ■Red broken line
◆Natural harmful factors (external pressure/ geographical / topographical): ■Orange
◆Social harmful factors(poverty /vulnerability): ■Purple

- 2.2 billion m of the volcanic deposition has washed away as mudflow
- The barangays gave the warning to evacuate over the radio.

- The residents quickly returned to the danger area

Evacuation warning communication failure

- They feared theft of their property
- Over time awareness of the danger grew lax

48,789 houses totally destroyed (1991-1995)
80,337 partially destroyed (1991-1995)
Forest 150km^2

Farmland 800km^2

500,000 livestock and poultry were damaged

Dead / missing 1,064 (1991-1995)
Injured 196 (1991-1995)
Work to confirm bodies not undertaken yet (Mar. 1996)

No other place to go but the landslide danger area

No wish to move as houses retain shape

The Aeta escaped from the lowlands to the Pinatubo area
Most victims were Aeta
Aeta have a distrust of lowlanders.
Few educational opportunities, unfair discrimination
Distrust / refusal of medical treatment
Refuse to let land be sold
Distrust of govt.

Fig 14 Summary Figure (Mudslides Accompanying the 1991 Mount Pinatubo Eruption)

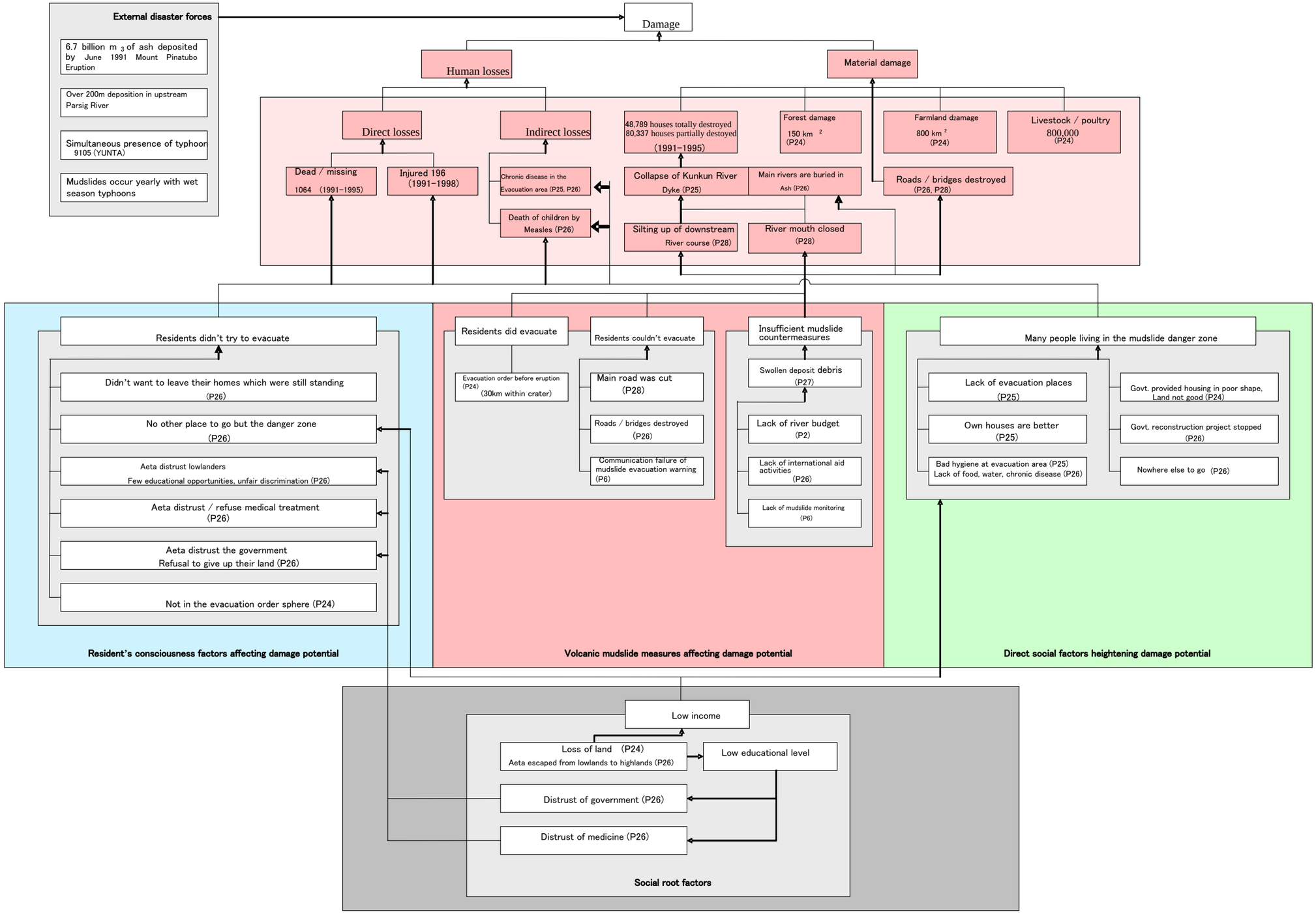


Figure 15 Factor Analysis (Mudslides Accompanying the 1991 Mount Pinatubo Eruption)

(2) Capiz Province Flood Damage, December 2000 (P5)

1) Flood damage outline

Capiz Province is often inundated with damaging floods leaving wide areas deeply submerged. From December 7 to 8 2000 Typhoon Ulpiang crossed the central Philippines.

Figure 16 shows the worst flood situation in 20 years in the Panay River Basin in December 2000. This flood caused 320 km^2 out of the river basin area of 2,181 km^2 to be submerged for ten days from the 2nd, affecting 220,000 people (including 19 dead) and causing property damage of 530 million pesos (Year 2000 prices).

