NATURAL DISASTER RISK MANAGEMENT IN THE PHILIPPINES:
ENHANCING POVERTY ALLEVIATION THROUGH DISASTER REDUCTION

THE WORLD BANK
EAST ASIA AND PACIFIC REGION
RURAL DEVELOPMENT

NATIONAL DISASTER COORDINATING COUNCIL
REPUBLIC OF THE PHILIPPINES

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Acronyms

AFP	Armed Forces of the Philippines
BDCC	Barangay Disaster Coordinating Council/s
BDOC	Barangay Disaster Operations Center/s
CBDM	Community-Based Disaster Management
CBO	Community Based Organization/s
CMDCC	City/Municipal Disaster Coordinating Council
DBM	Department of Budget & Management
DCs	Developed Country/ies
DCG	Disaster Control Group
DOC	Disaster Operations Center/s
DPM (Thailand)	Department of Disaster Prevention and Mitigation
DPWH	Department of Public Works and Highways
DRC	Disaster Resilient Community/ies
DLGI	Department of Local Government & Interior
DSWD	Department of Social Welfare & Development
EdM – (Japan)	Earthquake Disaster Mitigation Research Center
EqTAP – (Japan)	Development of Earthquake and Tsunami Disaster Mitigation Technologies and their Integration for the Asia-Pacific Region) Project
FEMA	(US) Federal Emergency Management Agency
EO	Executive Order
EMIP	Emergency Management Institute of the Philippines
IDNDR	International Decade for Natural Disaster Reduction
IDRM	Integrated Disaster Risk Management
JICA	Japan International Development Agency
LDCs	Less Developed Country/ies
LDCC	Local Disaster Coordinating Council/s
LGU	local government unit
LI	Letter of Instruction
LUM	land use management
MAAs	Mutual Aid Agreements
MMDA	Metro Manila Development Authority
MMDCC	Metro Manila Disaster Coordinating Council
MMEIRS	Metro Manila Earthquake Impact Reduction Study
NCDA	National Civil Defense Administration
NEDA	National Economic Development Authority
NGO	Non-Government Organization
NPO	Not-for-Profit Organization
NDCC	National Disaster Coordinating Council
OCD	Office of Civil Defense
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services
PD	Presidential Decree
PDCC	Provincial Disaster Coordinating Council
PDOC	Provincial Disaster Operations Center
PHIVOLCS	Philippine Institute of Volcanology & Seismology
PNP	Philippine National Police
RA	Republic Act
RDCC	Regional Disaster Coordinating Council/s
RDOC	Regional Disaster Operations Center
RoP	Republic of the Philippines
UP	University of the Philippines
WB	The World Bank

Executive Summary

The Philippines by virtue of its geographic circumstances is highly prone to natural disasters, such as earthquakes, volcanic eruptions, tropical cyclones and floods, making it one of the most disaster prone countries in the world. These hazards cost the Government an average of P15bn per year in direct damages, or more than 0.5% of the national GDP, and indirect and secondary impacts further increase this cost. In addition, to this significant economic cost, there are also substantial social and environmental impacts. This high level of risk is what prompted the Bank and the Government to mount an informal study to: document the impacts of natural disasters on the social and economic development of the Philippines; assess the country's current capacity to reduce and manage disaster risk; and identify options for more effective management of that risk. The primary audience of this report is the Government, at all levels, the donor community and stakeholders involved in disaster management. The report is also of interest to the Bank primarily as it provides a good basis to determine where its assistance could best be used.

The frequent disasters hinder the Philippine Government's efforts to reduce the incidence of poverty and reduce the number of people and assets vulnerable to these hazards. There are indications of close linkages between poverty and vulnerability to natural disasters and of their mutually re-enforcing effects. The poorer communities tend to be the most vulnerable. Data show that at the household level, poverty is the single most important factor determining vulnerability. This situation is exacerbated by rapid urbanization, environmental degradation and the increasing risk of environmental disasters, whether as a result of direct human impact and or from climate change.

The Philippine institutional arrangements and disaster management systems tend to rely on a response or reactive approach, in contrast to a more effective proactive approach, in which disasters are avoided, by appropriate land-use planning, construction and other pre-event measures which avoid the creation of disaster-prone conditions. There is a widespread emphasis on post-disaster relief and short-term preparedness (forecasting, evacuation, etc.) rather than mitigation or post-disaster support for economic recovery, such as livelihood regeneration or tax breaks to affected businesses. This much shorter term focus does not adequately emphasize natural hazards as a potential obstacle to long-term sustainable development.

To evolve to this more proactive role, it is important that a national framework for comprehensive disaster risk management be prepared and implemented. The framework would provide for political leadership and policy support at the highest levels, while facilitating the active engagement and implementation of all relevant stakeholders at the national, local, and household levels. The actors should include public agencies, the private sector, and civil society. The framework should incorporate the essential steps of integrated risk management, which include risk identification, risk reduction, and risk sharing/financing. The study identified some specific areas under these key themes that would need to be addressed to improve the current system and these are briefly presented below.

Risk Identification. In this area, the fundamental requirements are reliable data on the type and amount of Philippine economic activity at risk which if not available complicate planning and risk reduction and risk sharing activities. To achieve this, high quality comprehensive hazard and vulnerability maps for major natural hazards would need to be produced or updated. In addition, there is scope for knowledge enhancement and understanding of the nature and scale of impact of disasters and forms of vulnerability. This, in turn would aid the implementation of good risk management practices, including greater consideration of hazard-related issues in broader sustainable development and poverty reduction policies and programs as well as of appropriate, cost-efficient post-disaster relief and rehabilitation efforts. As part of the strategy to reduce risk, it will be important not only to increase the focus on mitigation, but also on post-disaster support for economic recovery, such as livelihood regeneration or tax breaks to affected businesses.

Risk Reduction. Once the risk has been adequately identified, measures would need to be taken to prevent, mitigate and reduce the inherent risks. The type of risk reduction measures to be implemented must be supported by appropriate institutional arrangements, including legislative and policy changes, as needed. The disaster management system in the Philippines is based on a decree that has not been updated in the last

20 years, and to create an enabling environment for a comprehensive disaster management strategy, it will be essential that the governing decree is updated. Changes proposed will need to take into account evolving roles of the central and local governments and directly bring the private sector, specifically utilities, into both emergency management strategic decision-making and operational contexts, while promoting the sustainable management of hazards and risks in a way that contributes to the well being and safety of the public and property. However, before this work can be carried out, a more detailed review of institutional arrangements and capacities for disaster risk management to identify gaps and priorities must be carried out.

Changes in the roles and responsibilities of the various actors will need to be accompanied by adequate coordination and implementing capacity in agencies involved in disaster management. In keeping with the shifting focus to a more proactive role, the type of coordination needed should be less of a top-down oversight function to one that is more participatory. Greater organizational, management and task synchronization would be prerequisites at both national and international levels. As risk reduction also requires that the resilience of the most vulnerable communities to hazard impacts be enhanced to help them cope with the hazards when they occur, the approach taken must emphasize a bottom-up approach with participation of all stakeholders. The Philippines system tends to be more of a centralized top-down administrative system than a community-based system and there are few incentives for local level initiatives. The system needs to be strengthened to encourage some local government units (LGUs) to initiate sustainable development practices just as much as it is to encourage other LGUs to continue along this path, often against bureaucratic obstacles. With very few exceptions, local level systems are response-driven – there is no obvious effort to initiate proactive hazard management/risk reduction coordination.

Risk Sharing/Financing. The study found that presently the Government of the Philippines and individual households bear the majority of costs caused by natural disasters. More effective options for financing disaster risk and relieving the burden of disasters from the public sector should be explored, including the idea of a catastrophe insurance pool, and/or contingent credit facilities. As a start, the fiscal vulnerability of the federal and local governments to natural disasters can be reduced significantly by introducing institutional incentives[1] for better risk management and institution building. To reduce the funding gap and the vulnerability of the poorest segments of the population and critical infrastructure to natural disasters, the existing national system of financing disaster losses could be redesigned to provide strong fiscal incentives to LGUs for more proactive risk management. More effective than diverting funds from ongoing development projects, a more efficient option for catastrophe risk financing would be the use of contingent credit facilities. The contingent credit facility could be extended to the National Calamity Fund to finance disaster management activities at the LGU level, Federal Government level as well as support an insurance pool. The credit facility could be designed to disburse quickly on an as-needed basis, triggered by the occurrence of a disaster of magnitudes agreed to by the Government and based on agreed criteria. If drawn down, the lending facility backing the National Calamity Funding could then be replenished without any major costs for the Bank or the Borrower. This funding approach for natural disasters would enable the Government to switch to a proactive mode of financing natural disasters by replacing multiple ex-post future emergency lending operations with a single line of credit, and to obtain access to immediate liquidity to meet reconstruction needs in the aftermath of a disaster.

The study found that despite the high hazard risk in the Philippines, the insurance coverage for catastrophic perils for residential dwellings is almost non-existent. In addition, there is a limited risk bearing capacity of the domestic insurance market and an over-dependence on international reinsurers for claims paying capacity. In this regard, the idea put forward by several local insurers to create a Philippines Catastrophe Insurance Pool warrants serious attention. A Working Group would need to be created to explore the establishment of a Philippines Catastrophe Insurance Pool.

[1] The level of post-disaster funding to the LGUs is based more on the size of disaster losses and the local economy. The current system does not provide incentive for those LGUs that may have taken proactive steps in risk reducing measures.

Potential Areas for World Bank Support

To support the Philippines' effort to better manage disaster risk and enhance poverty reduction, the World Bank should examine the ongoing portfolio to identify how its ongoing development projects can support the goal of disaster risk reduction. In addition, the Bank should consider more direct support to the development of an integrated disaster management risk approach, through the provision of technical assistance and lending.

The World Bank has developed a significant amount of expertise over the years through its provision of technical and lending support for disaster risk management. It should apply this to the Philippines in their efforts to improve poverty reduction. This assistance can take the form of a technical assistance loan to facilitate the development of a national framework for disaster risk management and institutional capacity building to implement the strategy. As described above, the Bank could also provide support in the development of contingency credit facilities to reduce the economic and financial impacts of disasters in the Philippines.

Chapter 1. Introduction

1. The social and economic cost of natural disasters has increased in recent years due to population growth, change in land use patterns, migration and unplanned urbanization, environmental degradation and global climate change. About 75 percent of the world's major natural disasters between 1970 and 1997 occurred in the Asia and Pacific Region. In the East Asia and Pacific Region, there are several countries that are located in disaster prone zones and are exposed to a number of natural disasters annually. The list includes Vietnam, the Philippines, Cambodia, and most of the Pacific Island countries. In addition to the loss of lives and major destruction of economic and social infrastructure, natural disasters set back poverty reduction programs and cause diversion of government funds to pay for reconstruction and recovery efforts.

2. The Philippines is known as one of the most hazard prone countries in the world. Disasters have destroyed human, social, and physical capital, and they have derailed social and economic development, as funds are reallocated from ongoing programs to finance relief and reconstruction assistance. While the documented losses caused by disasters are formidable, the full impacts are not known, and are probably much more significant.

3. Due to its geographic circumstances, the Philippines has an unusually high exposure to natural hazards. The most catastrophic of these hazards include earthquakes, volcanic eruptions, tropical cyclones, floods and droughts. These events have had grave social and economic consequences on the country, costing an average of P15bn per year in direct damages between 1970 and 2000, and killing about 866 people per year in that same period. These figures do not consider the equally devastating indirect and secondary impacts of disasters. In addition to the large catastrophes that command a considerable humanitarian assistance response from the international community, there are an even larger number of small hazard events that do not register on the global or even national news scene but that consistently wipe out the few assets of the poor, locking them into the poverty cycle. Data on disaster losses also does not fully consider the impacts on the poor, who are the most vulnerable to disasters. At the household level, poverty is the single most important factor determining vulnerability, in part reflecting location of housing (e.g., on floodplains, riverbanks, steep slopes or contaminated land previously occupied by industrial facilities); level of access to basic services (e.g., refuse collection) particularly for illegal squatters; sources of livelihood; and level of access to financial and other assets and resources, leaving limited recourse to inter-temporal consumption smoothing. In the case of the Philippines, linkages between poverty and vulnerability to natural hazards are clearly evident. Despite this, however, and despite Government's central objective to reduce poverty, efforts to reduce vulnerability to natural hazards are not systematically included as a central component of the government's poverty reduction strategy.

4. In addition to the large catastrophes that command a considerable humanitarian assistance response from the international community, there are an even larger number of small hazard events that do not register on the global or even national news scene but that consistently wipe out the few assets of the poor, locking them into the poverty cycle.

5. A rapid assessment of disaster management in the country indicates that disaster management systems tend to rely on a reactive approach, i.e., institutional arrangements and hardware for post-disaster emergency response; preparedness measures such as evacuation plans and stockpiling of emergency supplies; and the provision of relief. Financing arrangements also tend to be reactive, with a strong reliance on humanitarian support from the international community, calamity funds for relief activities, and the diversion of funding for development activities for post-disaster recovery. International experience has shown that this is an ineffective manner to deal with disaster risk which detracts from development objectives. This reactive approach is in contrast to a more effective *proactive* approach, in which disasters are avoided by appropriate land-use planning, construction and other pre-event measures which avoid the creation of disaster-prone conditions.

