

Cyclone Nargis, Myanmar

Risk Reduction in Natural Resource Management



John E Leake



Intellect and Morality
Precede Development

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Abbreviations

AHTF	ASEAN Humanitarian Task Force for the Victims of Tropical Cyclone Nargis
ALARP	‘as low as reasonably practicable’
ASEAN	Association of Southeast Asian Nations
DaLA	Damage and Loss Assessment Methodology
DRR	Disaster Risk Reduction
HIV	Human Immunodeficiency Virus
IASC	Inter-Agency Standing Committee
IFRC	International Federation of Red Cross and Red Crescent
INGO	International Non-Government Organization
DMH	Department for Meteorology and Hydrology
DSW	Department of Social Welfare
MIMU	Myanmar Information Management Unit
MOH	Ministry of Health
NDPCC	Natural Disaster Preparedness Central Committee
NGO	Non-Governmental Organization
OCHA	Office of Coordination of Humanitarian Affairs
PONJA	Post-Nargis Joint Assessment
PONREPP	Post-Nargis Recovery and Preparedness Plan
RCC	Recovery Coordination Centre
PDC	Peace and Development Committees
RH	Risk Hazard
TAG	Technical Advisory Group
TC	Tropical Cyclone
TCC	Township Coordination Committee
TCG	Tripartite Core Group
UN	United Nations
VPDC	Village Peace and Development Council
VTa	Village Tract Assessment
WASH	Water, Sanitation and Hygiene

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John Leake

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What this Book is About

There is a commonly held view that the incidence and scale of disasters is increasing in the modern world although some disagreement on whether the incidence of events, such as Tsunamis, earthquakes, fires, floods etc., that can give rise to disasters is increasing. The view is understandable, both population and their built environment are increasing so more is at risk and this trend of increased risk will continue while populations continue to rise. As the World Bank Independent Evaluation Group (IEG)¹ enumerates this:

'Natural disasters are becoming more costly: in constant dollars, disaster costs between 1990 and 1999 were more than 15 times higher (\$652 billion in material losses) than they were between 1950 and 1959 (\$38 billion at 1998 values) The human cost is also high: over the 1984–2003 period, more than 4.1 billion people were affected by natural disasters. The number affected has grown, from 1.6 billion in the first half of that period (1984–93) to almost 2.6 billion in the second half (1994–2003), and has continued to increase. Although disasters caused by natural events occur throughout the world, losses to disaster in developing countries are generally much greater than in developed countries in terms of percentage of gross domestic product (GDP) or government revenues.'

Disasters are commonly considered to be sudden events, as with modern communications it is possible for billions of people to experience almost simultaneous sympathy and desire to help. This suddenness facilitates collective action,

at least while the collective emotion persists, but may mask other more important impacts on the lives of all concerned.

Many of the most disastrous events in history however have had slow onset periods, for example;

- salinised irrigation systems that helped bring down civilisations such as the Sumerian states on the Euphrates river some 4,000 years ago,²
- deforestation leading to desertification and or massive erosion is a particularly widespread and pernicious example,³
- human induced climate change may be another that is unfolding before our eyes.⁴

These all relate to human interactions with the natural environment, which is most commonly considered under the rubric of natural resource management (NRM). The effect of speed of a disaster is, in public parlance, often illustrated by the metaphor of the 'boiled frog'⁵ – different human responses arise from whether a disaster is perceived to be of slow or rapid onset.

This investigation reflects on the interplay of short and long-term social and biophysical factors on the scale of one particular disaster, Tropical Cyclone (TC) Nargis, which hit the Ayeyarwady Delta area of Myanmar in May 2008, killing perhaps 140,000 people in four hours. This will be achieved through an evaluation of its impact on the people of the area, their built environment and the ecosystem of the delta, and by discussing its conclusions and recommendations in a wider context as a means to reducing the risk from the many disasters that threaten livelihoods as human populations grow.

This book discusses work undertaken to determine means of reducing the impact of disasters. It uses the Tropical Cyclone Nargis that ravaged coastal Myanmar in 2008 as a case study. It takes a broad view of the precursors of disasters as well as their effects and the effectiveness of responses by government, aid agencies and others – and especially the affected communities themselves. By examining these factors it arrives at conclusions that can potentially reduce the impact of natural disasters.

With the global population and built environment rising rapidly, the risk of an event causing damage is increased. While disasters are commonly considered to be sudden events, which with modern communication can lead to rapid responses, it can be argued that the major impacts of disasters through history have been slow onset events, such as deforestation leading to desertification. Such human imposts on the environment are now more widely appreciated and often make communities more vulnerable to periodic weather or other events.

When Tropical Cyclone Nargis hit the Ayeyarwady Delta area, it also destroyed livelihoods, impacted on health and led to a confusion of aid services. Nevertheless, the government response was fast, efficient and useful within its limited resources. However, what all agencies involved failed to appreciate sufficiently was that the area affected by the cyclone had been significantly exposed to increased hazard by a number of factors that could have been prevented or otherwise managed and this impacted on post recovery action. Such actions as mangrove clearing had removed a natural filter of tidal surges, and levee banks built after previous cyclones had not been maintained.

In this work, some key concepts of Disaster Risk Reduction and Natural Resource Management are integrated to consider the outcomes of actions taken in response to the cyclone. The environmental, social and biophysical elements of the setting are examined and the impact of the cyclone on the Delta environment and its communities discussed. The analysis revealed that the background 'slow acting' disaster – the destruction of the natural resource base – had increased the risk and vulnerability of the area. In assessing the successes and failures in the response of the government and international agencies, some conclusions are elicited that lead to recommendations for future disaster impact reduction by taking a natural resource focus.

The holistic approach described herein may be considered as systems thinking about the interlinking factors involved in reducing vulnerability to risk and building resilience. It is neither practical nor possible to monitor all variables in a system. This is where techniques from natural resource management that identify key systems can reveal the points of vulnerability to catastrophic change and might be gainfully used. Observing warning signals in a risk-based approach might focus on information ranging from pedological to hydro metrological to biological and technological, and lead to wider considerations about markets, governance and even personal and community values.

With such warning systems in place, an adaptive management approach to natural resources resilience is achieved on a landscape scale and a shared sense of risk reduction can be developed. Such a broad risk-based approach to Disaster Risk Reduction allows stakeholders to

prioritise activities for the more conspicuous fast acting disasters when they occur.

The work leads to the recommendation that Myanmar improve decision-making by establishing a regional system to integrate scientific information of the natural systems that underpin livelihoods and social systems. In particular, it recommends monitoring the natural resource base to inform disaster preparedness and guide all development that impacts on that base.

The following chapters trace the various impacts of Tropical Cyclone Nargis. Chapter One discusses some key concepts and definitions used in Disaster Risk Reduction (DRR) and in Natural Resource Management (NRM) that will be used in considering outcomes from observations and developing conclusions. It introduces the idea of the importance of reserves, social and biophysical, in the stability of the systems that underpin all human lives. In Chapter Two different systems for classifying the environment, social and biophysical are introduced to facilitate the open flow of information and resources necessary to plan disaster risk reduction strategies for different circumstances. Chapter Three then discusses human impact on their environment to examine whether it is possible for humans to collaboratively manage and enhance their environment on a landscape scale for extended periods, even if such action may be negative in aggregate over time.

Chapter Four then changes tack to introduce the country of Myanmar and Cyclone Nargis as a case study, which Chapters Five to Nine use to discuss the impact of Nargis on the Delta environment and its community under different classifications to illustrate different factors that required

investment for recovery. They show how a background 'slow acting' disaster, the destruction of the natural resource base of the Delta, augmented the scale of the TC Nargis disaster and consequently how continued failure to deal with this background disaster will impact on future large storm events and the livelihoods of people that depend on this natural resource base.

Chapter Ten then assesses the different responses to Nargis and how these were monitored and managed, while Chapter Eleven distils some findings that lead to conclusions on what worked, what didn't and why, in the response post-cyclone. Chapter Twelve then broadens the perspective to other situations in Myanmar and the 'developing world'. These place particular attention on the importance of the information and resource flows necessary for authorities to safeguard and enhance the capacity of the population to improve their lives and those of their children.

The final Chapter Thirteen then discusses the benefits of taking a risk-based approach to all management by reducing risk in both slow and fast acting disasters to the benefit of humans caught up in both. It suggests that this is a timely change in strategy from one suited to a world with lower population densities and response times to today's more populous world where disasters affect increasingly large numbers of people.

Chapter One

Key Concepts in Understanding Disasters

Disaster is axiomatically a natural fear of people; in a world of many unknown lurking dangers, 'things that go bump in the night' in the words of a traditional Scottish prayer, it is natural to address the most urgent. Why is this and how do we conceptualise and analyse disaster?

Disaster Risk Reduction

There is not one agreed definition of disaster. According to Webster,⁶ the root of the word is astrological (Greek 'a star' taken as 'a stroke of ill fortune'), or (in the French 'fate'). Disaster is no longer seen as quite so capricious or unpredictable, in modern times it has come to mean the result of a sudden calamitous event or catastrophe on people and property. This is distinct from the impact of such events on an unpopulated area with little economic or environmental value to people. That is, the same type of natural events may be considered as a disaster in one situation and not in another if no human or immediate economic cost is involved. To some extent, these human and economic impacts are foreseeable, even if timing of events may not be, and so can be allowed for in planning to reduce the risk of disaster.⁷

Disaster Risk Reduction (DRR) is a discipline that has arisen from the need for improved human responses to such natural events, and to minimize their 'disastrous' impact. There are now many national and international agencies that exist to build capacity to deal with disasters. The World Bank is now a substantial actor in this DRR space and since 2006 has sponsored the Global Facility for Disaster Reduction and Recovery (GFDRR)⁸ made up of 39 countries⁹ and seven international organisations.¹⁰ The World Bank reports that its assistance accounted for 9.4 per cent of total Bank commitments between 1984 and 2005 and that this share has been increasing steadily ever since.¹¹

The United Nations International Strategy for Disaster Risk Reduction (UN/ISDR) was perhaps the earliest international institution to focus on DRR and its report 'Living with Risk'¹² is an often quoted source document for DRR planning in all agencies. It was formulated in stages during and following the UN Decade of Natural Disasters 1990-1999. The significant steps included;

- the Yokohama Strategy and Plan of Action compiled in 1994,¹³
- the first edition compiled in 2002 for the World Summit on Sustainable Development (WSSD) held in Johannesburg in the same year,¹⁴
- the second (2004) edition presented at the World Conference on Disaster Reduction held in Kobe- Hyogo in 2005.¹⁵

This document as updated continues to be the guiding policy document referred to in UN conferences.¹⁶ As the policy

document most used in this investigation, it warrants some further discussion, as follows.

The UN strategy has two definitions of disaster to emphasize the important place of the human response in disaster perception. The first focuses on social aspects:

'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'.¹⁷

The second focuses on the impact of the lack of adequate preparation on the incidence of perceived natural disaster:

'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'.

Such definitions recognize that poor countries can be more vulnerable to disaster than richer ones, because they are less able to take precautionary steps, and have populations living in more vulnerable and marginalized conditions. It is also assumed that the cost of preparatory action is usually much less than the costs from disaster losses, and/or the cost of recovery and reconstruction. Hence the second of the ten principles that guides this international aid states:

'Disaster prevention and preparedness are of primary importance in reducing the need for disaster relief'.¹⁸

Risk

Risk is a critical consideration in DRR and is assessed in a similar manner to its use in business and environmental planning and monitoring to prioritise activities. However, in terms of disasters in poor countries, the elements of probability, severity and susceptibility to danger can be assessed separately, and their interaction considered as an overall definition of risk. The UN/ISDR uses definitions of risk that are oriented to assisting populations to reduce their vulnerability to disasters, natural or otherwise.¹⁹

‘Conventionally risk is expressed by the notation:

Risk = Hazards x Vulnerability where:

- *Risk is the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.*
- *Hazard is a potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation*
- *Vulnerability is the conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.’*

With this conception, the risk, hazard and vulnerability can be assessed for disasters according to their speed of onset.

Fast and Slow Onset Disasters

Disasters are mostly considered to be sudden events because these are the most newsworthy. However, these with some notable exceptions, such as the eruption of Mt Vesuvius and the burying of Pompeii²⁰ are perhaps historically less significant than the fall of civilizations, the mass movements of populations and warfare that are often set off by human induced 'triggers' resulting from the destruction of the natural resource base. Indeed social factors in disasters lead to more deaths than the natural hazard 'triggers' of storms, earthquakes and volcanoes. 'Slow onset' disasters are greater killers than 'rapid onset' disasters. Wisner et-al (2005)²¹ collated WHO data on the epidemiology of disasters²² and suggest that the percentage of deaths between 1900 and 1999 from slow onset disasters, such as famines and droughts was 87 per cent compared with rapid onset disasters of which the causes were floods (10 per cent) and earthquakes, tsunamis and storms together (4 per cent).

With international attention to improve the response to disasters has come the realisation that the impact of natural events is often greatly exacerbated by pre-existing human damage to natural eco-systems that have in the past served to mitigate impact.²³ For example, the impact of Hurricane Katrina on the subsequent flooding in New Orleans appears to have been exacerbated by mangrove destruction to the seaward side of the city.²⁴ Understanding that the actions of people can serve to increase or decrease their vulnerability to natural hazards²⁵ has introduced an appreciation of the relative degree of resilience that an individual, population or environment may exhibit.

Resilience

Deriving from the mechanical concept of elasticity,²⁶ resilience has become entrenched as a description of 'bouncing back' to close to an original state after a stress. Hence it is used to describe an individual's capacity to return to something like a normal state after trauma,²⁷ and by extension to a group's ability to return to normal social functioning. This is the common meaning of peoples' 'resilience in the face of disaster'.

From the 1970's the word began to be applied to in an ecological sense; for example, Holling (1973) coined a special definition of resilience in natural systems as being;

*'a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables.'*²⁸

Brand and Jax²⁹ have argued that the term resilience can be usefully widened to two uses; 1) as a descriptive ecological concept as employed by Holling above, and 2) as a wider '*bounded object with a rather vague meaning*' useful for communication across disciplines to analyse social-ecological systems. The former use retains the mathematical relationships of a conventional model, while the later is more useful for showing the patterns of change that may occur through interaction between the social and biophysical elements of a system.

Several writers have discussed the idea of building capacity, or reserves, to adapt to change and so build resilience. This idea permeates systems thinking in both social and biological realms.³⁰ This idea they suggest helps to facilitate planning for many purposes, notably for responses to natural disasters. This use of the concept of resilience is thus becoming common in natural resource management as it takes the inherent complexity of such social-ecological systems³¹ into account.

The complexity of the interaction between human and natural systems has stimulated use of simulation models as a tool to overcome individual limitations of mental capacity, and this has been applied in disaster models just as it has been in climate and a range of other fields. Such computer simulations are now a standard component of modelling of many natural systems across all disciplines, as a means of facilitating enquiry and refining understanding of the causes and effects in complex systems.³² The intension in the case of resilience to disasters is to understand the processes or patterns that move a system rather than relying on a numerical description of the system as a whole that will be valid indefinitely.³³ This development owes much to the field of systems thinking, which has come to be seen as of particular significance in understanding the dynamics of disasters.³⁴

Systems Thinking

These definitions of resilience build on work about 'systems thinking' by von Bertalanffy,³⁵ which for want of a date for such a widespread concept, is traced to the 1920s and the

General Systems Theory of Biology.³⁶ Systems thinking evolved as a means of communication of actions within complex systems and has been extended to problem solving in non-linear situations where no direct linkage between cause and effect can be readily discerned.³⁷ It has proved particularly useful in the analysis of natural and social situations such as disasters that require consideration of human actions, and with strict caveats can be used to postulate possible outcomes from alternative actions. This is because the search for simple linear solutions to disaster risk management problems does not work and may never work. Systems thinking enables a better understanding of the difficult management problems that occur in disaster risk management.³⁸ Applied to slow acting disasters such as climate change the ability to see the world as an interconnected entity helps us face the consequences of actions that push the problem (e.g. CO₂ build-up) into 'someone else's backyard'.³⁹ The same may be said for many NRM issues such as over use of forests that leads to increased erosion in some other place and time.

Another valuable use of systems thinking in disaster risk management is identifying key indicators of possible catastrophic change by looking for points where the different processes or patterns that may move the system in new directions interact. This goes some way towards avoiding the misuse of the systems approach that occurs by ignoring the myriad assumptions on which a system model is predicated.⁴⁰ There is considerable support in the literature for the idea that such points can be identified, even without a strict mathematical knowledge of the system as a whole. Such as in systems with high (but variable) rates of change influenced by strong feedback loops, as is common in nature (an example being rabbit populations under the

influence of resource variation with rainfall). A key characteristic of such nonlinear systems is that some factors are linear but others, often notably the time of resolution, are not. Indeed most systems are a combination of determinant and indeterminate factors that influence each other, in the same manner as double pendulums.⁴¹

Chaos Thinking,⁴² an important subset of systems thinking, deals with pattern changes in systems, particularly around the points where the predictability of linear systems gives way to unstable systems that are, for practical purposes impossible to resolve exactly, as discussed above. In Chaos Thinking the point where abrupt changes in a system occur, such the start of an avalanche, crowd panic, the onset of a heart attack, or a disaster are termed Bifurcation points⁴³ and these commonly follow a period doubling process.

There is another term in Chaos Thinking 'Strange Attractors', attributed to Taken and Ruelle⁴⁴ that is used to denote key factors acting on the resolution (or evolution) of 'chaotic' systems. For example wind in soil erosion. Figure 1.1.⁴⁵ illustrates the process by which most natural (and many other) systems break down from a 'normal' predictable situation (labelled mono- and multi-stable) into an unstable 'disastrous' situation (labelled n^{th} bifurcation). The bifurcation point, in the soil erosion example above, might be the point at which the strange attractor, wind overcomes soil stability, in turn influenced by other changing parameters, such as reserves of organic matter, see also Figure 2.2 below.

These points are often communicated in more simplistic terminology to 'tipping points'⁴⁶ as a means of highlighting major influencers – 'strange attractors'.⁴⁷ But this does not

give sufficient credence to the ubiquitousness of this phenomenon, which is important when contemplating a system to detect such points to reduce risk.

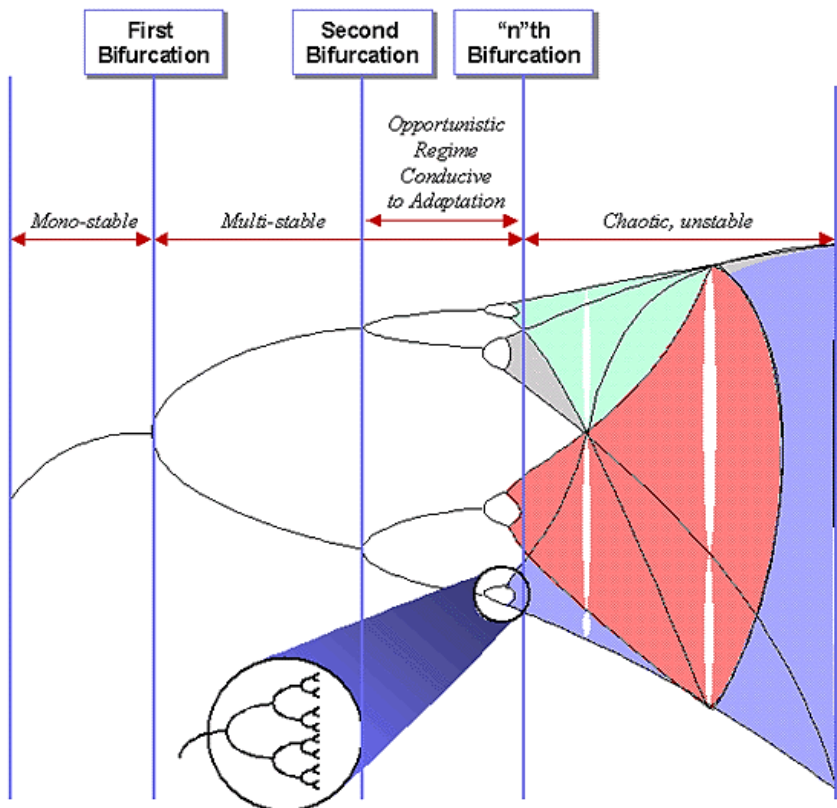


Figure 1.1 Bifurcation and Transition to Chaos

In this diagram strong attractors⁴⁸ would be likely to be dominant influences on the shape of the curves and the transition point is just before the Nth Bifurcation where the lines begin to break into islands of remaining order shown in colour and chaos shown in blue. The bottom cone illustrates

another feature of chaotic systems, their tendency to repeat patterns at different scales.

The importance of this discussion is that while the 'bifurcation points' where systems breakdown are difficult to predict, particularly in time, the forces driving them (the strange attractors) obey laws, thus providing support for a risk based approach to Disaster Risk Management (DRM) that looks for preconditions of disaster, monitors these and prepares plans to reduce vulnerability and enable a quick response and so reduce impact. One important signal of an approaching 'bifurcation' may be depleted reserves or buffering capacity as discussed above.

This idea of identifying such possible breakpoints is used in mechanical safety management as such points may overlap with the risk points in a disaster situation where breakdown is likely.⁴⁹ It is also used in NRM to look for points where a sudden loss in functionality may occur in a landscape as discussed further under Figure 2.2 below.⁵⁰

Study of the transition from order to chaos via period doubling in many domains revealed a constant at the final transition point, now given a name as the Feigenbaum number after the person who defined it⁵¹ because of its ubiquitous appearance in natural systems.⁵² For this thesis, combining the idea that transition points might be amenable to some calculation using the Feigenbaum number and the importance of reserves or buffering capacity in the stability of systems is significant to seeking signals of impending, non-time specific, disasters.⁵³ It is a point that will be returned to in the concluding chapter.

The question now is, how can such difficulties in disaster risk reduction planning be addressed in a coherent way? With a systems approach, the complexity of natural disasters can be considered both as part of a system influencing it from outside, or as within a system, a seemingly random yet possible event. In either case, the system has its means of self-organisation if the preconditions for this are in place or can be provided.

Self-organising Systems

The natural world may be conceived as systems that have evolved as dynamic outcomes of assemblages of factors that favour the continuation of the system. The term 'self-organising system' has been used⁵⁴ to describe this process and such systems can be animate, such as a biological cell, or inanimate such as a storm. The idea was developed by Ilya Prigogine, who called systems that take on and dissipate heat as they interact with the environment, 'dissipative structures'. A characteristic of such structures he said is that they exist far from equilibrium and are only held in place against the natural tendency to disorder if they remain open to flows of energy, matter, and information from their environment.⁵⁵

The following diagram, Figure 1.2, is a simplified concept of a self-organising system. The circle is the boundary of the system and the two arrows illustrate the requirement that they must be open at both ends to permit a flow of information (about the system) and resources to power the system.

As all systems are *ipso facto* dynamic, cessation of the movement of either information or resources leads to failure of the system; failure in this case, being an inability to 'bounce back' (resilience) or to maintain homeostasis, essential to maintain stable function.⁵⁶ Conversely the resilience of a system is dependent on this open flow of necessary information and resources against the natural tendency towards disorder.⁵⁷

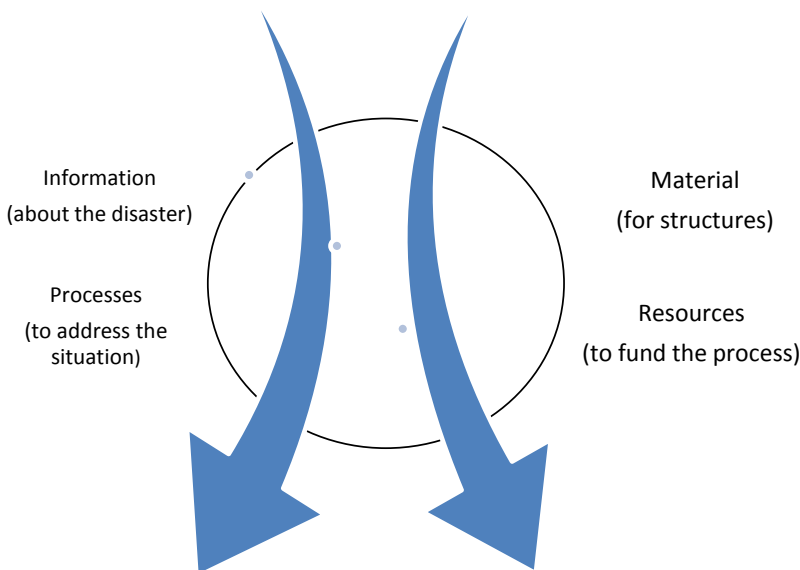


Figure 1.2 'Self-organising System' (after Capra 1997)⁵⁸

Thus a human system to 'manage' its environment will ideally self-organise if it is open to information and includes a throughput of both information and resources.⁵⁹ Useful information about such a system (and subsystem) in this disaster context is information about the risks in terms of its vulnerability to known hazards and knowledge about processes to address these. Since it is not possible to know

all about a system, openness to new information and about how the system is evolving is essential. Consistent with this importance of openness, the solution to education for DRM planning suggested by Simonovic⁶⁰ is to involve the potential actors; to switch from teacher-directed learning to learner-directed learning, by using open classrooms and offering interdisciplinary courses that facilitate thinking on multiple thought tracks simultaneously.

Complex dissipative systems can evolve other systems that 'emerge' from the interaction of different parts of the initial system and inherit characteristics of the parent as input information. This concept is important in appreciating that if the necessary conditions for a self-organising system can be established – that it be open to information (in this case risk to the system and ways to deal with it) and have a resource flow – then it can lead to a cascade of emergent systems at different scales of time and space to enable a response to natural events that threaten the system in other ways. An adaptive management system management used in NRM can be seen as an emergent system and this concept of emergent properties will be returned to in the concluding discussion in this thesis.

These factors of a dynamic open system may be seen as having been simplified into the system for DRR developed by the UNISDR.

A System for Disaster Risk Reduction

The UNISDR work to develop approaches to Disaster Risk Reduction (DRR) has influenced most other work in the field

and resulted in a Framework for DRR. This framework includes a diagram, Figure 1.3, illustrating the approach agreed in international conferences during and following the UN Decade of Natural Disasters (1990-99).⁶¹

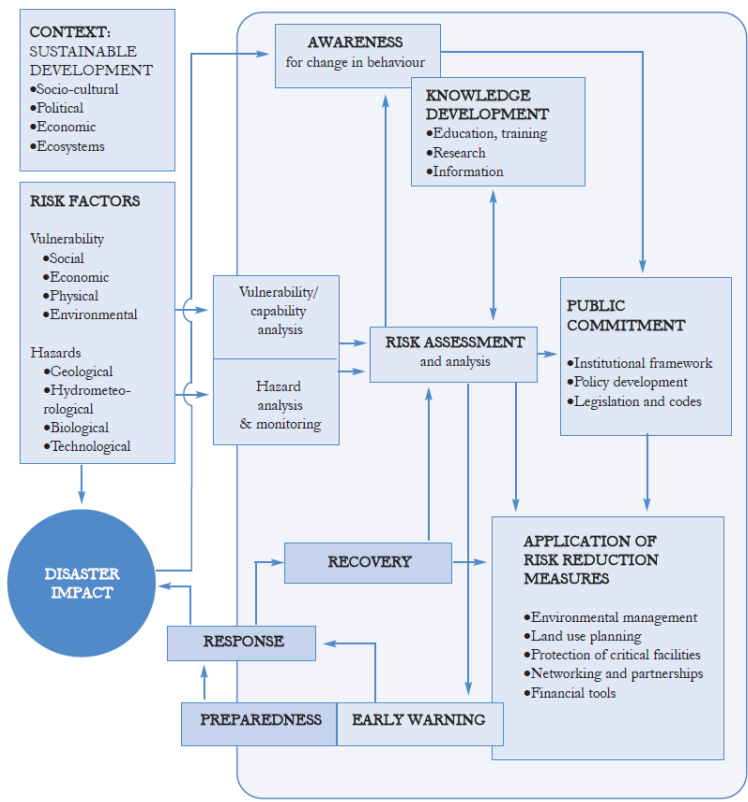


Figure 1.3 Framework for Disaster Risk Reduction.⁶²

Figure 1.3 illustrates all of the features of a comprehensive adaptive management (or self-organising) system. The importance of the system comes from its potential to facilitate addressing disaster impact, as its application gives

rise to knowledge development, public commitment, the application of risk reduction measures and financial resources. A key subsystem in the continuation of this system is the feedback loops from early warning through Preparedness, Response, and Recovery (PRR) through the application of new risk reduction measures.