2) Analysis of the Causes of Death

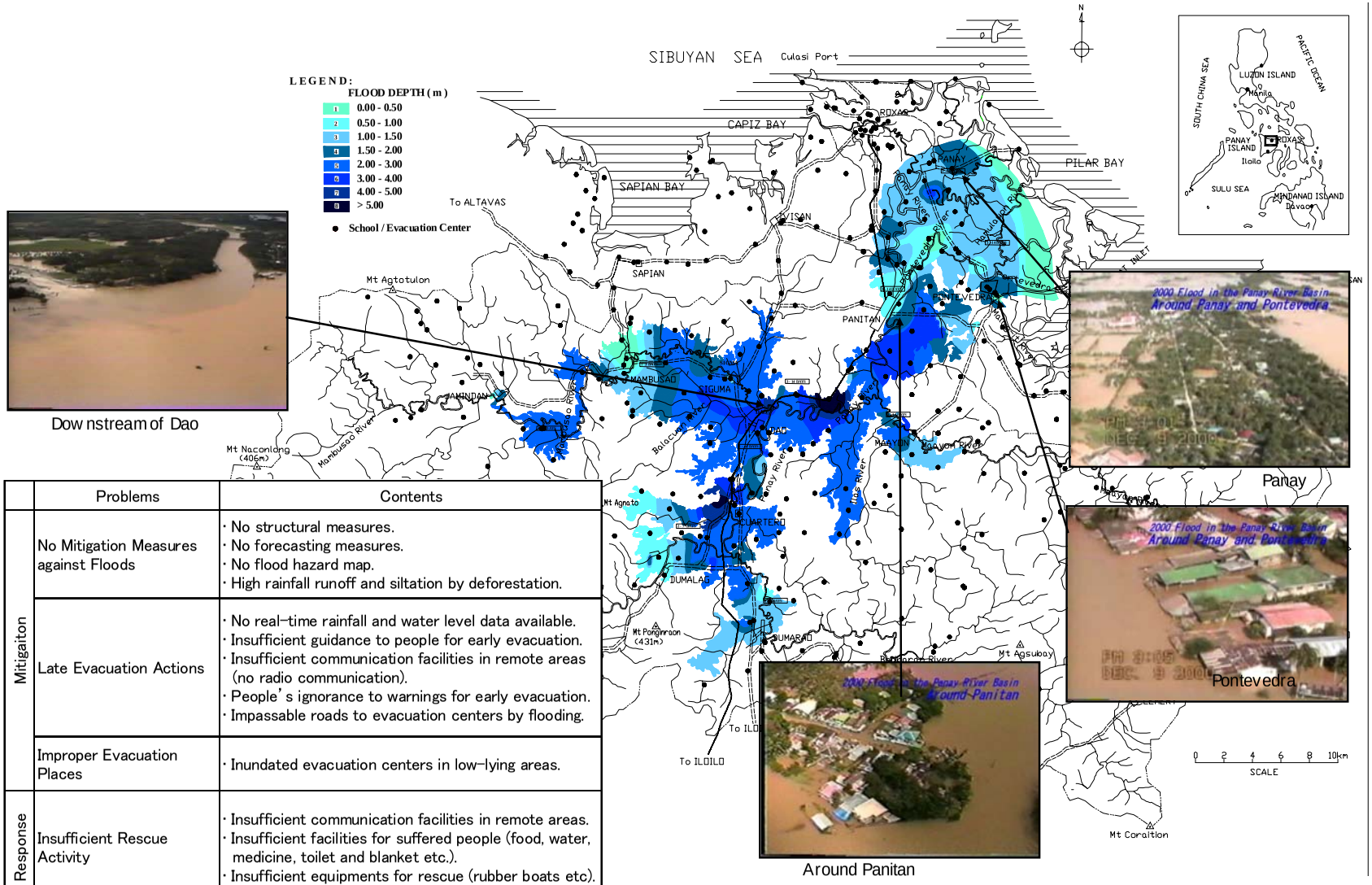
There were almost no flood control facilities in the area.

Also, evacuation warnings and guidance were frequently given to the residents both before the flooding and during it by the PDCC, MDCC and BDCC, but many people ignored the warnings and stayed in their houses until they were partially or completely flooded. According to a survey on the flood by JETRO F/S, 54% of people in the submerged areas stayed in their houses and created high places to escape to or went to the roof.

These actions were extremely dangerous for the people. The PDCC and MDCC had to put out dump-trucks and boats to rescue people in the flooded areas. Many people could not escape because the roads were flooded out and hence impassable.

Several of the evacuation centers (mostly schools) were flooded out themselves, forcing people to retreat to the second floor and compressing the space per person, and there were not enough blankets or toilets nor sufficient water, electricity or medicine.

Furthermore, the submerged towns tried to make people flee to their local evacuation centers, and there was almost no evacuation system network to give support to submerged areas from surrounding unaffected areas.



	Problems	Contents
Mitigaiton	No Mitigation Measures against Floods	· No structural measures. · No forecasting measures. · No flood hazard map. · High rainfall runoff and siltation by deforestation.
	Late Evacuation Actions	· No real-time rainfall and water level data available. · Insufficient guidance to people for early evacuation. · Insufficient communication facilities in remote areas (no radio communication). · People's ignorance to warnings for early evacuation. · Impassable roads to evacuation centers by flooding.
	Improper Evacuation Places	· Inundated evacuation centers in low-lying areas.
Response	Insufficient Rescue Activity	· Insufficient communication facilities in remote areas. · Insufficient facilities for suffered people (food, water, medicine, toilet and blanket etc.). · Insufficient equipments for rescue (rubber boats etc).

Fig 16 Panay River Basin 2000 Floods Submerged Areas and Evacuation Sites

3) Socioeconomic Structures in the Damaged Areas / Evacuation of the Victims / Damage Experience System

Problems for disaster management in Capiz Province are arranged in the following table.

Table 18 Problem Areas in Capiz Province Disaster Risk Management

Problems	Details
1. Mitigation No mitigation measures against floods	・No structural or forecasting measures ・No flood hazard map ・High rain discharge (rate) and debris accumulation due to logging
Late evacuation actions	・No real-time rainfall / water level data (for evacuation actions) ・Insufficient guidance to people for early evacuation ・Lack of communication facilities in remote areas (no radio transmission equipment) ・People ignored the early warning to evacuate ・Roads to evacuation center impassable due to floods
Improper evacuation places	・Evacuation centers submerged in low-lying area, lack of sufficient evacuation support networks from unaffected areas to affected areas
2. Response Lack of evacuation actions	・Lack of wireless communications equipment in remote areas ・Lack of supplies for evacuees (food, water, medicine, toilets, blankets etc) ・Lack of support machines (dinghies etc)

Note) Evacuation including the warnings is considered to emphasize mitigation, preparedness and emergency response

Source: Natural Disaster Risk Management in the Philippines Reducing Vulnerability Follow on Study Final Report (P5)

The condition of disaster management capabilities in Capiz Province and directions for reform

① With as little as 8% of the Panay River Basin covered by forest, humans have worsened the conditions for floods and caused deep accumulation of debris in the river course.
The Department of Environment and Natural Resources (DENR) has a reforestation project in place but only for a limited area.

② The traditional housing style in this region is for elevated houses, appropriate for flooding conditions and reducing the amount of damage to house and property.
However, there is a tendency for houses with floors on the ground to increase in the flood-prone zone, causing increased damage to houses and property in comparison to traditional elevated houses.

③ To alleviate and control flood damage in the Panay River Basin, structural countermeasures such as river improvements and nonstructural countermeasures such as flood warning systems are indispensable. In addition to these, it is important for

reforestation and preservation of the river basin's forest to be done with the participation of the local people. The flood-proof traditional elevated houses should be maintained and encouraged for new houses in flood-prone areas.

④ To improve flood safety in the Panay River Basin and Capiz Province there must be a good balance between structural and nonstructural countermeasures taken.
However, cooperation between the various governmental organizations such as the Department of Public Works and Highways (DPWH), DENR and LGU involved in putting such alleviating countermeasures into practice is somewhat lacking, as in other parts of the country.
Accordingly, we propose strengthening coordinating units such as the Provincial Disaster Coordinating Council (PDCC) and taking a comprehensive approach to allow coordination between related organizations so that alleviation measures can be put into practice.