6. The Philippines' main challenge for the medium-term remains to reduce poverty. Poverty is still largely a rural phenomenon. Its causes include: high dependence on agriculture where productivity has been declining and per capita economic growth is low; lack of adequate social safety nets, especially for poor women and children; and lack of educational attainment in terms of school drop-outs and low educational quality. Population pressures and a declining natural resource base have exacerbated these problems. To alleviate poverty, the Philippines has to overcome external and internal challenges. On the external side, it must cope with fluctuations in global markets on which it depends heavily. On the internal side, it needs to win back the confidence of investors in order to raise the currently low volume of investment that is necessary for the country's development. Moreover, institutional capacity must improve, especially at the level of local governments whose responsibility for delivering development services is growing.

7. Natural disasters are a key cause of increased poverty and environmental degradation, and reducing the risk of disasters will be key to achieving the strategic goals laid out for the nation. This study was undertaken by the Rural Development Department of the East Asia and Pacific Region (EASRD) and the Disaster Management Facility (DMF) of the World Bank in partnership with the Government of the Philippines (GoP). The study aims to document the impacts that natural disasters have had on the social and economic development of the Philippines; assess the country's current capacity to reduce and manage disaster risk; and identify options for more effective management of that risk. A research mission of the World Bank was carried out in collaboration with the GoP in May 2003. This report details the findings of that mission, and provides a starting point for a dialogue with the GoP on how the World Bank can best support the country's efforts to better manage disaster risk and thus more effectively reduce poverty.

Chapter 2. Hazard Exposure and Disaster Impacts in the Philippines

8. The process of managing disaster risk effectively begins with risk identification. Risk identification comprises assessing the hazard exposures of a country, as well as understanding the vulnerabilities of the targets of extreme events in order to determine the potential impacts and losses. In this way, informed decisions can be made regarding steps to reduce the impacts of disasters. The development of a clear understanding of the impacts and losses of past events is also important to comprehending the impacts of future events. As this chapter will show, the Philippines has a high exposure to a number of natural hazards, and these hazards have had grave social and economic impacts on the country's development over the years.

Natural Hazard Exposure

9. Due to a combination of the Philippines being at the junction of several tectonic plate boundaries, as well as being in an area of frequent tropical cyclones, the nation is unusually susceptible to natural hazards, with earthquake, volcanic eruptions, tropical cyclones, and floods being the most catastrophic hazards, see Table 1. This section provides an overview of each of these hazards.

Table 1. Ranking of Disaster-related 20th century Philippine Fatalities

Hazard event	Number Killed	Damage (USD millions)
Typhoon	28812	5653
Earthquake	9572	517
Volcano	6331	228
Flood	2545	431

Source: CRED, 1998

10. ***Earthquakes***: The Philippines is an archipelago of over 7,000 islands and islets with a total land area of 300,000 square kilometers. Geologically, the archipelago is the product of accretionary wedges and volcanic eruptions resulting from the collision of the Philippine Sea, Pacific and Eurasian plates, as well as smaller platelets (Sulu, Celebes Sea) being forced northward by the large India-Australia plate. The plate motions are accompanied by earthquakes and volcanism. As a result of its geological exposure, the country experiences on average 887 earthquakes every year, some of which have proved to be damaging.

11. The US Geological Survey lists 168 significant damaging events in the Philippines since 1599, equivalent to a damaging event every 2.5 years on average. However, this record is biased, in that earlier centuries had fewer damaging events due to lower population and assets at risk as well as poorer communications and little or no scientific instrumentation. Two major damaging earthquakes have occurred in the Philippines in recent years – the 1976 Mindanao event, which killed approximately 6,000 and caused about USD 400 million in damage (in present value), and the 1990 Central Luzon event, which killed over 1,000 and caused damages of about USD 400 million (in present value).

12. A comprehensive seismic hazard analysis for the entire Philippines is beyond the scope of this study and, indeed, such analyses for the Philippines are relatively scarce[2]. Few exist, such as seismic hazard analyses by Bautista et al (n.d.) and that by Thenhaus et al (1994) in which a probabilistic analysis, which shows peak ground accelerations (PGA) on medium soil was expected to be exceeded with probability of 10% in a 50-year period[3]. More recently, Torregosa et al (2001) performed a similar analysis, confirming

[2] R. Solidum, personal communication.

[3] *10% in 50 year probability of exceedance* is a standard measure of ground motion, used in the Philippine, US and other building codes as a design basis ground motion. It is also referred to, and seen as equivalent to, a '475 year return period' ground motion, although strictly speaking this is not an accurate equivalence.

Thenhaus' findings. A review of these studies shows accelerations in the Metro Manila area to be about 0.4g, comparable to those in San Francisco, Tokyo and other high seismicity areas.

13. The Philippines are bisected longitudinally by the Philippine fault, a major tectonic feature which has many subsidiary faults, one strand of which (the Valley fault system) bisects Metro Manila. This strand is capable of magnitude 6-7 events occurring on average every 200-300 years, and has not ruptured in over 200 years (Nelson et al, n.d.). PHIVOLCS, in association with the MMDA and JICA is currently carrying out a detailed analysis of the potential for damage in the Metro Manila area, focusing on this risk. Preliminary results indicate on a deterministic basis ground motions of about 0.4g or greater, depending on soil conditions, in the Metro Manila region. On a probabilistic basis, their preliminary analysis (which included recent paleoseismic data) shows lesser ground motions, in general.

14. In addition to shaking, earthquakes cause damage in other ways, the most significant of which are liquefaction, landslides, tsunami and fires following earthquakes. Liquefaction typically occurs in loose saturated sandy ground, and is the loss of strength of that ground due to strong ground motion – it was particularly damaging in Dagupan in the 1990 earthquake.

15. ***Volcanoes***: Out of 220 volcanoes in the archipelago, 22 are classified as active. Simkin and Siebert (1994) document literally hundreds of historic eruptions – Mt. Mayon, for example, is indicated to have erupted 12 times in the 20th century alone. The most active volcanoes are probably Pinatubo, Taal, Mayon, Canlaon and Ragang. Currently, PHIVOLCS, who have the responsibility for monitoring volcanic activity, can currently monitor only six of the 22 active volcanoes for possible eruptions.

16. Volcanic eruptions are accompanied with a wide variety of destructive effects including release of magma, explosive effects, expulsion of large projectiles, pyroclastic flows (flow of hot molten material), ashfall, release of clouds of very hot gases, lahars, mudflows and ground shaking, to name the most common.

17. The Mount Pinatubo eruption in June 1991 provided an example of how rapidly and destructively a volcano can erupt. That event was the second largest volcanic eruption of this century, and by far the largest eruption to affect a densely populated area. Fortunately PHIVOLCS had forecast the eruption, resulting in the saving of at least 5000 lives and USD 250 million. However, the eruptions have dramatically changed the face of central Luzon, and the impacts of the event continue to this day. About 200,000 people who evacuated the lowlands surrounding Pinatubo have returned home but face continuing threats from lahars that have already buried numerous communities[4]. Rice paddies and sugar cane fields that were buried by lahars will be out of use for years. Other volcanoes, such as Mt. Mayon, are even more active, and surrounded by many communities at risk to lahars and other hazards.

18. Probabilistic analysis of volcanic hazards is very difficult, and beyond the scope of this study. A review of the historic record indicates that a general approximation would be that central and southern Luzon are likely to see a significant eruption about once every 3 years, with a major eruption perhaps every few decades. Most active sources are Mayon and Taal. Mindinao appears to have a somewhat lower likelihood of a major eruption, based on the historic record. However, any probabilistic estimate of volcanic hazard needs considerably more study, with a close involvement of PHIVOLCS.

19. ***Tropical cyclones*****:** The climate of the Philippines is tropical and is strongly affected by monsoon (rain-bearing) winds, which blow from the southwest from approximately May to October and from the northeast from November to February, although there is considerable variations in the frequency and amount of precipitation across the archipelago. From June to December typhoons often strike the archipelago. Most of these storms come from the southeast, with their frequency generally increasing from south to north. On

[4] A lahar is a mixture of water, mud and rock, resulting in a landslide or mudflow of volcanic fragments on the flanks of a volcano.

average, about 20 typhoons occur annually, with the months of June to November averaging approximately 3 typhoon strikes per month. Luzon is significantly more at risk than more southern areas. Typhoons are heaviest in Samar, Leyte, eastern Quezon province, and the Batan Islands, and when accompanied by floods or high winds they may cause great loss of life and property. Mindanao is generally free from typhoons. Figure 1 attached shows portions of coasts prone to storm surge, based on the historical record.

20. Typhoons have killed about 29,000 people in the country in the 20th century, including about 6000 in the 1991 typhoon. As Table 2 indicates, about 500 people are killed each year, and about P4 billion are lost due to tropical cyclones. In certain cases, a single event can kill as many as 6000, and cause P20 billion in damage. In addition to high winds, a major damaging element of tropical cyclones is storm surge.

Table 2. Tropical Cyclones Impacts in the Philippines, 1970-2002

	Persons		Affected		Displaced		Houses Destroyed		Properties
	Dead	Injured	Families	Persons	Families	Persons	Total	Partial	Bn Pesos (~54.5 Pesos to US$1)
Tot	16,654	20,311	16,843,467	83,575,773	2,111,246	9,398,995	2,140,938	4,876,749	140
Per Yr	520	635	526,358	2,611,743	65,976	293,719	66,904	152,398	4

Source: http://www.ndcc.gov.ph/home_typhoon%20data%2070-2002.html

21. ***Flooding***. Flooding is yet another hazard facing the Philippines, and has annual impacts on the country. However, relatively little information is available on flooding, and a detailed mapping of flood prone areas in the Philippines has yet to be done. Figure 2 attached shows major flood prone areas in the Philippines.

Economic Impacts of Past Disasters in the Philippines

22. Between 1970 and 2000, the Philippines incurred an average annual direct damage of P15bn per annum (in real 2000 prices) as a direct consequence of natural disasters[5], equivalent to an average 0.7% of GDP every year (Table 3). In 1991 alone losses totaled P65bn (in 2000 prices), equivalent to 2.6% of GDP, as the country experienced both a major earthquake and exceptionally heavy typhoon-related damages. Over the period 1970 to 2000, an average of 866 lives was also lost every year. Typhoons alone accounted for 65% of lives lost (56% excluding the year of the Ormoc floods in which some 5,000 perished) and 76% of total damage, reflecting their high, annual frequency.

23. As regards the country's principal food staple, rice crop losses equivalent to 2.6% of actual production (in volume terms) were experienced as a consequence of typhoons and flooding between 1991 and 2000 (1.8% excluding 1998) (Table 4). Typhoons, floods and drought collectively caused losses equivalent to 3.3% of total actual production (2.0% excluding 1998).

24. It is generally accepted that the Philippines is one of the most hazard prone countries in the world, a ranking surely warranted by the above evidence. Yet, for a country with such a reputation, it scores extremely low on global disaster indices. It does not appear at all on the UNDRO ranking of the world's 50 "most disaster-prone" countries, defined as total damage from 'significant disasters' (exceeding 1% of GDP over the period 1970-89) (UNDRO, 1990); ranks 31st on the Commonwealth Secretariat index based on population affected over the period 1970-96 (Atkins et al, 2000); and 25th according to the Commonwealth Secretariat Index based on number of disasters relative to land mass over the period 1970-96 (*ibid*).

[5] Defined in terms of direct losses to agriculture, infrastructure and the private sector.