One important analytical tool used in knowledge development is evaluation, which consists of analysis of timely, accurate and relevant information. This can take several forms from Hazard analysis and monitoring to post recovery evaluations used in policy development.

Evaluation of Natural Disasters

Evaluation of natural disasters and the human response to them provides some significant challenges not experienced with most other human activities as they are considered, erroneously or otherwise, to be sudden events that overwhelm the capacity of the population to cope. As noted by Cosgrove in a summary evaluation of the international response to the 2004 Indian Ocean Tsunami,⁶³ the initial response to disaster is

‘usually spontaneous and by local people assisted only after time by others in a piecemeal way as they arrive and in conditions of confusion so that records and events can be hard to recall’.

The largest disasters can attract expenditure of billions of dollars from diverse organizations of different capabilities, languages and cultures so that the potential for misunderstandings between participants is significant and

cooperation can easily break down, as was the case with both the 2004 Tsunami and with TC Nargis.⁶⁴

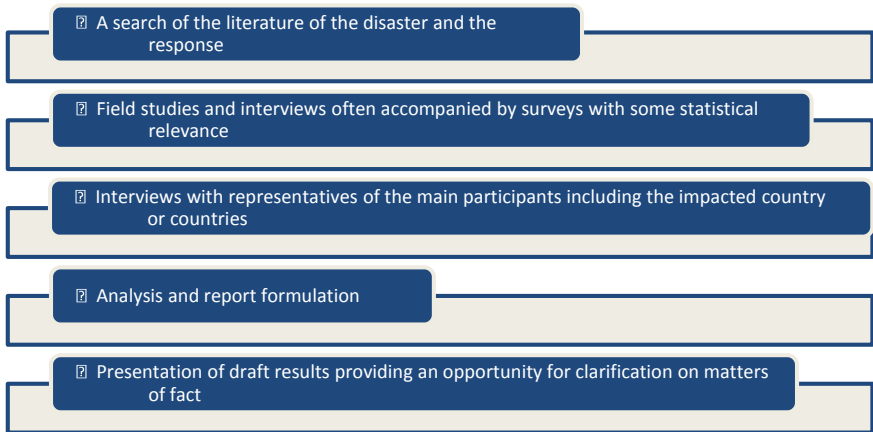
The structure of international evaluation of disaster response follows guidelines published on the OECD Development Assistance Committee (DAC) web site. This collates guidelines for most OECD countries and international development agencies and includes specific guidelines for evaluating humanitarian assistance.⁶⁵ They define evaluation for their purposes as;

- *'Evaluation is the systematic and objective assessment of an on-going or completed project, programme or policy, its design, implementation and results.*
- *The aim is to determine the relevance and fulfilment of objectives, development efficiency, effectiveness, impact and sustainability.*
- *An evaluation should provide information that is credible and useful, enabling the incorporation of lessons learned into the decision making process of both recipients and donors.*
- *Evaluation also refers to the process of determining the worth or significance of an activity, policy or program.'*⁶⁶

The OECD guidelines stress that evaluation methods need to be adapted to the specific purpose of the project or program being evaluated and that no two evaluations are alike. In addition to guidelines on the ethics of evaluation practice they also specify evaluation criteria that are now found in almost all evaluation reports for international agencies. Evaluation is often referred to as object -or results- based evaluation according to criteria of:

- *Relevance: The extent to which the aid activity is suited to the priorities and policies of the target group, recipient and donor*
- *Effectiveness: A measure of the extent to which an aid activity attains its objectives*
- *Efficiency: Measures the outputs – qualitative and quantitative – in relation to the inputs. It is an economic term, which is used to assess the extent to which aid uses the least costly resources possible in order to achieve the desired results.*
- *Impact: The positive and negative changes produced by a development intervention, directly or indirectly, intended or unintended.*
- *Sustainability: Concerned with measuring whether the benefits of an activity are likely to continue after donor funding has been withdrawn. Projects need to be environmentally as well as financially sustainable'.⁶⁷*

Evaluation methods for disaster recovery have evolved from simple case studies of natural disasters to more structured activities designed to justify and assist in subsequent recovery planning or to draw lessons for the future. They commonly involve the steps of:



With large disaster response evaluations it is common to also undertake peer review or independent studies of evaluations conducted ‘in house’ by the implementing agency. The Cosgrove summary evaluation of the 2004 Tsunami referred to above is one such example, the investigations upon which this thesis is based is another. It is also common to undertake comparative evaluations of different case studies; the World Bank Independent Evaluation Group (EIG) has a methodology they refer to as ‘objectives-based evaluation’ methodology in which performance is evaluated by measuring the Bank’s progress toward its objectives,⁶⁸ but which also follows the OECD guidelines in general terms.

There is also an emerging trend to ‘mainstream’ DRM into development planning in response to the finding referred to in the introduction that preparedness is cheaper than the response. The World Bank Sponsored GFDRR discussed above is to a significant extent a response to this. The EU Directorate-General for Humanitarian Aid (ECHO) recently

contracted a study to this end and produced similar conclusions that DRM should be mainstreamed into development planning.⁶⁹

The evaluation⁷⁰ upon which the investigation discussed in this thesis is based has a similar objective, but was directed at a risk-based approach to maintaining or enhancing the capacity of the natural resource base to reduce disaster impacts from cyclones.

The scale of damage in many disasters is often large and damage estimates can be controversial, as was the case with TC Nargis. The World Bank sponsored methodology has become a standard approach – and was used in TC Nargis – that is the Damage and Loss Assessment (DaLA) Methodology.⁷¹ This is essentially a numerical approach.

Evaluation is thus a combination of qualitative and quantitative factors in which the judgment of specialists is important, and as in case study research, subjective elements cannot be completely excised.

From this chapter we have seen that Systems Thinking facilitates planning in complex situations such as disasters and the human response to these as this enables the relevant components to be dealt with both individually and as part of a complex whole. Planning and analysis requires identifying or classifying the elements of a system according to the result required. In the next chapter different classifications that are used in analysing and evaluating disasters and natural resource management (NRM) are discussed.

Chapter Two

Components of Disasters and NRM

The previous chapter introduced the complexity of the systems operating in disasters and the theoretical approaches that have been used to explain their actions. In this chapter, practical approaches that grow out of those conceptual frameworks are discussed insofar as they relate to the natural environment (human factors are discussed in the following chapter), which then leads to consideration of the specific case study of TC Nargis. The types of analysis of relevance to disasters include: economic and especially forms of capital; the physical impacts of disasters, and effects on ecosystems.

Economic Analysis – Five Forms of Capital

Development in the industrial world has historically been analysed in economic terms, reflecting the incentives of investors. This contains only some elements of a system and it is now commonly recognised that this paradigm fails to adequately recognise externalities, notably those impacting on natural systems and people. This is not a criticism of economic analysis per se, but rather of its narrowed interpretation to become akin to financial analysis with externalities relegated to assumptions that are not

quantified in the arithmetic analysis.⁷² This in turn acts to distort investment decisions to the detriment of outcomes, particularly where the impacts are separated in time and space from the investment, such as with salinity damage to ecosystems⁷³ and forest removal on water movement. As in the discussion above on tipping points, the failure to take such influences into account can exacerbate impacts in disaster situations if not detected.

This reaction to the narrowed economic paradigm was given early impetus by Schumacher in his 1973 book 'Small is Beautiful'⁷⁴ whose ideas were overtaken by such diplomatically worded documents as the 1983 Brundtland Commission, which proposed an anthropocentric and progressive definition of 'Sustainable Development' to environmental externalities, viz.,

'Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs'. It contains within it two key concepts:

- *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*
- *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs.'*⁷⁵

Some economists, for example Costanza,⁷⁶ have attempted valuations for non-fiscal assets expressed as capital, such as natural and social assets, to facilitate such assets being taken into account in development planning. Attempts to

standardise classifications of capital that might adequately enable planning continue, such as use of ‘the triple bottom line’ promoted by the Global Reporting Initiative,⁷⁷ which has gained some currency in business and government. The ‘Five Forms of Capital’⁷⁸ is another classification gaining acceptance as it deals with more of the factors considered important in sustainable development. The five forms of capital are: financial, natural, produced, human and social.

This five forms of capital approach is being increasingly used in development projects where agencies are seeking to improve livelihoods in sympathy with a natural resource base and are looking for a basis to monitor and manage such development.⁷⁹ In particular, the approach was used by the Tripartite Core Group (TCG) formed by ASEAN, UNDP and the Government of the Union of Myanmar in its approach to reconstruction following TC Nargis in 2008.⁸⁰ It is therefore described in more detail below by means of an example of its use elsewhere in Myanmar for development planning.⁸¹

Under this example, representative stakeholders were asked to gather information under five categories to facilitate later strategic planning. The participants in initial planning were provided with an explanation as to how information on these five forms of ‘capital’ would be used to reduce the risks they may face in implementing post-disaster plans they would develop:

1. Financial capital: The plan needs to identify sources of funds and how they can be obtained, this will often require a financial analysis to show the likely return on investment. Finance availability is a risk, as it governs the pace at which activities can be implemented. The output is essential for a budget.

2. Natural capital: The plan needs to indicate the natural resources upon which the plan may be based. There is a risk that valuable natural resources may be damaged or lost pursuing the plan, or from natural events, thus jeopardizing the ability of people to make a living now or in the future. The output may be a description with maps.
3. Produced capital: The plan needs to describe the infrastructure it has or will need. The risk is that existing infrastructure may fail or that new infrastructure may not be available to support development; bridges, bunds, fire-fighting equipment, schools and hospitals etc and their state of repair. The output is a description and items for a budget.
4. Human capital: The plan needs to describe the skills needed or available in the area. The risk is that lack of skills will inhibit the achievement of goals, necessary education and training. The output is a description and a plan to address deficiencies.
5. Social capital: There is a risk that the community will not sufficiently share goals to achieve objectives. The output is a stakeholder engagement plan including promotion to inform the wider public of the process.

As this grouping of system components was used by the United Nations (UN) in its analysis of the investment and actions required for recovery from TC Nargis, it has continued to be followed in the case study presented later for TC Nargis.

Another aspect of disaster evaluation has been the development of analytical tools to place the disaster into its

social and bio-physical setting, in contrast to previous systems that focused on the physical setting and physical damage to infrastructure.

The Significance of Disaster Context

Natural disasters impact on both the built and natural environment of the inhabitants and various systems have been used to classify the elements so they can be analysed for planning and evaluation. Some have tended to emphasise the built environment where the financial cost of damage is felt, others have included more of the impact on people and the interactions between these.⁸² While the 'risk hazard' (RH) model of Turner et al⁸³ for example, tended to focus on the risk of physical manifestations of disaster, the approach was thought not to have sufficiently accounted for the potential for some parts of the system, such as social or political economy factors, to amplify or reduce the impact.

This led those authors to develop the Pressures and Release Model (PAR) which separates the progression towards vulnerability into stages according to root causes; (ideological, political and economic systems) through dynamic pressures, (lack of training, investment) and macro forces (population change, urbanisation and deforestation) and unsafe conditions, (physical environment, local economy social relations etc.), intersecting with exposure to natural hazard to influence the scale of the disaster.⁸⁴ Debate about the relative merits of these two models continues, the former being considered more useful in analysing the direct biophysical/social interactions while the latter is considered to be more useful in analysing the social feedback loops in formulating responses.

The system of classification used in the TC Nargis case study presented herein uses a synthesis of different approaches developed by Granger (1999)⁸⁵ who grouped the information under the key elements or assets (Five Ss) exposed to the risks, as discussed below:

- Setting
- Shelter
- Sustenance
- Security
- Society

Setting

Basic regional data accumulated from a very wide range of custodians for themes including:

- the environment (vegetation, soils, etc.);
- administrative arrangements (local government and other administrative boundaries);
- access (external links by major road, rail, air, marine and telecommunications infrastructures); and,
- population and its distribution.

Shelter

The buildings that provide shelter to the community at home and work vary considerably in their vulnerability to different hazards. Access to shelter is also significant, so information on mobility within the community by road and water is needed.

Sustenance

All communities are highly reliant on the availability of food and potable water supplies. The more urbanized

communities are also reliant on their utility and service infrastructures such as reticulated water and sewerage, power supply and telecommunications. Each of these is significantly dependent on each other and on other logistic resources such as fuel supply. Communities are also dependent on the supply of clothing, medicine and other personal items.

Security

The security of the community can be measured in terms of its health and wealth and by the forms of protection that are provided. Physically, these may be assessed by the availability of hospitals, medical centres, industries, commercial premises, emergency services and works such as flood detention basins and levees. Emergency plans are also a key component of community security.

Society

This group contains the more intangible measures such as language, ethnicity, religion, community and welfare groups, education, awareness, meeting places and cultural activities that contribute to the community's social cohesion. Some of these may be measured in terms of the facilities that they use, such as churches and schools, however, the more meaningful measures relate specifically to the individuals, families and households that make up the community.⁸⁶

These Five S's facilitate a risk-based approach to analysis where risk is seen as the interaction between the hazard phenomenon, the elements of the community exposed to the impact of that phenomenon (people, buildings, economy, etc.) and the degree to which those elements are vulnerable to that impact. Under this approach, total risk may be diminished by reducing the size of one or more of those

variables. This can be illustrated by representing the 'dimension' of each of the three variables as sides of a triangle, with risk being the total area of the triangle. In Figure 2.1 the larger triangle shows each of the variables as being equal, whilst in the smaller triangle the total risk has been mitigated by the halving of both exposure and vulnerability. The reduction of any one of the three factors to zero would consequently eliminate the risk and provides a conceptual basis for DRM planning that can also be applied in NRM to address the potential for slow moving disasters and those where there is interaction between the two.⁸⁷

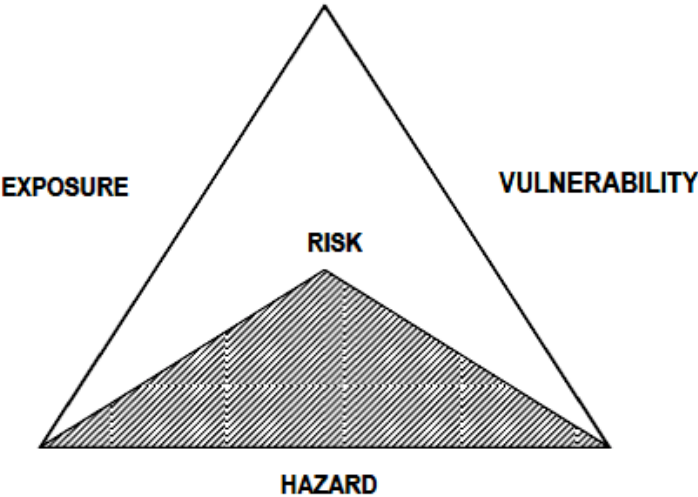


Figure 2.1 The Hazard-Exposure-Vulnerability Relationship (after Crichton, 1999)⁸⁸

These classifications in systems terms are assemblages of factors that tend to influence the resolution of the system (DRM) in common ways, for example an event that impacts on the setting will impact similarly across the setting. Consistent with the systems thinking described in the previous chapter, these assemblages are further broken

down into subsystems that contribute to the higher order system, where further commonalities can be analysed for action. For example the setting is divided into;

- the environment,
- administrative arrangements,
- access, and
- population and its distribution

This book draws attention to the natural resources base, the environment where most slow acting disasters manifest themselves. The natural resource base may be further subdivided to identify risk factors and vulnerabilities, which is appropriately approached through Ecosystem Functional Analysis (EFA).

Ecosystems Functional Analysis

Classifications of natural systems into ecosystem units across which similar actions can be expected to have similar outcomes and dissimilar impacts on other ecosystem units allows another means of analysis in disaster situations. One early writer⁸⁹ in this area developed a technique, which he called Landscape Functional Analysis (LFA), to facilitate the analysis of rangeland landscapes affected by wind and water erosion. Under this system landscapes are conceived as a number of components that form a spatial hierarchy based on size, which also have different functions.⁹⁰

The system also postulates a feedback process that governs the productive functions of the landscape, in both ecosystem goods and services terms and how these can become

dysfunctional when certain thresholds are reached, such as a depletion of reserves through high losses, as illustrated in Figure 2.2. These thresholds are really a matter of definition along a continuum between a fully functional landscape and a quite dysfunctional 'leaky' landscape, depending on the nature of the goods and services being looked for.⁹¹ The significance is that it facilitates identification of points of leverage in the landscape for monitoring where damage to its productive capacity is more likely to occur and can more effectively be addressed. In the parlance of Chapter 1, these can be seen as risk points in the landscape, and so facilitate a risk-based approach to NRM.

Although LFA was developed with rangelands in mind it has been used in a great many landscape and marine-scape situations and has been renamed Ecosystems Functional Analysis (EFA)⁹² as a consequence, which also reflects its background in systems thinking.⁹³ Multi-scale ecosystem analysis is increasingly being used for natural resource planning as it enables some projections to be made about the likely interactions between components of an NRM system and the possible outcomes.⁹⁴ For example, the EFA system is increasingly being employed in mine-site rehabilitation and natural reserves management as an objective way to specify objectives and intended outcomes for specifically defined activities directed at defined stresses (or strange attractors) in complex natural systems.⁹⁵

In Figure 2.2, which relates to slow acting 'disasters' or breakpoints, the term 'hazard' as used in DRM is termed a 'trigger point' for a possible system phase change. In this system the presence of reserves (of materials and energy) allows the system to restore itself to its previous state after a trigger event - if the reserves are sufficient.

Reserves are an important aspect of system resilience as depleted reserves render a system vulnerable to catastrophic phase change as is described here in biological terms and in elsewhere for social ecological systems.⁹⁶ The subject is returned to later when concluding similarities between fast and slow disasters, and means of minimising risk by focussing on monitoring by stakeholders who can mobilise the human and social capital required for this. The shaded triangle in Figure 2.2 may be interpreted to denote a lack of ‘reserves’ that effectively changes the ‘tipping point’. It should also be noted that ‘reserves’ can also refer to many domains for example spiritual reserves as a subset of human and social capital. In the diagram, the fulcrum illustrates the point that the system’s stasis can be upset if some factor depletes the reserve to the point growth pulls are no longer possible.

For the moment, the discussion is confined to the EFA in which ecosystem goods and services may also be considered. Ecosystem goods are those products normally sought by living organisms from their environment, energy, nutrients, etc. For humans these may be food, fibre, forests and energy. Ecosystem services are those ‘products’ of natural systems that constitute a ‘given’ to these organisms, such as air, clean water, biodiversity capable of providing useful plants and animals and influencing the reigning climate. Organisms that have survived in that ecosystem have done so by evolving to avoid destroying this base (conceptually the ‘reserve’ in Figure 2.2).

The role of exogenous physical disturbance in affect landscape function

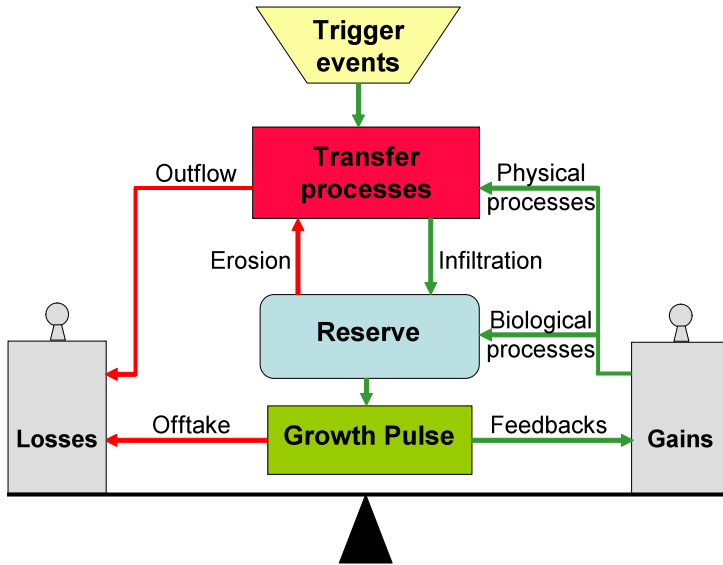


Figure 2.2 The Trigger, Transfer, Reserve, Pulse Cycle in Ecosystem Functional Analysis⁹⁷

Humans may or may not have passed the point at which homeostatic mechanisms correct their interventions in the natural environment. However, human ability to reflect and modify environments in fundamental ways may be one of these homeostatic mechanisms itself.⁹⁸ Humans are increasingly conscious of being a force of nature and if they are able to evolve conscious practices to avoid destroying this base then they may survive longer.⁹⁹ In any case, the concept of ‘ecosystem services’ assists planning to consider all variables and not just assume that some ecosystem goods

or services are 'given' in a world dominated by a progressive market mentality.¹⁰⁰

Before considering further aspects of human impacts in the next chapter, a short cautionary comment on statistics is warranted.

A Note on Statistics

The collection and analysis of statistics conventionally underpins planning, particularly where direct linear relationships are considered to apply, such as in financially oriented economic analyses. However, as the World Bank Evaluation Unit notes,¹⁰¹ statistics are extremely difficult to gather in disaster situations and it is not always clear where errors arise and for what reason. The Bank's '*basic approach taken (is) to avoid sampling by identifying a full universe*'¹⁰² – this in itself is an acknowledgement of the complexity of disaster systems as outlined earlier.

Statistical analysis of natural systems is likewise impossible where the number of factors and the likely permutations of interactions between them are simply too complex and expensive to monitor for strict mathematical treatment. Hence, while some statistical representation of events is usually attempted, as in the case study that follows in Chapter Four. It is the more qualitative forms of analyses used in social impact assessments that are more often relied upon in real-time disaster analyses. This trend has been termed Pattern Oriented Modelling (POM), in recognition that modelling systems need to '*look across scales and at multiple levels – especially to link population and ecosystem*

dynamics to individual behaviour’ if they are to be at all predictive and useful for decision making.¹⁰³ This echoes the discussion in Chapter One about how most systems are composites of linear and non-linear functions. As Milner-Gullard¹⁰⁴ notes with regard to decision making:

‘an interdisciplinary approach is required to quantify these interactions, with an understanding of human decision making at its core; otherwise predictions about the impacts of policies may be highly misleading’

For this reason, it is also important to consider the particular human impact on the environment, as is discussed in the following chapter.

Chapter Three

Humans as a Force of Nature

Human impact on the natural environment is, *ipso facto*, unavoidable when one considers the natural environment separate from humans. Conceptually, humans are inherently part of the environment and in that sense their impact on that environment must be considered natural. While accepting this embracing concept, this chapter uses the reductionist approach of considering humans external to the rest of nature for ease of discussion, and to demonstrate that changes in human actions may mitigate the impact of disasters. From the perspective of human influences on the environment – hereafter referred to as the natural resource base to illustrate the anthropocentric nature of the arguments – the effects may be greater today than in the past, such that a proposed name for the current age is ‘The Anthropocene’.

The Anthropocene

The term Anthropocene, popularised by Nobel Laureate Paul Crutzen,¹⁰⁵ was proposed as early as 1843 as a new name for a geological age to describe the period since the beginning of the industrial revolution from when, according to the protagonists, signs of human ability to influence the evolution of the planet will be obvious to future geologists.

Crutzen suggests that such signs should be recognised as defining new imperatives for collective action in order to make these changes beneficial to humanity.

The idea that humans can impact on natural systems is not new, but it has often been seen as negative, particularly over long periods of time and at a scale where the potential for self-interested cooperation is less easy to organise or enforce. For example, postulates of the reasons for the decline of Roman and other civilisations often refer to destruction of their natural resource base due to cultural and other factors.¹⁰⁶ One significant but diffuse example is the practice of slash-and-burn agriculture, one of the earliest forms of agriculture based on recognition of the regenerative capacity of the natural environment. Dating from agricultural advances in the Neolithic period, the technique has been used successfully for millennia, and has usually broken down only with rising populations or climate change.¹⁰⁷ Where the slash-and-burn cycle is accelerated to exceed the natural recuperative power of forests, it has often led to permanent change from forest to grasslands and with erosion to dry plains and gravel beds.¹⁰⁸ (The Trigger, Transfer, Reserve, Pulse cycle in Figure 2.2 above also illustrates this process)

In European history, Pliny the Elder for example, considered that tree cover regulated water supply; he referred to devastating torrents after mountain forests were felled and remarked that the forests had previously held and absorbed the rain.¹⁰⁹ By that time, slash-and-burn agriculture was radically altering the face of Europe.¹¹⁰ This example of negative impact is typical of many that lead to desertification, salinisation, famine and other disasters throughout history. A less settled question is whether

humans can have an impact beneficial to their own wellbeing over longer periods of time and over greater areas.

The notion that humans can manage their environment in the immediate sense is not new. A review of the history of deforestation¹¹¹ quotes references from history and concludes that forests tend to be better managed in periods of social and economic stability. For examples,

'Forest legislation under the Roman Republic dates from the 5th century BC when forests were sacred and were overseen by forest guardians', 'Plato's laws included special provisions for 'holy areas' in Greek forests' and 'early Ptolemaic Egypt (circa 330 BC) where felling of trees was under state control with penalties for unauthorised use'.

Of course, such historic references refer to specific areas rather than the global perspectives of today's environmental arguments. The aspiration to alter the environment on a global level for human good is now implicit in many arguments, often under the rubric of sustainability, which in turn may be traced to inherent underlying psychoses such fear of death that define humanity itself.¹¹² As sustainability embodies a range of good intentions to manage the natural environment for continued output of human-desired products, cultural mechanisms may encourage social control to reduce damaging actions, at least temporally. Alternatively, humans may be conceived as an evolutionary force including their potential to act in aggregate to their long-term benefit.¹¹³

However, the idea that humans can act in a collective way to improve their environment over long time scales and across

cultures suffers from individualistic rather than collective or organism-level conceptions of evolution. Many writers have addressed this difficulty.¹¹⁴ The proposition that evolution can operate at the group level has been suggested for different groups including; family, extended family, a military unit, a tribe and a nation. Maynard Smith suggests the limitation is the number of individuals a member of a particular species can recognise well.¹¹⁵ Others have suggested religion or tribalism as mechanisms that tend to bring people together to act in ways that work to the group's perceived best interest.¹¹⁶ A recent review of thinking since the 1960's as to whether evolution occurs at collective as well as individual levels concluded that collective evolution has been well demonstrated,¹¹⁷ although arguments persist.¹¹⁸

The emergence of these observations offer a more positive conception of human actions than the view that 'open access resources' will always be exploited by individuals in spite of common interest to the contrary – the Tragedy of the Commons.¹¹⁹ We now turn to large-scale human impacts on the environment.