⑤ Regarding evacuation, there was good support from the PDCC, MDCC (Municipal Disaster Coordinating Council) and BDCC (Barangay Disaster Coordinating Council). However, there was insufficient support at certain times due in particular to the lack of communications equipment for BDCCs in remote areas, the impassability of roads because of the floods, and a lack of real-time data on the torrential rain and flood level.
For implementing early evacuation, communications facilities and access routes need to be improved and real-time rain and flood level data supplied.
In relation to these improvements, development of the abilities of the staff of the PDCC, MDCC and BDCC may also be considered necessary.

⑥ In addition to the above, there is also a need to construct a support system network between the surrounding cities, towns and barangays outside the flooded areas and the cities and towns in the flooded areas.
Through such a system, even if the victims of the floods have to evacuate from the evacuation centers in their areas, there are still other safer areas they can go to in the surrounding cities, towns and barangay.

Natural Conditions in the Philippines
- Around 20 typhoons occurring yearly, half of them making landfall
- Wet season from June to November, frontal torrential rain commor
- Over 40 typhoons pass Panay Island yearly
- Mean average rainfall is 2,300mm

Typhoon Ulpiang passes Dec. 7 – 8 2000
Panay River Basin 320m^2 is submerged 0 – 5m

With torrential rain/storms Roxas city rainfall
for 2 days is around 330mm

◆Countermeasures (Flood control/evacuation facilities) ■Blue
◆Response (evacuation status etc) ■Green
◆Damages
Human: ■Red continuous line
Material: ■Red broken line
◆Natural harmful factors (external pressure/ geographical / topographical): ■Orange
◆Social harmful factors (poverty/vulnerability) ■Purple

Roads impassable due to floods, villages isolated
Evacuation centers flooded, their capacity, capabilities and supplies lacking
Few structural countermeasures
No nonstructural countermeasures: hazard map, early warning system, disaster information

No warning given / not heard
Did not evacuate; own house not flooded yet
Flooded areas could not receive support from surrounding unaffected areas

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Several hundred families lost houses
530 million peso property damage
(Y2000) Crops wiped out
Poultry infected, destroyed

19 Dead
222,000 people affected
54% of people in flooded areas stayed home, making high places or going to the roof

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- Almost no evacuation network system with neighboring cities towns villages
- Giving priority to personal judgments over govt. organization warnings
- A spirit of mutual aid exists among the people

Figure 17 Summary Figure (Capiz Province December 2000 Floods)

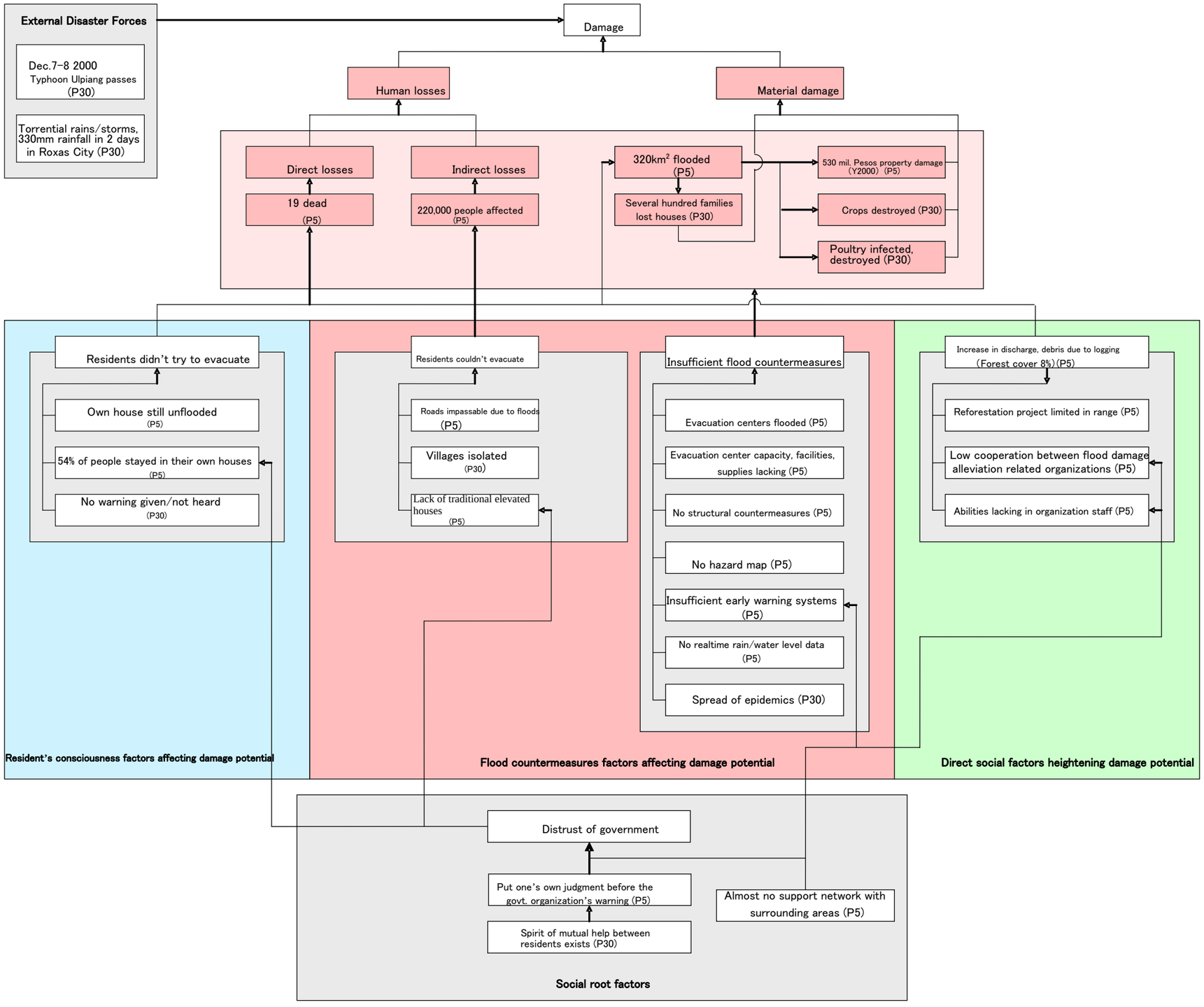


Fig 18 Factor Analysis (Capiz Province December 2000 Floods)

(3) Southern Leyte Province Landslide, 2003 (P5)

1) Landslide disaster outline

In December 2003, a disaster occurred when 2,000mm of rain fell in the space of ten days on Panaon Island in the south of Southern Leyte Province causing extremely large debris flow and mudslides.

Figure 19 shows the amount of damage in December 2003 on Panaon Island. Two villages suffered severe damage from earth slides (Punta and Pinut-an). 105 people died in Punta with 103 homes being destroyed by debris flow, in Pinut-an 5 people died and 496 houses were destroyed by mudslide. In the northern village of Lutao soil fall and floods caused 22 deaths and destroyed 25 houses.