Table 3. Estimated damage, in real 2000 prices and numbers of deaths from natural disasters [6] [7]

Year	Typhoons		Earthquakes[8]		Volcanic eruptions & lahars[9]		Other[10]		Total	
	Estimated damage (m Peso)	No. of deaths (units)	Estimated damage (m Peso)	No. of deaths (units)	Estimated damage (m Peso)	No. of deaths (units)	Estimated damage (m Peso)	No. of deaths[11] units)	Estimated damage (m Peso)	No. of deaths (units)
1970	2,472	1,328	137	17	0		27	3	2,636	1,605
1971	1,058	59	1				586	43	1,646	146
1972	4,395	298					294	28	4,688	1044
1973	5,295	74	106	15			743	51	6,143	180
1974	5,807	153	61	2			57	41	5,925	373
1975	524	39					126	17	650	248
1976	9,970	313	8,398	3,782			1,143	40	19,811	4202
1977	4,157	99	63	1			201	14	4,422	128
1978	69,002	663					0	2	69,002	665
1979	4,102	69					51	1	4,153	67
1980	12,674	143	22	51			3,169	336	15,865	530
1981	9,875	484					33	125	9,908	609
1982	11,821	337					820	27	12,640	364
1983	3,256	126	92	19			4,760	41	8,108	186
1984	23,144	1,979			264		10	0	23,418	1979
1985	9,424	211	0	14			25	59	9,449	284
1986	5,966	171					31	4	5,997	175
1987	12,759	1,020					2,209	0	14,968	1020
1988	24,982	429	2,459				0	0	27,443	429
1989	11,746	382					1,027	101	12,774	483
1990	29,333	670	28,285	1283			7,958	53	65,585	2006
1991	9,102	5,199			21,094	850	3,318	72	33,515	6121
1992	9,331	117	335	1	1,014	6	6,433	31	17,112	155
1993	34,417	794			126	80	1,912	4	36,455	878
1994	5,007	242	806	83	16	20	568	31	6,397	376
1995	22,207	1,204					2,041	149	24,248	1353
1996	3,832	124					378	34	4,210	158
1997	759	77					1,410	60	2,169	137
1998	19,609	490					9,696	28	29,305	518
1999	2,749	100	4	5			1,554	300	4,307	405
2000	7,469	345				90	1,779	206	9,248	641
1970-2000 average	12,137	572	1,315	170	726	34	1,699	61	15,877	886
Five-year averages										
1970-4	3,805	382	61	7	-	-	341	33	4,208	670
1975-9	17,551	237	1,692	757	-	-	364	15	19,608	1,062
1980-4	12,154	614	23	14	53	-	1,758	106	13,988	734
1985-9	12,975	443	492	3	-	-	659	33	14,126	478
1990-4	17,438	1,404	5,885	273	4,450	191	4,038	38	31,811	1,907
1995-9	9,831	399	1	1	-	-	3,016	114	12,848	514
1990-94 excl. year of Ormoc flood		456								

25. The Philippines' relatively low ranking in part reflects the indices' focus on single catastrophic events rather than the cumulative impact of annual, if individually often relatively localized, events in a country the size of the Philippines. Figures on reported damages in the Philippines are also almost certainly an underestimate of loss for several reasons. First, they are based on government damage assessment reports that only cover selected types of damage, focusing on damage to public property and to assets of lower-income households potentially eligible for state assistance. Second, it is not clear if disasters that are not officially

[6] Damage to agriculture, infrastructure and private property.

[7] Based on GDP at market price deflator as GDP deflator at factor cost is not available for the 1990s.

[8] From 1994 onward, "small" volcanic and earthquake events are reported under 'other'.

[9] From 1994 onward, "small" volcanic and earthquake events are reported under 'other'.

[10] Floods and droughts. From 1994 onward also includes "small" volcanic and earthquake events.

[11] Deaths were almost entirely as a consequence of flooding.

declared are included in the figures. As illustrated in the case of Navotas (Box 4) not all qualifying events are necessarily officially declared as disasters, depending on whether or not an LGU wishes to draw on Local and National Calamity Funds. Third, there are an unknown number of lesser events that fall below the threshold for an event that can be deemed to constitute a 'disaster'. Evidence collated by the DesInventar initiative in Latin America suggests that in some countries the impact of these 'everyday disasters' may be much greater than those of the larger events formally recorded as disasters (IFRC, 2002).

Table 4. Philippines- annual rice production and losses arising as a consequence of natural disasters, 1991-2000

		Typhoons and floods		*Drought*		*Total losses*	
	Total palay production	Loss in Production	Loss as % actual Production	Loss in Production	Loss as % actual Production	Loss in Production	Loss as % actual Production
Year	*000 t*	*000 t*	*%*	*000 t*	*%*	*000 t*	*%*
1991	9,673	152	1.6	16	0.2	168	1.7
1992	9,129	11	0.1	79	0.9	90	1.0
1993	9,434	246	2.6	0	0.0	246	2.6
1994	10,538	112	1.1	48	0.5	160	1.5
1995	10,541	328	3.1	45	0.4	373	3.5
1996	11,284	73	0.6	1	0.0	74	0.7
1997	11,269	75	0.7	15	0.1	90	0.8
1998	8,555	1,048	12.3	462	5.4	1,511	17.7
1999	11,787	321	2.7	1	0.0	322	2.7
2000	12,389	390	3.1	0	0.0	390	3.1
Total	104,599	2,757	2.6	667	1.5	3,424	3.3
Less 1998	96,044	1,709	1.8	204	1.2	1,913	2.0

Source: Philippine DA

26. The very fact that the Philippines experiences annual typhoon-related losses has also created an apparent dis-regard to their macroeconomic ramifications. Disaster losses are conventionally categorized as:

- *direct costs* - physical damage to capital assets, including social infrastructure;
- *indirect costs* - knock-on disruption to the flow of goods and services (e.g. reduced output, loss of earnings and job losses).
- *secondary effects* - short- and long-term impacts of a disaster on the overall economy and socio-economic conditions (e.g. fiscal and monetary performance, levels of indebtedness, the distribution of income and scale and incidence of poverty).

27. Yet only severe El Niño episodes and major geophysical disasters are generally regarded as economically significant events while the economic ramifications and impacts of, cumulatively, considerable direct damage as a consequence of annual typhoons are ignored.

28. Key events identified retrospectively in the literature are droughts in 1984 and 1987, the combined impacts of the 1989/90 drought and 1990 Baguio earthquake, the 1991 Mount Pinatubo eruption and the combined impacts of a further drought and the Asian financial crisis in 1997-98. All of these events are reported to have had a discernible impact on GDP performance (Figure 3).

29. The series of disasters in the early 1990s, in particular, were widely claimed to be responsible for a period of poor economic performance.[12] Drought in the latter part of 1989 and first half of 1990 reduced

[12] The following three paragraphs draw heavily on Benson (1997).

agricultural production, damaging some P 365m worth of crops and causing an estimated opportunity loss of P1.2bn in palay production and P 808m in corn production (Philippine NEDA, no date). It also resulted in severe power shortages, causing estimated daily losses to the industrial sector of P 25-75m and reducing the rate of industrial growth for the year from 7.4 percent in 1989 to 2.5 percent in 1990 (Philippine NEDA, no date). The severe earthquake in Luzon in July 1990 (see Box 1), caused a further economic setback, forcing NEDA to adjust GDP growth forecasts for 1990 and 1991 down from 4.8 to 3.8% and from 5.5 to 5.2% respectively. Actual performance was even lower, reflecting the combined impacts of the earthquake the 1989/90 drought and also the Gulf Crisis, which in turn increased the cost of oil imports and displaced many Filipino overseas workers.

Box 1: The July 1990 Luzon Earthquake

The Philippines suffered a major earthquake of intensity 7.7 on the Richter scale in July 1990 with an epicenter near San Jose City, Nueva Province, Luzon. Some 100,000 km^2 including all of North and Central Luzon as well as parts of Central Luzon were affected by the earthquake, with most serious damage over an area of some 15,000 km^2. The cities or towns of Baguio, Dagupan, Agoo, Aringay and Pura were particularly badly affected whilst Tarlac, Cabantuan, Rizal and Manila were marginally damaged (Rantucci, 1994). Total damage was estimated at P 12.2bn according to NDCC data. Some 56% of damages occurred to infrastructure, 12% damage to agriculture and 32 % to private property, principally non-housing properties. Some 1,293 lives were also lost.

The earthquake resulted in temporary major disruptions to transportation, communications and power networks and to the supply of water for agricultural purposes, affecting agricultural production capabilities and marketing and distribution arrangements in the short to medium term. As of 1993, road communications had still not yet been fully restored (Alatec-Harris-Tym Group, 1993). Fishponds and almost 87,000ha of rice land was destroyed, including 60,000ha of irrigated land and some fourteen national and 174 communal irrigation systems. The livestock population declined rapidly as animals were killed either accidentally as a consequence of the earthquake or deliberately to meet short-term food requirements (Fernandez and Gordon, 1993). Post-harvest and storage facilities and several dams were also damaged. Several dams suffered damage. In particular, Ambuklao Dam, located near Baguio, was silted up to a few meters below water level forcing the shutdown of electricity production and hampered irrigation activities. The dam had been expected to have a useful life of around 50 years but this was reduced to 28 years as a consequence of the earthquake (Rantucci, 1994).

Production capacity at the Baquio Export Processing Zone, at the time one of only four in the country, was also severely affected. One building in the EPZ housing two garment firms, one plastics firm, one electronics firm and one pipe fittings firm collapsed entirely whilst another building housing seven firms was partly damaged. Losses from the Baguio EPZ together with those from the mining sector were estimated at around US$35m (P 851m) between mid-July and the end of August 1990 alone (Philippine NEDA, no date).

Source: After Benson (1997)

30. The government responded with the introduction of a stabilization program at the beginning of 1991, including efforts to improve the fiscal deficit and control the money supply. However, any hopes of improved economic performance were thwarted by further disasters, including the eruption of Mt. Pinatubo in July 1991 (Box 2), Super Typhoon Trining in late October and the Ormoc flood towards the end of the year. These disasters contributed to negative GDP growth rates of 0.6 % year-on-year, in turn largely reflecting lower growth in Central Luzon and the Metro Manila region and tight monetary and fiscal policy as the government strove to meet pre-determined IMF economic targets.

Box 2: Eruption of Mt. Pinatubo

Mt. Pinatubo, a volcano located on the west coast of Central Luzon some 100 km northwest of Manila, violently erupted in July 1991. The eruption, one of the largest globally in the 20th century, caused severe damage. Some 6 km^3 of pyroclastic material was deposited in river basins whilst a further 1 km^3 of ash was deposited across an area up to 40 km from the volcano, effectively altering the hydrology of the whole region (USACE, 1994). Fallout affected a total area of 340,000 km^2 (PHIVOLCS, 1991). The impact of the eruption was exacerbated by Typhoon Diding, which occurred immediately after the eruption scattering water-soaked ash over a very large area and causing massive mudflows. These, in turn, covered large areas of agricultural land and destroyed buildings, bridges and roads and other infrastructure. Minor eruptions continued until 4 September 1991.

The provinces of Zambales, Pampanga, Tarlac and part of Bataan, all in Region III, were most severely affected by the initial eruption of Mt. Pinatubo. Some 80,000 ha of agricultural lands and fishponds was buried by ash and the initial lahars; transport, communications, power, irrigation and other infrastructure as well as houses and public buildings were damaged; drains and other water conduits were blocked, increasing the risk of flooding; commercial and industrial operations in the cities of Angeles and Olongapo suspended; some 600,000 jobs lost, equivalent to around a quarter of total employment in Central Luzon; and 200,000 people evacuated at the height of the eruption (PHIVOLCS, 1991).

Subsequent lahars generated by heavy rainfall have occurred in every year since the eruption, although lahar dykes defenses have gradually been constructed to contain lahars and reduce losses. The lahars have caused extensive damage to agriculture and infrastructure, for example, lahars in 1991 and 1992 alone affected almost 260,000 persons and destroyed 4,190 houses. The continued annual threat of lahars has created certain problems in designing appropriate rehabilitation programs for livelihood creation and for the reconstruction of infrastructure.

Prior to July 1991, Central Luzon had been the Philippine's prime rice growing region, accounting for 20.5% of national palay production and 15.7% of gross acreage. Ten years on, in 2000, it accounted for 15.2% of national production and 13.% of gross acreage. Sugar production and aquaculture had also been important. For example, had Central Luzon produced some 45 percent of the country's total fishpond production in 1990. By 1994 aquaculture output from the region was still only some 60 percent of previous levels due to the obstruction of water flows and tidal exchange. Coastal and freshwater fishing operations as well as fragile eco-systems, including mangroves and coral, were also disrupted by increased siltation, changing river flow patterns and destruction of breeding areas (USACE, 1994). These problems have continued as more ash is washed downstream.

Source: After Benson (1997)

31. From 1992, tighter domestic policies began to attract external capital flows whilst inflation fell and foreign exchange reserves rose. However, GDP growth remained very weak as a direct consequence of continuing tight monetary and fiscal policies. The economy also faced particular difficulties relating to electricity shortages in 1992, in part the consequence of a drought in the first four months of the year.

32. Towards the end of the decade, in 1998, the combined impacts of a further widespread drought – widely claimed the most severe ever (e.g., PCARRD/DA, 2001) – and the Asian financial crisis resulted in a 0.6% decline in real GDP, a 2.6% decline in real per capita GDP and a 6.4% decline in agricultural GDP. Unemployment and inflation both rose to double digits, the latter fuelled by food price increases.

33. However, direct damage resulting from the eruption of Mt. Pinatubo was equivalent to only 1.2% of GDP, and that from the 1991 Luzon earthquake was 0.9%. Damage from typhoons averaged 0.5% *every year* over the period 1970-2000, implying far greater cumulative losses. Despite this, typhoons, which occur annually in the Philippines, are apparently widely accepted as a fact of life and attract little interest from policy and decision makers in either the public or private sectors. The very fact that they occur so frequently also makes it more difficult to measure their impact because the benefits of a typhoon-free year are not readily visible, in turn again apparently contributing to the perception that they are of little macroeconomic consequence. At the local level, however, their impacts can be devastating, destroying key infrastructure and reinforcing poverty.

34. There has been little formal analysis of the longer-tem impacts of disasters in the Philippines but annual infrastructure losses and related diversion of scarce public resources into their replacement must ultimately have an impact on the country's long-term sustainable development. For instance, only modest success in efforts to improve the country's transportation systems and increasing difficulties in meeting the social infrastructure needs of the country's rising population have been in part attributed to the fact that a large proportion of available public resources earmarked for such purposes have had to be re-directed in response to calamities (Benson, 1997).