Landscape-scale Impacts

As discussed above, there is much literature on large-scale destruction of the natural resource base that has occurred as a by-product of industrial growth in the 19th and 20th centuries but comparatively little about deliberate and successful investment to mitigate negative impacts. The examples given below illustrate the importance of open access to information and resources (as described in Chapter

One) and of collaboration. Collaboration in these cases transcends international borders through information sharing between key stakeholders, even where they may be competing fiercely in other sectors.

The banning of atmospheric testing of atomic weapons at the height of the cold war is one example of collaborative international action to curtail the negative impacts at a time the collaborators were otherwise competing fiercely.¹²⁰ Another example is concerted action to reduce use of chlorofluorocarbons (CFC) implicated in atmospheric changes in ozone over the poles.¹²¹ The industrial uses of CFCs were discovered some 90 years ago, detected in the atmosphere about 40 years ago and perceived as a global threat about 30 years ago. The combined human reaction was a treaty to eliminate chlorofluorocarbon use about 20 years ago; with the apparent result that the level of reduction in ozone was only four per cent in the year 2000 when it had earlier been projected to be ten per cent, and its impact seems likely to even reduce further.

There are even earlier examples of positive human reactions to the excesses of industrialisation from the 1890's, such as the reappearance of salmon in the Thames, smog reductions in Britain and mercury pollution reductions in Japanese seas. There are more trees in the eastern United States than there were a hundred years ago.¹²² These beneficial human actions on the environment also extend to agriculture.

Fears of famine led to the Club of Rome articulating a response in the 1970's.¹²³ Not only was famine averted but the productivity of irrigation water increased by 3.3 times and the real cost of grain-based foods dropped by 50 per cent between the 1960's and the 1990's.¹²⁴ Multiplier effects

accompanied this; improved productivity increased employment, particularly of landless labourers so that in India, for example, the percentage of people below the absolute poverty line decreased from 50 per cent to about 35 per cent according to Datt;¹²⁵ this was due to both public investments in dams and irrigation canals and to private investment in tube wells, which now irrigate some 50 per cent of India's food production.

The CGIAR¹²⁶ - the coordinating umbrella of the 15 Green Revolution research centres – concludes that plant breeding with improved input supply resulted in this major human action to provide more and cheaper food. However, the improvement in productivity of water has only been appreciated more recently; some say the green revolution should have been called a blue revolution.¹²⁷ The International Water Management Institute, part of the CGIAR, points out that this was a greater achievement than any previous improvements in irrigation technology, for two main reasons. First, because once the crop canopy is closed, water use no longer rises proportional to yield, thereby indicating that irrigated field layout contributes to Water Use Efficiency (WUE), and second because water storage and canal systems can multiply the number of times water can be used in irrigation.¹²⁸

There are also examples of large-scale changes in land use that have had positive impacts on atmospheric carbon stocks. The data on forestry trends in temperate areas suggests that it is possible for a country or region to change from a net carbon emitter into a net carbon sink for wide areas in a relatively short period of time.¹²⁹ Europe and North America accounted for most carbon release through biomass degradation until the 1930s, yet by about 1960 they

had become net sinks as a result of plantation forestry and natural regeneration.¹³⁰ The change in sequestration rates over 30 years is estimated to have been from a net emission rate of about 0.4 Gt per annum to a net sink of about 0.05 Gt per annum or a change of 0.45 Gt of carbon and rising.¹³¹ These figures apparently do not include soil carbon and, taking this into account, the total change may have been more than twice this.¹³²

From the examples in this chapter it can be seen that humans can make positive changes to their environment when the information and resource flow is open and accepted, as was introduced in Chapter One. With this foundation of a theoretical framework of open systems and examples of its operation in the natural environment including situations in which human actions have been paramount, actions in a disaster situation can be considered. The following Chapters therefore present a case study evaluation of the TC Nargis disaster in Myanmar, from perspectives of its background slow acting disaster and associate feedback processes. From the case study and the foregoing theoretical framework, conclusions for improved responses are subsequently elicited.

Chapter Four

Myanmar and Cyclone Nargis

The following chapters are based on an independent review of the international recovery effort following TC Nargis in 2008.¹³³ This event and the response to it are considered relevant to the proposition that a similar risk-based approach can be taken to building resilience to both large slow and fast acting disasters and that doing so will reduce the impact of disasters where these compound each other, as was the case with TC Nargis.

The evaluation utilised publicly available reports, published on the GOUM information website known as MIMU,¹³⁴ and in particular those key reports generated by the international responders to the cyclone in the course of planning and implementation. These include:

- The post TC Nargis Joint assessment (PONJA), the first systematic assessment of the full scale of the impact and the requirements for both immediate humanitarian assistance and medium to long term recovery, which relied on;
- a systematic Village Tract Assessment (VTA), which was to provide an objective statistical and spatial basis for planning and implementation purposes, this was utilised by,

- the Periodic Review reports (PR) intended to progressively inform disaster responders of recovery actions for adaptive management purposes, and
- the Social Impact Monitoring (SIM) report series, which was intended as a more qualitative assessment of recovery action.
- The Post Nargis Recovery and Preparedness Plan (PONREPP) prepared about six months after the cyclone by which time the scale of international assistance became better known. This report was effectively a subset of PONJA focussing on a three-year strategy and utilised the first PR report of the results of immediate recovery activities.
- The Post Nargis Recovery and Preparation Plan Prioritised Action Plan to address the critical needs of Survivors to July 2010, prepared in October 2009 when it became apparent that donor contributions would be insufficient for even the PONREPP plan.

These reports are collectively referred to as the Nargis reports or referred to individually where relevant.¹³⁵

The following section introduces some details about the cyclone itself and the region of Myanmar that it affected before discussing specific impacts according to the evaluation methodologies described in Chapter Two. Many of the references and illustrations are drawn from the above five reports, or were developed for the evaluation report.¹³⁶ Essentially an evaluation in approach and methodology, it was termed a review to distinguish it from some other evaluations undertaken by other participants.

Overview of the Cyclone

Category 3 TC Nargis, struck Myanmar on 2 and 3 May 2008 making landfall in the Ayeyarwady Division, approximately 250 km¹³⁷ southwest of Yangon and affecting more than 50 Townships, mainly in Yangon and Ayeyarwady Divisions, including Yangon, the country's largest city.

With wind speeds of up to 200 km/h accompanied by heavy rain, the damage was most severe in the Delta region, where the effects of the extreme winds were compounded by a 3.6 metre storm tide. The track of the cyclone and the area affected by storm tide inundation are shown in Figure 4.1.

The official death¹³⁸ toll was 84,537 with 53,836 people missing, believed dead, and 19,359 injured. Around 2.4 million people were severely affected by the cyclone, out of an estimated 7.35 million people living in the affected Townships – the lowest level administrative division in Myanmar government system.¹³⁹ Some 61 per cent of deaths were women. The same estimates suggest that the number of people displaced by the cyclone may have been as high as 800,000, with 260,000 people living in camps or settlements throughout the Delta in the initial days after the cyclone. The highest level of deaths occurred at the foot of the delta where people were exposed to the full force of the storm surge, by now without the previous screen of Mangroves.¹⁴⁰

There was widespread devastation, with the near-total destruction of field crops and shelter in areas that were directly hit by the cyclone. In addition, damage to power and communication lines, and the loss of other infrastructure affected a much bigger area. Thirty-seven Townships were

50

significantly affected by the cyclone in Ayeyarwady and Yangon Divisions. The cyclone-affected area of the Delta covered some 23,500 square kilometres. The relative degree of impact is shown in Figure 4.2.

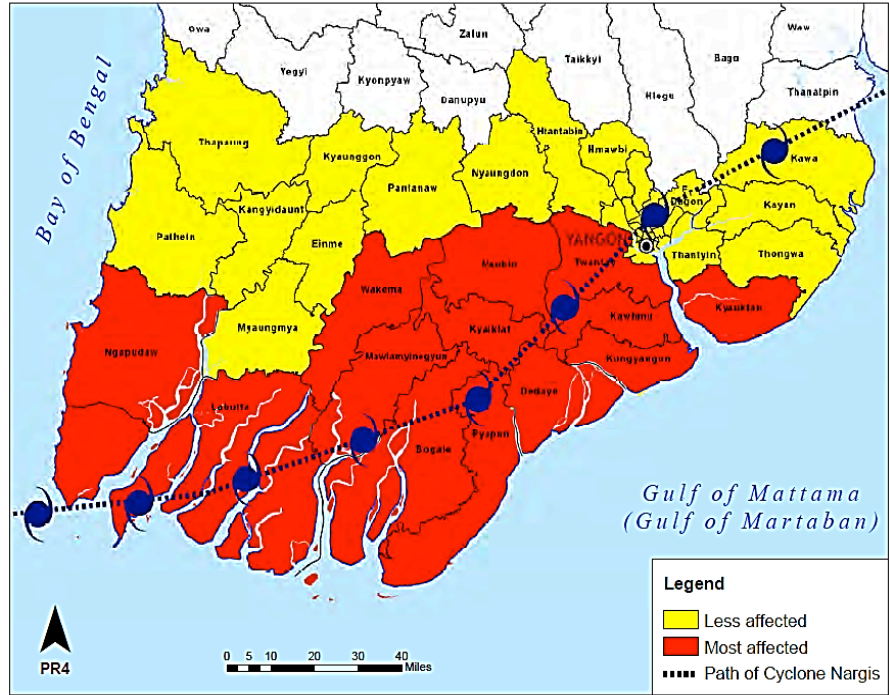


Figure 4.1 Track of the Eye of Nargis (left to right) across the Delta and Areas Inundated by Storm Tide¹⁴¹

This was quite a rare event for the Delta, although some eleven severe tropical cyclones have hit Myanmar in the past 60 years, only two (TC Mala in May 2006 and TC Nargis in May 2008) made landfall in the Delta region. TC Mala crossed the coast some 150 km north of the track of TC Nargis and caused 22 fatalities as well as destroying or

severely damaging over 6,000 houses and produced serious flooding in Yangon.

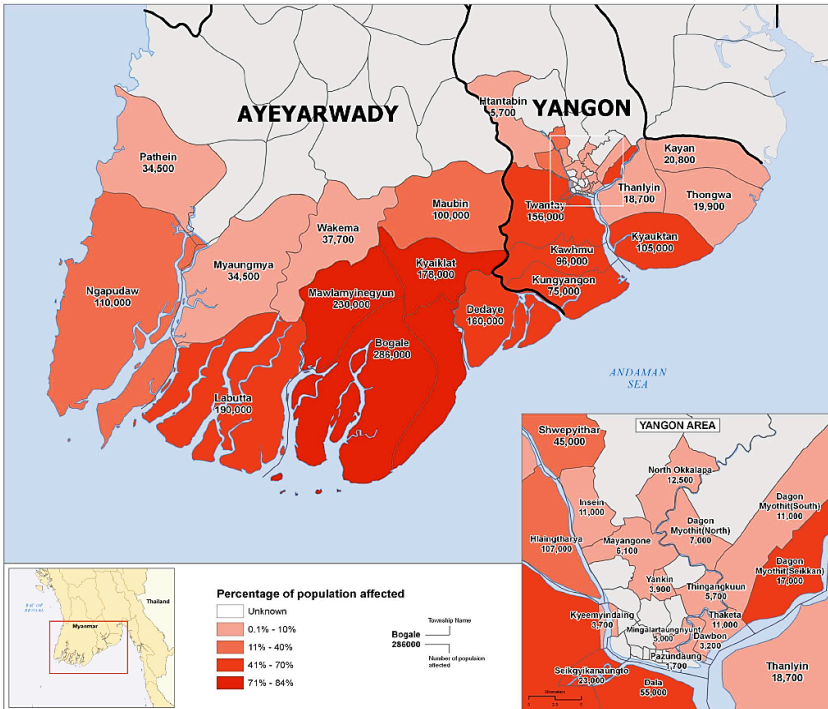


Figure 4.2: Affected Townships and Population (higher death rates in darker red) Coinciding with Lower Areas Previously Protected by Mangroves.¹⁴²

The Delta region experiences an average recurrence interval (ARI) of 30 years for severe cyclone impacts, which is somewhat longer than coastal areas in the north of Myanmar where the ARI is around 6.5 years. The Bay of Bengal has experienced 164 severe cyclones over the 122 years from 1877 to 1999 – an average of more than one severe storm per year.¹⁴³ The majority of these storms have had their

impact in the northern parts of the Bay of Bengal. The frequency of severe tropical cyclones in the Bay of Bengal has been increasing over that 122-year period, although there may be an effect of better monitoring by satellites and other technologies since the 1970s.

There is also some suggestion that the Delta region may anticipate an increase in severe cyclone frequency driven by warming of the Bay of Bengal and changes in the monsoon trough. It is possible, however, that the limited length of records may mask a similar multi-decadal cyclical pattern of cyclone frequency variability to that identified in the Pacific Ocean.¹⁴⁴ What is important is that the region is subject to such damaging events.

Tsunamis are also a related threat to coastal areas of the Delta region. Eleven tsunamis have been recorded in the Bay of Bengal over the last 250 years (an ARI of 23 years), many of which have had some impact on the Delta region. The 2004 Indian Ocean tsunami caused some 60 deaths in the Delta with some 2500 being rendered homeless.

Myanmar supports a wide range of landscapes and human cultures that each has a specific bearing on the available responses to an impacted community of such events.

The Country of Myanmar

Although largely situated in the tropics and dominated by monsoon climatic influences it has some significant altitude variations due to its north-south alignment as an offshoot of the Himalayan range, which includes a significant uplifted

plateau with a mild climate. Its rainfall ranges from 5,000 mm in areas exposed to the South-West Monsoon influence from the Bay of Bengal particularly along the coast, to dry rain shadows in the centre, which receive less than 2,000 mm.

Situated between China to the north, India to the west and Thailand to the east, Myanmar represents cultural influences from each of its neighbours as well as specific cultures within its territory. The uplifted plateau and the north-south alignment has provide a significant cultural divide that has been a cause of conflict both between upper and lower Myanmar and between groups inhabiting different zones in the hills and valleys of upper Myanmar.¹⁴⁵ In common with Thailand,¹⁴⁶ the Delta area has been developed relatively recently, mostly in the late 19th and 20th century and it has received immigrants from all of the other regions of Myanmar.

The nation is relatively rich in natural resources both mineral and vegetative. In 1938 it was simultaneously the largest rice and oil exporter in the world; the plateau area is known as a highly prospective area for minerals. Upper Myanmar has relatively rich soils and good rainfall. The Ayeyarwady river valley also has some excellent soils and with considerable underutilized irrigation capacity and arable land it is one of the only remaining areas of South East Asia with the potential to substantially increase food production.¹⁴⁷ There are four seasons – cool dry, hot dry, pre-monsoon and monsoon – although the cool dry season is less apparent in the wetter coastal areas such as the Delta. The soils and vegetation of the Delta area are described in further detail in Chapter 5 below.

Economy and Political Developments

The Union of the Republic of Myanmar remains one of the poorest countries in the world and has suffered from decades-long internal conflicts¹⁴⁸ and international sanctions.¹⁴⁹ The political elite has been of military origin since independence in 1948 and its response to these internal disputes has been one of control and isolation. This may have exacerbated the conflicts and has in any case resulted in considerable adverse treatment and commentary from most OECD countries and has served to limit international investment. The United Nations (UN) Human Development Index (HDI) for Myanmar was 0.451 in 2010, ranking it 135 out of 172 countries.¹⁵⁰ The graph below presents a comparison between countries in the region and the world average HDI. Myanmar's very slow HDI growth over the last six years consolidates its status as a developing nation with low income and a low level of human development, even noting that data prior to 2005 are unreliable.

Since TC Nargis much has changed politically, yet the nation remains critically poor compared to its resource potential and historical role. Largely peaceful elections were held in 2010 and a new Constitution that was developed in 2008 began to take effect in March 2011 with the appointment of a civilian President in 2010, leading to tentative international acceptance. These factors underpin the value of evaluating government response to the TC Nargis disaster in order to strengthen capacity for future disaster responses.

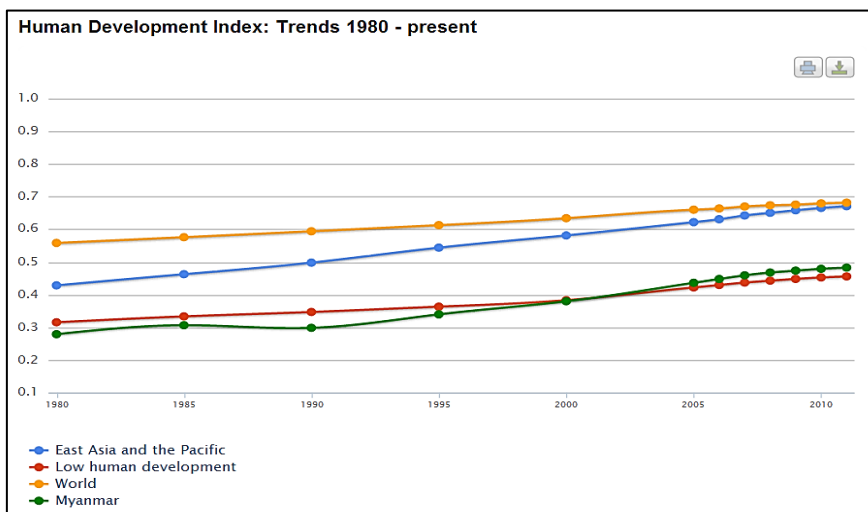


Figure 4.3 Myanmar Human Development Index¹⁵¹

With the promulgation of the 2008 Constitution, administratively Myanmar is now divided into seven regions (previously called divisions), divisions (taing) and seven states (pyi-nè), classified by ethnic composition. The seven regions are Ayeyarwady Region, Bago Division, Magway Division, Mandalay Division, Sagaing Division, Tanintharyi Division and Yangon Division; the seven states are Chin State, Kachin State, Kayin State, Kayah State, Mon State, Rakhine State and Shan State. There are also five Self-administrated zones and a Self-administrated Division ‘for National races with suitable population’.¹⁵²

It was within this administrative structure that Myanmar responded to the disaster of TC Nargis, as described in the following chapter.

Chapter Five

Response to Cyclone – Setting

The evaluation provided guidance to the Government on the adequacy of the response to the cyclone and the remaining gaps requiring funding for the future. For this purpose the affected area was segregated into the different five elements previously mentioned. This chapter deals with the element of setting.

The discussion was structured to follow the elements at risk and their relative vulnerability as discussed in Chapter One. To provide a basis for eliciting lessons from the responses to the disaster, each aspect of the above five elements was described in terms of:

- the situation immediately before the cyclone,
- immediately after the cyclone,
- the situation after restoration in the emergency recovery phase,
- the plans for restoration under International plans as described in the PONJA and PONREPP plans.

The Setting of TC Nargis

Basic regional data were accumulated from a wide range of sources under the Nargis reports, as summarised below, including:

1. the environment
2. administrative arrangements
3. access and communication
4. population

Each of these is discussed below.¹⁵³

The Environment

Two aspects of the environmental setting considered were vegetation and soils.

In terms of vegetation:

Before TC Nargis: Prior to significant agricultural development in the 20th century the Delta was a region of extensive rainforest and mangroves. Development for agriculture has changed this leading to some 70- 75 per cent of these forests being cleared since 1924. Clearing increased its susceptibility to floods and storm tides especially storm surges, as has been observed more widely.¹⁵⁴

The population in the storm-affected area had been low until the 20th century and had been dependent on the resilience of key ecosystem services but these ecosystems had been substantially reduced by the time TC Nargis occurred while population pressures had increased.

The natural mangroves and other forests along the tidal streams have historically provided significant protection from the effect of most tidal surge and storm impacts. As evidence of this, in Kan Bala Tabin village in the Labutta Township, where villagers had planted and maintained 380

ha of mangroves, only seven out of the 300 inhabitants were killed by the storm tide from TC Nargis. The low mortality rate was attributed to the presence of mangrove plantations,¹⁵⁵ although multiple factors were more likely active.

Besides cash employment from the forestry sector, the forests also provide basic cooking fuel and construction material for local residents, often at no or low cost. Villagers also gather food, especially fish, from the mangrove forests. Agricultural and shrimp pond development and charcoal production in the 20th century depleted mangrove forests to about 67,000 ha (20-25 per cent of the natural cover in 1924 prior to development)¹⁵⁶ seriously diminishing their historical protective and resilience roles. Nearly half of the decrease in mangroves has taken place over the last 15 years, and especially after 2001, with most clearing taking place in communal lands, land leased by individuals from the government as well as in reserved land.¹⁵⁷ While there were some laws to protect forest lands for example, an environmental protection law that was passed in 1990 but not enforced, and there was little understanding of the link between forest preservation, bio diversity conservation and Delta resilience.¹⁵⁸

Immediately after TC Nargis: A total of some 35,000 ha of natural and replanted mangrove forests were destroyed or damaged. Within a protected forest area of Meinmahla alone, 12,592 ha were assessed as damaged. This caused immediate as well as significant medium- to long-term social impacts on the rural population that is dependent on the forests for their livelihood. Households dependent on half the accessible forested area were probably affected with reductions in local GDP of over 70 per cent, comparable to

the 2004 Indian Ocean tsunami in Aceh,¹⁵⁹ and the traditional resort of returning to subsistence for survival was no longer feasible since other forested areas had been cleared. A secondary factor not sufficiently acknowledged was that the significant damage to forests also reduced security from further storm tides.

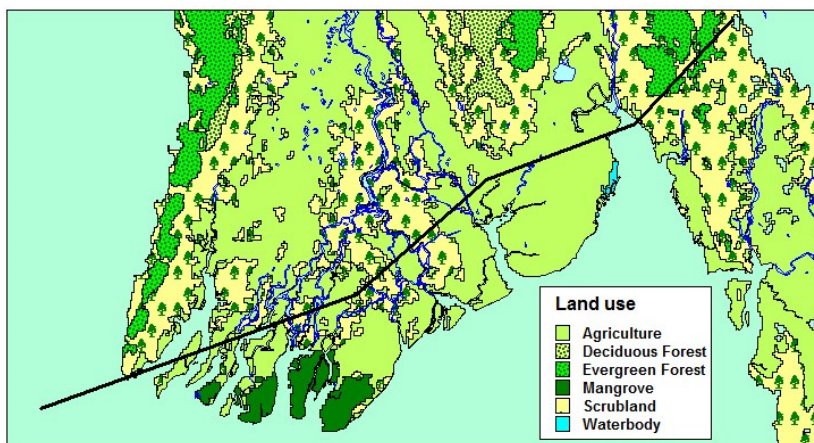


Figure 5.1 Land Use in Delta¹⁶⁰

Restoration since TC Nargis: Replanting and regeneration has begun, and further protection measures were announced for forest reserves progressively from May 2008 until August, 4 months after the disaster. Some cash-for-work funds were used to support replanting of mangrove forests in obvious gaps where risks from normal flooding required immediate action. Some of the planned activities noted below had begun by June 2008 but little of the identified need had been met by June 2010.¹⁶¹ This exposes the region to even greater damage from any future cyclone storm tides or tsunamis.

Restoration plans: In August 2008 the Government announced a five-year recovery plan – ‘Programme for Reconstruction of Cyclone Nargis Affected Areas and Implementation Plans for Preparedness and Protection from Future Natural Disasters’, forestry sections of which were to be implemented by the Ministry of Forestry. A synopsis of these plans was adopted as part of the Post Recovery and Preparedness Plan (PONREPP). The PONREPP identifies restoration areas of around 24,000 ha at an estimated cost of US\$12.3 million. These plans include the rehabilitation of the Meinmahlakyun Reserved Forest, involving 2,000 ha of gap planting, 8,546 ha of natural regeneration and 1,990 ha of plantation development.

According to the PONREPP, damaged mangrove forests in Townships in the Ayeyarwady Division were to be rehabilitated through development of plantation forests and natural regeneration under a five-year plan. This covered a total area of 119,192 ha, of which 80,264 ha were to be of plantations while 38,928 ha were to be allowed to regenerate naturally. Assistance was to be provided to develop privately owned forest plantations under a five-year plan involving a total of 18,744 ha in four Townships of Ayeyarwady Division and 600 ha in Yangon Division.

Local community- or village-owned forest plantations were also to be developed under a five-year plan of PONREPP covering 12,000 ha in Ayeyarwady and 360 ha in Yangon Division. Trees to serve as windbreaks were to be planted alongside the riverbanks to a width of up to 200 m, for a distance of 1,304 km, covering a total area of 3,360 ha. This task was to be undertaken by a mass participation movement to be organized by the Forestry Department in cooperation with the local authorities under a five-year plan

in seven Townships of Ayeyarwady Division. A further 184 km of river bank was to be planted in Yangon Division.

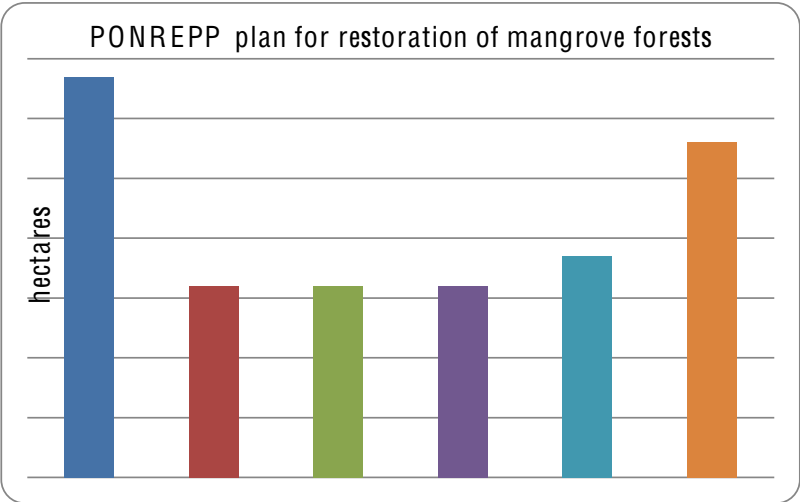


Figure 5.2 Derived from PONREPP, to show proportionality, columns left to right are Pre Nargis, as of Nov 2008, expected June 2009, expected December 2009, and expected December 2011¹⁶²

Community awareness and training in forestry management and environmental practices were to be planned to support the increased protection of forested areas. PONREPP did not identify what was to be used to substitute for the basic fuel and construction materials the forests provided.

In terms of soils:

Before TC Nargis: The Delta and Southern Yangon Division is an area of rich low-lying sediments interspersed with tidal streams along which much of the population lives and which provides them with their main access to the outside world.

Soils are predominantly alluvium. Salinisation of these soils, which has always been a problem along the coast, has been exacerbated by the increased inundation resulting from the loss of forest barriers and breaches in embankments. Salinisation, although of environmental and agricultural importance, has not been reported as a problem by the local population to date because affected land has been converted to salt farming.

Immediately after TC Nargis: Some ten per cent of cultivated rich sediments were salinised by seawater incursion and there was now a greater vulnerability to further salinisation. Significant parts of the constructed embankments were also damaged, increasing the risk of further exposure to salt.