2) Analysis of the Causes of Death

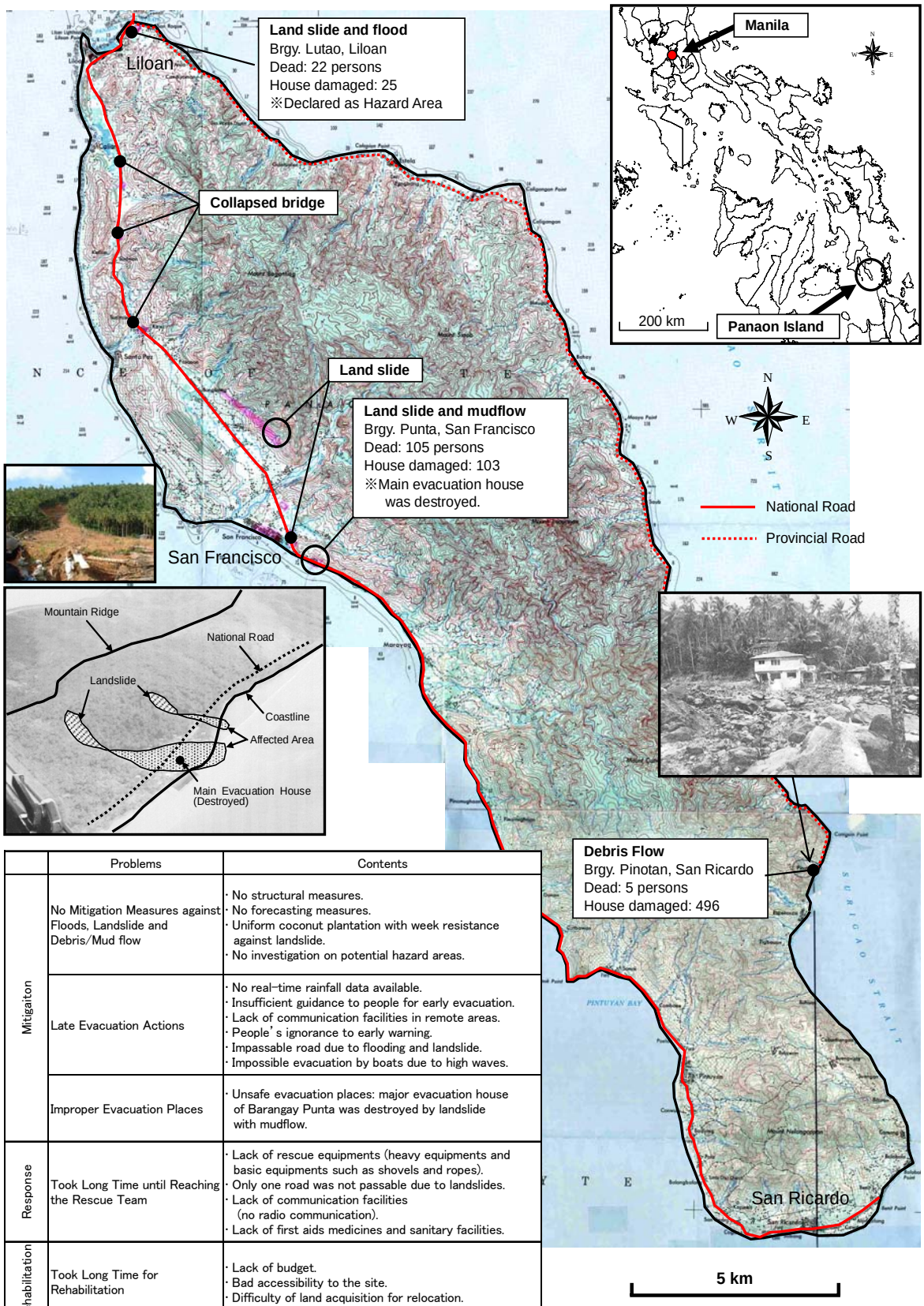
After the first small earth slide the villagers took shelter in one house (the evacuation center), but almost immediately the second massive earth slide occurred and became a mudslide which slammed into the evacuation center, causing great loss of life.

Worse, when the villagers of Punta tried to evacuate, the single road to the nearby town of San Francisco was rendered impassable partway through by an earth slide and the overflow of a small river, forcing them to stay in their own village.

Attempts to leave by boat were rendered impossible by the high coastal waves. Because the road was impassable attempts by rescuers to reach the damaged areas were hampered, delaying rescue efforts.

Lutao Village was the victim of flash flooding. Many houses were clustered dangerously in a small valley, where flash flooding and earth slides occurred.

On top of this, the lack of real-time rainfall data from PAGASA and the lack of communications equipment such as wirelesses in the neighboring towns meant the localized torrential rain date for these remote areas did not reach the PDCC of Maasin Ctiy, the main city in the area.



	Problems	Contents
Mitigaiton	No Mitigation Measures against Floods, Landslide and Debris/Mud flow	· No structural measures. · No forecasting measures. · Uniform coconut plantation with week resistance against landslide. · No investigation on potential hazard areas.
	Late Evacuation Actions	· No real-time rainfall data available. · Insufficient guidance to people for early evacuation. · Lack of communication facilities in remote areas. · People's ignorance to early warning. · Impassable road due to flooding and landslide. · Impossible evacuation by boats due to high waves.
	Improper Evacuation Places	· Unsafe evacuation places: major evacuation house of Barangay Punta was destroyed by landslide with mudflow.
Response	Took Long Time until Reaching the Rescue Team	· Lack of rescue equipments (heavy equipments and basic equipments such as shovels and ropes). · Only one road was not passable due to landslides. · Lack of communication facilities (no radio communication). · Lack of first aids medicines and sanitary facilities.
Rehabilitation	Took Long Time for Rehabilitation	· Lack of budget. · Bad accessibility to the site. · Difficulty of land acquisition for relocation.

Fig 19 State of Landslip Damage on Southern Leyte Province, Panaon Island, 2003

3) Socioeconomic Structures in the Damaged Areas / Evacuation of the Victims / Damage Mitigation System

Problems for disaster management in the damaged areas are as follows in Table 19.

Table 19 Problem Areas in Southern Leyte Province Disaster Risk Management

Problems	Details
1. Disaster mitigation 1) No mitigation measures floods, landslide and debris/mud flow	・No structural measures even in priority areas ・No forecasting measures ・Uniform coconut plantations with weak resistance against landslide ・No studies made of danger areas on the hazard map or in regards to peoples' daily lives
2) Late evacuation actions	・No real-time data available ・Insufficient guidance to people for early evacuation ・Lack of communication facilities in remote areas such as wirelesses ・Final decision to evacuate was highly dependent on BDCC, lack of information on disaster likelihood and means of communications meant extremely low support from MDCC and PDCC ・People ignored the early warnings ・Impassable road due to flooding and landslide ・Evacuation by boats impossible due to high waves (no jetty)
3) Improper evacuation places	・Unsafe places of evacuation: major evacuation house of Punta was destroyed by landslide with mudflow
2. Response A long time passed before the rescue team arrived	・Lack of emergency supplies (heavy equipment, essential items such as shovels and ropes) ・Only one road, impassable due to landslide and floods ・No means of communication (no communication by wireless) ・Lack of first aid medicine and sanitary facilities
3. Rehabilitation Rehabilitation took a long time	・Budget lacking ・Bad access to the site resulting from institutional problems (rehabilitation of the west coast road is over, but only parts of the east coast road have been repaired) ・Difficulty of land acquisition for relocation (however, finally an area for relocation was found for Punta, houses are under construction)

Note) Evacuation including warnings is considered to emphasize mitigation, preparedness and emergency response

Considering the state of disaster monitoring on Panaon Island and the landslide-related problems, the following points are necessary for reform and conditions of the disaster management capabilities in this region.