35. A fuller analysis of both the impact of individual disasters and of current and likely future vulnerability to natural hazards from a macroeconomic perspective is required. Careful analysis would shed light on the extent to which and how risks emanating from natural hazards could be better managed. It would help facilitate the consideration of risks emanating from natural hazards both in the broad development planning process and in the design of individual projects as well as help ensure provision of appropriate post disaster economic support.

Assessing Impacts of Disasters

36. According to rules and regulations under the provision of PD 1566, in the aftermath of a disaster all concerned agencies should undertake a survey of damage within their scope of responsibility and submit detailed damage assessments and requirements for relief and rehabilitation assistance. The reports should include information on numbers of casualties, deaths, persons affected and losses to housing, public infrastructure and crops.

37. These assessments should be undertaken by local disaster coordinating councils (DCCs) and submitted to the regional and then the national council. The NDCC should collate the various assessments together with reports prepared by various regional government departments and submit a single document to the President of the Philippines recommending whether or not a disaster should be declared and the amount of national funds that should be released in support of the relief efforts.[13]

38. Various efforts have been made to improve the quality and coverage of government post-disaster damage assessments in recent years, including via the provision of some limited training in assessment processes. Individual departments have also drawn up their own forms for reporting damage to help improve reporting practices. [14]

39. Additional efforts have been made to corroborate damage assessments, in part by ensuring that damage estimates are validated by the relevant department at national Government level before being released. The DA has also undertaken considerable additional effort to improve reporting of crop damages, including by developing a matrix for validating rice and corn losses resulting as a consequence of strong winds, floods and drought. These calculations take into account the growth stage of the crop; expected losses from winds of varying strength and length of exposure to them; and days submerged under clear and muddy flood waters. The DA is thus able to compare reported losses against expected ones and adjust figures accordingly if necessary.

[13] The UN is not involved in the damage assessment process but could be in the event of a big disaster and so has recently provided some training to UN staff.

[14] Under an initiative in the mid-1990s involving the NSCB and a disaster statistics task force, a detailed assessment checklist was additionally prepared to complement the much briefer assessment forms already in use. However, this initiative was latterly shelved following a change of administration.

40. However, a number of problems still remain with the damage assessment process and the quality of reports is variable.

- Most fundamentally, there are no comprehensive guidelines on how damage assessments should be undertaken. Different government departments follow different practices and there appears to have been little attempt to coordinate either their scope of coverage or assessment methodologies. In particular, different departments use different methodologies for valuing damage. For example, agricultural losses are valued at replacement value. Destroyed houses are also valued at replacement value but based on the cost of provision of core shelters to eligible households only.[15] Partially damaged houses are valued at amounts to be made available for repair (maximum of P5,000 per house).[16] Damage and destruction of agricultural infrastructure is valued at book value. Damage to other infrastructure for which DPWH is responsible is valued at re-establishment or cost of repair. NDCC has developed some standard formats for reporting overall damage, including some information on costs, but there is no guidance on how this damage should be valued.[17]
- The scope of coverage and detail of reporting is limited, focusing on damage experienced by lower income groups and sub-sectors that may be eligible for public assistance. Each agency is concerned only with losses within its own mandate of activity while private sector losses are ignored. This reflects the fact that, as already noted, the primary purpose of damage assessments is to determine emergency response, relief and rehabilitation requirements.
- Assessors typically lack relevant training, adding to the uncertainty concerning the accuracy of assessments.
- There is no baseline data for use in undertaking assessment.
- There is often apparently poor coordination between agencies. Some government departments report (contradictory) information on the same category of loss. Requirements on the timing of reporting also vary. A series of reports at various points after a disaster is required by various government Departments to provide validation of impacts reported in the earlier reports but these appear to follow different schedules. According to PD 1566, for instance, reports should be submitted two weeks and two months after the occurrence of a calamity. The NDCC itself has drawn up standard reporting formats on impacts to be submitted one hour, six hours and 12 hours after a disaster, but apparently not beyond that period. Meanwhile, the DA requires reports on agricultural damage upon advise of an impending disaster (detailing forecast impacts), within 24, 36 and the 72 hours of a disaster, within a 'subsequent' period and finally within 10 days of an event.
- There is no clear system for reconciling differences in data reported by more than one agency. For example, figures on casualties and mortalities are reported by both the DoH and DSWD while the DSWD and DA both report data on numbers of people affected. To do this will also require that an assessment of the current data collection and analysis is carried out.

[15] Post disaster, the DSWD runs a core housing project, providing cyclone proof housing to families who have lost their homes. The cost of a single unit ranges from P3,500 to P25,000, depending on the type of construction materials used. They are $15m^2$ and can house a family of around six. Approximately 35,000 core shelters have been built since the program began in 1998, funded out of the QRF.

[16] The DSWD's standard damage assessment form also requires information on the numbers of houses totally and partially damaged and on the 'cost of assistance', which appears to be defined as monetized assistance provided by DSWD, LGUs and NGOs and other governmental organizations.

[17] A flash report outlining basic information on the type of disaster, location of incidence and so forth should be submitted to the NDCC within one hour of a disaster; a damage and needs assessment, primarily focusing on medical, health, food, clothing and shelter requirements and on damage to lifelines, within six hours; and an information guide on damage assessment within 12 hours, giving further information on the damage to infrastructure (including commercial facilities) and agriculture, provision of essential utility services and so forth.

- Individual agencies sometimes report directly to their regional and national counterpart agencies rather than to the LGU, further contributing to problems in integrating agency assessments and prioritizing needs. Meanwhile, some LGUs report directly to the President before regional and national agencies have had time to validate figures.
- Damage assessments are typically completed in a very short period of time, with no later attempt to assess longer-term socio-economic impacts or lessons learned in reducing future vulnerability. Post-disaster damage assessments often represent little more than stocktaking exercises, focusing on direct costs relating to damage to buildings, other infrastructure, capital equipment and standing crops and human losses.
- There can be some political massaging of figures, particularly at the LGU level.

40. In summary, there is scope for considerable improvement in post-disaster damage assessment methodologies and practices. It is recommended that existing guidelines developed by the Economic Commission for Latin America and the Caribbean (ECLAC) should be adapted for use in the Philippines. More comprehensive assessment would enhance knowledge and understanding of the nature and scale of impact of disasters and forms of vulnerability. This, in turn would aid the implementation of good risk management practices, including greater consideration of hazard-related issues in broader sustainable development and poverty reduction policies and programs as well as of appropriate, cost-efficient post-disaster relief and rehabilitation efforts.

Fiscal impacts

41. Natural disasters can have important implications for public finance. Disasters are likely to result in additional expenditure and/or the partial reallocation of already committed financial resources, with implications for planned investment and other expenditures. Public revenue may also decline as levels of economic activity fall. In consequence, a government may face increasing budgetary pressures which could in turn increase levels of domestic and/or external borrowing or increasing the money supply, each, in turn, with potentially significant knock-on effects (Benson and Clay, 2003).

42. In the case of the Philippines, national budgetary resources in the form of calamity funds, as well as local government resources, are annually appropriated for emergency relief and rehabilitation activities. This constitutes good budgetary practice in a country where disaster-related expenditure occurs every year. Annual budgetary allocations help strengthen both financial planning and also fiscal discipline more broadly (Benson and Clay, 2003).

43. However, available evidence suggests that, at least at the national level, existing calamity funds may be insufficient to meet much of the costs of rehabilitation and reconstruction even in years of lower loss and are likely to be grossly inadequate in the event of a major disaster. Despite this, it is difficult to discern much impact of natural disasters on either government expenditure or revenue at the aggregate level in the Philippines. This is not an uncommon or surprising finding. When broad fiscal aggregates, such as central government's recurrent and capital expenditure, revenue and the budgetary deficit are examined, disasters are often found to have little discernible impact (Benson and Clay ,2003). Instead, a fuller understanding of fiscal consequences of disasters requires a careful, more disaggregated examination. This examination should be undertaken in the context of overall budgetary performance, recent government policies and budgetary targets, and the structure of government revenue and expenditure itself (ibid).

44. For example, even major disasters in the early 1990s may have had little apparent impact on broad fiscal aggregates in the Philippines. However, this reflected a gradual underlining increase in direct tax revenues that had started in the mid-1980s as a direct consequence of tax reforms, and a concerted and successful effort to reduce the consolidated public sector deficit. National government expenditure actually fell in 1991 due to efforts to satisfy conditions under an IMF stabilization program, despite particular pressures placed on

government spending by both the July 1990 Luzon earthquake reconstruction program and by the Mt. Pinatubo relief and rehabilitation efforts.

45. The composition of government expenditure, particularly the share of non-discretionary expenditures, is also relevant in analyzing the budgetary implications of natural disasters. In the case of the Philippines, there is little flexibility in the national budget due to very high levels of non-discretionary spending. Total expenditure on personal services, the allotment to LGUs under the IRA and interest payments alone totaled 73% of the 2001 actual national government budgetary obligation; 73% of its adjusted expenditure in 2002; and 76% of proposed expenditure in 2003. Total capital expenditure (including capital transfers to LGUs) accounted for only 14% of total expenditure in 2001, 14% in 2002 and 13% of planned expenditure in 2003. Capital expenditure as a percentage of GDP is also very low, standing at a mere 2.9% of GDP (at factor cost) in 2001. Operations and maintenance (O&M) is similarly under-funded, with implications for vulnerability to natural hazards. Thus, disaster-related expenditure has to compete for very limited budgetary resources. The World Bank (2000: 74) comments that limited capital and O&M expenditure 'cannot but damage the long-term development prospects of the country', a problem that must be exacerbated by annual damage and destruction of existing infrastructure. With some loss of international revenue expected as trade is gradually liberalized, limited fiscal flexibility seems set to remain a problem in the short to medium term. This limited flexibility leaves the Philippine government potentially highly exposed to economic shocks such as major natural disasters.

46. Indeed, the government needs to develop an explicit policy on the financing of post-disaster response; beyond making some relatively limited budgetary allocations for use in the event of a disaster and relying on annual unscheduled reallocations of resources. In developing this policy, the Government should explore risk transfer options as well as the precise scale and nature of annual reallocations and the appropriateness of current levels of expenditure on mitigation and preparedness. It should also bear in mind that disaster-related external assistance for immediate response or reconstruction *cannot* be assumed to be additional (Benson and Clay, 2003).

Disasters and Poverty in the Philippines

47. Poverty and vulnerability to natural hazards are closely linked and mutually reinforcing. Poor and socially disadvantaged groups are usually the most vulnerable to hazards, reflecting their social, cultural, economic and political environment. Disasters, in turn, are a source of transient hardship and distress and a factor contributing to persistent poverty. Indeed, at the household level, poverty is the single most important factor determining vulnerability, in part reflecting location of housing (e.g., on floodplains, riverbanks, steep slopes or contaminated land previously occupied by industrial facilities); level of access to basic services (e.g., refuse collection) particularly for illegal squatters; sources of livelihood; and level of access to financial and other assets and resources, leaving limited recourse to inter-temporal consumption smoothing. The covariate nature of natural hazards also implies that there is limited scope for community level support systems. The poverty-exacerbating nature of vulnerability can be further reinforced by deliberate risk-averting livelihood choices that poorer households may make. For example, poorer households may choose to forego the potential benefits of higher yielding crops in favor of more hazard-tolerant ones, implying more stable and secure but, in most years, lower earnings.

48. The Philippines has a high incidence of poverty, standing at 26% in 2000 and poverty reduction is a central theme of development policy. The country had achieved considerable progress in reducing the level of poverty between 1990 and 1997, falling from 34% to 25% (World Bank, 2001). However, in 1998 it rose again to 28% and was still higher than the 1997 level in 2000. Poverty is largely a rural phenomenon in the Philippines. The rural poor accounted for about 77% of the poor in 1997 and the agriculture, fishing and forestry sector alone for two-thirds of the poor.

49. In the case of the Philippines, linkages between poverty and vulnerability to natural hazards are clearly apparent, despite the fact that they have not been systematically analyzed. Rapid urban growth and lack of tenure, for instance, have forced many to live and work in high-risk areas, such as on the shores of Navotas (Box 3) or flanks of active volcanoes.[18] Families may have little choice but to return to such areas post disaster even when resettlement options are available because of the importance of proximity to place of work.[19] Disasters can be associated with spiraling debt, reflecting limited provision of rehabilitation assistance for repair of houses and restoration of livelihoods, poor access of lower income households to lending facilities and extremely low rates of saving.[20] In the aftermath of a disaster, poor families may be forced to rely on borrowing from informal sector 'five-six' moneylenders, forcing them into further poverty, and/or on remittances from relatives elsewhere in the country and overseas.[21] Other post disaster coping mechanisms include diversification of livelihood strategies. Household responses to the 1997-98 El Niño event, for instance, included cultivation of different crops, such as vegetables and rootcrops and increased engagement in activities such as sewing, carpentry, construction and domestic services) as well as the withdrawal of children from school and a reduction in the quality and quantity of food intake (PCARRD/DA, 2001). Much of the increase in poverty in 1998 was attributable to the El Niño shock, reflecting its particular impact on the agricultural sector where the poor are concentrated, rather than the financial crisis, which primarily affected relatively better-off wage earners (World Bank, 2001). Balisacan (1999) comments that the withdrawal of children from school following disasters is particularly disturbing given the role education attainment plays in determining income and the implications this finding has for second-generation poverty.