Restoration since TC Nargis: Repair and raising of embankments and repairs to sluice gates assisted farmers to manage the leaching of salt from salinized land, source documents did not quantify the levels.

Restoration plans: Apart from activities to improve the capacity of villages to leach salty ground, there were no plans to restore salinised land. The impact of salinisation on livelihoods was thought likely to increase during the restoration, as the mangrove forests, traditionally the 'next step' for people to develop productive land, would be protected and expanded under GOUN plans. There would be continued exposure to further inundation while the mangroves were being restored.

Administrative Arrangements

Before TC Nargis: Myanmar is made up of 14 States or Divisions. Although the national capital of Myanmar moved to Naypyitaw in 2006, much of the Central Government in 2008 was still based in Yangon City, which remains the commercial centre. In addition to the central level, the Government is represented in all 67 Districts, which in turn are subdivided into 435 Townships. The Central Government has strong representation and control down to Township level, where most central Government institutions are represented. Influence extends into village tracts through the appointed village headman with the main departments providing services to the population being represented by bureau and local service centres.

TC Nargis had its most serious impact on Ayeyarwady and Yangon Divisions. The Nargis reports did not discuss the Government sector in much detail except for mention of disaster preparations and the supporting actions of Government and the Tatmadaw (armed forces) during the relief response stage. The following sections are a summary of what appeared in the Nargis reports¹⁶³ and may consequently not indicate the full Government role; no other information could be obtained at the time.

The three levels of local government in existence before the cyclone were i) Township councils, and ii) town or ward and iii) village committees. Each of these levels also interacts with the religious institutions, retired service personal and other associations. There is an important interface between central government and village traditional leaders that occurs at the village level – sometimes the appointed government village headman and the traditional leaders are

the same people. It is this pragmatic interaction between government, religious and traditional leaders at the town and village levels that assists the Delta community with its ability to solve problems in a self-reliant way. However, there was no evidence of a specific strategy or long-term plan for disaster preparedness in place at these local government levels in any of the Nargis reports.

Immediately after TC Nargis: Although the cyclone directly impacted Yangon City, the place of residence and administrative centre for much of government, the apparatus of government was able to respond on the day of the cyclone, with units of the armed forces mobilized on the following day. The Central Government continued to operate for all essential purposes. The Central Government infrastructure also continued to operate at Township level, although with significant difficulty due to communications, power and other infrastructure damage.

This basic social cohesion survived at the local level in spite of the catastrophic losses and damage so that early responses were largely carried out by local people and religious bodies using whatever means were available. Less damaged towns assisted the most damaged towns by taking-in and feeding displaced people. Local efforts were aided greatly by the Tatmadaw (armed forces) who facilitated the movement of early assistance from elsewhere in Myanmar and undertook much work to clear roads and re-establish logistics. They also provided many other services ranging from search and rescue, evacuation of the injured, setting up of camps for the displaced, collection, identification and burial of the dead, clearing of roads, removal of debris, loading and unloading of relief goods, and generally helping in the distribution of relief assistance to the distressed.

Restoration since TC Nargis: Most essential services supporting Government at Township level were restored within three weeks. The repair and replacement of basic logistics and communications enabled pre-cyclone Local Government structure to re-establish. The influx of international assistance under UNDP further assisted in the re-establishment of the Local Government apparatus.

Restoration plans: There were no specific plans for recovery for Central Government noted in the Nargis reports. Government is leading several new initiatives in the area of disaster risk identification, assessment and monitoring as discussed below. There are no particular plans for the recovery of local government structure discussed in PONREPP.

Access and Communication

Three key facets of access to the area are access by water, access by road, and telecommunication.

In terms of water:

Before TC Nargis: The water transport sector in Myanmar consists of international ocean shipping, domestic coastal shipping and inland water transport. Yangon Port is the country's premier port that handles most of the seaborne international trade cargos. It had an annual turnover of 12 million tons in 2007. Coastal shipping services are operated along the country's long Indian Ocean and Andaman Sea coastline. Inland water transport is highly developed in the Delta, which is crisscrossed by a dense network of tidal and

riverine waterways. Almost all Townships and Sub-townships in the Delta rely heavily on inland water transport for freight and passenger transport. Both the public and private sectors are involved through ownership of assets (for example, jetties, pontoons, vessels and boats) and provision of freight and passenger transport services.

Yangon has several public and private ports along the Yangon River, both for international and domestic traffic. The two main ports are the Myanmar Port Authority (MPA) and the Thilawa Port. The MPA has 17 wharves with a maximum capacity of 15,000 DWT, and handles 85 per cent of the total export and import traffic of the country. The Thilawa International Terminal has six wharves, and a capacity of 20,000 DWT. The ports in Yangon together handle 80 per cent of the estimated 20 million gross tonnage of domestic and international freight. In contrast, the inland water transport infrastructure in the Delta Townships is far more rudimentary, basically consisting of wooden jetties and occasionally floating pontoons – yet these facilities are vital to the Delta community.

Immediately after TC Nargis: TC Nargis caused substantial damage to the jetties, vessels and boats, and associated buildings. Many jetties and pontoons sank, broke or collapsed. A large number of vessels and boats sank, capsized, were blown or washed ashore, or were lost at sea. The transport office buildings and handling equipment were damaged to varying degrees. Yangon ports suffered the heaviest damage in terms of asset value: 24 steel jetties and pontoons out of 37 were sunk or heavily damaged; nearly one hundred sizable vessels were either grounded or sank in the Yangon River and traffic stopped completely for two weeks after the cyclone. The MPA predicted that it would

require 1-2 years before its facilities could become fully operational again. Details about other small wharves and jetties damaged or destroyed in the Delta were not available.

Restoration since TC Nargis: In the Delta region, publicly provided inland water transport services were resumed within a few days of the cyclone, but service supply fell short of demand due to the heavy losses of vessels and boats.

Restoration plans: Damage to the main ports of Yangon and Thilawa was to be repaired by the Government but the details were not recorded in the PONREPP reports. The larger and more well-to-do commercial fishing enterprises were expected to fund the replacement of their fleets with credit provided by the Government. There were no particular plans mentioned in PONREP for the reconstruction or repair of wharves and jetties in the Delta area.

In terms of roads:

Before TC Nargis: The primary and secondary road networks in the cyclone-affected areas mainly link the largest cities (Yangon and Patheingyi) and Township capitals, as well as larger towns within a Township. The road network is contiguous to almost all Township capitals in the Ayeyarwady Division with major bridges across the large rivers in the Delta. Only the capitals of Mawlamyinegyun and Ngapudaw Townships are not connected to the road network, and these are accessible by inland water transport. The national highway from Yangon to Patheingyi is a six-metre wide, bituminous sealed road. Most of the other main roads in the Delta are unsealed, typically with a 3-4 meter wide, water bound macadamised surface. They were only in fair

condition before TC Nargis. In the remote rural areas around the Township capitals and in the coastal areas, there were few engineered roads and bridges. Most of the villages in the areas were accessible either by informal vehicle tracks in the dry season or by boats.

Immediately after TC Nargis: The direct effects of TC Nargis included major damage to some lower standard secondary and tertiary roads and bridges, as well as trails and bamboo foot-bridges that were close to the coastline in Labutta, Ngapudaw and Bogale Townships. The cyclone also caused minor damage to other roads, mainly associated with flooding and fallen trees and utility poles. Damage to roads and bridges in Yangon Division, particularly in the Yangon city areas, was minimal due to higher design standards, more favourable ground conditions and the lower intensity of TC Nargis this far inland.

Restoration since TC Nargis: Clean-up work to remove trees and make the roads serviceable for the relief effort occurred quite quickly as a result of actions of the Tatmadaw (armed forces). However, subsequent to TC Nargis, major damage has been caused to the main road network and minor damage to bridges by the high traffic volumes and heavy loads of trucks bringing the relief goods and supplies to the cyclone affected areas. Much of the primary road network and particularly the unsealed roads and some key bridges were not designed to handle the types of trucks used for relief work.

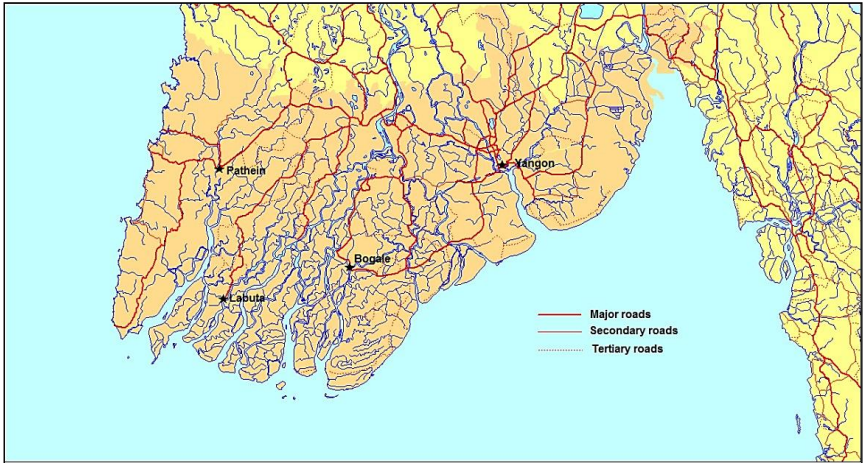


Figure 5.3 Road and Waterway Network in Impact Area.¹⁶⁴

Restoration plans: No particular plans beyond repairing damage as part of regular maintenance programs were mentioned in PONREPP.

In terms of telecommunications:

Before TC Nargis: Posts and telecommunications services are entirely government-owned and are operated through the Ministry of Communications, Posts and Telegraphs (MCPT). Postal services are provided by a network of post offices located in each of the Townships and Sub-townships. The telecommunication services include both a fixed-line telephone system and mobile phone system.

The city of Yangon is the telecommunication centre of the country. It possesses a significant portion of the telecommunication assets, and accounts for 50 per cent of the country's subscribers. The phone network coverage,

which had previously been limited in the Delta area and concentrated in cities and towns, had been widened by the mobile phone and associated microwave towers and optical fibre routes – both GSM and CDMA – across to a large part of the Delta by the time of the cyclone. According to the MCPT,¹⁶⁵ the mobile phone systems covered roughly 70 per cent of the Delta area. However, most of the remote rural communities did not have access to telephone services, due mainly to the high cost of acquiring mobile phone handsets. Most cities and towns had fixed-line telephone services carried by the digital auto telephone systems. The older rotary telephone system (magneto technology) was being phased out but still existed in a few small towns. Overall, most of Townships in the Delta had low levels of telephone usage.

Immediately after TC Nargis: The cyclone caused major damage to the post offices, fixed-line telephone systems and a few microwave towers. Telephone posts, overhead cables and drop wires were mostly destroyed. Several microwave towers fell. A number of communication office buildings (including post offices) collapsed or had roofs blown off. As a result, services were interrupted although the CDMA mobile phone systems were largely unaffected.

Fallen trees and utility poles cut most telephone cables. Altogether, in Yangon Division alone, some 3,600 telephone posts broke and fell, damaging some 466 km of telephone cables and 14 km of fibre optic cables. Inside Yangon City, three telephone exchanges were damaged and 92 sub-exchanges lost connection leaving only 25 per cent of the 157,300 automatic telephone lines in a serviceable condition.

International links via satellite were cut when the antennae of the microwave link between ground stations became misaligned. The same was true of the overhead and underground fibre links, underwater cable systems, voice and Internet links between the MPT satellite terminals and data communication networks. Similarly telecommunications by mobile phones stopped when 37 of the 56 GSM radio stations were cut off and antennae pole mounts failed or fell. Long distance communication within the affected area stopped as the various cable, microwave and optic-optic links failed following the storm. The main telecommunication towers at Dedaye, Pyabon, and Mawgyun all collapsed.

Restoration since TC Nargis: Most towns had services restored within one to three weeks while a few others had not yet fully been restored at the time of the Village Tract Assessment (VTA) in June 2008. For example, about 90 per cent of the digital automatic telephone services in the city of Yangon were restored within five days.

Repair work was carried out with two objectives – to service emergency telecommunications and to enhance long-term quality improvement in the sector. Repairing of damaged infrastructure commenced almost immediately after the storm had passed with the clearing fallen trees, repairing buildings and lines and replacing optic-optic cable transmission lines. International direct dialling from the microwave link was restored by 4 May 2008 and between Yangon and Ayeyarwady Division in stages between 6 and 13 May 2008. Twenty-three main exchanges and 92 sub-exchanges of telephone lines were repaired and were being used by the time of the PONJA study. New CDMA stations were opened enabling 3,662 CDMA phones to be put

into service. This proved to be vital in the ongoing emergency relief and rehabilitation work. By 26 June 2008 all repair work in the Ayeyarwady Division was completed.

Restoration plans: Government-owned facilities were expected to be further developed; no particular plans were set out in the PONREPP.

Population

The final theme of the VTA setting considered was the affected population: its size and distribution, and its general character.

In terms of the size and distribution of population:

Before TC Nargis: The size of the pre-Nargis population is not known with any certainty, given that the last census was conducted in 1987. The best estimate¹⁶⁶ is that there were approximately seven million people in the Delta area, primarily farmers, fishermen and labourers, with a smaller proportion engaged in service industries and trading. Some 50-60 per cent of families in the Delta were engaged in agriculture and some villagers were also craftsmen, including boat builders and carpenters.¹⁶⁷

Immediately after TC Nargis: Of the some seven million people living directly in the path of the storm, perhaps 1.5 million in Ayeyarwady Division were seriously affected. The most affected were the seven Townships of Ngaputaw, Labutta, Mawlamyinegyun, Bogale, Pyapon, Kyaiklatt and Dedaye.

The numbers of persons lost accepted as realistic by the Tripartite Core Group was 84,537 dead, 53,836 missing presumed dead, and 19,359 injured – a total of 138,373 casualties from the cyclone, with 91 per cent of these losses in the Delta region.¹⁶⁸ Some small villages in the low-lying areas of the Delta exposed to winds and the waves were obliterated. Two Townships near the point of landfall (Labutta, and Bogale) suffered particularly high losses. The losses in Labutta amounted to over 80 per cent of the pre-cyclone population of that Township.

The survey conducted by this VTA indicated that 61 per cent of those dead were female. In some severely affected villages, twice as many women aged 18-60 died as men, due apparently to the time of the day when men were in the field away from the shore line where many houses were located. Estimates at the time reported in PONJA suggest that the number of people displaced by the cyclone may have been as high as 800,000, or over 30 per cent of the population, with some 260,000 people living in camps or settlements throughout the Delta in the initial days after the cyclone. All estimates in such an emergency situation are subject to significant error as all attention was directed towards assistance.

The survey also indicated incidences of; 23 per cent for experienced and/or observed psychological problems as a result of the cyclone, ten percent having lost at least one family member, and only eight per cent reported having access to post-disaster trauma counselling.

Restoration since TC Nargis: Displaced persons returned to their places of living or were otherwise relocated remarkably quickly.¹⁶⁹ As of the first week of June 2008, a

month after the cyclone, many camps and settlements had been dismantled. For example, in the worst impacted Township of Labutta the camp population had declined from 40,000 to 10,000 and in Bogale Township all camps were closed within the week.

Restoration plans: PONREPP provided for a continued investment for the resettlement or return of displaced people and for re-establishment of their livelihoods. It provided for the identification of communities and households where resettlement to a new site was the only option and aimed to provide direct assistance according to international practice to reduce subsequent risks.

In terms of the general character of the population:

Before TC Nargis: In terms of livelihoods, the area affected by the cyclone can be broadly divided into three different livelihood zones. The coastal area of the Delta region (24 per cent of the population) is a fragile eco-system. Most of households were in one way or another engaged in fisheries activities. The agriculturally productive area (29 per cent) is dominated by rice farming. A number of people in the peri-urban zone are still dependent on agriculture, livestock and fisheries. By contrast, the bulk of the economy in urban areas is dependent mostly on the industry and service sectors including Government and the Armed Forces. The peri-urban and urban areas account for 47 per cent of the population.

The Delta was slightly more wealthy than the national average (29 per cent of the population was poor in 2004-05, compared with 32 per cent nationally).¹⁷⁰ However, 44 per cent of agricultural households experienced floods in the last

five years, and 43 per cent experienced drought, figures above the national average. As agriculture is the driving force in the Delta economy, these uncertainties impact on the incomes of households in other sectors.

Estimates from several Townships showed more than half the population as being landless.¹⁷¹ Landlessness is particularly high in Labutta where a high proportion of people were engaged in fishing and salt production. Overall in the Delta, 32 per cent of the landless work in agriculture as renters/sharecroppers, agricultural workers or seasonal agricultural workers, compared to the national average of 26 per cent. The other two-thirds worked in other sectors including fisheries, salt production, trade, and transportation. The landless are more likely to be poor in the Delta region than elsewhere: 44 per cent of the landless live below the government poverty line, compared with 33 per cent nationally. Of those classified as 'poor' in the Delta 31 per cent were landless, while the 'very poor' were almost always landless – eight per cent.

The population was ethnically and culturally diverse and has learnt to be self-reliant with Government, community and religious leaders relating fairly well at the community level to solve local problems.

Immediately after TC Nargis: Notwithstanding the large losses of life and property, experience had produced a resilience that, together with assistance from Government, citizens, the wider business community and the international community, enabled relatively fast recovery.

Restoration since TC Nargis: There had been a significant investment to assist the population to recover from the pain

of losses and damage produced by the cyclone, but insufficient attention had yet been given to disaster risk reduction strategies.

Recovery plans: A significant program to rebuild individual, physical and social capital was planned.

This chapter has dealt with the setting of the disaster, the following chapters deal with the other four elements of risk, beginning with shelter.

Chapter Six

Response to Cyclone – Shelter

This chapter deals with the element of the **Shelter** in order to provide recommendations for future action.¹⁷²

Buildings that provide shelter to the community at home and work vary considerably in their vulnerability to different hazards. Accordingly, they were grouped into three types:

1. residential shelters
2. public buildings
3. commercial structures

Residential

Before TC Nargis: There were two types of housing in the Delta region: traditional houses and modern (solid) houses. Traditional houses are generally a combination of wooden and bamboo structures with thatched roofs. Before the cyclone, it is estimated that about 50 per cent of all housing units were built on stilts constructed of wood and bamboo with wooden or bamboo floors. About 35 per cent were all wooden and about 15 per cent were brick or concrete with metal roofs. The construction technology most commonly in use was representative of traditional knowledge and skills.

Immediately after TC Nargis: It is estimated that TC Nargis destroyed or damaged approximately 450,000 housing units, of which around 350,000 units lost all or part of their roof. Collaborative effort had rebuilt an estimated 77 per cent of houses by the time of the VTA survey. Given the communities' meagre resources, there had been a shift to smaller bamboo houses; these are generally less stable and have a shorter life. The aim of the housing sector recovery strategy was, therefore, to support owners' efforts to rebuild on their own land and to strengthen the structures they put in place to improve disaster resilience.

In the worst impacted Townships of Labutta, Bogale and Hainggyikyun it was estimated that 95 per cent of structures were seriously damaged. There were heavy losses in other Townships as well, with a loss of 90 per cent reported for Pyapon and Mawlamyinegyun, while damage was also significant in the remaining Townships. Although the storm's fury abated somewhat when it reached the densely populated Yangon Division, it affected four million people and caused damage to 486,539 houses, together with over 7,900 factories and commercial establishments.

Restoration since TC Nargis: The Village Tract Assessment (VTA) household survey indicated that more than three-quarters of households had rebuilt their homes within a month of the cyclone, using recycled debris and timber provided free by or subsidised by Government.

In the seven Townships of Ayeyarwady Division and one in Yangon Division, about 50,000 economy houses were reported¹⁷³ to be under construction. To support that effort, the Government provided about 90,000 cubic tons of round wood and scantlings. In addition, the Government also

provided about 5,000 cubic tons of sawn timber for reconstruction of infrastructure and dwellings, 4,000 cubic tons of timber for the schools, hospitals, and religious buildings, and 9,000 cubic tons of round logs for the Ministry of Livestock Breeding and Fisheries to construct fishing boats.

The Village Tract Assessment (VTA) survey indicated that concrete houses did not suffer damage to any significant degree and that no materials were supplied to assist reconstruction of the more solid structures. It also showed evidence of a reduction in size and standard of construction with the percentage of bamboo construction increasing from 46 per cent before the cyclone to 65 per cent after the cyclone, although the cyclone experience was that 65 per cent of households with bamboo construction suffered damage compared with 46 per cent for wooden houses and five per cent for brick. Construction of 8,000 durable shelters was also reported to be underway at the time of the survey.

Restoration plans: Assistance to partially rebuild or repair housing to a higher standard for 400,000 households, including 50,000 for vulnerable groups, was to have been completed within 2011. Solutions to provide community shelters were to be explored and Disaster Risk Reduction (DRR) measures integrated into housing repairs for an additional 24,000 households by 2011. It was assumed that enterprises, such as salt fields and fish processing that provided housing for workers pre-cyclone, would again provide this post-cyclone. Community storm shelters are to be constructed in targeted communities and DRR techniques are to be incorporated into the rehabilitation of community structures, such as schools and health facilities to eventually

benefit more than 1,500 villages across the Delta by 2011. There is an implication that some villages may not be rebuilt and that some people would, as a result, need to be relocated. A budget was provided for this without further detail. Plans for restoration of sound shelter are presented in Figure 6.1. No specific provision for research into the psychological and social impact or needs for care of the elderly has been addressed.

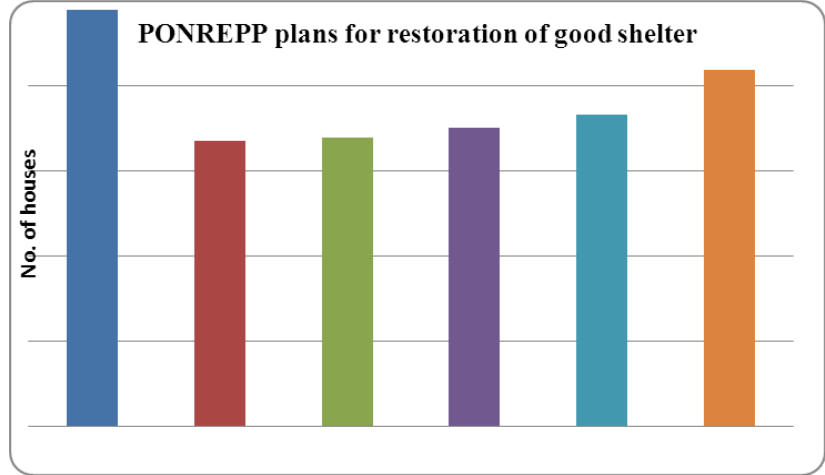


Figure 6.1 Plans for Restoration of Good Shelter (columns show proportionality left to right: Pre-Nargis, after Nargis, as of Nov 2008, expected June 2009, expected Dec 2009, expected Dec 2011)¹⁷⁴

Public Buildings

Before TC Nargis: There were no data available on the numbers of public buildings such as schools, hospitals, and temples throughout the Delta region prior to the cyclone. It also appears likely that they were, for the most part,

constructed of solid materials. One example of critical public buildings in such a circumstance was health centres and hospitals in Townships covering 100,000-200,000 people. A typical Township public medical care system includes a Township hospital with 50, 25 or 16 beds depending on population, one or two station hospitals and four to seven rural health centres (RHCs) serving about 20,000 to 25,000 people each. An RHC had about four sub-centres (sub-RHCs) operated by a midwife and a community health worker. By 2008, the Ministry of Health (MOH) reported having 839 hospitals, 86 primary and secondary health centres, 1,473 RHCs and 6,599 sub-RHCs nationwide. Figures specific to the Delta were not available, but were probably similar to national averages.

Immediately after TC Nargis: The VTA produced estimates that the cyclone resulted in the destruction or severe damage to about 57 per cent of public facilities in all affected areas. Between 10 and 15 per cent of these facilities were fully destroyed while the remainder was damaged to varying degrees.

Most of the cyclone affected health facilities were station hospitals, RHCs or sub-RHCs serving rural and more remote areas. Larger facilities and training centres were also affected but the damage was either partial or restricted to roof damage. Housing of staff was also affected: about 18 houses were reported to be totally destroyed and 76 partially destroyed. Housing damage was likely an underestimate as many midwives in villages sometimes reside in the sub-centres and thus lost their residence when these sub-RHCs were destroyed. Damage to health facilities was accompanied by losses of equipment, supplies, vehicles and ambulances, all of which combined to disrupt early

response to the cyclone. For educational facilities, a total of 1,778 primary schools, 166 middle schools, 129 high schools and 163 university buildings and office complexes under the Higher Education Department were either totally or partially damaged.

Restoration since TC Nargis: A substantial and comprehensive medical emergency response was mounted by Government health services, the Military, NGOs and international and bilateral agencies. This occurred through a mixture of mobile clinics, riverboats and village and Township clinics that were partially repaired in the process. Village leaders indicate that about 50 per cent of the damaged facilities had been temporarily repaired at the time of the VTA survey. Repairs that were done without adequate technical assessment would require further restoration work later.

The Government accorded priority to the timely reopening of schools. Where repairs were possible to schools, the Ministry of Education sometimes in concert with private construction companies acted quickly. Temporary school buildings were constructed in many cases of bamboo and thatch with the aim allow schools to quickly function as normally as possible. Such rapid action was facilitated by Government provision of construction materials including timber, nails, sheets of iron at no or low cost for urgent shelter, often used in conjunction with private sector initiatives.

Restoration plans: PONREPP proposed that 1,000 schools be rebuilt by December 2011, and 2,600 schools repaired to standards developed in the immediate post cyclone period.

Some 400 totally destroyed schools are to be replaced by permanent structures by 2011.

Commercial Structures

Before TC Nargis: As a major commercial hub with some 168 organized marketplaces housing over 130,000 individual shops and stalls, Yangon houses retail markets that range from modern shopping centres to more traditional covered markets and farmers' markets. There are also two large wholesale markets that supply foodstuffs and building materials to retail shops throughout Yangon as well as much of the Delta region. Ayeyarwady has 53 organized marketplaces, which comprise traditional covered markets and farmers' markets that together account for some 15,000 individual stalls. Commercial activity outside of organized marketplaces is typically conducted by home-based shops that sell a wide range of cheap consumer goods. Extrapolating from the UNDP household survey of 2007, it was estimated that there may have been over 210,000 such businesses in the affected areas immediately before the cyclone.

Industry in the Delta is concentrated on the processing and marketing of its main products, rice and other crops, fish and salt factories. Structures to house workers ranged from steel frame warehouses with masonry walls and metal roofs, to wooden and bamboo structures with thatch roofs in rural areas; detailed pre-cyclone statistics were not available for the Delta. It was estimated¹⁷⁵ that there were some 20,000 salt farm workers in Ayeyarwady Division along with their families at the time of the disaster, these were provided with simple houses and garden plots by the salt companies.

Immediately after TC Nargis: Over half of small rice mills and two-thirds of larger mills in the affected areas were damaged by the cyclone. About 75 per cent of firms in industrial parks were affected by the cyclone. While the extent of damage varied, on average firms reported stoppages lasting about three weeks for necessary repairs to damaged buildings and machinery. An estimated two-thirds of small and medium industrial enterprises suffered some form of cyclone damage. Small enterprises in this sector were usually home-based, damages of which have been discussed under housing. Given that homes are typically constructed of bamboo and thatch and can be rebuilt within a few days and it is assumed most micro-enterprises resumed operations within a week.