① Regarding slope erosion, weak coconut trees cover Panaon widely, hence from the perspective of this area's safety from landslides, the addition of the nonstructural countermeasure of reforesting with various kinds of trees is necessary.

This requires the cooperation of the local society. Hence, there is a need to consider the financial advantages for the residents through the introduction of agroforestry.

② Furthermore, many people are living in high-risk areas such as along the rapids, there is a need to limit the risks to residents from such landslide and flood risks.
Regardless of the fact that several dangerous areas like Lutao Village are recognized by Liloan City and the Mines and Geosciences Bureau (MGB) of Region VIII as high risk areas, there are also other areas similarly requiring damage risk studies.

③ In addition to these structural countermeasures and preparatory measures, nonstructural countermeasures are concerned with various organizations such as the DPWH, DENR, DoH and LGUs, hence cooperation between these organizations is necessary in order to comprehensively put into practice these mitigatory and preparatory measures to enable balanced improvement of the safety of these regions against landslides and floods.
However, in practice disaster management is handled in a makeshift manner to handle one emergency after another, with no comprehensive mitigatory and preparatory measures undertaken. What's more, there is no coordinator for such a comprehensive method of management. It follows that the disaster management system must be reformed to make possible such a comprehensive system.

Natural Conditions in the Philippines
・Around 20 typhoons occur every year, half making landfall
・Wet season from June to November, frontal torrential rain common

2,000m of rain in 10 days
From November, torrential rain connected to La Nina
Small scale earthquake (M2.6)
Tidal waves occurring

Flash floods, earth slides occurring
Small rivers overflow

◆Countermeasures (flood control/evacuation facilities): ■Blue
◆Response (evacuation status etc): ■Green
◆Damages
Human: ■Red continuous line
Material: ■Red broken line
◆Natural harmful factors (external pressure/ geographical/topographical): ■Orange
◆Social harmful factors (poverty/fragility): ■Purple

No structural countermeasures: (Only one road, no jetty, lack of danger / disaster equipment in the evacuation place)
No nonstructural countermeasures (no hazard map, prediction measures, rainfall disaster prevention data, insufficient communications)

・Torrential rain information wasn't communicated to the residents
・Residents ignored the early warnings

103 Houses buried / destroyed (Punta Village)
496 (Pinut-an Village)
22 (Lutao Village)

Destruction of evacuation center
Road destroyed

105 Dead (Punta Village)
5 dead (Pinut-an Village)
22 dead (Lutao Village)
24,000 people affected

・Forced to live on dangerous, earth slide prone land
・Change in land use from 1920s (forest to coconut plantation)
・Result: low resistance to earth slides
・Stopgap measures
・Difficult to find land for transference to

Figure 20 Summary Figure (Landslide in Southern Leyte Province, December 2003)

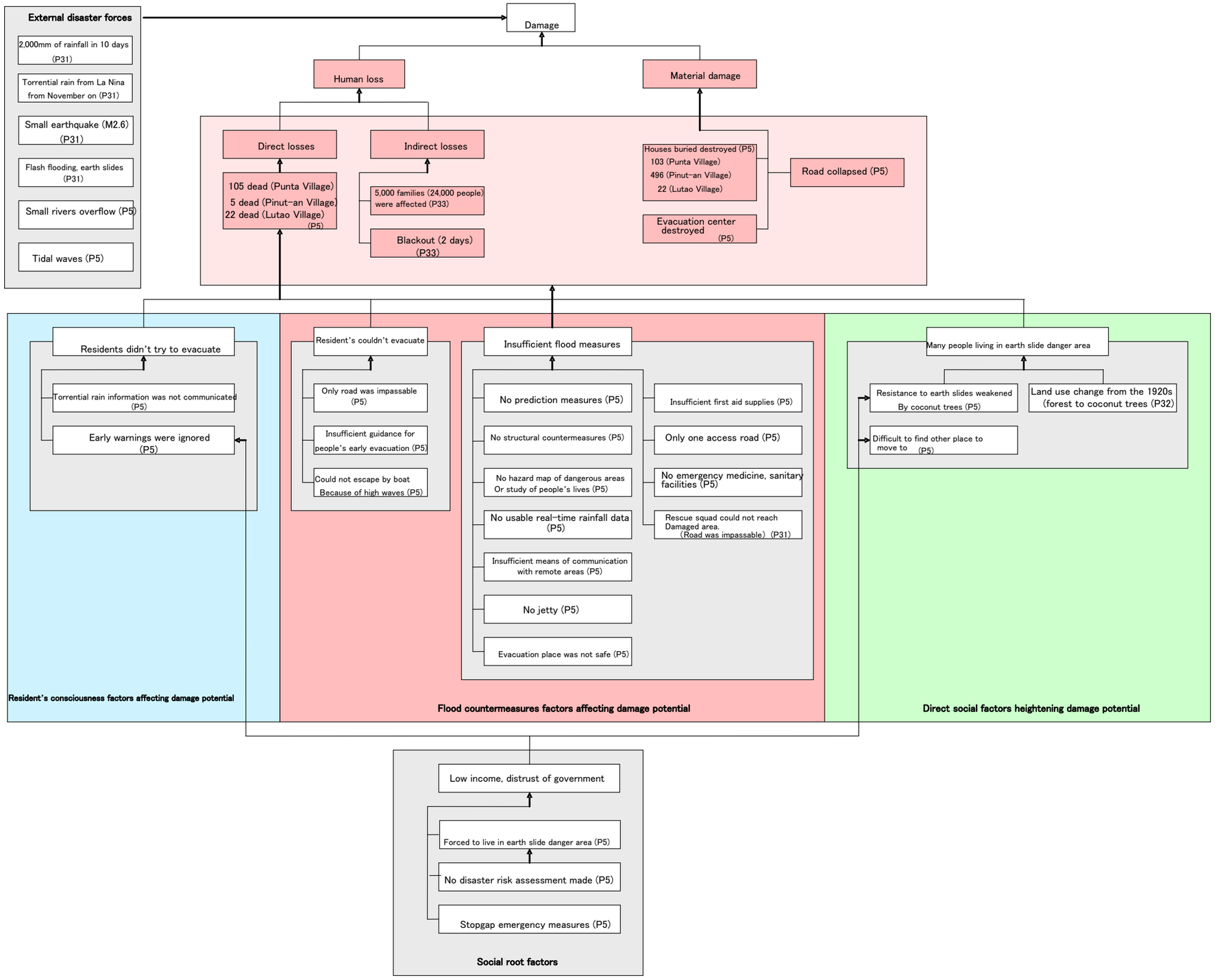


Figure 21 Factor Analysis (Landslide in Southern Leyte Province, December 2003)

5.2 Damage from the 1976 Moro Gulf Earthquake Tsunami (P21, P23)

(1) Outline of earthquake tsunami disasters

Before dawn on August 17 1976 in the Moro Gulf of the southern Philippines, a magnitude 7.9 (Richter Scale) earthquake occurred several miles off the coast of Mindanao Island in the Cotabato Trench, causing a tsunami which hit the areas surrounding Moro Gulf.