[18] For example, marginalized farmers continue to live and work on the flanks of Mt Mayon, an active volcano, because it provides them an opportunity to produce food without secure land titles. People tend to ignore evacuation orders, typically only moving when the highest level of alert is reached (Heijmans, 2001).

[19] For example, a survey of 90 victims of the tragic Ormoc flood found that of the 30 respondents remaining on the riverside after the flood, 80% had returned to this location because they had no other place to live, despite the fact that two-thirds of them now recognized the dangers of living on the riverside. Although 60% were awaiting resettlement at the time of the survey, 50% indicated that they were happy to remain on the riverside, most commonly because of ease of access to their place of work and to markets (JDI/ECFA/DEVMAN, 1993).

[20] As a nation, the Philippines has one of the lowest domestic savings rates in East Asia and the Pacific. The lowest three deciles of the population do not save (World Bank, 2000).

[21] Transfers are a significant feature of the Philippine economy and have been increasing over time, accounting for an average 13% of pre-transfer household income in 1997 with 57% received from abroad (World Bank, 2001). Transfers are also highly progressive, benefiting lower per capita income households.

Box 3: Navotas Municipality – poverty and natural hazards

Navotas is a small coastal municipality located on the extreme northeastern shore of Metro Manila. It regards itself as the 'fishing capital of the Philippines', with about 70% of the population directly or indirectly dependent on fishing in Manila Bay and related industries. Its overall vision is to emerge as a marina city. The municipality has a population of approximately, 230,000 persons, of which an estimated 70% are below the poverty line.

Physically, Navotos is comprised of a long narrow strip of land, with shorelines both along the sea to the east and the Navotos-Malabon river to the west. It has a total land area of 10.8km^2 and a shoreline of 12.5 km. The municipality is elevated only 2 meters above sea level and around 50% of the total land area is vulnerable to flooding. Regular low-level flooding occurs approximately ten times a month, during high tides (1.8 meters above sea level). Two or three times a year more serious flooding, up to waist height, occurs as storms or typhoons coincide with high tides, necessitating temporary evacuation of many homes for several days. Fishing operations cannot resume for about a week, leaving many families with no source of livelihood.

Over a quarter of the population are informal settlers mainly located along the shorelines. They were attracted to Navotos by the 'availability' of land in the form of easements along the bay and river, and fishing opportunities that required little educational attainment. The municipality estimates that a total of 2,500 households are located along rivers and 57,500 people along the coastline. Assuming, say, that the average household contains 8 people, this implies a total shoreline population of about 77,500 people – that is, 77,500 people who are potentially particularly vulnerable to flooding. The municipality now has a firm policy barring new squatters from settling in the municipality but demographic growth implies that these numbers are likely to rise.

Flooding is evidently exacerbated by a solid waste management problem, with considerable amounts of garbage thrown into the river, sea and drainage channels despite the existence of a fine for dumping in waterways. The construction of houses also increases the risk of flooding where dwellings along riverbanks constrict the flow of water.

Navotas is a 1st class municipality. Its 2002 IRA was around P130m and total revenue, including locally raised taxes (primarily from business and property taxes), around P350m. This implies an annual 5% Local Calamity Fund of around P18m (US$350,000).[22] Despite annual flooding, however, in most years Navotas spends very little of its 5% calamity fund and does not make any claims on the National Calamity Fund. Some funds are spent on stockpiling relief supplies. Post-disaster, the municipality provides only food and clothing. No assistance is forthcoming for repair of homes or livelihood support, perhaps in part to avoid encouraging people to remain on the land. Poorer households apparently scavenge for materials to repair their homes. Limited use of the Local Calamity Fund also reflects reluctance on the part of the local government to declare a calamity because it would be 'bad' for business.

However, expenditure on efforts to reduce structural vulnerability to flooding do account for a significant share of total LGU expenditure. The LGU estimates, for instance, that it spends around 60-70% of its total annual infrastructure budget of P15m (excluding municipal roads) on flood control. Meanwhile, the ten-year investment plan for 2003-2013 envisages a P677 million investment program including a riverbanks protection and management project (P30m); a mangrove reforestation project (P6m); and a community-based coastal protection project (P6m). Another proposed project to develop and implement alternative coastal livelihoods (P65m) could also play in important role in reducing vulnerability to natural hazards. A separate P3.9bn JICA tidal defense project is also intended to close off the Navotos-Malabon river.

Also of relevance in reducing vulnerability to flooding, DPWH and the National Housing Authority (NHA) have resettled 500 families, with further resettlement planned. Fishponds account for around 40% of land area in Navotos but these are now largely unproductive, replaced by large-scale sea fishing. The municipality has therefore embarked on a program to reclaim some of this land for resettlement. It has purchased 8.4ha of land, at a total cost of P26m, which it intends to divide into 1,680 lots (35 m^2 per household). Construction costs are estimated at around to P5,000 per m^2 although the municipality is also exploring pre-fabricated housing as a cheaper option. It is looking to devise a 25-year payment scheme for relocated families to buy their homes and land, but estimated monthly payments of P2,000-3,000 month would be required, well beyond the means of much of those requiring resettlement.

The Navotas MDCC has developed a municipal disaster plan, preparedness and response plan for typhoon and flood preparedness and an earthquake preparedness plan. However, the emphasis is on preparedness and post-disaster relief, while mitigation or rehabilitation is not covered. Earthquake risk is considered 'low' because Navotas does not have any high-rise buildings and is not located on reclaimed land.

[22] A copy of summary municipal accounts was obtained but this reports expenditure on a functional basis, implying that it is not possible to determine actual amounts spent on disaster-related activities other than fire fighting equipment and accessories.

50. Disasters can also contribute to longer-term states of poverty by delaying development of poorer areas. For instance, Balisacan et al (2002: 24) in an initial poverty mapping exercise of the Philippines report that the results from the rapid appraisal demonstrate the importance of road conditions and distances to "centers of trade" as a determinant of poverty. Yet disasters destroy roads and many, particularly feeder roads, may not be repaired for several years after a disaster.

51. Despite both the high incidence of disasters in the Philippines and the government's central objective to reduce poverty, however, efforts to reduce vulnerability to natural hazards are not systematically included as a central component of the government's poverty reduction strategy. There is recognition of the need to support the poor post disaster as victims, as for instance, reflected in post-disaster relief activities implemented by DSWD. Similarly, the government's central poverty reduction engine, the National Anti-Poverty Commission (NAPC), established in 1998, is composed of 14 Commissioners each representing the 14 basic sectors (farmers, workers, indigenous Filipinos, women, and so on), including the victims of disasters and calamity sector (VDC). There was some discussion at the time NAPC was created that vulnerability to natural hazards should be considered as a cross-cutting issue instead, in part because 'victims' eventually return to other sectors (fisherfolk etc). However, there was concern that hazard vulnerability concerns could then end up being overlooked as each sector chose to focus on issues of most pressing concern to the group it represented and also that it would lose out in the allocation of budgetary resources.

52. Elsewhere, again, there appears to be little if any discussion of efforts to reduce vulnerability to natural hazards as a central component of poverty reduction initiatives. For instance, there is no explicit mention of this issue in the current *Medium Term Development Plan 2001-04*. Similarly, the five cross-cutting priorities of a major new poverty-reduction initiative, the Kalahi project, launched in May 2002 with NAPC as lead agency are asset reform; the human development services; employment and livelihood opportunities; participation in governance of basic sectors; and social protection and security against violence. Achievements in all of these areas could play an indirect – and in some cases direct – role in reducing vulnerability to natural hazards but reduction in vulnerability itself is not seen as a priority.

53. The World Bank's 2001 *Philippines Poverty Assessment* does identify climate and economic instability as the likely main sources of vulnerability and notes the role that effective public policies and regulation in areas such as watershed management, water impounding, drainage, flood control, forestry regulation, housing and zoning standards and trash collection can play in reducing impacts. It also comments that public safety nets are also needed. However, this analysis focuses primarily on drought and its inclusion is clearly directly a consequence of the severe El Niño event occurring just before the report was drafted. There is no discussion of the impact that typhoons or other natural hazards can have.

54. As a starting point in promoting greater consideration of vulnerability to natural hazards in anti-poverty strategies, more research needs to be undertaken on the linkages between poverty, vulnerability and the environment or the socio-economic impact of disasters. There appears to have been surprising little research in this area to date. In addition, disaster management needs to be more systematically mainstreamed into all aspects of national economic planning, Sectoral Plans and at a more operational level into assessments such as those on the environment.

Future Vulnerability to Natural Hazards

55. A comprehensive multi-hazard loss estimation for the Philippines is beyond the scope of this study. Based on the above review of hazards and vulnerabilities, the following observations can be made regarding expected impacts of natural disasters on the Philippines.

56. The population of the Philippines was 76 million per the 2000 census, and is currently estimated to be approximately 81 million, with an average population density of 270 per sq. kilometer. Manila, the capital and largest city, is located on Luzon, the largest island. The National Capital Region, generally coinciding

with greater Manila, has a population of approximately 10 million, and a population density of 15,000 persons per sq. kilometer.

57. Philippine Gross National Product (GDP) is estimated for 2001 to be USD 80.8 billion, or approximately USD 1,000 per capita. While only about 12% of the population, the Metropolitan Manila area accounts for 31% of the Philippines' GDP.

58. The 2000 National Census of Population and Housing indicates building construction for the period 1977-1998 in the Philippines to have been 1.1 million buildings, with a total floor area (TFA) of 177.5 million sq. m., and an indicated value of 657 billion Pesos (average value per sq. m. is 3,700 Pesos). A recent study by JICA (2003) provides a complete building count for the Metro Manila area (see Table 5 below). Note that the 90 million sq. m. for the Metro Manila region equates to about 9 sq. m. per capita. As a rough approximation, based on 90 million sq. m. of total floor area in the Metro Manila region, the total building value of the Metro Manila region is estimated to be approximately USD 20 billion. Infrastructure would be approximately the same, for a total value at risk in the Metro Manila region of about USD 40 billion[23].

Table 5. Building Exposure Data, Metro Manila (Source: NSO, 2002, per JICA, 2003)

LGU Nam	Area (ha)	Total No. of Building (Buildings)	Density (bldgs/ha)	Total No. of Household	Total No. of Habitant	Total Floor Area m2
Manila	4,130	168,528	41	333,546	1,569,581	11,475,903
Mandaluyong City	1,107	32,942	30	59,681	275,106	2,149,173
Marikina City	2,265	53,422	24	80,159	389,758	4,217,033
Pasig City	3,189	72,143	23	107,834	503,674	4,856,306
Quezon City	16,539	302,818	18	480,623	2,166,314	22,194,266
San Juan	588	11,793	20	24,604	117,392	1,253,073
Kalookan City	5,314	168,480	32	249,566	1,174,669	9,116,205
Malabon	1,597	51,694	32	74,136	336,511	2,498,690
Navotas	1,095	35,124	32	49,449	229,710	1,537,689
Valenzuela City	4,454	62,778	14	106,381	481,039	3,866,230
Las Pinas City	3,228	73,919	23	97,961	471,764	5,600,672
Makati City	3,197	50,381	16	103,980	470,304	5,031,045
Muntinlupa City	3,814	55,522	15	78,015	370,329	3,398,054
Paranaque City	4,563	72,230	16	94,108	447,901	6,084,705
Pasay City	1,779	39,968	22	78,179	354,011	2,597,026
Pateros	195	8,726	45	12,028	57,389	470,536
Taguig	2,753	65,428	24	102,722	464,552	3,825,264
MM: Total	**59,809**	**1,325,896**	**22**	**2,132,972**	**9,880,004**	**90,171,870**

59. Regarding infrastructure, the Philippines has about 200,000 km. of roads, 20% of which are paved. The Philippines produces about 41 billion kWh of electricity per annum, or about 1.4 kWh per person per day.

60. The Philippines built environment, particularly Metro Manila, is a study in contrasts, with some of the most modern high-rises in Asia within sight of some of the worst poverty in the region. Metro Manila's built

[23] As much as possible, all estimates are based on Philippines replacement costs and converted to USD at current exchange rates. As appropriate, values of losses in earlier years are inflated to present values, although no attempt is made to systematically adjust the tabulated loss or other data, nor to normalize it for population.

environment is particularly stressed by rapid population growth, and migration of the rural poor to the metropolitan region. Population and economic pressures undoubtedly create a situation in which high hazard areas are built on, and substandard building practices proliferate. Poor or non-existent land use exacerbates, to an extreme degree, all natural hazards risks – houses are built in floodways, and on soils prone to failure in earthquakes and/or high rains, not to mention development on the slopes of volcanoes. The following paragraphs discuss briefly the vulnerability of typical construction and expected impacts of each of the hazards described above.