Restoration since TC Nargis: Most firms reported stoppages of about two weeks for essential repairs. Shops in most markets, in spite of damage, were back to business within 2-3 days.

Restoration plans: Losses to industry and commerce, being private in nature except for those in the Yangon industrial parks, were not compensated from public funds or international assistance. The exception has been micro-enterprises where assistance in the form of building materials was provided; this was intended to continue. While much of the damage to factories in industrial parks was quickly repaired by owners, the cost of doing so was substantial, and thus limits the possibility of future investments from retained earnings. Few factory owners had insurance, and those that did had typically limited it to fire damage; measures to promote wider insurance coverage are now important.

This chapter has dealt with the effects of the disaster on shelter, the following chapters deal with the remaining three elements of risk, beginning with sustenance.

Chapter Seven

Response to Cyclone – Sustenance

Continuing the assessment according to the five S's of setting, shelter, sustenance, security and society in order to enable recommendations to be made to Government on the use of remaining funds, leads to the next element of risk, sustenance.

The discussion¹⁷⁶ continues to follow the structure of:

- the situation immediately before the cyclone,
- immediately after the cyclone,
- the situation after restoration in the emergency recovery phase,
- the plans for restoration under International plans as described in the PONJA and PONREPP plans.

Sustenance was considered in terms of food, potable water availability and other essential services, and as urbanized communities also rely on utility and service infrastructures, water supply and sewerage and power supply were included. Thus the elements considered in this chapter are:

- food security
- food production
- other essential goods

- water supply and sewerage
- power supply

Food Security

Before TC Nargis: In Myanmar, food security is generally an issue of access and utilization rather than availability as the country is usually in food surplus, being at least self-sufficient in rice, pulses and many other food commodities. Nevertheless, large segments of the population, including in the cyclone-affected areas, were food insecure in terms of sub-optimal nutrition before the cyclone.

Immediately after TC Nargis: In the immediate aftermath of the cyclone, a majority of households in the affected areas who were displaced faced difficulties in meeting basic daily food needs. The VTA survey indicated that 42 per cent of households lost all food stocks during the cyclone, with another 33 per cent losing most or some of stocks. Thirty four per cent of households reported no remaining food stocks on the day of the survey, and a further 45 per cent reported stocks sufficient to last only one to seven days. Variety of remaining foodstuffs was limited. As a consequence many households faced increased risks of acute malnutrition and micronutrient deficiencies among infants, young children and pregnant and lactating women. The impact was found to be particularly acute among the some 140,000 landless labourers who lost an estimated combined total of 200 million working days, and consequently the income that would otherwise have allowed food purchases.

Restoration since TC Nargis: A large-scale emergency feeding program was mounted in the immediate post-cyclone period. At the height of the relief period in mid-May 2008, 419 relief camps in 29 Townships in Yangon and Ayeyarwady Divisions were serving a total of 380,529 victims with food, clothing, medical care and other daily needs. The VTA indicated that while 54 per cent of households were able to source food from local markets, over 50 per cent of households obtained food from humanitarian agencies, with many households depending on multiple sources. The camp population had reduced to 10,567 in seven camps in the Ayeyarwady Division at the time of the VTA survey. The employment and income opportunities generated by rehabilitation and reconstruction programs served to re-establish an economic system for these commodities.

Restoration plans: The major emphasis for restoration of food security was improving livelihoods through increased food production, assistance to SMEs and improved opportunities for cash income – particularly through ‘cash for work’ schemes for restoration of public infrastructure and natural capital assets such as mangroves as is discussed further below. No specific plans existed for investments in improved food security as a social service, although some indirect support for the elderly was evident.

Food Production

Three key areas of risks to food production were considered: agriculture and fisheries generally, agricultural processing facilities and some fishing infrastructure.

AGRICULTURE AND FISHERIES

Before TC Nargis: The agriculture sector, encompassing crops, plantations, livestock and fisheries, comprised 44 per cent of the national economy in 2007, and about a third (31 per cent) of the regional GDP of Ayeyarwady and Yangon Divisions. The sector is the mainstay of the rural economy in the Delta area.

According to official figures,¹⁷⁷ the 13 hardest-hit Townships normally produce an annual total of 4.3 million tons of paddy rice. In addition to other crops, livestock also play an important role in the livelihoods of the rural population, both as a source of food and as draught animals for agriculture.

Paddy-grown rice is the major crop, which relies entirely on rainfall during the monsoon season, and low-level pumping for irrigation during the dry season. The principal crop is that of the monsoon, which is grown on 2.0 million ha in the two Divisions and produces approximately 7.5 ton of paddy (29 per cent of the national total). A second, dry season rice crop grown on 600,000 ha produces approximately 2.7 million ton of paddy annually (48 per cent of national total). However, these estimates were considered unreliable by some PONJA authors¹⁷⁸ as they omitted home consumption and were subject to other errors; for example, according to PONREPP baseline figures,¹⁷⁹ 1,242,857 ha was planted to rice in the two Divisions.

Other important crops include: pulses (628,000 ha) and sesame (12,200 ha) in the late monsoon; jute (18,800 ha) and kenaf grown during the pre-monsoon season, and 90

groundnut grown in the cool dry and monsoon seasons (52,200 ha). Home gardens include a variety of vegetables, while plantation crops include mango, coconut (27,400 ha), banana, betel nut (8,500 ha), betel leaf (3,700 ha), cashew nut, rubber (13,800 ha) and nipa palm roofing and building materials.

The importance of buffalo and cattle for food and draught power – about 55 per cent or 360,000 (*sic*) are so used – reflects slow adoption of agricultural mechanization. Likewise, cattle, pigs, goats, chicken and ducks provide an important source of farm income as well as subsistence production on small farms. Several large dairy and poultry farms also existed in Yangon Division. According to PONREPP baseline figures,¹⁸⁰ there were at least 500,000 cattle and buffalo, 240,000 pigs, one million ducks, 2.5 million chickens and 20,000 goats prior to the cyclone in the two divisions.

Fisheries and aquaculture were also important, as both a subsistence food source and commercial production. While no statistics are available for the subsistence catch, the Ministry of Livestock and Fisheries (MoLF) reports that commercial production of marine fisheries, inland fisheries and aquaculture was 1,517,000, 717,000 and 604,000 metric tons respectively in 2006/07.¹⁸¹ According to PONREPP baseline figures¹⁸² there were 200,000 inland fishing boats prior to the cyclone.

Immediately after TC Nargis: The cyclone struck just prior to the start of monsoon paddy planting season and was consequently expected to result in major production losses. The VTA indicated that only 25 per cent of farmers had sufficient planting seeds for the next year's crop, with

villages in the Townships of Labutta, Bogale, Pyapon, Dedaye, and Kyaiklat being the worst affected. Damage to farm equipment further hampered production.

There were at least three estimates of the agricultural damage caused by TC Nargis, and they varied widely, even for such items as cultivated land plotted from satellite images. For example, the cyclone-flooded areas covered approximately 615,000 ha based on Township-level and satellite data for the 13 worst-affected Townships. Within this area, the Government estimated a reduction in paddy area through damage to agricultural land at 38,500 ha, while FAO has estimated 30,000 ha and the VTA survey indicated that as much as 28 per cent of arable lands (equivalent to 172,200 ha) were damaged. Variances probably derive from different definitions of land damage and flow through to rice production. Predictions for value of the next monsoon's crop ranged from K575,000 million to K700,000 million.

Using the PONREPP baseline,¹⁸³ the effects of cyclonic winds were estimated to have surge-flooded some 783,000 ha or 63 per cent of low lying farm land, particularly in the south. A high proportion of households with rice paddy holdings prior to the cyclone were impacted, of these, an average of 50 per cent was under cultivation and 26 per cent had lost all their pre-cyclone production capacity, mainly due to salt water inundation and drainage problems.

Small family vegetable gardens and small-scale cash crops that complement rice production were also lost by almost all rural families irrespective of their land holdings. While relatively low in terms of total calories and minor in financial terms, these gardens were critical for nutritional balance of children and mothers in poor households.

According to the VTA survey only six per cent of the households had vegetable seeds after the cyclone. Almost all salt workers garden plots were destroyed in the cyclone.

About 33,900 ha of plantation crops were damaged, including mango (2,700 ha), coconut (8,700 ha), rubber (2,700 ha), banana (3,900 ha), nipa palm (10,800 ha), betel leaf (400 ha), betel nut (3,300 ha) and cashew nut (1,400 ha). These plantations, with the exception of rubber, were typically small and widely dispersed. Those most important to the poor were betel leaf, which is generally grown on small plots of less than one ha, and nipa palm, which is produced along riverbanks and the edges of fields. Wind damage was widespread, especially in the form of fallen trees, and will take capital and time to re-establish.

Fishery losses were equally difficult to estimate but both the subsistence and commercial catches clearly suffered from the loss of boats and fishing equipment. The VTA indicated that income from fishing had dropped by half as a result of the cyclone. Damage to mangrove forests had probably reduced available nursery areas for some fish species, which would in turn reduce the sustainable yield of fisheries for more than one season.

Losses of livestock were estimated as: 227,000, or 50 per cent of buffalo and 25 per cent of cattle for draught in the 11 worst affected Townships; 67,000 or 28 per cent of pigs; 500,000 or 52 per cent of ducks; 1,250,000 or 45 per cent of chickens, and 7,000 or 30 per cent of goats.¹⁸⁴

Restoration since TC Nargis: Following the cyclone the Government, the Food and Agriculture Organisation (FAO), bilateral donors and international and national NGOs

launched a major recovery effort in the agriculture sector to ensure the timely planting of the monsoon paddy crop by the end of July. That included employing draught animals transported from other regions, replacing the lost animals with hand tractors/power tillers and providing farm equipment and key inputs (seeds, fertilizers and fuel) to farmers.

Amongst the villages sampled in the VTA, plans to distribute fertilizers were confirmed by 11 per cent of villages, seeds by 21 per cent, tools 17 per cent, and pesticides by four per cent. The Government also reported that emergency repairs to coastal embankments were almost completed. However, efforts to enable timely planting of the monsoon paddy crop faced some difficulties, such as lack of farmers experienced with hand tractors, or lack of cash to purchase fuel and lubricants. In some cases there were reports of unsuitable equipment, with missing or incompatible spares supplied. Stored (un-milled) paddy was distributed as seed, but its viability was reportedly low.

Both the Government and the private sector responded to meeting this requirement. Accordingly, the Government distributed 23,205 metric tons of rice seeds to seven Townships in the Ayeyarwady Division, which was 71 per cent of the requirement. Similarly, 4024 metric tons, which met 88 per cent of requirement, were distributed in six Townships in Yangon Division. At the same time, a private donor contributed a further 5,013 metric tons of paddy seeds worth USD1.25 million, for distribution to farmers in those Divisions. As for draught power 6,708 power tillers were provided by the Government, while 15 private donors contributed 1,489 power tillers worth USD2.08 million.¹⁸⁵

All but ten per cent of the paddy fields, which were salinised from storm surges, were fully or partially rehabilitated. However, reports of the recovery of crop production were not consistent. The PONREPP¹⁸⁶ prioritized action plan reported a yield reduction of only 13 per cent based on the Progress Report 2 (PR 2) report, whereas the Bogale Technical Working group¹⁸⁷ reported around a 50 per cent yield reduction depending on variety, due to various factors including pests, insufficient soil preparation capability, lack of inputs and labour unavailability. Starting from the third day after TC Nargis, vaccination against Foot and Mouth and Haemorrhagic Septicaemia diseases was undertaken in Ayeyarwady and Yangon Divisions. The restocking of pigs, chickens and ducks for backyard farming was also underway at the time of the VTA amounting to 11 per cent of ducks and only one per cent of chicken losses. Only about two per cent of lost draft animals had been replaced at the time of the VTA and in the absence of effective power tillers this was suggested to be a serious inhibition to restoring pre-cyclone rice production.

Restoration plans: Plans were listed in two places – the PONREPP Recovery Framework¹⁸⁸ and the PONREPP Prioritised Action Plan¹⁸⁹ – that were complimentary although having two different time lines. Both were budgeted for within the overall PONREPP. As the PONREPP Recovery Framework has a later target of July 2011, some Government plans were also mentioned in it. Plans include:

- 60,000 households to receive seeds and equipment
- 50,000 landless labourers to receive seeds
- 60,000 farmers and labourers to receive training in production and harvest techniques
- 15,000 draft animals were to be distributed

- 11,000 landless and other vulnerable households were to receive small stock, goats, chickens ducks and pigs etc.
- 2,300 + producer groups were to be formed for mutual help
- 3,000 village silos were to be constructed
- animal health services, particularly vaccination were to be restored
- 3,800 farmers and labourers are to be trained in livestock husbandry
- a livestock banking system was to be developed and extended to vulnerable households
- 3,150 cyclone proof livestock shelters were to be provided.

There were no particular plans to improve training in mechanical cultivators and access to spare parts, although presumably this may be covered under the assistance to farmers and producer self-help groups as listed above. If not then this could be a serious difficulty in re-establishing food production as it was acknowledged that draft animal distribution has been less than planned.

PROCESSING FACILITIES

Before TC Nargis: A well-established infrastructure of rice mills and storage facilities existed across the Delta.

Immediately after TC Nargis: Large inventories of rice from the recently harvested summer crop were destroyed or damaged. While some 88 per cent of damaged mills were expected to be operational by the next harvest, the sector was expected to suffer significant losses due to stoppages from cyclone damage, destruction of rice stocks, and lower

expected yields and quality of the next rice crop. A majority of firms also reported significantly reduced sales following the cyclone and expected those conditions to persist for at least 3-6 months. In terms of value, the surveyed firms indicated that damage to inventories was of greatest significance, followed by damage to buildings, and then to machinery. Significant parts of the value chain of fisheries from; hatcheries, ponds, wharves, ice works to processing facilities and logistics to market were destroyed. Three of the main towns where the fish processing industry was concentrated (Bogale, Labutta, and Pyapon) were hit hard by the cyclone resulting in heavy damage to onshore processing facilities.

Shops in Ayeyarwady were particularly badly affected, as most of their customers were farmers and fishermen who were not able to earn income until the next harvest season or boats were rebuilt. Many shop owners in this area also faced losses from having to write off credit extended to customers who had been killed by the cyclone or can otherwise no longer repay due to changed circumstances.

Restoration since TC Nargis; As with other sectors, rehabilitation had been aimed at temporary repairs followed by more permanent construction, and the private sector nature of the sector has led to some innovative solutions to allow an early return to business.

Restoration plans: Recovery to full function in industry and commerce is constrained by access to finance. Many firm owners in fish processing lack the capacity to self-finance rebuilding and their access to new bank loans may often be hindered by existing loans (that cannot be currently repaid due to lack of income) as well as lack of collateral.

Alternative sources of finance such as friends and family or local traders are likely to have also been adversely affected by the cyclone and unable to provide significant financing. Small and medium enterprises, which typically have relatively little access to institutional finance, are also constrained by lack of capital to invest in repairing or replacing damaged physical assets.

FISHING INFRASTRUCTURE

Before TC Nargis: In excess of 1,100 marine fishing vessels, 1,160 small inland motorized boats and 1,130 small non-motorized boats were licensed in the two Divisions. A large number of rural families in the Delta also owned small canoes, which they used for local transport and subsistence fishing. Most fishing in the region required the use of a boat to set or tow fishing gear.

Immediately after TC Nargis: Marine fisheries were severely affected by the cyclone, particularly in Pyapon Township. A total of 136 marine fishing vessels are reported lost and 168 vessels were damaged but considered to be salvageable. Inland fisheries suffered the largest damage in terms of number of lost or damaged boats with more than 1,800 licensed boats reported lost, most of them non-motorized; the actual number of small boats may be significantly higher.¹⁹⁰ The VTA survey found that half of all small boats were lost along with 70 per cent of fishing gear. Since these boats are small compared to the marine fishing vessels, the overall damage value of the inland boats is less than that for the marine fisheries fleet, however such a large loss of small multi-purpose boats has a serious impact on the livelihoods of the large number of households involved.

Hatcheries that provide the fish and shrimp material to stock ponds and restock the lease-able water bodies also sustained damage to pumps, cages, mobile aquaculture equipment such as aerators, and buildings for feed storage and processing. As aquaculture and inland fisheries employed large numbers of labourers including women especially for processing of the catch, job losses have compounded financial hardship in the region.

The PONREPP baseline¹⁹¹ suggested a baseline of some 100,000 boats and 70 per cent of fishing gear lost but the actual loss may have been more. The vast majority of boats lost were small unregistered boats owned by families and although their value was low in terms of food security, they constitute a significant loss.

Restoration since TC Nargis: About 15 per cent of lost inland fisheries boats had been replaced by the Central Government, about 25 per cent of fishing tackle had been replaced and 9,500 fishing boats were under construction for sale at heavily subsidized prices at the time of the survey. All were to be equipped with 3.5 hp engines.

Restoration plans: PONREPP proposes that 64,000 small boats, 15 per cent of large boats and some 44,500 sets of fishing gear will be provided as depicted in Figure 7.1.

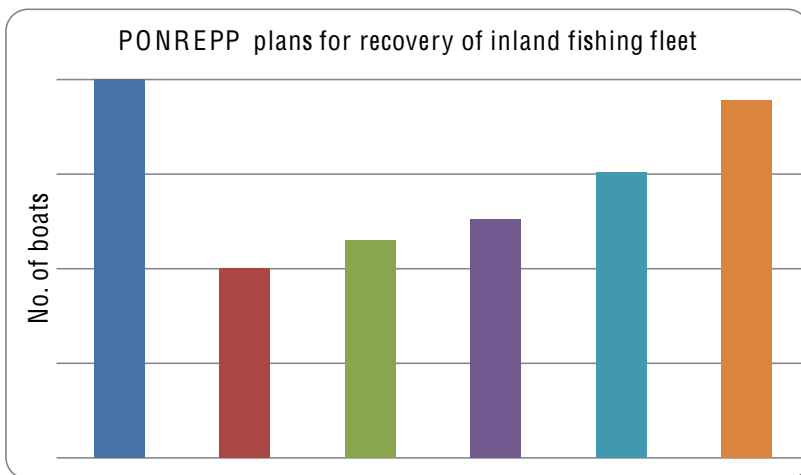


Figure 7.1 Plans for Restoration (columns show proportionality left to right: Pre Nargis, after Nargis, as of Nov 2008, expected June 2009, expected Dec 2009, expected Dec.)¹⁹²

Other Essential Goods

Before TC Nargis: The supply of clothing, medicines and other personal items was generally via small and very small traders who obtained stocks from main towns and Yangon.

Immediately after TC Nargis: Many families in the most-affected areas lost all of their belongings, and any money they kept in the house. This loss of savings had a proportionally bigger impact on the prospects for the personal recovery of the elderly, notably where they became separated from traditional support structures, such as family. Most small traders lost their stock on hand and savings that would otherwise have been available for restocking. Some 20,000 small traders were uninsured.

Restoration since TC Nargis: Some 70,000 personal hygiene kits and 1.5 million soaps were distributed to 40,000 households. Assistance provided by citizens from elsewhere in Myanmar, from local and international NGOs, religious institutions and family connections also assisted with immediate personal needs.

Restoration plans: Existing financial services or credit institutions were assessed and a strategy for expansion developed by Government in its reconstruction plan.¹⁹³ Existing credit and banking systems (government and non-government) were strengthened to benefit self-reliance and livelihood groups in 1,500 villages for 20,000 microfinance applicants. Two Enterprise Development Support Facilities (EDSFs) were established to provide assistance for enterprise skills upgrading and market access assistance. Some 8,000 households were provided with capital grants to redevelop small enterprises. With the low availability of formal and informal credit lines and the high interest rates (ten per cent per month was common), restoration plans may not even lead to the low levels of credit available pre-cyclone. Credit remained a significant need.

Water Supply and Sewerage

Before TC Nargis: Throughout Myanmar, coverage of piped water supply systems is low with only six per cent of households connected in towns and two per cent in rural areas. The piped water supply networks distribute non-potable water mostly from rivers for domestic uses. In the affected areas, between 2.5 to 15 per cent of the population living in Ayeyarwady Division and 13 to 42 per cent in

Yangon Division were connected to the piped water network, for they paid a flat rate of approximately K1, 000 per month. In some locations, local vendors supplied water at the rate of about K1 per litre.

Traditional houses usually have their own water wells and/or rainwater jars or rely on water supply from nearby rivers, canals and ponds. Water collected from rivers and canals is usually consumed untreated, thereby posing a considerable health risk to users. Based on the VTA survey nearly 50 per cent of the water supply of rural areas came from ponds, 20 per cent from open wells and about 15 per cent from collected rainwater with the remainder from the river, hand pump, water trucking or tube wells.

Toilets (latrines) in rural areas are normally separate outdoor shacks. Washing facilities are generally planks or stairs leading to the river. In urban areas, households use septic tanks with two chamber soak pits. Prior to the cyclone, 77 per cent of those interviewed had access to pit latrines.

Immediately after TC Nargis: The population's access to fresh water was severely affected with rainwater collection and storage systems severely damaged for some 675,000 houses, and with 13 per cent of ponds in Yangon Division and 43 per cent of ponds in Ayeyarwady Division damaged. There was limited community and Township capacity to manage water and sanitation programmes. Almost 40 per cent of the villages surveyed reported that their rivers and ponds had become salty. Most had shifted from these sources to rainwater tank collection. Some 74 per cent were using risky water sources at the household level, which include ponds, rivers and open dug wells. Households were

aware of this risk; more than 60 per cent of households reported the use unsafe water sources.

Post-cyclone pit latrine use had declined to 60 per cent of pre-cyclone levels and those who had lost their latrines defecated in open areas. Together, practices of unsanitary defecation – comprising open defecation, floating latrines and trenches – had almost doubled after the cyclone from 23 to 40 per cent. A particular concern was also the increased use of floating latrines, which had risen from three to seven per cent in combination with the still common use of river water as a drinking water source as well as the low usage of soaps in only one-third of households. This is reflected in almost 60 per cent of households that report not having access to clean water, further underscoring the potential for future health problems.

Restoration after TC Nargis: Water supply was re-established in 33 Townships in Yangon Division within four days. There was no comparable data for Ayeyarwady Division. More than 2,000 ponds and wells had been cleaned and improvements had been made to the rainwater harvesting system, including with 74 per cent of houses being temporarily repaired by the time of VTA. To substitute for natural processes, water purification equipment was distributed and over 30 water treatment units providing at least 285m³ of clean water were installed under a government coordinated program. Latrine materials were distributed to 85,000 households and 1,800 prefabricated latrines were installed. However Progress Report 2 (PR2) reported that 84 per cent of households were still disposing of their solid waste inappropriately.

Restoration plans: PONREPP did not detail plans for further restoration of main town water supplies and other utilities. While it contains plans for assistance to the community under an environmental protection program, this mostly relates to assistance for protection, treatment, storage and distribution of water at the community level. There were plans for safe water to be provided to 1,000 villages, or 160,000 households considered to be at risk during the dry season, with additional support for the formation of local committees and education of private water vendors on safe water handling and treatment.

A national water supply and sanitation policy was to be implemented. This was to include latrines and waste disposal systems at the household level and awareness raising and training. In addition, basic latrine construction materials were to be provided to 14,000 households and technical support for the development of appropriately designed latrines for high water table and flood prone areas. A national sanitation week campaign is needed.

Power Supply

Before TC Nargis: The extent of power connection in rural areas was very low, estimated to have been between two and ten per cent outside major towns.¹⁹⁴

Immediately after TC Nargis: Damage to electricity generating facilities in both Ayeyarwady and Yangon Divisions was slight, and repaired within a few days for larger towns. In smaller villages, on the other hand, generators were either washed away or affected by the flooding – no estimates could be elicited. Most of the loss and

damage was in the transmission and distribution networks, ranging up to 82 per cent in some Townships. In Yangon Division, loss and damage to transmission and distribution lines was largely caused by fallen trees and collapsed structures.

Restoration since TC Nargis: Power supplies were generally restored within one to three weeks, except in smaller centres where generators were lost or badly damaged.

Restoration plans: PONREPP did not provide details of plans for further restoration of main town power utilities.

This chapter has dealt with the effects of the disaster on sustenance, the following chapters deal with the remaining two elements of risk, beginning with security.

Chapter Eight

Response to Cyclone – Security

Within the five S's – the five elements under discussion in these chapters, viz., setting, shelter, sustenance, security and society, this chapter deals with the element of security.¹⁹⁵ It follows the same structure of:

- the situation immediately before the cyclone,
- immediately after the cyclone,
- the situation after restoration in the emergency recovery phase,
- the plans for restoration under International plans as described in the PONJA and PONREPP plans

Security is here discussed under the six subheadings of:

- emergency management
- emergency responders
- structural defences
- warning systems
- health services
- public health management

Emergency Management

Before TC Nargis: The Government of Myanmar had established institutional arrangements for dealing with

disasters and had systems and practices for disaster prevention and preparedness. While there were a number of ongoing public sector initiatives on disaster prevention, there was no specific long-term national strategy or plan for disaster risk reduction in place. At the national level, the Natural Disaster Preparedness Central Committee (NDPCC) chaired by the Prime Minister was the peak body on disaster issues. At the lower administrative levels, the Chairmen of the State/ Division/Township Peace and Development Councils head the Disaster Prevention and Preparedness Committees.

Emergency response functions were primarily assigned to the Fire Services Department under the Ministry of Social Welfare. In addition, the Department for Meteorology and Hydrology (DMH) was responsible for disaster forecasting and early warning dissemination. Other major partners for disaster risk management include the Myanmar Red Cross Society, the Departments of Health, Irrigation and General Administration, as well as the Police and Armed Forces.

Immediately after TC Nargis: The Central Government disaster risk management apparatus remained intact and was strengthened by the experience. While the disaster had sensitised the community to the need for disaster risk management skills, there was little evidence in the Nargis reports that the Disaster Preparedness Committees were operational at the Township or below levels.

Restoration since TC Nargis: Key stakeholders had been identified and sensitized on community disaster management. Disaster management action plans had been established in 30 villages. A train-the-trainers package had been developed and 110 trainers on community disaster risk

management at the Township level had graduated at the time of the VTA. An action plan was prepared to include disaster risk reduction (DRR) in public education.

Restoration plans: Sector-specific Disaster Risk Management (DRR) guidelines were to be developed to ensure that they were integrated in all recovery plans. Technical support was to be provided for ongoing multi-sectoral DRR initiatives, disaster resistant housing, buildings and community infrastructure, health and education facilities. Guidelines were to be developed to incorporate DRR into embankment projects. Policy makers, local officials, and the corporate sector were to be sensitised to DRR principles. Advanced DRR management training was to be provided for fire and police services. Key stakeholders at Township and national level were to be trained in DRM. Development of a National DRM framework was to be supported and the capacity of technical and sector institutions will be built. DRM was to be introduced into curricula of public education, non-formal education and the training of civil servants.

Community risk assessment and multi-hazard community disaster risk management plans (CBDRM) are to be developed. A micro-insurance programme was to be explored and a pilot program developed. Community awareness campaigns on disaster risk reduction were to be organized; community disaster management teams were to be formed and their capacity built. A mid-term evaluation of DRR activities was to be undertaken between 2010 and 2011 on which to base the replication and expansion of activities in other villages and other coastal areas. The effectiveness and relevance of training modules, guidelines

and tools were to be reviewed to continue to improve quality.