Figure 22 Location of Southern Mindanao Island and the Moro Gulf

The tectonics of the Celebes Sea - Sulu Sea region, between the Philippines Islands and the southern Philippines Trench on the northeast and Borneo on the southwest, are complex, and the ocean basin deep. From a precipitous ocean ridge the area shows large-scale fault activity accompanied by volcanic activity. As a result, this area is the origin point for large scale earthquakes and destructive typhoons. The principal two faults are the Sulu Sea Sulu Fault and the Cotabato Fault.

The Cotabato Fault is a region of subduction that crosses the Celebes Sea and the southern Mindanao Moro Gulf.
The August 16 1976 Moro Gulf Earthquake occurred close to this Cotabato Trench subduction.

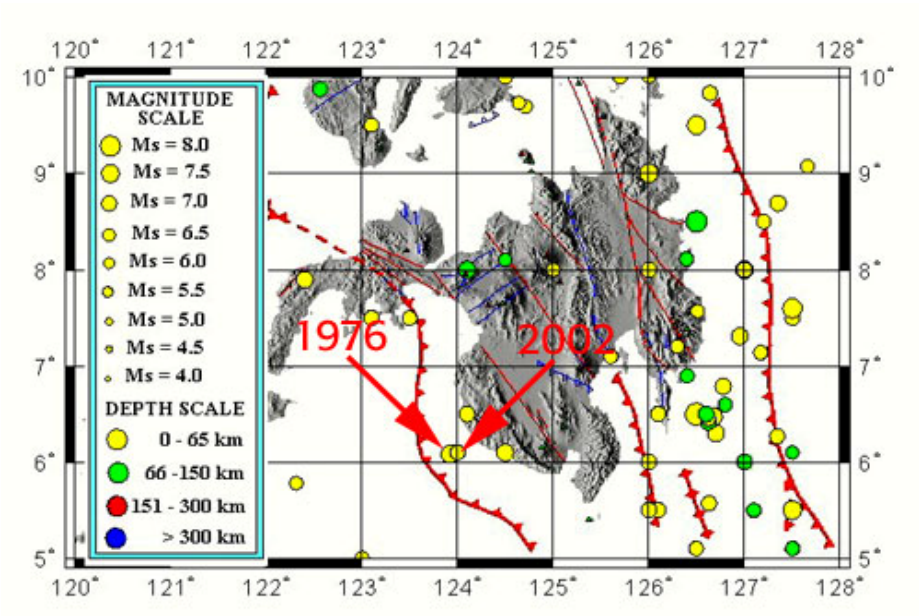


Figure 23 Epicenter Location of the 1976 Moro Gulf Earthquake and 2002 Earthquake

The seismic intensity of this earthquake over the Philippines is shown from PAGASA data in the map at the right. The seismic intensity is expressed by the modified Mercalli scale.

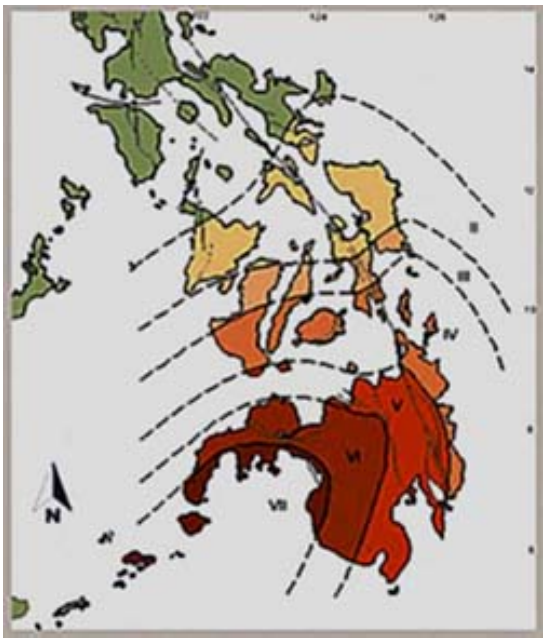


Figure 24 August 1976 Moro Gulf Earthquake Seismic Intensity Distribution (Modified Mercalli Scale)

Most of the earthquakes around the Cotabato Trench are shallow, but deep ones do occur.

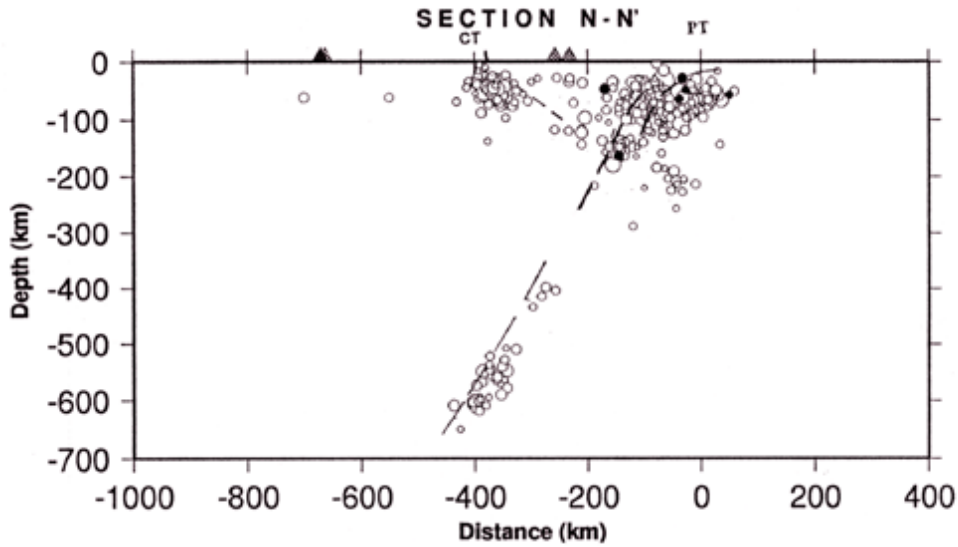


Fig 25 Distribution of Depth of Hypocenter on the Cotabato Trench

There was remarkable earthquake devastation in the Cotabato Province, but the devastation caused by the tsunami wreaked havoc along 700km of the Moro Gulf coastline, hitting Pagadian City, Zamboanga City, and the villages of the Sulu Archipelago. The damage from this tsunami was 4,791 dead, 2,288 missing, and 9,928 injured, and housing was also washed away in many areas such as Pagadian City and Lanao del Sur. 90% of these casualties were caused by the tsunami.