61. **Earthquake risk**: High quality planning and engineering is readily available in the Philippines, and is clearly employed in the construction of high-rises and some transportation infrastructure. Encouragingly, seismic retrofitting of selected highway structures was observed, indicating a responsible capability and recognition of risk in that sector. The Philippine structural engineering code is taken literally from the California code (DeGracia, 1994; also personal communications with local engineers)[24], and was observed to be followed in better quality buildings in Manila. However, code enforcement for small to mid-size buildings is unknown, and many of these buildings may well evade the code. Small to moderate sized buildings have proved very vulnerable in past earthquakes, see Figure 4.

62. On an annual basis, physical damage due to earthquakes are comparable to those due to flooding – that is, about 10~20% of typhoon losses (see section below on typhoon risk). However, the Valley fault system, in Marikina City is capable of a magnitude 7 event, posing a major threat to the Metro Manila region. This situation is further exacerbated by the findings of the recent paleoseismic work (Nelson et al, n.d.), which found the system capable of magnitude 6-7 events occurring on average every 200~300 years, and that it has not ruptured in over 200 years (i.e., it is due!). An ongoing PHIVOLCS-JICA study is in the process of estimating the potential impacts of such an event, and their results will be available next year (N. Ikenishi, personal communication). In the interim, it is estimated that a magnitude 7 event on the Valley fault system may likely result in about damage equivalent to about 20% of total building value at risk, and 5% of infrastructure value at risk – that is, approximately USD 4 billion in building damage, and USD 1 billion in infrastructure damage, for a total direct property loss of about USD 5 billion, in terms of present values. This is approximately 6% of the Philippines GNP. This compares to a total loss in the 1995 Kobe earthquake of USD 100 billion, which was magnitude 7 event directly in the middle of a highly urbanized area (comparable in some ways to the Metro Manila – Valley fault situation). When adjusted for GNP per capita, these are comparable losses. Not accounted for in these numbers are secondary economic impacts due to the loss and disruption of Metro Manila as a center of economic activity (and Government center) for an extended period.

63. **Volcanic risk**: Building and infrastructure vulnerability to volcanic effects is quite high in the Philippines. In most cases, pyroclastic flows and lahars are localized, and devastating, and the only feasible mitigation is land use controls, which typically prove difficult to enforce. Review of the pattern of settlements, indicates the high degree of vulnerability to lahars in the area surrounding Mayon volcano. Given PHIVOLCS' excellent record of monitoring and prediction at Pinatubo, it is possible that future eruptions may not be accompanied by large loss of life, but the surrounding area would still be very vulnerable to economic impacts, due to ash fall and other effects. In this regard, some observations on the Pinatubo disaster are worth quoting:

> *The Mount Pinatubo eruptions…have wrought havoc to the infrastructure and to economic activities of Central Luzon. Damage to crops, infrastructure, and personal property totaled at least 10.1 billion pesos (USD 374 million) in 1991, and an additional 1.9 billion pesos (USD 69 million) in 1992. In addition, an estimated 454 million pesos (USD 17 million) of business was foregone in 1991, as was an additional 37 million pesos (USD 1.4 million) of business in 1992.…The actual destruction, coupled with the continuing threat of lahars and ash fall, has disrupted the otherwise flourishing economy of Central Luzon, slowing the region's growth momentum and altering key development activities and priorities. Major resources have*

[24] See JICA (2003) for a good discussion of the National Structural Code of the Philippines.

been diverted to relief, recovery, and prevention of further damage. The costs of caring for evacuees (including construction of evacuation camps and relocation centers) was at least 2.5 billion pesos (USD 93 million) in 1991/92, and an additional 4.2 billion pesos (USD 154 million) was spent during the same period on dikes and dams to control lahars. (Mercado et al, n.d.)

64. Volcanic eruptions are a frequent event in the Philippines, although not usually as catastrophic as Pinatubo in 1991, which caused perhaps USD 500 million in losses, in present value terms[25]. A major eruption of Mayon or Taal might result in comparable losses. On an annual basis, physical damage due to volcanic eruptions are perhaps 50% of those due to flooding – that is, about 5-10% of typhoon losses (see section below).

65. **Typhoon and flood risk**: Typhoon and flooding are treated together here since they are often correlated. Typhoons damage buildings via wind pressure, especially damaging to roofs, via wind-born missiles, wind-driven water penetration of building envelopes and via storm surge. Typhoons are often accompanied by heavy rains, which can cause localized or widespread flooding. Flooding damages buildings via inundations and, in fast moving waters, via velocity effects. Flooding can have significant long-term human effects due to contamination of drinking water as well as providing sites for disease vectors. Damage to infrastructure is similar to that of buildings although infrastructure is also often damaged by ground failure due to rain or flood saturated ground.

66. Typical modern homes in the Philippines consist of concrete block construction with light metal roofing .If protected from storm surge, this type of housing is not especially vulnerable to typhoon effects, with the worst effect being damage to the roofing in high winds. Only very high typhoon winds will be catastrophic to this type construction, though some damage can occur at significantly lower winds. Flooding can be more damaging, but still not catastrophic. Bamboo and wood construction in rural areas is more vulnerable to typhoon, but loss and rapid replacement of this light and inexpensive construction has historically been culturally acceptable.

67. Examination of data on typhoons reveals a gradual increase in five yearly losses (ignoring particularly high losses of 1978) until the latter part of the 1990s when they fell (and remained relatively low in the 2000, 2001 and 2002). Losses exceeding P20bn (in real 2000 prices) were experienced only once during the 1970s, twice in the 1980s and 4 times in the 1990s.

68. Recent much lower typhoon-related losses appear to have been more a matter of luck than successful mitigation. Manila, for instance, has not been hit by a severe typhoon since 1995. The marginal decline in relative importance of the agricultural sector, which averaged 22.6% of total GDP in 1990-94 compared to 20.6% in 1995-99, could also have played a minor role. Many of the poor are located in rural areas and heavily dependent on agriculture, as already noted. Gradual growth of non-agricultural sectors is implicitly reducing relative dependence on the particularly hazard-sensitive agricultural sector and thus the macroeconomic consequences of hydro-meteorological disasters. Indeed, a continued structural shift of employment and output out of agriculture is necessary both to reduce vulnerability to natural hazards and also poverty. The extent of efforts to reduce the sensitivity of the agricultural sector itself to natural hazards will also be critical in determining future vulnerability. Another, not entirely implausible partial explanation of the decline in typhoon-related losses is that with devolution disasters are also being increasingly under-reported.

69. Large portions of Metro Manila are vulnerable to flooding, as well as storm surge should a major typhoon strike Manila. Informal settlements are in or adjacent to extremely flood-prone areas, and are regularly inundated for several months each year, see Figure 5.

[25] Its not clear if the loss of Clark Air Base is included in these numbers.

70. Table 6, provides detail on one year's experience with typhoon-related and non-typhoon floods in the Philippines. Modern high rise construction in Metro Manila should not be especially vulnerable to typhoon, with the exception that wind-borne missiles may cause a significant amount of glass damage, followed by water penetration and damage.

Table 6. Philippine Flood Experience in Year 2000

Detailed Locations	Began - Ended (m/d/yr)	Duration (days)	Known Dead	Number Displaced	Damage Estimate (US$)	Flood Type	Geographic Flood Extents (sq km)
Northern and eastern Manila city - districts of Caloocan, Quezon, Malabon	09/04/00 - 09/04/00	1	3	5,000	nd	90 milliliters of rain	1636
Island of Luzon - Manila and north; Towns: Valenzuela, 21 towns in the provinces of Bataan, Bulacan, Nueva Ecija and	05/18/00 - nd		6	112000	nd	Tropical depression	11740
Luzon Island - Provinces: Rizal, Laguna, Cagayan and Nueva Vizcaya. Manila area, suburban Taguig	11/03/00 - 11/04/00	2	43	668,000	2,600,000	Typhoon rains	6000
Philippines - Southeastern Luzon: Provinces: Cavite, Sorsogon, Catanduanes, Samar, Albay. Manila and nearby areas	10/28/00 - 10/30/00	3	41	100000	12,500,000	Flash floods triggered by continuing heavy rains	7000
Northern Panay Island - Capiz province	12/08/00 - 12/10/00	3	11	55,000	nd	Strong rains brought about by a tropical depression	2200

Source: Dartmouth Flood Observatory

71. On a regular basis, typhoon (with associated flooding) represents by far the largest loss natural hazard in the Philippines, killing about 500 people per year and causing about USD 200 million per year[26], in present value terms. A major typhoon striking Metro Manila could cause larger losses than this. Warning would presumably save lives in the informal settlements near the Pasig and Bay, but would do little to prevent catastrophic economic impacts in these communities. A major typhoon striking Metro Manila might result in total losses for the region of several percent, with USD 1 billion being perhaps an upper bound. Flooding is also a regular disaster in the Philippines, although typically on a smaller and more localized basis. Based on review of the data, non-typhoon immediate flooding impacts are perhaps 10~20% of typhoon losses.

72. **Overall Vulnerability**. Taking into account the annual losses and probability-weighted losses for catastrophic events, such as a major earthquake in Metro Manila, as discussed above, the total direct economic impacts of typhoons, earthquakes, volcanoes and floods in the Philippines are estimated to be about USD 500 million, with a coefficient of variation of about 70%, Figure 6. These annualized losses are significantly higher than the Philippines have experienced historically, estimated to be approximately USD 300 million when (very approximately) adjusted for inflation and exchange variation. This difference is dominated by the potential for a very large loss in Manila due to earthquake. The magnitude of this loss is highly dependent on the probability of the event, which is very uncertain. Therefore, the estimates presented here have substantial uncertainty associated with them. More precise quantification of mean annual losses, and variation around this mean, is necessary.

73. Moreover, there are a number of factors which seem to imply potentially far greater losses over the medium and long term if appropriate mitigation measures are not stepped up significantly. These include: increasing urbanization and demographic growth; environmental degradation and the threat of environmental disasters; and, climate change.

[26] USD 200 million is estimated by taking the P4 billion per annum during the 1970-2002 period in Table 7, and doubling it to account for exchange rate variation and deflated values in earlier years.

74. **Urbanization**. The urban population accounted for 59% of the total population in 2001 and is forecast to rise to 75% by 2030. Urbanization is creating large concentrations of people and physical capital that are potentially exposed to natural hazards. For instance, rapid urbanization, low levels of income and lack of areas allocated for affordable residential developments have led to the proliferation of unplanned, informal and overcrowded settlements (NLUC, 2000), often in more hazard-prone areas as illustrated in the case of Navotas, and this trend is set to continue. The rapid growth of Metro Manila, in particular, is placing increasing numbers of people and physical assets at direct risk from potential seismic events. The National Capital Region already accounted for 30.8% of national GDP in 2001 and this figure seems set to rise. A major earthquake in Metro Manila would thus have substantial short and longer-term economic ramifications, far beyond those experienced as a consequence of the 1990 Baguio earthquake. Demographic growth and urbanization is also placing considerable pressure on the provision of basic services. Resulting shortfalls in provision – for example, deteriorating solid waste management and related siltation of rivers and drainage channels – could have direct implications for the future incidence and severity of flooding.[27] Informal settlers are no longer welcomed in some cities and municipalities, as seen in the cases of Marikina and Navotas. However, others continue to allow them in, in some cases as a deliberate political, vote-raising strategy.

75. **Environmental degradation**. Environmental degradation is also playing a significant role in increasing the incidence of natural disasters. Demographic growth and poor land-use planning have led to the massive depletion of natural resources and destruction of the environment (World Bank, 2002). Declining forest cover, in particular is contributing to increased run-off, resulting in more frequent flash flooding, landslides and droughts. Upland communities in Panay, for instance have started to experience periods of drought since the 1980s, becoming more frequent in the 1990s, as a direct consequence of deforestation. Reduced forest cover has also left the area also increasingly exposed to typhoons, which in the past had little impact (Heijmans, 2001). Urban flooding is also on the increase. Bagiuo City, for instance, has begun to experience problems of flooding in recent years, again due to deforestation.

76. In order to help overcome these trends, it is important to address environmental degradation directly as well as consider land use plans and building codes in addressing physical vulnerability to natural hazards. Indeed, the wider importance of improving environmental management is well recognized. The World Bank (2002: 29), for example, writes that 'unsustainable resource management and environmental quality problems have become a critical constraint to economic development and social cohesion, necessitating a closer linkage of environmental strategies with key economic objectives and poverty reduction efforts.'

77. Degradation of the environment is also increasing the risk of environmental disasters, another type of event with the potential for devastating results. A number of these disasters have been experienced mainly in densely populated and developed areas of the country. A recent example is the March 24, 1996 mine tailing tragedy in Marinduque, which affected 20,700 people when 1.6 million cubic meters of copper mine waste spilled into the Boac and other nearby rivers. This was by far the country's worst industrial pollution disaster. In urban areas, incessant rains brought about a tragic landslide in Cherry Hills, Antipolo on August 3, 1999 claiming 58 lives and injuring 31. The following year, on July 10, 2000 the same set of monsoon rains caused lethal landslides in the Payatas dumpsite, claiming 223 lives and affecting 680 urban poor families. The undocumented cumulative toxic loading of the agricultural soils, the gradual but progressive warming of the fishing waters, and the perennial flooding of Metro Manila are only some examples of this type of disaster that can be attributed not entirely to *force majeure* but to socio-economic and political forces.