International cooperation was to continue building on the Disaster Management and Emergency Response (AADMER) agreement¹⁹⁶ signed soon after the Indian Ocean Tsunami. This was considered the cornerstone of the ASEAN region's integration in the field of disaster management. The AADMER has several associated apparatuses that are constantly evolving and were at varying levels of maturity. These include the ASEAN Committee on Disaster Management (ACDM), Standby Arrangements and Standard Operating Procedures (SASOP), ASEAN Regional Program on Disaster Management (ARPD), ASEAN Regional Disaster Emergency Response Simulation Exercise (ARDEX), ASEAN Disaster Management and Emergency Relief Fund, and at the core the ASEAN Coordinating Centre for Humanitarian Assistance on disaster management (AHA Centre).

Emergency Responders

Before TC Nargis: The fire brigade is the first line of defence for natural disasters; fire brigades exist at all Township levels. Police exist down to village tract level. These services were in place at the time of the cyclone.

Immediately after TC Nargis: Although these services suffered significant disruption in the path of the cyclone they remained effective and were supported by the Central Government, Tatmadaw (armed forces) and others.

Restoration since TC Nargis: The Government emergency services sector infrastructure has not been specifically

covered under PONREPP. Assistance was focused on training and preparation of response plans and early warning systems.

Restoration plans: The Government is responsible for the reconstruction or replacement of previously existing emergency service infrastructure.

Structural Defences

Before TC Nargis: Development in the Delta since about 1924 included the construction of levees and embankments that have also served to protect agricultural land and settlements from ordinary storm and tidal surges. The total length of the embankments and polders prior to the cyclone was 1,079 kilometres although according to UNEP these embankments had been significantly eroded prior to the cyclone.¹⁹⁷

Immediately after TC Nargis: Almost all embankments were overtopped during the storm and breached in many places. In Ayeyarwady Division along the storm's path from Ngaputaw to Kyaiklatt Township, 20 inland polders were damaged together with a further 14 embankments along the coastline over a total length of 265 km. A further seven embankments in four Townships in Yangon Division with a length of 1.4 km were also damaged.

Restoration since TC Nargis: Emergency repairs to these embankments and polders, involving total earth works of approximately 660,000 cm³ were carried out in time for the following planting season. As a result the harvest in the area

proved to be much better than was predicted immediately after the cyclone.

Restoration plans: The Government plans to address the existing and possibly increased risk of saltwater incursion from future storm tides by improving maintenance of 41 embankments and polders in the Ayeyarwady and Yangon Divisions. This undertaking, for the entire 1,079 kilometre stretch, were to involve a total of 11,532 million cubic metres of earth-works. This work was not detailed under PONREPP, which instead focused on the provision of flexible cash-for-work schemes that might be used to augment embankment repair, particularly where this involves tree planting or sluice gate repair.

Warning Systems

Before TC Nargis: The post-Nargis joint assessment by Department of Meteorology and Hydrology (DMH) and the Asian Disaster Preparedness Centre (ADPC) concluded that the DMH's system for cyclone detection, prediction and forecasting had functioned well.¹⁹⁸ It was able to detect the cyclone at an early stage and was well-linked with other information sources such as the Joint Typhoon Warning Centre, the India Meteorological Department, the Thai Meteorological Department and the ADPC. However, the absence of a risk communication infrastructure beyond the Township level resulted in a devastating impact on those communities who did not receive advance warning of the crisis.

Immediately after TC Nargis: The DMH system remained intact at the central level but communications to the Township level deteriorated further.

Restoration since TC Nargis: Communications to the Township level were restored within a few days but communications to the community level remained poor.

Restoration plans: The existing capacity of the early warning system (EWS) was to be assessed and an end-to-end EWS from national to community level is to be developed and tested. The Government had cooperated with the ADPC on early warning issues that can be further strengthened, and there has also been a broader dialogue with the WHO, UNESCO, IOC and ESCAP on strengthening early warning systems in the country.

Health Services

Before TC Nargis: The health service was quite centralised, a typical Township hospital had between four and seven rural health centres (RHCs) serving about 20,000 - 25,000 people each. A RHC had, on average, four sub-centres operated by a midwife and a community health worker.

Immediately after TC Nargis: About a quarter of rural health centres (RHC) and about half of the sub RHCs were damaged in the two Divisions but virtually all in cyclone affected areas were damaged.

PONREPP lists the following as a baseline from the VTA survey: hospitals with less than 25 beds - 25 destroyed (35

per cent); RHC - 60 destroyed (25 per cent), and Sub RHC – 300 destroyed (30 per cent).

Restoration since TC Nargis; About half of the damaged medical facilities had been repaired to some extent by the time of the VTA survey.

Restoration plans: PONREPP lists: continued documentation of destruction and planning designs and construction standards, agreement and contracting initiated; 492 Sub RHCs restored by end of 2011; 97 RHCs restored by end 2011; up to 10 hospitals with less than 25 beds restored.

Public Health Management

Before TC Nargis: Health surveillance occurred through the established health clinics and through mass campaigns. An indication of the pre-cyclone coverage can be seen from the 2003 Multiple Integrated Cluster Survey (MICS),¹⁹⁹ which found that 79 per cent of children aged 12-23 months were fully covered by the immunization program. The percentage of births attended by a health worker rose from 46 per cent in the 1990s to 57 per cent during 2000-2006. Notwithstanding these achievements, utilisation of government health services had declined over the last decade. This, in part, reflected the expansion of the private sector following the market-oriented reforms of the late early 1990s. Sixty per cent of all visits were now estimated to occur in private facilities. Traditional medicine also plays an important role in service delivery.

UN agencies (WHO, UNICEF, UNFPA, UNAIDS) and bilateral agencies (JICA, DFID) provided assistance. In 2002, there were at least 27 international NGOs active in the sector,

mostly in maternal, child and primary health, environmental sanitation, rehabilitation of disabled and handicapped, and prevention and control of communicable diseases. Bilateral agencies and the European Commission (EC) provided funding to address HIV, tuberculosis and malaria. The EC and USAID, in collaboration with WHO and technical support from the World Bank, also provided aid for preparedness and surveillance of Avian and Human Influenza.

Immediately after TC Nargis: The influx of emergency health workers in the post-cyclone period may have improved surveillance, at least temporarily although that focus was on treatment rather than surveillance, except for water borne diseases.

Restoration since TC Nargis: The PONREPP baseline noted that significant service delivery restoration had taken place through international NGOs, makeshift health facilities and mobile services by the time of the VTA.

Restoration plans: PONREPP proposed that the Township planning approach would be used as a basis for establishing a single health delivery system with a community-based approach to primary health care and key medical supplies. It also proposes that a Township expenditure plan would be established by the end of 2011 and would be updated following a review in 2011.

This chapter on security is followed by the chapter dealing with the remaining element of risk, society.

Chapter Nine

Response to Cyclone – Society

The previous four chapters have discussed four of the five Ss that define risks, namely setting, shelter, sustenance, security and society. This chapter deals with the final element of the society. It is presented under the same headings as the other four chapters of:

- the situation immediately before the cyclone
- immediately after the cyclone
- the situation after restoration in the emergency recovery phase
- the plans for restoration under International plans as described in the PONJA and PONREPP.

For the element of society,²⁰⁰ a range of intangible measures must be considered, such as:

- language, ethnicity and religion
- vulnerable groups
- community and welfare groups
- legal issues
- education
- vocational and skills development
- religious institutions
- NGOs and self-help Groups
- non-agricultural economy
- commerce

Language, Ethnicity and Religion

Before TC Nargis: Unsurprisingly for such a diverse country, the Delta region is home to people of a number of different ethnicities. There are three primary ethnic groups: the Bamar make up the majority of the population with smaller numbers of ethnic Karen and Rakhaing. The latter live on the largely unaffected west coast whereas the Bamar and Karen are distributed throughout the Delta. Villages can be classified into those segregated by ethnicity, and those with an ethnic mix depending on settlement history. In addition to the Karen, who are often Christian there are small numbers of Mon who are Buddhist, as well as Indian Muslims.

Communities are relatively socially cohesive and have strong capacities for collective problem-solving and decision-making. While the usual inter-group cleavages exist (including between those of different ethnicity and religion, genders, the young and old, and different income and livelihoods type groups), village activities tend to cut across such boundaries. There are a number of reasons for the strength of social capital. First, development resources from higher levels are scarce. This accentuates the importance of working together at the community level and carefully prioritizing resources for public goods. Second, in the absence of a state or employer safety net, community members support each other in times of need, something particularly evident in their response to TC Nargis. Traditions of reciprocity, evident across Myanmar as in many other Southeast Asian cultures, encourage acquiescence from those providing help.

Immediately after TC Nargis: The social mix in the Delta remained about the same and the practice of mutual self was particularly evident in the community's response to TC Nargis.

Restoration since TC Nargis: The VTA survey suggested that the community's resilience had probably been strengthened as a result of the cyclone.

Restoration plans: Two principles of reconstruction planning are designed to build community resilience further: i) protect the humanitarian interests of the affected population while respecting local culture and customs; and ii) 'build back better,' to reduce future disaster risks but avoid radical redesign and restructuring of settlements or patterns of land use.

Vulnerable Groups

Before TC Nargis: Comprehensive statistics were not provided in the Nargis reports. For the purposes of this review, vulnerable groups included children (separated, unaccompanied or orphaned), women (including women-headed households), the elderly, chronically sick and disabled, and the displaced. Those who lost documentation may also have been in need of special assistance.

Social welfare mechanisms: The social welfare system in Myanmar has limitations in the provision of services, due among other reasons, to a shortage of trained social workers. The Ministry of Social Welfare, Relief and Resettlement includes the Department of Social Welfare (DSW) which is mandated to carry out various programs and

services for children, young people, women, disabled people, ex-drug addicts, and older people who are socially and economically disadvantaged. There were DSW representatives at the national and Divisional levels but not at the District, Township or village level, due to a lack of resources. In this context, community-based mechanisms provided an important avenue for social welfare activities benefiting women, children, the elderly and disabled.

Immediately after TC Nargis: Vulnerability increased, although for some households this was a transient state as they re-established their livelihoods in farming or fishing or as casual labourers. Many cyclone survivors were in a fragile psychosocial state. Results from the VTA survey indicate that approximately 23 per cent of those surveyed report having experienced and/or observed psychological problems as a result of the cyclone, ten per cent report having lost at least one family member, and only eight per cent report having access to structures and mechanisms supporting a capacity to cope with the distress associated with TC Nargis.

The VTA survey found that some 61 per cent of those who died as a result of the cyclone were female. In some severely affected villages, twice as many women aged 18-60 died as men. The impact on children was not detailed separately. The elderly were particularly vulnerable. However the VTA found that the social fabric remained strong after TC Nargis, and the elderly continued to play an important role in village life, much as they had in the past. In the stressed economic situation many families, the sick and disabled become an additional burden.

As the devastation displaced hundreds of thousands of people from their communities and forced them to seek

shelter and security elsewhere, many people sought shelter with extended family or friends in neighbouring villages or towns, bringing the total number of the displaced at its height to an estimated 700,000,²⁰¹ equivalent to approximately 30 per cent of the estimated 2.4 million people affected by TC Nargis.

There were three broad categories of vulnerable persons displaced by the cyclone: those displaced and still in camps or temporary settlements or who could otherwise not return to their communities of origin; those who could not return to their communities of origin but have already been relocated, and those who have successfully returned to their communities of origin.

Restoration since TC Nargis: Some 600 informal settlements were established and in the third week of May 2008, it was estimated that at least 260,000 people were living in these camps and informal settlements in schools, monasteries and churches throughout Ayeyarwady and Yangon Divisions.

As of early July 2008, DSW and the humanitarian community had established 132 child-friendly spaces in Ayeyarwady and Yangon Divisions; over 200 more child-friendly spaces were to be established over the next month-and-a-half. Thirty thousand dignity kits, which comprise undergarments and feminine hygiene products, were distributed. Community support mechanisms, which included psycho-social support, had been developed and were being expanded.

A plan of action for child protection had been established and an interagency tracking system established with 1,410

extremely vulnerable children registered. Some 280 community support groups for children and women had been established and five social workers reassigned to the Delta area in pilot villages. A women's protection planning structure was established with strengthened links to local and international NGOs and a limited number of women's protection/GPV specific programs implemented. Data collection on women's protection issues had commenced.

Restoration plans: The DSW capacity for case management was to be strengthened with 135 more social workers assigned progressively by the end 2011. Social work training was to be strengthened with international assistance. Community based social support mechanisms in pilot villages were to be expanded. Women's protection services were to be expanded to cover at least 25 per cent in the Delta by 2011 and social mapping for settings related to transmission of HIV was also to be undertaken.

Community Support and Welfare

Before TC Nargis: There is little information about community groups in the Delta in the pre-cyclone period. It is evident that religious institutions were the most important centres of community life and while service retirement associations and trade associations were also known, they were not disaggregated in the Nargis reports. Both Government and religious bodies sponsored and promoted community awareness with religious organisations taking the lead culturally.

Immediately after TC Nargis: Community groups of many kinds were evident in the immediate aftermath of the

cyclone and these were supported by a great many new or existing groups who came in from other parts of Myanmar with the assistance of logistics provided by the military. Cultural groups remained intact and continued these activities.

Restoration since TC Nargis: Community action, along with other manifestations of social capital, was noted by survey teams to have been strengthened by the experience. As discussed above, the recovery response aimed to involve a mix of community and government leaders from the outset and it was assessed that this helped build community resilience further.

Restoration plans: The PONREPP plans feature a high level of community and government interaction at the Township and lower levels as part of the strategy to 'build better'.

Legal Issues

Before TC Nargis: In terms of land tenure, even those with land did not have secure rights of use. Land was owned by the State and farmers given user-rights through application for a sub-lease to the Village Peace and Development Council (VPDC), which managed the head leases on behalf of the Ministry of Agriculture. Farmers applied on a yearly basis for such a right with the primary criterion for renewal being past history of productive use of land; if land was judged to have not been used productively, it could have been reallocated by the Peace and Development Councils (PDCs). Land not in use could also be applied for and there was some indication that communal grazing areas were being encroached upon before the cyclone.

Fishing concessions were obtained from the Department of Fisheries on a yearly basis. Large-scale operators obtained licences and leased fishing rights to local fishermen who were obliged to sell their catch to concessionaires, reportedly at below-market prices.²⁰² Lakes that provided fishing grounds during the monsoon season and planting grounds or irrigation sources during the dry season were governed by the Department of Fisheries and customary rules, which also determined such matters as net size, fishing prohibition during spawning and displaying signs of net locations to prevent damage from passing boats.

Indebtedness was a problem for many villagers in the Delta. Farmers borrowed for agricultural inputs and home consumption, and fishing households borrowed boats and fishing supplies from traders against their catches. The landless poor often sold their labour in advance at roughly half the going wage rate in order to meet consumption requirements during the 'hungry season' of June-October.²⁰³ In the 2005 rainy season, 43 per cent of households in the Delta were in debt, compared to a national average of 33 per cent.

Immediately after TC Nargis: Farmers and their families were evidently worried about losing their right to use land in the aftermath of TC Nargis. The VTA suggested that anxiety about renewing their land user-rights along with a desperate need to ensure food security was a central reason why farmers were disproportionately likely to return to their villages soon after the cyclone, including to the most severely affected areas close to the coast. Where farmers died, their families believed that they would still enjoy the right to farm for at least the current crop season, although it

was less clear whether such rights would be renewed. The loss of documentation recording land use history was also a problem, especially for records kept at the village level.

The loss of birth, marriage and death certificates, personal identification, and education and health certificates which are often necessary to access basic social and health service and for children to attend school, was also reported as a problem. Large amounts of documents, often stored in the private residence of the head of the village or village tract Peace and Development Committee (PDC), were lost during the cyclone.

Restoration after TC Nargis: Many or most households had returned to their places of origin and signs of recovery were observed by the VTA. Technical assistance was provided and a working group on land and other rights was established. A pilot system to verify land tenancy rights and to resolve disputes transparently was created, which included a common policy between stakeholders and tracking systems of land use patterns.

Restoration plans: A community based verification system was to be established and best practice promoted.

Education

Before TC Nargis: The number of public general education schools had increased steadily in the ten years prior to the cyclone. According to the Government of Myanmar, private general education schooling did not exist in the country; officially all schools are public and managed by various Ministries such as Education, Agriculture, Science and

Technology. Monastic schools receive a public subsidy for education costs through the Ministry of Religious Affairs. In 2005/06 the student-teacher ratio for primary education was 30:1 (34:1 in Yangon and Ayeyarwady). Perhaps as much as ten per cent of primary school education is provided through monastic schools. According to UNICEF in 2008 there were a total of 5,592 schools in Ayeyarwady and 2,665 in Yangon Divisions, 86 per cent being primary schools.²⁰⁴

Immediately after TC Nargis: TC Nargis destroyed about 4,000 schools. The VTA also indicated that; (i) a large share of schools were left with unusable latrines (only five per cent were functional) raising issues of public health safety, and (ii) there was widespread loss of school furniture, teaching and learning materials.

Restoration since TC Nargis: Temporary school buildings were constructed in many cases of bamboo and thatch, with the aim of getting children back into the classrooms without further delay. Plans for new 100 schools were approved. Funds were raised for another 600 schools with 20 per cent funding by the Central Government. Some 1,200 games kits and 700 library boxes were provided to these temporary schools.

Restoration plans: Consistent with the 'build back better' policy, PONREPP proposes to strengthen education services by training 4,500 teachers in child-friendly approaches, conducting orientation workshops provided for parent-teacher associations, including for religious and private schools, developing early childhood care and education services and establishing disaster preparedness programs for schools.

Vocational Skills and Resources

Before TC Nargis: Training for artisans, builders and associated skills for the simple construction techniques in the Delta was mostly 'on the job'. Trades training schools existed in Yangon and in Military trade schools, which produced sufficient skills for pre-cyclone needs. All established industries were reasonably equipped and had stores available for current use.

Immediately after TC Nargis: Losses of technicians and builders, particularly for those industries at the coast such as fish processing and salt production, led to an immediate critical shortage of skills and stores of equipment, tools and materials.

Restoration since TC Nargis: Fish processing trades were reported in the VTA to have immigrated from less affected coastal areas.

Restoration plans: Technical and vocational training needs are to be assessed and appropriate training centres are to be provided in two Townships, initially for 200 young people with some 1,000 young people slated to receive skills training by 2011 and provided with start-up capital in the form of tools equipment and material. No plans existed for the salt fields.

Religious Institutions

Before TC Nargis: The Delta, like the rest of Myanmar, supported a large number of monasteries, pagodas, churches, and mosques, which formed the centre of community life.

Immediately after TC Nargis: The religious community was at the forefront of efforts to bring assistance to cyclone survivors during May and June 2008 and provided aid to all faiths on an equitable basis. Most of the damage to religious facilities occurred in Ayeyarwady Division.

Restoration since TC Nargis: Repair and reconstruction of religious buildings were of equal top priority as schools for communities, according to the VTA. Government has provided significant timber and other materials to assist rebuilding. Statistics on rebuilding of religious buildings were not available; VTA results indicate that assistance was provided on an equitable basis by Government, international and national NGOs and other groups assisting the recovery response. Religious groups continued to be in the forefront of disaster-relief efforts and have stressed the non-sectarian nature of assistance.

Restoration plans: No particular plan for further assistance to religious sectors at local or central level was apparent in PONREPP. Nevertheless, their involvement in planning for future disaster preparedness and awareness is implied in PONREPP planning. There was a minor reference to PONREPP providing monastic/private schools with training for child-centred approaches to education and community DRM planning.

NGOs and Self-Help Groups

Before TC Nargis: There were some successful community-based development approaches in Myanmar prior to the cyclone based on UNDP.²⁰⁵

Immediately after TC Nargis: The PONJA teams visited several community-based projects and found that these are well managed in terms of participation of disadvantaged groups in decision-making, avoidance of capture by elites, and transparent budget and financial management procedures.

Restoration since TC Nargis: The recovery program actively involved indigenous NGOs, which were probably strengthened by the experience.

Restoration plans: There were no particular plans for further assistance to NGOs in PONREPP plans, but they continued to provide significant assistance for ongoing recovery investment and building social capital.

Non-Agricultural Economy

Before TC Nargis: The economy of the area impacted by the cyclone is segmented into two sectors; i) the largely rural sectors of the southern Delta in Ayeyarwady Division where the population is engaged in primary production and early stage processing, marketing, input supply and service, and ii) the main city of Yangon and its associated industrial parks in Yangon Division from where downstream processing, marketing, input supply, Government and other support services are provided.

Industry accounts for 33 per cent of Yangon Division GDP, but only 7.1 per cent in Ayeyarwady Division where agriculture represents 44.6 per cent of GDP. The main components of the industrial sector; salt farms, dried fish/shrimp, fish paste production, rice mills, factories located in industrial parks, other small and medium industrial enterprises and micro-enterprises. The commerce sector includes wholesale and retail markets, along with trading firms, many of which are micro-enterprises engaged in small-scale retail. Much of the country's salt is produced from salt farms located in the Delta region; there are some 12,140 ha of salt fields in Ayeyarwady division alone. It is estimated²⁰⁶ that there were some 20,000 salt farm workers in Ayeyarwady Division along with their families prior to TC Nargis.

Immediately after TC Nargis: About 5,630 industrial establishments sustained partial or complete destruction of business premises, equipment and inventories. Many had to cease operation for two to five months. The losses among small enterprises were serious but uncounted. An estimated 9,860 ha of salt farms (out of 12,140 ha) were damaged.

Almost all commercial enterprises, an estimated 20,000 establishments, most trading shops were partially or completely destroyed with interruptions to activities extending for one or two weeks and capacity reduced for four to six months, depending on access to financial support or credit. The VTA survey indicated that only 27 per cent of households had access to small grants or credit, 95 per cent of which came from family and friends. Private moneylenders were still present and offered loans at similar rates as before the cyclone, but since they had also suffered

from losses and lower repayment rates, the size of such loans was reduced.

Restoration since TC Nargis: The provision of capital or new loans for recovery of the non-agricultural sector was noted in VTA surveys to be insufficient and the lack of insurance was similarly noted to inhibit recovery and increase vulnerability.

Restoration plans: PONREPP plans to the end of 2011 included: micro-credit to be provided to 20,000+ farming households; \$10 million in credit to be provided to fishermen; rehabilitation of Government hatcheries; rehabilitation of some value chain facilities, cold stores, ice plants, processing equipment and small-scale aquaculture ponds, as well as resource monitoring and protection system to be developed with associated awareness raising. There were no plans in PONREPP to restore or increase credit availability for the non-agricultural sector, apart from SMEs.

Commerce

Before TC Nargis: The majority of medium and large-sized factories in the affected areas were concentrated in Yangon, and much of the population was in turn contained within industrial parks located in 12 Townships. These parks hosted a wide range of industries and together contained over 5,000 firms employing an estimated 250,000 workers. In addition, based on registration figures, there were an estimated 28,000 small and medium-sized manufacturing firms in the affected areas of Yangon and Ayeyarwady Divisions.²⁰⁷

Data on micro-enterprises, typically household businesses serving local markets, was not available. Based on a recent UNDP household survey, it was estimated that there may have been over 130,000 such enterprises in the affected areas.²⁰⁸

As a major commercial hub with some 168 organized marketplaces housing over 130,000 individual shops and stalls, Yangon's retail markets ranged from modern shopping centres to more traditional covered markets and farmers' markets. There were also two large wholesale markets that supplied foodstuffs and building materials to retail shops throughout Yangon as well as much of the Delta region. Ayeyarwady had 53 organized marketplaces. These comprised traditional covered markets and farmers' markets, which included some 15,000 individual stalls. Commercial activity outside of organized marketplaces was typically conducted by home-based shops that sold a wide range of cheap consumer goods. The UNDP household survey²⁰⁹ estimates that there were over 210,000 such businesses located in the affected areas.

Immediately after TC Nargis: Almost 75 per cent of firms in industrial parks were damaged in the cyclone.

Restoration since TC Nargis; While the extent of damage varied, firms on average reported to the VTA survey that stoppages occurred about three weeks for necessary repairs to damaged buildings and machinery. A majority of firms also reported significantly reduced sales following the cyclone and expect these conditions to persist for at least three to six months. An overwhelming proportion of firms had retained their regular workers.

An estimated two-thirds of small and medium industrial enterprises suffered some form of cyclone damage. In terms of value, the surveyed firms indicated that damage to inventories was greatest, followed by damage to buildings, and then to machinery. Most firms reported stoppages of about two weeks for necessary repairs. Sales following the cyclone had been less than 50 per cent of prior levels and most firms did not expect demand to recover for at least another three months.

Almost all commercial markets in Ayeyarwady suffered damage, with a third of these being heavily damaged or destroyed. Markets in Yangon were not as badly affected with less than half of markets reporting damage, mostly confined to loss of roofing panels and rain damage to goods. Shops in most markets were back to business within two to three days. Sales were estimated to be some 40 per cent lower than pre-cyclone levels and demand was not expected to recover for another four to six months. Shops in Ayeyarwady were particularly affected as most of their customers were farmers and fishermen who were not able to earn income until the next harvest season or new boats were built. Many shop owners in this area also faced losses from having to write-off credit extended to customers who have been killed or could not otherwise repay.

Restoration plans: PONRREP did not propose to directly assist in the rebuilding of commercial premises apart from assistance to obtain credit and capital grants for the establishment of self-reliance and livelihood groups to facilitate improved livelihood opportunities. Larger enterprises were expected to fund their own recovery from mainstream financial institutions.

In this and the preceding four chapters, the elements of risk before and after the cyclone according to the five S's of have been discussed in some detail in order to contribute to the evaluation of government and other inputs. In the following chapter this is complemented by an evaluation of national, community and international responses to the cyclone.

Chapter Ten

National, Community and International Responses

Although different agencies use different methodologies for monitoring responses and their subsequent evaluation, the following discussion²¹⁰ seeks a common basis for comparison for responses at national, community and international level.

National Response

The cyclone made landfall in the Delta at 1200 hours UTC (1630 local time) on the 2nd of May 2008, with winds estimated at 200 km/hr and travelled northeast passing just north of Yangon with wind speeds estimated at 130 km/hr. The GOUM reacted quickly, holding a meeting of its National Natural Disaster Preparedness Central Committee (NDPCC) chaired by the Prime Minister on the morning of the 3rd of May 2008. This meeting formed ten Emergency Disaster Response Sub-committees, each chaired by a Cabinet Minister, to prepare plans to meet goals set out for each Sub-committee for relief, recovery, rehabilitation, and reconstruction. The ten sub-committees formed dealt with:

- News and Information,
- Emergency Communication,

- Search and Rescue,
- Assessment and Emergency Relief,
- Confirmation of Loss and Damage,
- Transportation and Route Clearance,
- Natural Disaster Reduction and Emergency Shelter Provision,
- Healthcare,
- Rehabilitation and Re-construction, and
- Security.

Armed with this authority and the initial funding it allocated, the Government was able to immediately commence, manage, spend and supervise relief and rehabilitation operations including the setting up of relief camps, field hospitals, verification of identity and cremation of the dead, installation of a temporary communication system, clearance of the main roads, provision of fuel, opening of markets, restoring security in the affected areas and other relief activities. The initial assessments and plans by these committees were summarised by MIMU²¹¹ and became the basis of GOUM plans that emerged during the first month prior to agreements being reached with the international community.

