

**FLASH FLOOD AND LANDSLIDE DISASTERS IN THE
PHILIPPINES: REDUCING VULNERABILITY AND
IMPROVING COMMUNITY RESILIENCE**

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**A thesis submitted for the degree of Master of Science,
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DECLARATION

This work contains no material which has been accepted for the award of any degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying subject to the provisions of the Copyright Act 1968.

I hereby certify that the work in this Thesis is the result of original research, the greater part of which was completed subsequent to admission to candidature for the degree.

Signature:  Date: 

DEDICATION

I dedicate this humble work to the memory of my father,

Rodolfo Salcedo Ollet

and to my loving mother,

Magdalena Nolasco Jaucian

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LIST OF ABBREVIATIONS

ADPC – Asian Disaster Preparedness Center
am – ante-meridian (morning)
AS/NZS – Australian Standard/New Zealand Standard
AUMDP – Asian Urban Mitigation and Disaster Preparedness
BDCC – Barangay Disaster Coordinating Council
CRED – Centre for Research Epidemiology of Disasters
km³ – cubic kilometre
CVP – Community Vulnerability Profile
DA – Department of Agriculture
DENR – Department of Environment and Natural Resources
DILG – Department of the Interior and Local Government
DOST – Department of Science and Technology
DPWH – Department of Public Works and Highways
E - East
EMA – Emergency Management Australia
FEMA – Federal Emergency Management Agency
GDP – Gross Domestic Product
HREC – Human Research Ethics Committee (The University of Newcastle)
IDNDR – International Decade for Natural Disaster Reduction (1990-1999)
IFRC - International Federation of Red Crosses and Crescents
ISDR – International Strategy of Disaster Reduction
ITCZ – Inter-Tropical Convergence Zone
JICA – Japan International Cooperation Agency
km – kilometre
km/hr – kilometre per hour
LCEs –Local Chief Executives
LGUs – Local Government Units
MBB – Model's Building Block
MGB – Mines and Geosciences Bureau
MDCC – Municipal Disaster Coordinating Council
NDCC – National Disaster Coordinating Council
m – metre
m/sec – metre per second
m² – square metre
mi/hr – miles per hour
mm - millimetre
mm/hr – millimetre per hour
mm/day – millimetre per day
nn –noontime
N – North
NEDA – National Economic and Development Authority
NRCP - National Research Council of the Philippines
OCD – Office of Civil Defence
PADR – Participatory Assessment of Disaster Risk

PAGASA – Philippine Atmospheric, Geophysical, Astronomical Administration
Services
PDCC – Provincial Disaster Coordinating Council
PCIERD - Philippine Council for Industrial Energy Research and Development
PHIVOLCS – Philippine Institute of Volcanology and Seismology
PNRC – Philippines National Red Cross
PD – Presidential Decree
pm – post-meridian (afternoon)
PSWS – Public Storm Warning Signal
RDCC – Regional Disaster Coordinating Council
REINA – Real, Infanta, and Nakar (municipalities of Quezon Province)
S – South
SOLERT - Southern Leyte Emergency Response Team
TAP - Technology of Assessment and Participation
UNDP – United Nations Development Programme
W – West
WB – World Bank

GLOSSARY

The following terms are defined to help the reader understand this study. They have been adapted from the 2003 World Disaster Reduction Campaign information kit, journals on natural hazards and emergency management, and local experts' presentations to the Philippines' National Disaster Coordinating Council/Cabinet Meetings:

Climate Change – refers to a statistically significant variation in either the mean state of the climate or its variability, persisting for an extended period (typically decades or longer).

Community – a social entity or group of people that has a number of things in common generally defined by location, but which may include such things as shared experience, culture, heritage, language, ethnicity.

Disaster – a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope, using its own resources. A disaster is a function of the risk process. It results from the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk.

Disaster risk reduction (disaster reduction) – a holistic framework of elements considered to have the potential to minimize vulnerabilities and disaster risks throughout a community or society, to avoid (prevention) or to limit (mitigation and preparedness) the adverse impacts of hazards, within the broad context of sustainable development.

Early warning – the provision of timely and effective information, through identified institutions, that allow individuals exposed to a hazard, to take action to avoid or reduce risk and prepare for effective response. Early warning systems include three primary elements: (1) forecasting of impending events; (2) processing and dissemination of

warnings to political authorities and population; and (3) undertaking appropriate and timely actions.

El Nino-Southern Oscillation (ENSO) – refers to an irregularly occurring pattern of abnormal warming of the surface coastal waters off Ecuador, Peru and Chile. This coupled atmosphere-ocean phenomenon is associated with the fluctuation of inter-tropical surface pressure pattern and circulation in the Indian and Pacific oceans, called the Southern Oscillation. A La Nina is the opposite of an El Nino event, during which waters in the west Pacific are warmer than normal and trade winds are stronger.

Environmental degradation – means the reduction of the capacity of the environment to meet social objectives and needs. Some examples include: land degradation, deforestation, desertification, wildfires, loss of biodiversity, land, water and air pollution, climate change, sea level rises, ozone depletion.

Flash-flood – is a sudden, unusually large volume of water, usually carrying a lot of sediments and floating debris, mostly trees and plants, which deposits its load at the valley mouth. A flash-flood commonly occurs after long duration heavy rain that induces landslides whose deposits can form dams across constricted segments of a river valley and impound runoff upstream. The failure of relatively large landslide dams causes the release of their impounded water as flash-floods. Flash-floods are also generated by lake breakout, reservoir dam failure and log jam breaching.