78. Public concern for this type of disaster is still minimal. While early warning systems for natural disasters such as typhoons and volcanic eruptions are in place, pre-disaster alarm systems on environment-related catastrophes are largely non-existent.

[27] As of 2000, of an estimated 16,400 tons of waste generated by the urban population, only 2,600 tons was properly disposed in controlled dumpsites. Projections for the following 15 years indicated that an additional 12 million poor people in cities would generate an additional 4,000 more tons of daily waste (World Bank, 2000).

79. The complex nature of environmental disasters can be described by a matrix that categorizes their impact according to spatial and temporal scale, as shown below:

	Short term	Long term
Local	A	B
Global	C	D

80. These categories can be distinguished from each other by defining "local" as that which spans the barangay to the national scale, while "global" is taken to mean the wider regional (transnational or continental) and worldwide context. "Short term" is used to refer to time scales of the order of weeks to a year, while "long term" is predicated of disaster events that can span decades or even centuries.

81. Of these categories, Type A environmental disasters (EDs) are more commonly understood and acted upon. The impacts of this type of disasters are more direct and the causes more immediate in time. Examples of this type of EDs are the annual flooding of Metro Manila caused by the congestion of garbage in the city's sewage system. Needless to say, the direct and indirect damages wrought by this ecological scourge can be significant.

82. Environmental disasters of Type B are often not as well understood as the previous type. The domain of environmental damage may be localized, as in deforestation or mangrove depletion in a particular area, but the adverse impacts could well extend into the long term. The potentially tragic, long-term consequences of this type of assault on the environment are easily blurred by short-term economic benefits. For subsistence communities in a developing country context such as those of the Philippines, what is known as "long-term" remains an abstraction vis a vis the exigencies of poverty and survival.

83. Type C EDs are relatively recent, having come to the fore of public concern only in recent decades. An example of this type of disaster is the semi-annual El Nino Southern Oscillation (ENSO), which, in the case of the Philippines, brings about massive drought lasting several months to almost a year. In other years, ENSO's twin sister, La Nina (LN), brings about intense rainfall and flooding to the country. The impacts of these phenomena are not confined to the Philippines alone, but are nearly global in extent. While ENSO and LN events are natural phenomena caused by the oscillatory warming of the eastern Pacific Ocean, there may be reason to expect that the additional warming of the sea surface due to the increasing anthropogenic release of carbon into the atmosphere could affect this cycle. Even without this supposition, it is acknowledged that ENSO or LN events already exacerbate the impacts wrought by present environmental stress. Preliminary maps showing the vulnerability of the country to both ENSO and LN are presented in **Figures 7 and 8.** These indicate areas such as the central and western parts of Luzon island which are most vulnerable to the onset of either event. Traditional agricultural areas such as the plains of central Luzon are thus most likely to be affected by recurring ENSO or LN events in the future.

84. While environmental disasters that are global in scope and long term in duration (i.e. Type D) can be the most controversial due to scientific uncertainties, geopolitical forces, economic and equity considerations, the potential damages associated with this type of ED can be quite extensive and protracted, cutting across critical sectors such as agriculture, human health, forest ecosystems and biodiversity. A major cause of impact in type D disasters is climate change, discussed in more detail below.

85. **Climate change**. The world's leading scientific body on climate change, the Intergovernmental Panel on Climate Change (IPCC), has concluded that the human release of carbon dioxide and other greenhouse gases due to industrial, agricultural, and urban activities has contributed to the increase in global surface temperature in the last 50 years. Climate change is expected to increase the frequency and intensity of weather related hazards in the longer-term.

86. Over the last century, the observed rise of surface temperatures in the Philippines follows the global trend. This is shown in **Figure 9**. Even while the extent of the anthropogenic contribution to this warming

trend continues to be debated in scientific circles, warming impact signals are already being observed in the archipelago.

87. Temperature increases in a tropical country may seem innocuous at first, but the recent crop failure in Region 2 (Summer, 2003) point to the critical importance of temperature in agricultural productivity. The observed warming of the sea during the 1997-98 ENSO event led to the bleaching of corals off Southern Luzon, which in turn is expected to adversely affect marine productivity.

88. Rainfall variability, particularly during the wet season, is on the rise making it more difficult to predict precipitation events on an inter-seasonal basis. Sea level rise (SLR), although a complex phenomenon, has been documented for various ports in the country such as Manila, Legaspi, and Davao. Such a plot is shown in **Figure 10**, where the SLR rate in Manila Bay is about 15 cm per decade. This plot is an example of how the confluence of many environmental factors such as silting, land reclamation, subsidence, and warmer sea surface temperatures, can lead to a rapid rise in sea level. **Figure 11** shows a map of areas in Metro Manila that are likely to be inundated further by a rise in sea level from 0.3 to 2.0 meters. Increases in sea level will eventually affect freshwater supply from aquifers, storm surge vulnerability of coastal communities, and the archipelago's rich coastal resources.

89. Initial studies of the impact of climate change in the Philippines for the 21st century show that temperatures are bound to rise by as much as 2.2 degrees in the last quarter of this century. Rainfall is more difficult to predict. Many of the results modeled in the tropics confirm an increase of rainfall during the wet seasons but a marked decrease during the dry seasons. Initial maps showing the vulnerability of geographic areas to temperature and rainfall change are shown in **Figures 12 and 13,** respectively. These maps were generated by intersecting the human development index of the UNDP with climate model results. Although preliminary, the maps show that Mindanao is most vulnerable to projected increases in temperature while Luzon is likely to be affected the most in the face of changing rainfall patterns in this century.

90. Historically typhoon-vulnerable areas in the country (shown in **Figure 14**) all need to be reevaluated as typhoon trajectories, intensities, and frequency could change unexpectedly.

91. However uncertain these projected impacts are, a potential environmental disaster caused by global climate change cannot be summarily dismissed from the discourse of current disaster management. Critical areas such as food and water security, natural resources, ecosystems and public health are bound to be stressed even further, not only by the impact of largely transient natural disasters, but also by the advent of environmental disasters of varying spatial extent and duration.

Conclusion

92. While data on the full social and economic impacts of disasters on the Philippines is incomplete, the existing data clearly indicates that these events have had a grave impact on the development of the country over past decades. Moreover, current trends such as urbanization, environmental degradation, and climate change will bring even more severe impacts. Poverty and disaster vulnerability are inextricably linked, and efforts to reduce poverty in the Philippines will simply not be sustainable without addressing disaster risk reduction.

93. A more comprehensive risk analysis is necessary to effectively determine the potential impacts of disaster events in the Philippines. Undertaking such an analysis will allow more informed decisions to be taken in terms of priority actions and investments to reduce these potential impacts and ensure the social and economic growth of the country in years to come.

94. The Philippines does have in place institutions and arrangements for dealing with disaster risk. The following chapter examines those arrangements.

Chapter 3. Disaster Management Capacity in the Philippines

Background

95. Following risk identification, risk reduction mechanisms need to be developed and implemented. However, their degree of success and or applicability is dependent on the institutional structure that is in place. This Chapter examines the disaster management in the Philippines, and to an extent possible, given the limited time, propose areas for improvement.

96. The disaster management system of the Philippines originated from World War II, and was very much geared towards preparations for war. President Manuel Quezon created the Civilian Emergency Administration (Executive Order EO335) in 1941 to prepare the population in case war shifted to the Pacific, and to adopt measures to control and coordinate civilian participation to meet grave emergencies. Under EO335 a National Emergency Commission was established. At the same time, a Provincial Emergency Committee was also established in each province, which in turn had supervision and control over Municipal Emergency Committees and City Emergency Committees.

97. In 1954 Republic Act RA1190 (the Civil Defense Act) came into being, establishing the National Civil Defense Administration (NCDA), under the Office of the President. RA1190 also created civil defense councils at national and local levels.

98. Executive Order EO159 (November 1968) required the establishment of a disaster control organization by all government offices including departments, bureaus, offices, agencies, instrumentalities and political subdivisions of government, including all corporations owned and/or controlled by government. The NCDA was designated the national coordinator to oversee and implement EO159 and to report on the degree of preparedness of all government offices to the Office of the President. As a planning body, however, observers noted that NCDA was constrained due to budgetary constraints, apathy and indifference by the public and government officials alike. After a series of natural hazard impacts in 1970, including major flooding in Metro Manila, President Marcos approved a Disaster and Calamities Plan prepared by an Inter-Departmental Planning Group on Disasters and Calamities.

99. The Office of Civil Defense (OCD) was established in 1972, by Letter of Instruction LI19, which was mandated to coordinate national level activities and functions of the national government, private institutions and civic organizations. The tasks of OCD included formulating plans and policies to protect the general public; estimate the total material, manpower and fiscal requirements for carrying out a national civil defense and civil assistance program; allocate to provinces, cities, municipalities and barangays such aid in facilities, materials and funds as may be available from the national government; to coordinate programs for informing, educating and training the general public; and provide guidance to sub-national levels on planning, organization and operations for their civil defense requirements.

Institutional Set-up for Disaster Management

100. Presidential Decree PD1566, promulgated on 11 June 1978 is the current basis of the Philippines' disaster management arrangements. PD1566 provides for the National Disaster Coordinating Council (NDCC) as the highest policy-making body on matters pertaining to disasters, advising the President. PD1566 stipulates:

- State policy on self-reliance among local officials and their constituents in responding to emergencies and disasters
- Each political and administrative subdivision to utilize all available resources in the area before requesting assistance from neighboring or higher authority

- Primary responsibility rests on government agencies in the affected areas in coordination with the people themselves
- Government departments, bureaus and agencies to have documented plans
- Planning and operation shall be done at the barangay level in an inter-agency, multi-sectoral basis to optimize resource utilization
- Responsibility for leadership rests on the Provincial Governor, City/Municipal Mayor and Barangay Chairman
- When an emergency covering several towns or cities occurs the Provincial Governor assumes operational control
- Periodic exercises to be conducted at all levels, principally in barangays.

101. National Disaster Coordinating Council (NDCC) member agencies are responsible for carrying out respective tasks and responsibilities, which include preparedness, mitigation, response and rehabilitation. NDCC does not have a regular budget; but operates through member-agencies and their local networks, namely the regional and local disaster coordinating councils (DCCs). Members of the NDCC and their respective responsibilities are as follows:

- Chairman – Secretary of National Defense, convenes NDCC as necessary and calls on other government agencies and private sector when need arises;
- Secretary of Public Works & Highway, restores destroyed public structures, such as flood control, waterworks, roads, bridges and other vertical/horizontal facilities; provides equipment for rescue, relief and recovery;
- Secretary of Transportation & Communications, restores destroyed communication and transportation facilities such as railroads and vertical structures; organizes national transport services;
- Secretary of Science & Technology, (*Philippine Atmospheric, Geophysical and Astronomical Services PAGASA* – continuing watch on environmental conditions to prepare daily weather forecasts, typhoon watches and flood outlooks. *Philippine Institute of Volcanology & Seismology PHIVOLCS* – issues advisories on earthquakes, volcanic activity and tsunamis; identifies appropriate evacuation sites and organizes disaster control groups and reaction teams. *Philippine Nuclear Research Institute* – issues advisories on radioactive fallout, contamination and radiation incidents; organizes disaster control groups and reaction teams;
- Secretary of Social Welfare & Development, extends relief assistance and social services to victims and provides rehabilitation;
- Secretary of Agriculture, undertakes surveys in disaster-prone areas and actual disaster areas to determine extent of damage of agricultural crops, livestock and fisheries; technical assistance to disaster victims;
- Secretary of Education, Culture & Sports, provides assistance in public education and campaigns regarding disaster preparedness, prevention and mitigation through integration of relevant subjects in school curriculum; makes school buildings available as evacuation centers; trains education staff in disaster preparedness;
- Secretary of Finance, issues rules and regulations regarding funding by local governments of DCC requirements; with DBM issues rules and regulations on preparation of local government budget and utilization of the 2% reserve for disaster operations;
- Secretary of Labor & Employment, organizes and trains Disaster Control Groups in factories and industrial complexes; provides emergency employment opportunities to disaster victims and implements industrial civil defense programs and measures;
- Secretary of Trade & Industry, maintains normal level of commodity prices during emergencies and organizes disaster control groups and reaction teams in large commercial and recreational premises;
- Secretary of Interior & Local Government, oversees organization of local DCCs, the establishment of Disaster Operations Canters (DOCs) of all local governments, and the training of DCC members in coordination with OCD, DSWD and other relevant agencies;

- Secretary of Health, provides health services during emergencies and organizes reaction teams; also issues public health warning notices;
- Secretary of Environment & Natural Resources, responsible for reforestation and control of areas prone to flood, landslide, mudflow and ground subsidence; also technical assistance on environmental pollution;
- Secretary of Tourism, organizes and trains disaster control groups and reaction teams in hotels, pension houses, restaurants and other tourist-oriented facilities;
- Secretary of Budget & Management, releases funds required by departments for disaster operations;
- Secretary of Philippine Information Agency, provides public information service through dissemination of mitigation and preparedness measures;
- Secretary-General, Philippine Red Cross, conducts disaster leadership training courses, assists in DCC training at all levels; helps in provision of emergency relief;
- National Housing Authority, assessment of housing requirements of displaced persons; provision of temporary housing and rebuilding of destroyed areas;
- Chief of Staff, Armed Forces of the Philippines (AFP), responsible for provision of security in disaster area and assistance in reconstruction; provides transportation for relief supplies and personnel;
- Director-General, National Economic Development Authority, responsible for determination and analysis of effects of disasters on socio-economic programs, and the development of damage assessment schemes; and
- Administrator, Office of Civil Defense, acts as NDCC Executive Officer; coordinates activities and functions to implement policies and programs, and advises Chairman on disaster management matters). The OCD serves as the operating arm of NDCC.