After carrying out emergency relief and rehabilitation operations, the NDPCC planned to continue its work in four phases consistent with the International Strategy for Disaster Reduction (ISDR),²¹² namely:

- Phase 1: Transition (the period between emergency relief/rescue and rehabilitation)
- Phase 2: Short-term Rebuilding (quick rebuilding of both urban and rural areas until farming and fishery

activities could be resumed were, and livelihoods restored)

- Phase 3: Longer-term Reconstruction (further improvement and upgrading of reconstruction and resettlement tasks carried out under Phase 2)
- Phase 4: Preparedness and Prevention

The last phase (Phase 4) was to include creating early warning systems including the establishment of procedures and mechanisms to mobilize local and national effort for quick response to the danger. Special attention was to be devoted to building stronger and storm resistant roads, embankments and polders. Storm shelters of proven design to cater to needs of those in impending danger and in distress were also to be constructed to protect humans as well as farm animals, and to be used as community centres to improve the social and cultural life of villagers. Another objective was an expanded program for the regeneration and development of mangrove forests throughout the coastal regions.

The Government's objectives were to facilitate and direct the rehabilitation and reconstruction of the damaged and destroyed towns, villages, business enterprises, schools, hospitals, monasteries and places of worship, as well as assisting re-unification of divided families, and more generally help the morale and psychological needs of the storm victims. The government's approach and priorities were summarized as follows:

- Rebuilding of houses by the townspeople
- Reconstruction of hospitals, schools and markets
- Repairing of roads and bridges
- Reconstruction of communications

- Restoration of electricity
- Resettling and construction of villages that were washed away by the storm surge
- Construction of damaged houses in village tracts
- Rehabilitation of drinking water sources
- Resuscitation of business enterprises, factories and workplaces for employment generation
- Revival of agriculture and rural industries to restore basic livelihoods of the villagers
- Revival of the fishery industry for restoring employment and earning opportunities for village folk
- Rehabilitation of rice mills
- Restoration of salt production facilities
- Restoration of the means of production for fruits, vegetables, and livestock by rural population.

The Government established Township Coordinating Committees (TCCs) to implement its program. The Nargis reports²¹³ do not give details of any GOUM arrangements to facilitate or coordinate the international response in the initial recovery stage.

Community Response

The reaction of the Myanmar community and the business sector was immediate, spontaneous and mounted on a considerable scale. This very substantial effort was the traditional community reaction to the needs of extended family and to requests for help from existing community bodies, particularly to Buddhist and other religious groups, pre-existing NGOs and some new ones formed in response.

The early planning by the NDPCC and the mobilisation of two divisions of the Tatmadaw (armed forces) on the day following the cyclone facilitated this spontaneous community response. This greatly assisted the establishment of large assembly areas and temporary camps as the initial shock was absorbed. The religious community was an important part of this community response, both locally and from elsewhere in Myanmar.

International Support

In the absence of any international contingency plans for an emergency of this scale for Myanmar, apart from an un-ratified ASEAN Agreement on Disaster Management and Emergency Response²¹⁴ negotiated in 2005, the initial international response was based on the International Interagency Standing Committee (ICSC) 'cluster'²¹⁵ approach to coordinating disasters of this nature. This involved interested donors taking 'responsibility' for sections of the disaster response.

The Nargis reports indicate international response was also swift, sizeable and sustained and was mounted and delivered both bilaterally and multilaterally through international NGOs, regional mechanisms through ASEAN and the UN. However, the activities took some time to become coordinated and focused around identified and agreed needs as can be seen by the following instances.

The humanitarian response initiated through the United Nations included in the flash appeal was launched on the 9th of May 2008 using the 'cluster' approach as a form of organisation, but it proved difficult to organize on the

ground. For example, substantial numbers of entry visas were not issued to international personnel associated with aid for another month, beginning on the 9th of June 2008.

An ASEAN Emergency Rapid Assessment Team (ERAT), coordinated by the ASEAN Committee on Disaster Management, assessed critical needs in the aftermath of the cyclone on a mission from the 9th to the 18th of May 2008. This assessment was significant for the development of cooperation of humanitarian and development actors to bring together relief, early recovery and longer-term recovery.²¹⁶

The Tripartite Core Group (TCG), comprising ASEAN, Government of the Union of Myanmar and UNDP was formed after the 19th of May 2008 Special Foreign Ministerial Meeting in Singapore, and the 25th of May 2008 International Pledging Conference in Yangon. The aim of the TCG was 'to act as a mechanism to facilitate trust, confidence and cooperation between Myanmar and the international community in the urgent humanitarian relief and recovery work after TC Nargis hit Myanmar on the 2nd and 3rd of May 2008'.²¹⁷

Aid that arrived in considerable volume following this 19th of May 2008 meeting was organized into the 11 clusters consistent with the ICSC approach²¹⁸ and delivered through five UN recovery hub offices²¹⁹ and three ASEAN recovery hubs.²²⁰ Working with this complexity required a large number of fora, meetings, consultations and working groups, between many international agencies, concerned ministries, local and international NGO. This was considered by the to be unsuitable for longer-term reconstruction activity.²²¹

On the 31st of May 2008, the TCG agreed to prepare the Post Nargis Joint Assessment (PONJA) report²²² to determine the full scale of the impact of the cyclone and requirements for both immediate humanitarian assistance needs and medium to longer-term recovery. This was based on information collected by the joint assessment teams between the 9th and the 18th of May 2008, as discussed above. These surveys and assessments were also used to initiate a Periodic Review (PR) report series intended to progressively inform all disaster responders in the future, as is discussed below.

On the 24th of June 2008, a roundtable meeting was held in Yangon, bringing together the ASEAN Humanitarian Task Force and TCG members, GOUM, potential donors and humanitarian and development partners, to review progress made since the May 2008 'pledging' conference, and to present initial findings of the Post-Nargis Joint Assessment. In December 2008, the TCG published the Post Recovery Preparedness Plan (PONREPP),²²³ which outlined a three-year strategy, from 2009 through 2011 based on the PONJA assessment. This plan benefited from the first PR report (PR I)²²⁴ and provided an opportunity to review and rationalise the structures that existed in the recovery stage, while at the same time addressing weaknesses and gaps to ensure the effectiveness, coordination, and tracking of post-cyclone assistance. This simplified the previous cluster approach into three programs of eight sectors as follows:

1. Productive lives

- Livelihoods
- Shelter and settlements
- Education

2. Healthy lives

- Health (and nutrition)

- WASH (water and sanitation)

3. Protected lives.

- Disaster risk reduction
- Environment, and
- Protection

This classification formed the basis of subsequent reporting of most international assistance, although the evolution of monitoring set up under the Village Tract Assessment (VTA) retained the IASC 'cluster' classification.

The PONREPP plans covered the assistance made available from international sources for largely humanitarian purposes and complemented the Government plans for reconstruction. PONREPP also included a synopsis of the GOUM 'Program for Reconstruction of Cyclone Nargis Affected Areas and Implementation Plans for Preparedness and Protection from Future Natural Disasters,' issued in August 2008.²²⁵ This plan articulated the Government's intention to 'build back better' and focused more on re-establishing basic capital infrastructure of roads and other logistics, main Government buildings such as hospitals and environmental protection structures such as embankments and forestry.

In October 2009 the TCG published the PONREPP Prioritized Action Plan²²⁶ to better focus available funds on post-recovery activities to July 2010. This report covered a subset of the activities planned in PONREPP but otherwise maintained the basic organization of post recovery activities into the three programs of eight sectors. It also confirmed the coordination role of TCG in three main aspects:

- (i) ensuring coordinated allocation of resources;

- (ii) facilitating operations;
- (iii) coordinating monitoring of and evaluation on the progress and achievements of the relief and recovery work in the Nargis affected areas.

Monitoring, Evaluation, Reporting and Management

In the immediate aftermath of Nargis, local authorities, UN Agencies, international non-governmental organisations (INGOs) and community-based organisations (CBOs) made various rapid assessments of the situation to guide the very early humanitarian response. However, these were neither consistent nor comprehensive in their geographical coverage and this resulted in significant knowledge gaps.

Accordingly, the comprehensive single collaborative assessment referred to above, was conducted between the 10th and the 19th of June 2008. This consisted of two components – the Village Tract Assessment (VTA) focusing on humanitarian needs, and the Damage and Loss Assessment (DaLA) focusing on damage and losses.²²⁷ These surveys were accepted as a baseline for subsequent planning and monitoring, and as an agreed statement of damage and losses to justify the assistance being requested.

As discussed above, in preparation for PONREPP, the TCG began two report series designed to inform PONREPP and subsequent planning. The PR reports focused on quantitative data, while the SIM reports focused on qualitative social monitoring. These different approaches were designed to provide partners with a richer picture of the reconstruction effort for adaptive management purposes and are discussed further below.

These reports were designed to focus on the budgeted, largely humanitarian activities, in PONREPP.²²⁸ Although these reports do not include all investment in recovery activities discussed in PONREPP, such as the infrastructure recovery investments by GOUM and other activities supported by other national or international organisations including NGOs, they provide the only basis for evaluating achievements against cost as discussed below. However, the nature of the questions, particularly those of the VTA and SIM series, meant that the findings are to some extent relevant to all activities and in the absence of a more comprehensive evaluation they are used here as an input to deducing lessons from the responses to the disaster.

Both report series built on the VTA, which had established a broad sampling strategy covering 2,931 households in 105 villages across the 40 Townships worst affected by TC Nargis. This sampling and reporting evolved and retained sufficient common factors for valid observations and strategic advice for all disaster response providers.

Periodic Review Series

The Periodic Review (PR) Report²²⁹ process was to generate data useful for monitoring the ongoing relief efforts, to identify the evolving needs of the affected population for continued support. By monitoring selected indicators at regular intervals, the assessments were to produce a series of snapshots of the situation of affected people and communities that all disaster recovery or reconstruction

providers, including GOUN, could use in an adaptive management process.

The process included a Technical Advisory Group (TAG) and Strategic Advisory Group (SAG), which was responsible for overall guidance of the Periodic Review process. Each of the TCG's three components was represented in the TAG and the SAG. The aim of the TAG was to provide technical advice and background information to the Periodic Review Team on methodological matters relevant to the Periodic Review process.

The aim of the SAG was to provide strategic advice to the Periodic Review Team. The SAG provided this guidance in order to ensure that the Periodic Review was implemented successfully by: mobilizing necessary resources; ensuring that progress towards the goal of the Review was effectively communicated to all stakeholders, and ascertaining that the combined resources of all stakeholder groups were utilised.

Social Impact Monitoring Series

Reports on Social Impact Monitoring (SIM)²³⁰ used qualitative research to examine the impacts of TC Nargis in 40 villages in eight Townships and focused on three areas:

1. The recovery effort at the village level as experienced by affected villagers. This included an assessment of how much and what types of aid people were receiving, needs and shortfalls, and aid targeting and delivery.
2. The socioeconomic impacts of TC Nargis, including the effects on farmers, fishermen and labourers, how they

were recovering, and other issues such as debt and migration.

3. The impacts on social relations and cohesion, which examined the impact on social relations and cohesion, within and between villages, and between leaders and their communities.

The SIM reports to a significant extent reflected a community's experience of all aid and recovery investments not just that of PONREPP and so were a useful indication of remaining gaps and requirements for the recovery of the Delta's previous resilience, as discussed earlier.

Sampling Methods

The sampling methods of the VTA and the four subsequent Periodic Reviews (PR I, PR II, PR III and PR IV) were selected to be appropriate for the different stages of post-disaster response and recovery assessment progress at which they were conducted. It has not, however, been possible to make direct comparisons between the results of the VTA and PR surveys because different sampling frameworks and questionnaires were used. An analysis of the sampling framework conducted by Granger²³¹ revealed that different sample villages and questions were used in many of these reports (Figure 10.1).

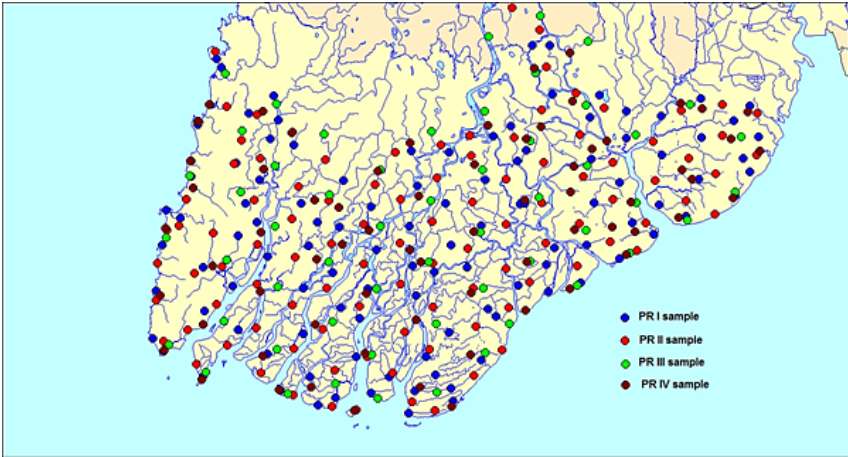


Figure 10.1 Sample Villages' Variation Across Reports.²³²

Although there is a discussion on the VTA in Annex 1 of PONJA, it is not clear from the reports why different survey grids and different sample villages were used in successive surveys. While such a practice might eliminate potential bias if the original sample villages selected were not 'representative', the practice does not permit change to be tracked through time. For this reason greater reliance was placed on the PR and SIM series reports for the evaluation, which forms the basis of this thesis. This difficulty is but one example of the shortcomings (Figure 10.2) of relying only on statistical analysis. For useful and reliable results it is important to see across different types of data, statistical physical and social impact data and interview, as discussed in Chapter Two.

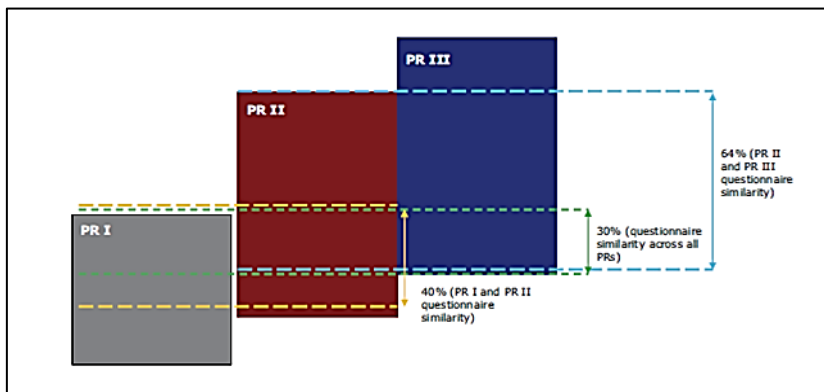


Figure 10.2 Methodological Shortcomings in Sampling.²³³

Social Impact Monitoring Surveys

In addition to the six-monthly PR report surveys, three parallel surveys were undertaken to monitor the social impact on the Delta communities by TC Nargis. These surveys were conducted in 40 villages selected as being representative of eight Townships that had been significantly impacted. There was significant consistency in the villages sampled, especially between SIM II and SIM III. Even though there was a consistency in the spatial distribution of sample villages there was a significant variation in the numbers of villagers surveyed. In SIM I there were 1,500 villagers surveyed; in SIM II there were 2,450; and in SIM III the sample size was reduced to 960.

Data Collection

The VTA collected primary information from key informants; people representing an opinion or view on

behalf of a community – such as religious leaders, teachers or head teachers, health workers in a community, village leaders, farmers and agriculturalists. The assessment tool combined key questions from nine clusters: Health; Food and Nutrition; Protection of Women and Children; Water and Sanitation; Agriculture; Early Recovery; Temporary Settlements; Education, and Emergency Shelter. Teams of enumerators visited 291 villages across 30 Townships over a ten-day period in early June 2008. Communities were assessed using a household survey and various participatory approach tools, including transect walks, key informant interviews and focus group discussions.

The Myanmar authorities provided full cooperation, and no restrictions were placed on access to any location. The survey used the Hubs established by the UN, located in Bogale, Labutta, Pathein, Pyapon, Wakema, and Yangon. Ten villages out of the 40 selected were unable to be assessed due to logistical reasons.

Coordination and Logistics

The third theme of actions considered in this part of the study was coordination of recovery work and logistics.

The TCG responded to the difficulties experienced with coordination of the large number of actors involved in the emergency response period by developing a mechanism through which all actors engaged in post-Nargis relief and recovery were to be coordinated and share information under PONREPP.

The coordination task was not simple as PONREPP was not the only recovery mechanism in action in the Delta. The Government also implemented its reconstruction plan, which is summarised in PONREPP, and there were others who provided assistance independent of either framework. The figure below from PONREPP²³⁴ reflects the intended coordination mechanism across three levels: (i) policy, strategy and impact monitoring; (ii) programmatic operations, and (iii) field operations.

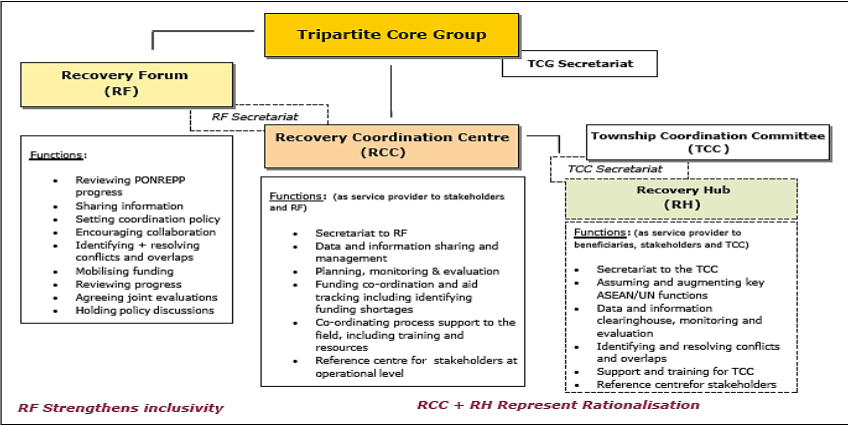


Figure 10.3 Intended Coordination Mechanisms.

The performance of the mechanism was not assessed in any of the Nargis reports. However, apart from the observation that some participants still preferred to implement their activities outside this framework, this mechanism had not attracted the criticism that the former cluster system did. The information management system has attracted positive comment in the IASC evaluation report, while the PR and SIM series reports have been widely quoted in third party reports and were considered useful in adaptive management.

By contrast there have been persistent reports of the failure of the objective to involve the community in decision-making about aid delivery. This was identified as a key objective in PONJA and PONREPP but several reports indicate the lack of success, for example the UN-OCHA report in December 2008 and 2010 on behalf of IASC.^{235,236}

The PR IV²³⁷ summarised this experience in July 2010:

'The way in which aid is being delivered has not changed significantly from the first year after Nargis. Aid providers continued to play a major role in decision-making and there is little evidence of local coordination between providers at the village level. Despite increased exposure to external providers, key aspects of village leadership have changed little. The village leaders have tended to respond well to the increased pressures they face. At the same time, there are indications that the capacity of village level institutions can have a major impact on aid and aid effectiveness.'

In terms of outcome, this lack of community involvement at the field level has impacted on aid effectiveness and particularly on Disaster Risk Preparedness.

Based on analysis of the material and reports on the MIMU web site and links thereto, the Recovery Forum has apparently worked well to improve communications between partners. The Recovery Coordination Centre continued to operate effectively, particularly its information dissemination function. However there was less evidence to indicate that the Recovery hubs were working well as a reference centre for stakeholders. The summary in PR IV strongly suggests there was room for improvement.²³⁸

It may be fairly concluded that the TCG system for organization and management of the recovery from TC Nargis worked well in solving identified problems at the policy, strategy and impact monitoring level and reasonably well at the programmatic operational level – but less well at field level.

Funding and Disbursements

The control over the flow of funds needed to implement recovery work was another aspect of implementation that showed areas of weakness.

The TCG responded to the difficulties experienced in tracking monitoring and planning aid disbursement during the early response period in its plans for PONREPP. The proposed system was set out in the PONREPP figure (Figure 10.4) reproduced below.²³⁹ Operationally the mechanism was intended to reduce duplication, fill gaps and account for resource flow to improve governance. The system was guided by principles provided in the PONJA assessment to address relief, early recovery and medium to longer-term recovery. These were: (a) effectiveness, transparency and accountability; (b) independence, self-sufficiency and capacity building; (c) a focus on the most vulnerable groups; and (d) strengthening communities.²⁴⁰

However, as with the proposed organisational arrangements, this task was not simple because not all funding was required to be directed through the TCG mechanism. GOUM had its own financial channels, some international participants operated separately as did most

business responses and some NGOs. The TCG was therefore not in the position to compel this reporting.

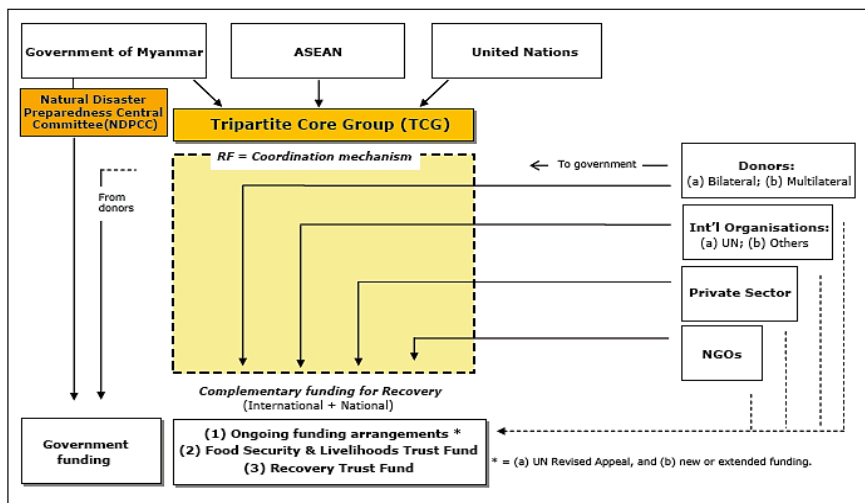


Figure 10.4 Funding Mechanisms²⁴¹

The performance of these arrangements was not analysed in any of the Nargis documents, however some evaluation is relevant to coordinated disaster risk reduction (DRR) planning for the future.

Governance and Accountability

The main TC Nargis reports and others obtainable through links to the MIMU web site do not enable any reconciliation statement of funds committed to be prepared, or either funds received or funds expended by plan category. This is due to vagueness in partner reports, for example the UNDP Annual Report for 2009²⁴² states that UNDP is funding a two-year recovery plan following the end of emergency aid

for TC Nargis but no expenditure figures are given. The ASEAN Annual Report for 2008-2009²⁴³ identifies TC Nargis and mentions a total figure \$690 million but gives no actual expenditure figures. The IFRC Annual Report for 2009²⁴⁴ reported the collection of more than budgeted funds for TC Nargis, but expenditure of only 80 per cent of budget; it cited lack of access to some Nargis areas and lack of long-term sustainable funding as reasons. The IFRC also identifies other reporting structures not included within the Annual Report. A USAID Fact Sheet for March 2009²⁴⁵ mentions \$74 million spent in the early months of which only \$33 million seems to have been spent in country. Accountability and transparency of aid for TC Nargis was thus poor.

The IASC 2010 evaluation,²⁴⁶ which includes activities funded under PONREPP, indicated that four of the 11 clusters showed poor coherence between delivery of investments and the 'financial pillar' responsible for accounting for expenditures such that allocation between sectors may be inaccurate. It also reports that the effectiveness of programs through clusters was weakened by poor communication, high turnover of staff and weak leadership of many of the clusters. Communication may have been further hampered by a desire to work around systems designed to centralise control or restrict access to some areas.

Transparency in how donors' funds are disbursed plays a key part in securing on-going donor and volunteer support. In this case, there are many indications that funds committed were less than required (as identified within the plans), that less funds were received than committed and that spending against targets varied significantly between programs. For instance, the following Table 10.1 shows

PONREPP estimated a recovery requirement of \$640 million (not including the \$50 million cash grants for 'fragilised' housing), but actual expenditure tracked by the Recovery Coordination Centre (RCC) only reports \$177.7 million to June 2010.

Table 10.1 contains estimates of planned expenditure for PONREPP programs against actual expenditure based on the Aid Tracking tables provided by the RCC. Variances are significant (> ten per cent) across all program categories and the overall estimate of funding received is 27.3 per cent of planned funds, two years into the three-year plan. The lowest variance was in WASH (which received much more than planned) and Recovery Coordination, and the highest in Environment, Education, Shelter and Vulnerable Groups. Significantly, programs with a key long-term resilience focus were under funded – Environment and Education, with environment receiving no funding at all.

The PONREPP Prioritised Action Plan October 2009²⁴⁷ is a subset of the PONREPP designed as a way to focus the reduced funds available on the important activities considered achievable within two years; it does not change the requirement for recovery over the remainder of the PONREPP period to 2011 and so has not been separately analysed.

It can be expected that the effectiveness of recovery efforts will be less than expected, and that early gains may be lost through diminishing funds to consolidate programs. It may also be expected that beneficial effects anticipated to accrue from training might decline as trust in programs is weakened with the lack of follow-up funding.

Table 10.1 Actual and Planned Expenditure (\$US).²⁴⁸

Program	2009				2010				2011
	Planned	Actual	Variance	%	Planned	Actual	Variance	%	Planned
Livelihood	87.1	41.8	-45.3	-52	26.0	19.8	-6.1	-24	26.0
Shelter	70.6	21.8	-48.8	-69	51.5	5.0	-46.5	-90	51.5
Education and Training	19.0	7.4	-11.6	-61	69.0	3.0	-66.0	-96	69.0
Health	21.2	8.8	-12.4	-58	16.3	3.8	-12.5	-77	16.3
Water, Sanitation and Hygiene	17.8	32.3	14.5	82	16.1	12.0	-4.1	-26	16.1
Disaster Risk Management	16.5	10.2	-6.3	-38	7.8	0.0	-7.8	-100	7.8
Environment	0.9	0.0	-0.9	-100	0.6	0.0	-0.6	-100	0.6
Protection & Vulnerable Groups	9.2	3.6	-5.6	-60	7.0	0.3	-6.6	-95	7.0
Recovery Coordination	5.0	6.8	1.8	36	2.5	1.0	-1.5	-59	2.5
Rounded Totals	247	133	-115	-46	197	45	-152	-77	197

Notwithstanding the difficulties experienced reconciling expenditure figures reported on the MIMU site, and considering the fact that the TCG was not able to impel all partners to report expenditure, the RCC has maintained records and undertaken monitoring and reporting. However, taken as a strategic objective, financial reporting currently available does not demonstrate achievement of the first principles of the PONJA, that is, effectiveness, transparency and accountability. The remaining principles outlined in PONJA of independence, self-sufficiency and capacity building, a focus on the most vulnerable groups and strengthening communities will be tested in the next section concerning achievements.

Such a result is not unusual in international disaster responses and it may be that a comparison with other major disasters, such as the 2004 tsunami may reveal relative success in the case of TC Nargis, since the Tsunami disaster had much more generous funding. For example, the Tsunami Evaluation Coalition in its summary synthesis report in 2007 commented unfavourably on the ability of international

agencies to coordinate their activities in ways that maximise the potential for communities to act themselves.²⁴⁹

'The tsunami highlighted the arbitrary nature of the current funding system for humanitarian emergencies. This system produces an uneven and unfair flow of funds for emergencies that neither encourages investment in capacity nor responses that are proportionate to need. Despite the commitment to Principles of Good Humanitarian Donorship by some donors, the TEC studies found that donors often took decisions on funding the response based on political calculation and media pressure.'