Recent Earthquakes in the Same Area

An earthquake occurred in the Cotabato Trench at 5.15am (local time) on March 6 2002. According to PHILVOLCS, the epicenter was almost exactly the same as for the August 16 1976 earthquake, with a depth of 15km. According to the Pacific Tsunami Warning Center, the earthquake had a magnitude of 6.8.

According to the Philippines Office of Civil Defense (OCD) this earthquake caused several deaths and injuries, the effects being felt in the provinces of Sultan Kudarat, Sarangani, North Cotabato and South Cotabato.

(2) Analysis of Causes of Death

The earthquake that caused this tsunami occurred at 16.11 UTC (Coordinated Universal Time) on August 16 1976 (0.11 am on August 17 by local time).
The tsunami struck five minutes after the earthquake, leaving no time for the warning to be sounded.

The incident occurred at night, with the tsunami reaching a height of five meters at North Cotabato, there being no warning system in place and almost all of the people in the towns were asleep when the typhoon struck.

Damage was severe in the Muslim communities of the Moro Gulf where most people lived close to the shoreline or on the water. There was similar damage on Jolo Island from the tsunami.

(3) Socioeconomic Structures in the Damaged Areas / Evacuation of the Victims / Damage Mitigation System

- The hardest hit area was that of the Muslim communities. Most of the houses there were close to the shoreline or in houses sitting on stilts in the water.
- Almost all the casualties in these communities did not know of the dangers of earthquakes and tsunamis in the area.
- Although in some areas a five to fifteen minute interval passed between the tsunami waves, the people in the area did not seek higher ground but remained in their homes.
- A survey was carried out directly after the tsunami, but because of transportation route problems between the Sulu Archipelago Basilan Island and Jolo Islands and an ongoing civil war access could not be made to these areas.

Natural conditions in the Philippines / Moro Gulf area
- Complex tectonic structures
- Deep ocean basin from a precipitous ocean ridge, showing large-scale fault activity
- Subducted Cotabato Fault crosses the Celebes Sea and Moro Gulf
- Most Cotabato Trench earthquakes occur in shallow places

Earthquake occurs at 0.11a.m. August 17 1976 (local Time) several miles from the coast at the Cotabato Trench and measures M7.9 (Richter Scale)

Five minutes after the earthquake a 5m-high strikes the Moro Gulf area. 700km of coastline struck by the Tsunami.

◆Countermeasures (flood control/evacuation facilities): ■Blue
◆Response (evacuation status etc): ■Green
◆Damages
Human: ■Red continuous line
Material: ■Red broken line
◆Natural harmful factors (external forces/geographical/ Topographical): ■Orange
◆Social harmful factors (poverty/vulnerability): ■Purple

No structural countermeasures (many people living next to the tsunami danger zone of the coastline or on the water)

No nonstructural countermeasures (no warning system, people didn't know it was a dangerous place for earthquakes/tsunami)

People remained in their homes between the waves

No time to evacuate

Just before dawn, almost all families were asleep

93,382 people lost their homes or property

4,791 dead
2,283 missing
9,928 injured

Since the 1970s, a war for independence intensified in Mindanao
Political instability
Low income Muslim communities living along the coast

Figure 26 Summary Figure (Damage from the 1976 Moro Gulf Earthquake Tsunami)

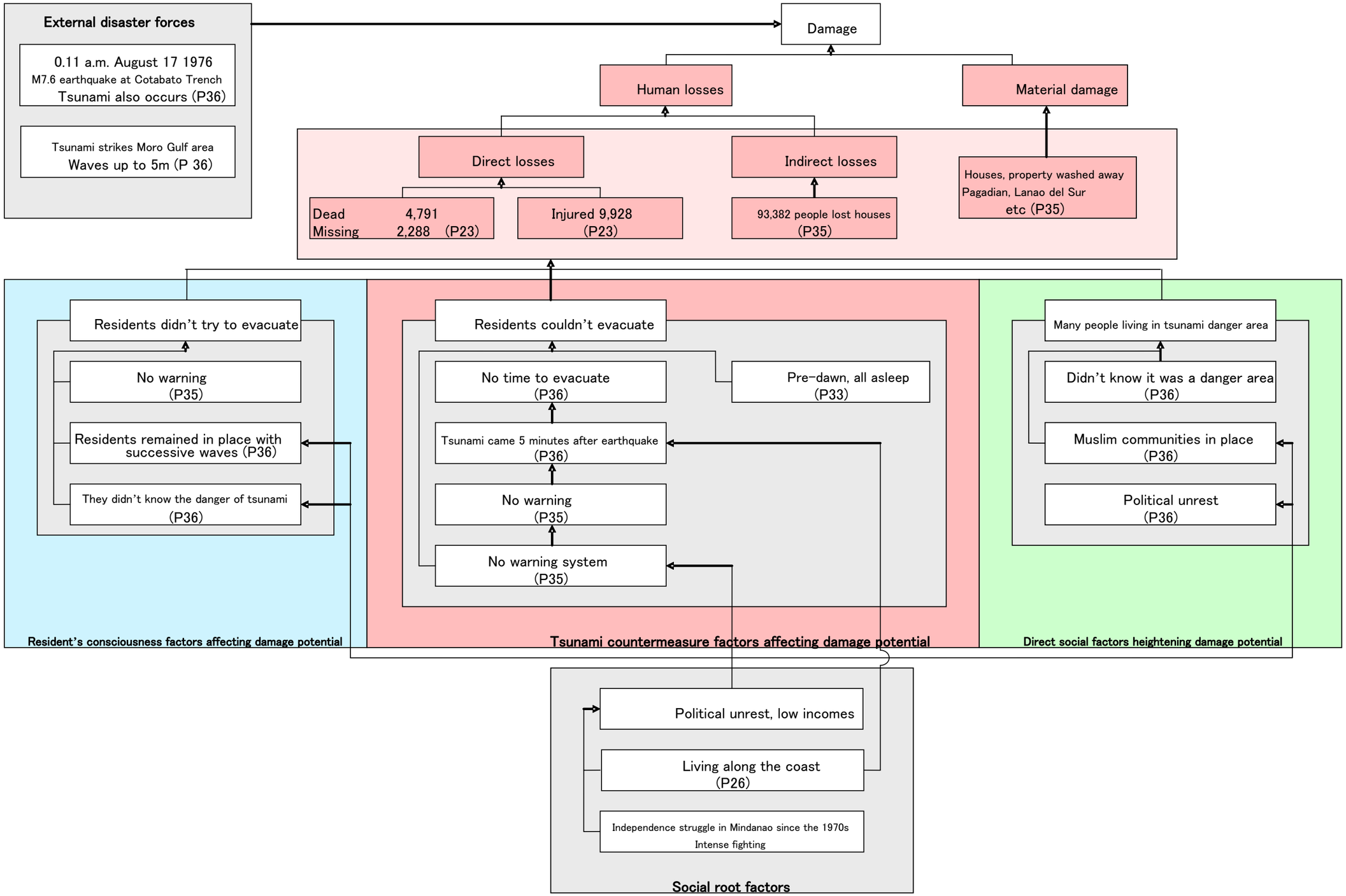


Figure 27 Factor Analysis (Damage from the 1976 Moro Gulf Earthquake Tsunami)

6. Conclusions

The Philippines has an unusual topographical and climactic environment, with conditions that can easily give rise to various external disaster forces. Each year twenty typhoons form near the Philippines, and half of those make landfall to cause floods and landslides. Also, the collision of the Philippines Sea Plate and the Eurasian Plate cause subducting zones to form, there is frequent volcanic and earthquake activity and earthquakes and tsunamis often occur.
In social terms the economy is sluggish, and along with the problem of poverty are the problems of minorities and the religious strife in the southern area.
Under these conditions there are insufficient disaster prevention countermeasures, and the vulnerability to water disasters is well exposed.