101. The Chairman convenes the NDCC when necessary, calling on member agencies or the private sector when the need arises. The NDCC is replicated at regional and local levels, with each tier operating and utilizing its own resources.

102. Regional Disaster Coordinating Councils

103. (RDCCs) coordinate activities of national government agencies at the regional level. The NDCC Chair assigns the chairman of a RDCC to the post by presidential designation, although under the present arrangement the Philippine National Police (PNP) regional directors are the designated chairpersons. In autonomous regions, the Chief Executives automatically become chairmen of the RDCC. In Metro Manila, the Chairman of the Metro Manila Development Agency (MMDA) is also chairman of the Metro Manila Disaster Coordinating Council (MMDCC).

104. RDCCs have no budget of their own and can operate only through mutual coordination of the member agencies. The OCD Regional Director acts as the Executive Officer of the RDCC. The RDCC is expected to:

- Establish a Regional Disaster Operations Center (RDOC)
- Implement guidelines within the regions set by the NDCC
- Advise local disaster coordinating councils (LDCCs) on disaster management
- Submit recommendations to the NDCC as necessary

105. The term 'Local Disaster Coordinating Council' appears to cover all non-national level activities, thereby embracing provincial, city/municipal and barangay system levels. Chief executives are, by law, chairmen of their respective LDCCs. The primary functions of LDCCs are detailed in an NDCC document *Calamities and Disaster Preparedness*, the details of which are:

106. Provincial Disaster Coordinating Council (PDCC)

- Establish a Provincial Disaster Operations Center (PDOC)
- Coordinate disaster operations within the province from the PDOC
- Implement within the province guidelines set out by the RDCC
- Advise City/Municipal and Barangay DCCs regarding disaster management
- Submit recommendations to the RDCC as necessary

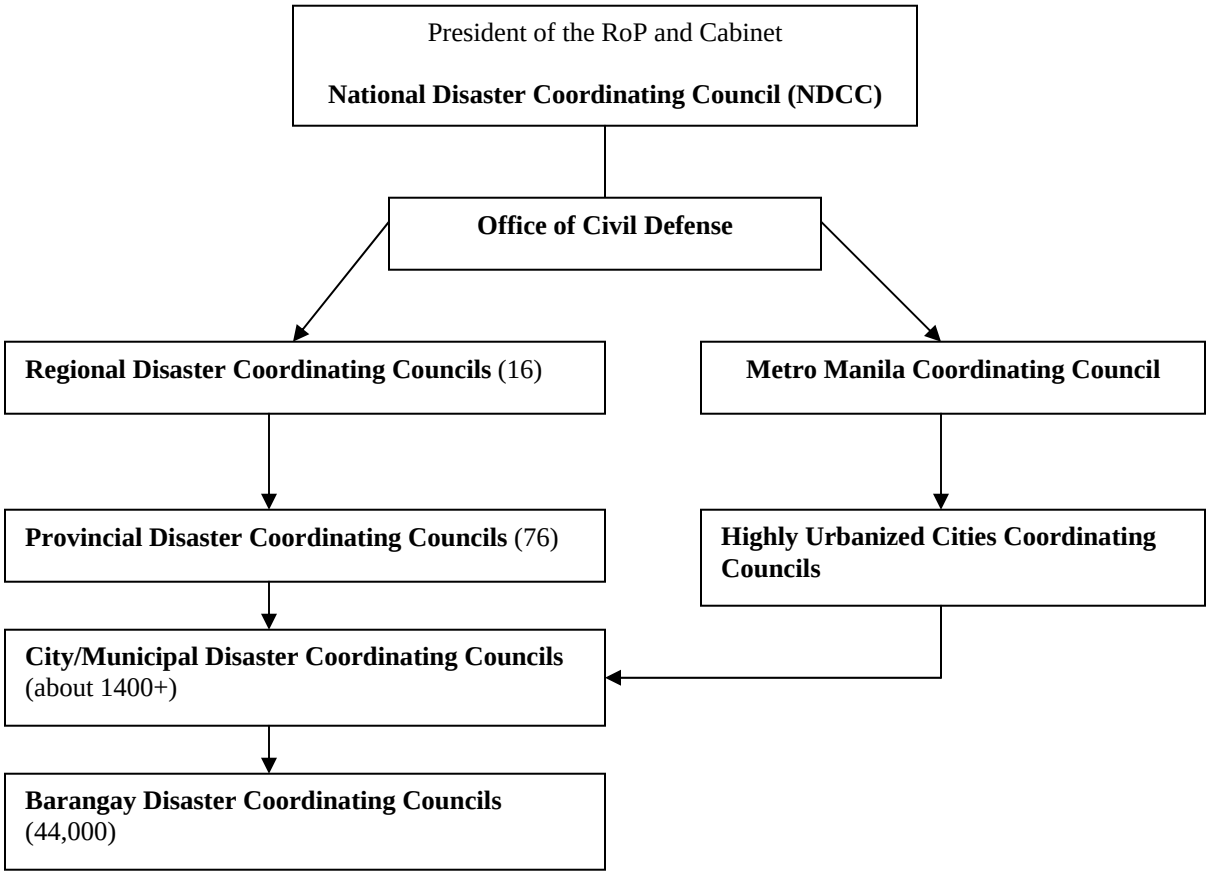
107. City/Municipal Disaster Coordinating Council (CMDCC)

- Establish a City/Municipal Disaster Operations Center and coordinate disaster operations from it
- Implement guidelines set by the PDCC within the city/municipality
- Advise Barangay Disaster Coordinating Councils regarding disaster management

108. Barangay Disaster Coordinating Council (BDCC)

- Establish a Barangay Disaster Operations Center (BDOC) and coordinate disaster operations from it
- Implement guidelines established by the CMDCC
- Advise BDCC member son disaster management.

109. A summary diagram of the institutional arrangements for disaster management is provided below:



Funding Support for Disaster Management

110. As mentioned in the previous chapter on economic and fiscal impacts of disasters, the Philippines Government provides for annual appropriations of calamity funds for emergency relief and rehabilitation efforts.

National government[28]

111. Government expenditure on disaster related activities is provided from a number of budget lines held by various government departments and various levels of government.

112. ***National calamity fund*** At the national level, the government's primary fund for responding to disasters is the National Calamity Fund, which is intended to supplement and complement Local Calamity Funds. Priority in use is given: firstly, for urgent and emergency relief operations and emergency repair and rehabilitation of vital public infrastructures and lifelines damaged by calamities occurring within the budget year; secondly, for the repair, rehabilitation and reconstruction of other damaged public infrastructures; and thirdly, for pre-disaster activities outside the regular budgets of line agencies and proposed capital expenditures for pre-disaster operation.

113. Part of the annual appropriation is immediately, a priori, allocated to the Quick Response Fund, with allocations within that to particular agencies. Under the 2002 budget, for instance, 37.5% of the total P800bn calamity fund was pre-allocated as QRF. Some 12.5% of the total National Calamity Fund was pre-allocated as QRF to the DSWD, 7.5% to OCD, 10% to the DPWH and 7.5% to DND. QRFs are intended as rapid stand-by funds for use in the immediate aftermath of a disaster. The NDCC recommends the release of the NCF, including QRFs.

114. Most applications for National Calamity Funds come from 4th, 5th and 6th class LGUs, who have relatively little income and so rely only on small Local Calamity Funds.[29] LGUs have to put up a local counterpart fund ranging from 50% of the total project cost for 1st class LGUs to 30% for 4th class LGUs. Those LGUs in the 5th and 6th classes are exempt but no single request is allowed to exceed P3bn a year.

115. According to PD 477, two per cent of the budgetary reserve should be allocated to the National Calamity Fund. In reality, appropriations to the National Calamity Fund have been far lower and, moreover, have gradually declined in recent years, falling from as high as P2.8 billion in 1996 to only P800 million in 2002 and P700 million in 2003 – a drop of over 80% in real terms (Table 3). This decline reflects increasing fiscal difficulties combined with a lower incidence of major disasters in recent years, allowing the government to justify falling appropriations. The DBM actually reported a surplus on the calamity fund budget in 2002. However, the NDCC maintains that resources are far lower than required and that this has led to a backlog of claims on the National Calamity Fund. For instance, part of the 2003 National Calamity Fund will be used to meet requests received for damage incurred in 1998 and 1999. In March 2003, use of the calamity fund was extended to cover insurgency, including the conflict in Mindanao, and acts of terrorism, placing additional pressures on already limited resources.

116. Evidence on the use of resources confirms that calamity funds are extremely stretched and able to meet only a small proportion of relief and rehabilitation costs. Between 1996 and 2000, total disaster-related damage amounted to P 49.2 bn (in real 2000 prices) according to the NDCC whilst total expenditure under the calamity fund totaled P 8.9 bn, or just P 7.5 bn excluding expenditure on mitigation and preparedness.

[28] There is also some off-budget external assistance both for mitigation and preparedness and post-disaster response. However, consolidated data on this assistance could not be readily obtained for the purposes of this report.
[29] The DILG/DOF classify LGUs in descending order from class 1 to 6 based on average annual total income.

117. ***Other sources of post-disaster funding*** Other sources of funding have also been drawn upon – and sometimes specifically created - for use in responding to more severe events, beyond the capacity of the National Calamity Fund. These include:

- *Special rehabilitation funds* – following both the 1990 Baguio earthquake and the 1991 eruption of Mt Pinatubo, special relief and rehabilitation funds were established to fund reconstruction and rehabilitation operations.
- *Property replacement fund* – this used to operate as a sinking fund for the restoration of national government buildings, equipment and transport vehicles damaged by fire and national calamities. However, its role was reduced to high-risk public properties (primarily aircraft and ships) only in the late 1990s.
- *Line agency standby funds* - some government agencies have separate standby funds under their own budgets for stockpiling relief supplies and so forth. For instance, the DSWD's standby fund stood at P200m in 2002.
- *Reserves Control Account* – this account, comprising 5% of maintenance expenditure and 5% of capital outlay of each government department, is intended to meet unforeseen requirements, in some cases arising as a consequence of disasters. It was drawn upon, for example, as part of the initial government response to the Mt. Pinatubo eruption.
- *Allocation of Congressmen* - in responding to the 1998 El Niño event, each of the country's 224 congressmen allocated P5m for construction of deep-water wells, water tubes, procurement of seeds and other measures.
- *Presidential Social Fund* – this is sometimes used by the DA to fund post-disaster operations.

118. Following the 1998 drought, further relief and rehabilitation funding was also allocated from the Agricultural Production Fund and from the National Government lump sum whilst resources from the Poverty Alleviation Fund were used to fund food distribution. NDCC's own costs are separately funded out of the general appropriations.

119. Aggregate data on total disaster-related expenditure under these various budget heads is not available. However, in some years expenditure may be substantial, placing significant pressure on other areas of government spending. For instance, in response to the Mt Pinatubo eruption the GoP released a total amount of P32.3 billion (in nominal terms) over five years, of which P2.99bn was for various foreign-assisted projects relating to infrastructure. This was equivalent to 1.5% (excluding foreign-assisted projects) of total nominal expenditure over the period 1991 to 1995; and 4.7% of expenditure excluding interest payments on domestic and external debt and wages and salaries.[30]

120. Additional rehabilitation spending is drawn from existing operational budgets of relevant agencies, most obviously the DPWH, DA and DENR on a regular basis. DPWH, for instance, has a rehabilitation fund within its annual budgetary appropriation. Upon declaration of a calamity, concerned national agencies and LGUs are permitted to program or reprogram funds for the repair and safety upgrading of public infrastructures and facilities and reallocations occur on an annual basis. However, such reallocations are largely unrecorded and thus difficult to capture without detailed examination of budgetary operations as they occur internally, within budget heads. Some surplus funding can also currently be 'borrowed' from projects that are being implemented more slowly than anticipated in determining budgetary appropriations, although the DBM is trying to streamline this process and only issue funding for projects that are ready. There may be substantial additional unrecorded reallocations within the recurrent budget, relating to re-deployment in kind – of government staff, vehicles and equipment, supplies of drugs and other items and so forth.

[30] Figures cannot be reported in real, rather than nominal, terms because only the total, rather than annual, figure on expenditure in response to the Mt Pinatubo eruption was available.