Hazard – a potentially damaging physical event, phenomenon and/or human activity, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Hazards can include latent conditions that may represent future threats and can have different origins; natural (geological, hydro-meteorological and biological) and/or induced by human processes (environmental degradation and technological hazards).

Hydro-meteorological hazards – natural processes or phenomena of atmospheric, hydrological or oceanographic nature, which may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation. Examples are: floods, debris and mud floods; tropical cyclones, storm surges, thunder/hail storms, rain and wind storms, blizzards and other severe storms; drought, desertification, wildfires, temperature extremes, sand or dust storms, and snow or ice avalanches.

Lahar - is an Indonesian term that describes a hot or cold mixture of water and rock fragments flowing down the slopes of a volcano and (or) river valleys.

Landslides – defined as downward-moving earth materials aided by gravity, types of which are **slide** (*movement parallel to planes of weakness and occasionally parallel to slope*), **fall** (*material free fall*), **topple** (*the end-over-end motion of rock down a slope*), **flow** (*viscous to fluid-like motion of debris*), **slump** (*complex movement of materials on a slope; includes rotational slump*), and **creep** (*gradual movement of slope materials*).

Lifelines – refers to systems or networks that provide for the movement of people, goods, services, and information upon which the health, safety, comforts and economic activity of a community depends.

Mitigation – structural and non-structural measures undertaken to limit the adverse impact of natural hazards, environmental degradation and technological hazards.

Preparedness – activities and measures taken in advance to ensure effective response to the impact of hazards, including the release of timely and effective early warnings and the temporary removal of people and property from a threatened location.

Prevention – activities to provide outright avoidance of the adverse impact of hazards and means to minimize related environmental, technological and biological disasters.

Public awareness – the processes of informing the general population, increasing levels of consciousness about risks and how people can act to reduce their exposure to hazards. This is particularly important for public officials in fulfilling their responsibilities to save lives

and property in the event of a disaster. Public awareness activities support changes in behavior leading towards a culture of prevention. This involves public information, dissemination, education, radio or television broadcasts and the use of printed media, as well as the establishment of information centers and networks.

Resilience - the ability of systems to absorb change and to either bounce back, or to shift to new points of stability. For disaster risk reduction, this means focusing more effort on reducing the vulnerability of a community to 'extraordinary' events. It also requires more emphasis on planning for, and undertaking, post-event recovery in order to make communities less vulnerable to future events.

Risk – the probability of harmful consequences, or expected losses (death, injuries, property loss, livelihoods' loss, economic activity disrupted or environment damaged) resulting from interactions between natural or human induced hazards and vulnerable conditions.

Sustainable development – refers to development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It is based on socio-cultural development, political stability, economic growth and ecosystem protection, which all relate to disaster risk reduction.

Vulnerability – a set of conditions and processes resulting from physical, social, economic, and environmental factors, which increase the susceptibility of a community to the impact of hazards.

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ABSTRACT

Recent flash floods and landslides in the Philippines have caused many fatalities, loss of livelihoods; destroyed infrastructures, damaged natural resources and displaced several communities. Investigation of five disaster cases of flash floods and landslides from 1991 to 2006 was undertaken to gain an understanding of the causes, behaviour, distribution and biophysical impacts of these recurrent natural hazards. Sustaining healthy and resilient communities and protecting the ecosystem from natural disasters is a key development goal. Therefore, communities at risk need to adequately prepare for, respond to, and recover from the impacts of these natural disasters. A theory model on community resilience called the Landslip-Disaster Quadrant Model was developed to examine the capacity for resilience and the vulnerability of threatened communities. Six building blocks comprise this Model. A community study of the February 17, 2006 landslides in St. Bernard, Southern Leyte, was conducted to test and refine this Model.

Major findings of the study have revealed that flash floods and landslides have been frequent due to changing climatic patterns and greater interaction of natural processes. Extreme weather conditions have resulted in intense rainfall that seeps through fractures and cracks in the ground. Rains saturate and loosen soil particles, weaken slope resistance, triggering landslides that formed natural dams. Failure of these natural dams or log jams caused flash floods and debris flows. The rapidity and destructiveness of these hazards were influenced by the angular position of sliding materials, slope resistance, type of cascading materials caught in the flow, river channel configuration, and human structures that obstruct and/or intensify overflow. These were the physical conditions of vulnerability to disasters in the five cases of natural disaster investigated.

Rural livelihoods and the economic base of the local people in Saint Bernard, Southern Leyte, were limited and subsistent. Though the local people have a high literacy rate, they have inadequate understanding of the natural processes associated with landslides. Natural observations such as receding water levels in the river, fractures and cracks in the ground on the mountain, excessive rains and landslides in nearby communities could have been used as early warnings by the local people and authorities for safe evacuation. Many lives in Guinsaugon village could have thus been saved from the deadly landslides of 17 February 2006. Political interests have affected progress of resettlement housing and development projects that obliged many local people to extend the period spent living in the evacuation centres. However, the local people were expressive of their faith and hope to rise from the tragedy. These 'bouncing back' attitudes of the local people were indicative of their strong cultural values that formed the core of their coping capacity for natural disasters. The results of the community study tested and refined the Landslip-Disaster Quadrant Model. Among the six blocks for building a disaster-resilient community, cultural values and local norms ranked first. This is followed by ecological security, then livelihood sufficiency and economic base, and further by human health and wellness. The last two blocks were structural networks and institutional arrangements, and political will and priorities.

This Model could form the framework for a Comprehensive Landslide and Flash Flood Disaster Risk Assessment in the Philippines. The community assessment toolkit developed in this study could be expanded further into policy and planning guidelines of the National Disaster Coordinating Council of the Philippines.