Conclusions for damage mitigation measures will be drawn from an examination of the following specific cases of damage.

Landslides following the Mount Pinatubo Eruption

The causes of the severe damage were the huge volume (6.7m^3 billion) of volcanic ash deposition, and the frontal torrential rain and typhoon prone nature of the area. Over a long period of time, great numbers of mudslides have occurred over a wide area from the rain brought by the typhoons that seem to come year after year.
At the same time, many of the Aeta minority live in the area. They are the descendants of people who fled to the mountain areas after Spain conquered the Philippines in the 16th Century; they have a deep distrust of people from the lowlands coming from unfair discrimination and poor education. This is a central reason for the large-scale damage suffered. Similarly, their distrust of the government led to refusing medical treatment and taking negative attitudes towards the government's disaster countermeasures. The prolonged evacuee period has also led to many of them returning to seek their homes and hence becoming victims of disaster.
Also, while mudslide control facilities and mudslide monitoring and prediction systems are being developed, they are still not sufficient.

Thus, as measures to mitigate future losses to disaster, the following are necessary:

1) Structural countermeasures such as greater development of mudslide control, mudslide monitoring and evacuation facilities.
2) Full development of nonstructural countermeasures such as early warning systems for evacuation from observation of rainfall and mudslide occurrences.
3) Development of systematic and financial framework for the construction social stability for the Aeta from a long-term perspective

December 2000 Floods in Capiz Province

Capiz Province is subject to many disasters involving flooding caused by typhoons. There are still many elevated houses built on stilts in the traditional style to alleviate flooding damage in the dangerous areas, but recently other styles of houses are increasing.
In December 2000 Typhoon Ulpiang crossed the center of the Philippines, causing the biggest flood damage in the last twenty years in Capiz Province.
Event though warning was given and guidance for evacuation made, the majority of people did not follow these instructions. The social situation may have forced them to choose to protect their own property themselves.
In regards to regional disaster prevention for such disasters, the development of:

1) Frameworks for the practice of traditional disaster countermeasures with the participation of the residents
2) Heightening the regional disaster prevention potential capabilities by building comprehensive disaster prevention frameworks including surrounding areas as well as the damaged areas must be considered as necessary in addition to structural countermeasures.

2003 Southern Leyte Province Landslides

Southern Leyte has always been an area of high rainfall, and with the changes in land usage since the 1920s (felling the forests and planting coconut trees) making the land vulnerable to earth slides, the risk of landslides occurring has greatly increased.
In December 2003 on Panaon Island in Southern Leyte Province, the fall of 2,000mm of rain in ten days caused the suffering of large-scale landslide and mudslide damage. The evacuation places and evacuation routes were both damaged, greatly expanding the losses.

The following ideas are given for mitigating damage in these areas.

1) Implementation of land use guidance aimed at mitigation of long-term disaster potential
2) Surveys for the creation of hazard maps
3) Furthermore a comprehensive disaster prevention framework allowing coordination between areas in the danger zone and surrounding areas and government organizations.

The 1976 Moro Gulf Earthquake Tsunami

The reasons behind the large-scale damage from the 1976 Moro Gulf Earthquake Tsunami involve the extremely short time between the magnitude 7.9 earthquake occurring in an ocean trench close to the coast and the subsequent tsunami striking the coast, with the people on the coasts still asleep in their beds, unaware of the dangers of tsunamis.

To alleviate such disasters, countermeasures focused on soft measures such as the following are necessary.

1) Surveys of the regional tsunami danger level
2) Creating a danger distribution map based on 1) and making it known to relevant organizations and the local people

3) Restrictions and guidance on land usage based on 2)
4) Development of tsunami warning systems, evacuation guidance methods, evacuation areas etc

Apart from these particular cases, great damage is caused almost every year by other water-related disasters. Many elements are extremely similar to the cases outlined above. In addition to the large size of the external disaster forces and the frequency of occurrence, the vulnerability to disasters brought on by the economy's difficulties and poverty is underscored. Promotion of comprehensive disaster countermeasures both hard and soft to improve effective disaster prevention capabilities in the Philippines must be made not only from a national but also from an international perspective.

Appendix

1) December 2006 Typhoon Damage (P45, P46, P47)

Typhoon 21 Durian (Philippines name Reming) crossed the south of Luzon at the beginning of December 2006.

It was super typhoon measuring a peak wind speed of 65 m/s, bringing heavy rainfall 466mm in the 24 hours from November 30 8a.m. to December 1 8a.m, and causing large-scale mudslides and lava flows on the southeastern slopes of Mount Mayon (2,462m above sea level) in Luzon's Bicol Province.

The damage is not yet fully known, but information from the Internet is as follows.

- South Luzon: 450 dead / 600 missing
- Damage to agriculture and fisheries (in 13 provinces): 830 million pesos (approx. 1.9 billion yen)
  23,000 ha of rice cultivation destroyed
  37,000 t of harvest destroyed
- Large damage to agricultural products, livestock, fisheries, irrigation works, infrastructure-related facilities in the provinces of: Catanduanes, Albay, Camarines Sur, Sorsogon, Masbate.
- Destruction of farmland, infrastructure in provinces of: Quezon, Batangas, Laguna, Rizal, Occidental Mindoro, Marinduque, Romblon
- 1.7 million pesos worth of stockpiled rice destroyed with warehouse in Albay Province
- 7,348 ha of corn farms, 4000t destroyed (61 million pesos) in provinces of: Occidental Mindoro, Albay, Camarines Sur
- 44,000 ha of coconut plantation (53.5 million pesos worth of damage) in provinces of: Batangas, Cavite, Laguna, Quezon
- Damage to fruits, vegetables (229 million pesos worth)
- 70 million pesos worth of damage to irrigation facilities
- Steel towers, power cables, and wooden power poles damages of 900 million pesos
  89 steel towers toppled, 27 broken
  877 wooden iron poles burnt
  9.065 pesos expenses for emergency electric repairs

The Philippines Disaster Coordinating Council on the 8th submitted a report on the damages of the three recent super typhoons (September's Xangsane (Milenyo), October's Cimaron (Paeng), December's Durian (Reming) that struck the Philippines, calling attention to the terrible nature of the damages. The three typhoons have caused 808 deaths, 2,652 injuries, and 820 people missing. Damage from Typhoon 21 Durian (Reming) is still not completely known. As of the 8th, 350,329 people have been evacuated because of the typhoon.

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