The chapter has evaluated the national, community, and in particular, the international responses to the disaster. The next chapter assesses achievements up to June 2010.

Chapter Eleven

Tripartite Group Achievements

The TCG's (GOUM, ASEAN and UNDP) PONREPP is a composite program that focused on the humanitarian aspects of recovery. Although it did discuss the GOUM's program to rebuild infrastructure, it did not track expenditure in this direction or expenditure by others such as some bilateral programs, business and some NGOs. The PR series of reports similarly focus on the humanitarian aspects of recovery but the SIM series reflects general social attitudes and so is of possible relevance to the total impact of the recovery effort.

Accordingly, for this part of the review, three sources of evidence were used to form a view about the achievements of the recovery program outlined in PONREPP:

- evidence of expenditure obtained from the Aid Tracking sheet provided by the RCC
- the findings of the PR series
- conclusions from the SIM series.²⁵⁰

The aim of this analysis was to rebuilding of resilience to build a base for our suggestions for targeting future expenditure. This section therefore discusses²⁵¹ the

implementation of the National Reconstruction Plan, and the internationally supported components of the PONREPP.

National Reconstruction Plan

The National Reconstruction Plan is the GOUM's plan for reconstruction compiled by Ministerial submissions shared with the PONREPP planning team.²⁵² As noted in Chapter 10 above, in most cases the action of GOUM and international assistance provided under PONREPP were complementary, GOUM tended to undertake larger infrastructure works under each programme while the international assistance tended to focus on the humanitarian aspects. The impact of these complementary activities, and other activities not included in PONREPP, are apparent in the impact on people's lives as assessed under the PR and SIM series reports and so are not separately assessed here. While cost indications for GOUM's investment are provided in the PONREPP text there is no tracking of this expenditure by the RCC apparent either on the MIMU web site or in inputs by others. Thus achievements cannot be directly ascribed to investments by any participant. The key elements of the Government plan are discussed in turn.

Housing Sector

GOUM's plan was to build a total of 20,847 housing units in the storm affected areas utilising a combination of a Government subsidy of over US\$1,700 per unit and international and local donor contributions. A key part of the plan was 'to build back better'. GOUM provided:

*'fairly detailed guidelines on the layout of villages, and their location in relation to typical rural geographic features such as rivers, streams, lakes, forests and hills. Likewise, specifications were established for design, dimensions, and materials to be used in the construction of dwelling units. The size of a house plot for an individual family was specified to ensure adequate space for a small vegetable garden, a few fruit trees and for rearing of poultry and small animals to enhance household food self-sufficiency and to generate additional income. Guidelines include provisions for the construction of sanitary latrines. Provision is also made to construct a network of roads as well as to plant trees at appropriate places to act as barriers against high winds and storm surges. All these measures aim at improving the life of villagers, enhancing their livelihoods and enabling them to be better prepared and protected against natural disasters.'*²⁵³

An overall evaluation of the achievements in this housing sector is provided by PR IV²⁵⁴ with some reflection on the effectiveness of aid in this area from SIM III provided for under 'Sheltered lives' below.

Health Sector

Following the relative success of emergency health service provisions, as evidenced by the lack of expected epidemic disease, GOUM's plans were to repair and re-establish health services and to 'build back better' the major hospital network. The major infrastructure provided was to be funded by GOUM with other facilities and service at the village level being assisted by others. The GOUM plans were to upgrade and expand a number of hospitals. These

included: Labutta General Hospital from 25 beds to 200 beds; Pyapon General Hospital from 100 beds to 200 beds; Bogale General Hospital from 50 beds to 100 beds, and Mawlamyinegyun General Hospital from 50 beds to 100 beds, with additional plans to construct five new 16-bed sub-township hospitals. The achievements in the health sector were assessed in PR IV in terms of service provided with some reflection on effectiveness from SIM III. This is summarised under 'Healthy Lives' below.

Education Sector

Significant rehabilitation of school buildings had already occurred by the beginning of the PONREPP program. GOUM's plan was again to 'build back better' by undertaking further repairs and reconstruction or the provision of new buildings strengthened to provide community storm shelters. The achievements in the education sector have been assessed in PR IV under the 'Productive Lives' section below.

Access to Safe Drinking Water

GOUM planned an extensive programme of rehabilitating village ponds and wells traditionally used by villagers in the Delta as sources of drinking water and to introduce a new well digging programme and more effective water purification systems throughout the affected region. The achievements under this sector were assessed in PR IV and referred to under SIM III.²⁵⁵ This is summarised under 'Healthy lives' below.

Electricity and Communications Sectors

Significant repair and rehabilitation in these sectors had been achieved prior to the beginning of Recovery under PONREPP. GOUN had plans to further restore and upgrade these services, but this is neither detailed in PONREPP, nor assessed under PR IV or SIM III.

Agricultural Sector

The GOUN plan aimed to rehabilitate damage to the agricultural sector in three phases, namely: a) rehabilitation of storm affected crop-lands to enable timely replanting; b) compensation for paddy lost by increased production of paddy in other non-storm affected regions in the country, and c) enhancing global food security by increasing paddy output through higher yields and expansion of sown acreage in non-storm affected other regions in the country.

With regard to (a) this would be achieved through provision of agricultural inputs such as farm machinery and implements including tillers, harvesters, winnowers and hullers as well as essential supplies of seeds, fertilizers and insecticides. Significant repair of embankments was reported²⁵⁶ to have been achieved under PONREPP and GOUN planned to complete repairs along the whole 1,079 km of embankments and polders. This was expected to have a significant impact on the area of cropland available and crop yields. The achievements were assessed under PR IV and SIM III²⁵⁷ - see 'Productive lives' below.

UNEP also undertook an evaluation of the lessons from TC Nargis, which included significant references to agriculture as part of livelihoods and the importance of taking an integrated approach to recovery. The achievements in this context are assessed under lessons learnt section below.²⁵⁸

The Fishing Sector

GOUM planned for the rehabilitation of the fishing sector in two ways; (a) recovery, repair and replacement of damaged and lost physical assets, and (b) reengagement and resumption of fishing workers in productive activities. Progress was reported²⁵⁹ in the emergency period including the provision of many new boats and materials to repair others and the provision of nets and other fishing equipment. This was to continue in the recovery period including the re-floating of sunken or grounded deep sea and coastal fishing vessels, and the provision of loans to owners of fishing companies to resume production so storm-affected fishing workers could return to their respective occupations. The achievements in this sector are assessed under PR IV and SIM III²⁶⁰ - see 'Productive lives'.

Salt Industry

The GOUM plan was to replace lost equipment and material to bring production back to normal with greater protection against natural disasters by building stronger buildings using reinforced concrete for the 400 workers at the state owned salt fields. The method of funding was not reported in PONREPP nor were achievements assessed in the PR or SIM reports.

Trade and Commerce

The GOUM plans for this sector included the provision of credit, micro-credit or start-up capital as relevant depending on the type of business activity of the borrower concerned. The provision of credit facilities and the opening of shops for sale of goods and services were seen as important requirements for recovery. The achievements were assessed particularly in the SIM series reports and are summarised under 'Productive Lives' below.

Subsistence Agriculture and Livestock Breeding

The GOUM planned for recovery in this sector through a combination of inputs and extension to re-establish the previous level of life and to create conditions for a better life and a higher standard of living through improved performance in backyard agriculture and livestock breeding activities. Inputs in the form of saplings and seeds, hand tools and use of organic fertilizers were to be provided to grow fruits and vegetables village yards. It planned to replace the large numbers of draft and farm animals that were lost in the cyclone through a programme to rear animals to meet draft and traction needs in agriculture as well as to meet meat and poultry requirements for consumption in the storm-affected areas. The achievements here were assessed under PR IV and SIM III²⁶¹ and are summarised below under 'Productive lives'.

Preparedness for Future Natural Disasters

The GOUM plans for this sector envisaged a well-integrated set of successive natural and man-made barriers and shelters to provide refuge and safety from danger posed by high winds, heavy rains and storm surges generated by cyclonic storms. These would include natural barriers such as natural forests and natural embankments, hills and high ground, and man-made protective structures and shelters such as embankments, sea-walls and storm shelters. The tasks outlined would be implemented after a comprehensive needs assessment of specific Townships.

The programme was to include a series of storm shelters of varying sizes to accommodate 300, 500 and 1,000 persons, complete with power and water. Earthworks, brick-baking and site preparation were reported to be underway under PONREPP. An expanded and improved network of roads between storm affected Townships and their adjacent areas were to be established for better access and more efficient communications, totalling some 330 km.

The UNEP evaluation of the lessons from TC Nargis referred to above included significant references to preparedness for future disasters and the importance of taking an integrated approach to recovery. The achievements in this context are assessed under lessons learnt section below.²⁶²

Rehabilitation of Forests and Forestry Resources

The GOUM plans for this sector was to rehabilitate storm-devastated mangrove and plantation forests under a five-year plan including gap planting, natural regeneration and

new plantation development, as well as local community owned/village owned forest plantations covering a total of 162,382 ha. Trees to serve as wind breaks were to be planted by the side of the river banks to a width of up to 200 metres from the river, and extend along river banks for a distance of 1,304 km, covering a total area of 3,360 ha. This task was to be undertaken by a mass participation movement organized by the Forestry Department in cooperation with the local authorities in seven Townships of Ayeyarwady Division and 184 km in Yangon Division and 400 ha in sanctuary areas.

JICA was to support a five-year programme to develop a community-owned forest plantation of 2,780 ha and a research plantation of 1,600 ha in Bogale and Labutta Townships. FRED A committed to a five-year programme to develop mangrove forests of 752 ha in Pyapon Township.

The Forest Department of the Ministry of Forests reported that it had initiated the rehabilitation of 3,100 ha of Departmental forests in Boglay, Payapon and Laputta Townships. It had, with assistance from JICA, established about 624 ha of action research plantations in the same Townships with the community and about 310 ha of community forests in Bogalay Township. It had cooperated with NGOs to redevelop 220 ha of forests also in Bogalay Township. It had also distributed about two million seedlings in Ayeyarwady Delta for re-greening of roadsides, public lands and compounds of homes and schools.

The total activity initiated by the Forestry Department since 2008 was some 3,950 ha of mangroves and 310 ha of community forests some of which was to occur in 2011. This is less than five per cent of that identified in PONREPP.

There is likely to have been some natural regeneration and it is also likely that activity, including that with the community will continue.

The UNEP evaluation of the lessons from TC Nargis referred to above included significant references to mangrove and other forestry recovery needs and the importance of taking an integrated approach to recovery. The achievements in this context are assessed under lessons learnt section below.²⁶³

Planning and Implementation of The National Plan

The National Plan summarised above was developed by line ministries and intended to be implemented by these ministries, assisted where noted by others. The GOUM indicated it is a strong advocate for community self-reliance and supports recovery efforts that do not create longer-term dependency on external assistance. Township and higher-level authorities were to promote self-help and the active involvement of target communities for all aspects of the recovery effort, including encouraging INGOs and UN agencies to support village self-help initiatives and the work of local NGOs.

This emphasis on the importance of involving communities in planning and implementation was similarly a priority for international assistance under PONREPP. The extent to which this was achieved was assessed in some detail under the PR and SIM series reports as discussed in more detail below, which includes reference to the importance of community involvement from the UNEP report referred to above.

Internationally Supported Components of PONREP

While some particular aspects of the funding for PONREPP have been discussed above, the progress achieved with those funds is reviewed here. PONREPP was a three-year framework covering the period from January 2009 through December 2011. It provides a platform for the transition from emergency relief and early recovery towards medium-term recovery, and for guiding those efforts across eight operational sectors. These sectors were grouped into themes and presented in three sections; productive lives, healthy lives and protected lives.

The PONJA painted a stark picture of the devastation caused by TC Nargis and the vulnerabilities it created for the affected population, including the loss of shelter, clean water, food, access to health and education services, and livelihoods. Much was achieved in the emergency period to address the most urgent needs. PONREPP aimed to address remaining vulnerabilities to the most vulnerable groups, both individuals and households.

The vulnerabilities addressed are a complex mix of pre-existing livelihood insecurities and the consequences of the cyclone. PONREPP aimed to provide access to the necessary resources; financial, natural, physical, and human, including social safety nets to the communities who have to assist them continue to take responsibility for their lives.

The assessments that follow compare the needs addressed in PONREPP with achievement, leaving where relevant a balance still to be achieved to restore or 'build back better'

the resilience of the Delta ecosystem including its population. It records what has been spent under PONREPP according to the RCC Aid Tracking sheets, as an indication of expenditure, although there has been additional investment towards these objectives by GOUM and others.

Productive Lives

Less than half the planned expenditure on livelihoods occurred. PONREPP had appreciated the importance of livelihoods to the restoration of resilience in the Delta by planning for some US\$139 million (21 per cent of the total PONREPP budget) to. However, the actual expenditure to June 2010 was only around 44 per cent of that planned in PONREPP as indicated in Table 11.1.

Table 11.1 Expenditure (\$US) and Estimates 2008 -2010²⁶⁴

Planned	% of PONREPP	Actual	Variance	% of Planned
139.0	21.7	61.6	-77.4	-55.7

PONREPP visualized delta resilience as an interaction between people on the one hand, and capital – human, physical, financial and otherwise – on the other. In doing so, it recognised that it is not is only the quantity of capital, but also the quality of the interaction between people and capital that influences the outcome. In practical terms this meant that:

- physical capital needs to be restored (boats, draft animals, ploughs, tools, seeds, productive land, transport, processing plants);

- human capital needs to be strengthened (vocational training, management of technologies, community-level organisational skills for production and self-help);
- financial capital needs to be made available (micro-credit, commercial loans, cash grants and conditional cash transfers such as cash for work, insurance);
- natural resources need to be sustainably rehabilitated and managed (fisheries, mangrove and land, mainly through community-led processes supported by enabling frameworks), and
- social capital (levels of cooperation, trust, and mutual help) should be further deepened, and activities structured accordingly, through the involvement of village-level user and producer groups.

In keeping with GOUM's principle of 'building back better', a key goal was to;

*'restore the livelihoods of the cyclone-affected population to increase their resilience to future disasters. This included raising and diversifying production; diversifying employment opportunities (including by creating a better-trained workforce); improving communications and market infrastructures; and promoting better management of natural resources at both the community and regional levels.'*²⁶⁵

An analysis of reports on achievements to the 30th of June 2010 indicates that this key goal had not yet been achieved although some progress has been achieved as discussed below. The PR IV report assessed mainly the physical capital

needs and indicates some serious deficiencies to be addressed in its conclusion.

‘Two years on, the Cyclone-related destruction of sources of livelihood and the capacity of people to generate income and sustain their families continued to impact households. Those involved in agriculture (the lifeblood of not only households but of the regional economy) had their livelihoods devastated by the disaster. These households, which have the knowledge, experience and management ability to re-start the economy, are yet to come near the level of asset ownership prior to the Cyclone. Among PR IV-sampled households there was a decrease in the following:

- *Fishing gear-namely nets and traps: down by 58 per cent.*
- *Fish processing-down by 77 per cent for fish/shrimp drying equipment and 66 per cent for fish/shrimp paste equipment.*
- *Boats owned-down on average by a third.*
- *Buffalo ownership-down by nearly two-thirds.*
- *Poultry-down by half for ducks and over half for chickens*²⁶⁶

The report concluded that agriculture had achieved a measure of uneven progress but that the most seriously impacted families, as indicated by the degree of housing damage they had experienced, were still seriously disadvantaged in their quest to recover their previous resilience.

‘Households whose dwellings were completely destroyed by Cyclone Nargis, accounting for about half of those surveyed, were at a distinct and continuing disadvantage in their

*ability to produce crops and to have household gardens, further reducing opportunities to earn money and to provide food for their families. Furthermore, these same households were less likely to have arable land. Reflecting their limited labour, farming and gardening options, these households are much more likely to use severe coping strategies to deal with household food shortages.'*²⁶⁷

The SIM III report corroborated and deepened these conclusions, providing clear pointers to future needs to restore resilience.

*'There are signs of a recovery in the farming sector ...'*²⁶⁸
*Recovery in the farming sector has started. Farmers in almost half the villages have grown both monsoon and summer paddy during the second year after Nargis, compared to only one-fifth during the first year. Furthermore, yields have rebounded on average by over 15 per cent across the 40 villages, and villages with increasing yields outnumber those with decreasing yields by over two to one. This achievement is a qualified success, however. During the 2009 cropping seasons, farmers in two-thirds of the villages studied had to cope with crop diseases, rodent and crab infestations, the depletion of mangrove trees, and soil deterioration due to salt-water intrusion. As a result, monsoon yields have reached pre-Nargis levels in only eight villages and in only three cases surpassed them. Villagers in the remaining 26 villages for which comparative data are available have estimated that output is still over 30 per cent below pre-Nargis levels.'*²⁶⁹*... whilst the fishing sector has not fully recovered ...'*²⁷⁰

In a sharp turn over the past year, fishing in the 21 villages with a significant fishing population has experienced a

*drastic reduction in fish stock, output and employment. Furthermore, most fishermen in the fishing villages studied still have not been able to replace the boats, nets and other gear that had been lost or destroyed during Nargis, mainly as a result of lack of credit. As a result, it is estimated that most of the fishermen have lost their traditional livelihood in these villages over the past year, forcing many of them to become casual labourers.*²⁷¹

*... and many labourers are facing hardship*²⁷²

The number of labourers seeking employment has increased markedly. At the same time, their employment prospects have continued to worsen due to their dependence on farming; in 24 out of 40 villages, farmers reduced their demand for labour especially for maintaining land. Labourers have to rely on doing low paying 'odd jobs' that are insufficient to cover basic household expenses. In fact, in almost half of the villages labourers have become significantly worse off than other villagers during the past year.

Debt continues to undermine the prospects for recovery. The debt dynamics are complex. Two years after Nargis, the average debt by borrower was 5.4 lakh,²⁷³ based on a sample of over 600 borrowers in the sample villages. Interest rates have largely remained stable. ... Across all occupational groups the average maximum debt across villages two years after Nargis is higher than before the cyclone, with the average maximum debt of labourers and fishermen having more than doubled over the past two years, and that of small farmers being almost twice as high. The poor, thus, carry the greatest debt burden. Fish collectors, rice millers and big farmers, important sources of credit for small fishermen and farmers, respectively, are

struggling financially themselves since Nargis.... However, farmers in particular have gone to great lengths to remain current on at least their interest payments and have been selling their assets in order to do so.

... The story of debt in the Delta two years after Nargis is, thus, one of continued asset depletion but not yet of widespread default.'

Lack of credit had been identified as a serious restraint at the time of PONJA, PONREPP and in each SIM series report since; evidently the situation was worsening. A Press account²⁷⁴ of the visit of the Professor Joseph Stiglitz ex-Chief Economist at the World Bank, to Myanmar and many reports have highlighted this serious constraint although the reasons for its continuation are not clear. For example a recent ACTED Microfinance Report²⁷⁵ summarised the issue as follows:

'PONREPP estimated recovery needs as 690.5M US\$ for 3 years, out of which 189 M were allocated to the livelihood component, including:

50M US\$ were initially identified as cash grants needs but not linked to a specific outcome at this stage;

12.2M US\$ were identified as needed to improve access to credit, especially microfinance (outcome 6 of the livelihood component being to 'increase livelihoods opportunities through improved access to credit, especially microfinance'.)

However, despite having identified microfinance as a key reconstruction tool in their periodic reviews, in October 2009 the TCG surprisingly removed microfinance from the PONREPP prioritised action plan up to July 2010. The

reasons provided were two-fold; (i) the timeframe for implementing sustainable microfinance was too short, and (ii) no official microfinance framework existed in the country.

If this decision translated into a lack of funding for further microfinance initiatives, there were two very serious risks: First, that the economic recovery of the Delta would be unsustainable shaped by externally driven grant-distribution systems and hampered by high levels of indebtedness to informal lenders. Second, that the window of opportunity (provided by funding availability and by the momentum of the reconstruction effort) for developing microfinance in the region and nationally would be lost.

SIM III showed that credit and micro-credit was by far the most significant need reported in interviews (120 out of 740 interviews compared with about 66 for the next category, village infrastructure). It also pointed out that while the livelihood situation in regard to fishing deteriorated significantly over the last year, investment in fishing recovery declined each year.

SIM III also suggested, based on interview responses concerning the decline in fishing livelihoods, that:

'While the causes of this decline were not known to the fishermen, it can be surmised that the following factors conspired to achieving this result, which was not nearly as evident one year after Nargis: (1) the damage Nargis inflicted on the Delta's ecology; (2) over-fishing and the use of wrong equipment; and (3) the loss of knowledge.

Nargis damaged the Delta's marine flora and fauna, at the wrong time. The enormous water movement caused by Nargis wrought havoc to aquatic life, killing fish in multitudes both near shore and in inland water bodies. Nargis also destroyed mangrove forests which shelter and nourish many fish species, especially during breeding. Equally disconcerting was the timing of the cyclone: it hit the Delta at the beginning of the spawning season. Many freshwater species migrate down the Ayeyarwady to the Delta and many saltwater species migrate up to the Delta, to breed in its brackish waters. The cyclone not only killed many of these migratory fish but also their brood, inevitably leading to a decline in the stock of fish over the medium-term.

The depletion of the fish stock in the Delta had started already before Nargis, due to unregulated fishing and destruction of Mangroves for fuel and timber, which are the key habitat for fish. In the post-Nargis period this problem has been compounded by fishermen having to use the often inadequate nets they received as livelihoods assistance, fishermen caught many young fish, thus putting pressure on the natural stock.'

This conclusion regarding damage to the Delta aquatic ecosystem and its impact on livelihoods was corroborated in several studies by UNEP.²⁷⁶ In particular they pointed to a vicious circle in which pre-existing damage to the Delta ecosystem due to deforestation, caused in part by pressures due to poverty and lack of knowledge, increased vulnerability to natural disasters, which in turn further damaged the ecosystem and so on. This issue is discussed further below but in this context it is concluded that in spite of some successes with agricultural production the

PONREPP plans to re-establish or 'build back better' livelihoods had not yet achieved success in terms of the condition of the forms of capital discussed in the introduction to this section.

The physical capital has not been sufficiently restored (boats, draft animals, ploughs, tools, seeds, productive land, transport, processing plants). The human capital has not been sufficiently strengthened (vocational training, management of technologies, community-level organizational skills for production and self-help and most importantly for managing the natural resource base). Sufficient financial capital has not been made available (micro-credit, commercial loans, cash grants and conditional cash transfers such as cash for work, insurance). The natural resource base has not been rehabilitated and is not being managed sustainably. The pre-existing social capital has been maintained, even strengthened (levels of cooperation, trust, and mutual help). They should be further deepened, and activities structured accordingly, through the involvement of village-level user and producer groups.

Healthy Lives

Although TC Nargis severely impacted the health system and its capacity to deliver essential services, destroying some health facilities and damaging others, much was restored in the emergency period. There was also rehabilitation of water supplies and sanitation, and improvements in access to food supplies in the emergency period. However, much was yet to be achieved.

About 8.4 per cent of PONREPP funds were allocated to health but the actual expenditure was only around 24 per cent of that planned. Water sanitation and hygiene fared better – some 7.8 per cent of PONREPP funds were allocated to these sectors and the actual expenditure to June 2010 was almost 89 per cent of planned, as shown in Table 11.2.²⁷⁷

Table 11.2 Expenditure (\$US) and Estimates, 2008-2010.

	Planned	% of Total PONREPP	Actual	Variance	% of Plan
Health	53.8	8.4	12.6	-41.2	-76.6
Sanitation	50.0	7.8	44.3	-5.7	-11.4
Shelter	173.6	27.1	26.8	-146.8	-84.6
Education	157.0	24.5	10.4	-146.6	-93.4

The emphasis of both PONREPP and GOUM was on the restoration of services through the restoration of infrastructure and service capability. According to PR IV:²⁷⁸

'By May 2010, when the data for PR IV were collected, the physical health of the people living in cyclone-affected areas had stabilised. Compared to the first Periodic Review in November 2008 household heads were more likely to have access to health facilities, and less likely to indicate that facilities needed medicine and trained health personnel.

Household health, as measured by the health of children and pregnant women improved. The per centage of households, which do not visit health facilities because they perceive themselves to be healthy, increased. Immunisation for childhood diseases improved, although progress was not consistent across all areas.

There was a general improvement in the ability of households to access safe drinking water, during both the rainy and dry seasons; more households treated their drinking water and there was a greater capacity to store water compared to previous Periodic Reviews. Nevertheless, many households still lacked safe drinking water, particularly in the dry season.

Hygiene practices have improved since the first Periodic Review as household use of improved sanitation facilities increased. However, the devastation brought by Cyclone Nargis was still being felt, as households whose dwellings had been completely destroyed were less likely to have access to these facilities or to have soap compared to other households.

Food security in the Cyclone-affected areas stabilised, food security was relatively good at the time of PR I, when food aid was relatively abundant, but deteriorated a year later when the PR III assessment was carried out and when major food assistance programmes were winding down or had ended. The final map in the series shows improvements from PR III, but also shows that a quarter of households over a broad area still had insufficient food in the seven days prior to the assessment.

Although nearly two thirds of households reported that their dwellings were fully repaired, their dwellings were repaired to a condition highly vulnerable to storms. Three quarters of dwellings lack adequate foundations and nearly all lack adequate reinforcing of walls and roofs. The absence of these features contributes to weak storm preparedness scores in many vulnerable areas.

The majority of the household heads indicated that their housing was poorer at the time of the assessment than before Cyclone Nargis. This is particularly the case for households that had their dwellings completely destroyed by the Cyclone; they were far more likely to report that their present dwellings were hotter, wetter and more crowded compared to before the Cyclone.

School attendance was up among children aged 11 and above, but down among those aged 5-10, compared to earlier Periodic Reviews. Cyclone damage to household dwellings continued to influence the likelihood of whether children attend school, particularly among younger children, reflecting the larger negative impacts on livelihoods observed among households which suffered total loss of their pre-Cyclone dwellings.'

The SIM series of reports corroborate these findings with only about 18 out of 740 requests for each of health, and water and sanitation. Requests for education were significant at about 22 out of 740 but requests for village infrastructure were ranked second with about 66 out of 740 requests.

Food security continued to be an issue, linked to livelihoods as above, and there is some unevenness in access to clean water and good sanitation, as discussed in the next section. It was concluded that this part of PONREPP has been a qualified success and this has contributed to a recovery of human capital and maintenance of social capital.

Protected Lives

TC Nargis not only affected individuals and families in special circumstances or with special needs, it also created many more. Many people lost their spouse as well as extended family members. Children were orphaned. Some were disabled, and others already disabled were left without supporting family to assist them. Elderly couples or individuals who lost their children or extended families found they were unable to support themselves. These people and others like them made up a special category of those left most vulnerable by the disaster.

One of the most important factors influencing the post-cyclone outcomes was whether a household dwelling was completely destroyed or not; in many sectors achievements in the worst affected areas were less than anticipated.

Disaster risk management was identified in PONJA and PONREPP as a significant requirement for the recovery period and some five per cent of PONREPP funds were allocated for this purpose. However, it has not yet been treated as seriously in implementation and actual expenditure to date has been only 68.1 per cent of that planned.

More problematic still has been relative lack of attention to environmental protection. Both PONJA and PONREPP had emphasised the importance of this but only 0.3 per cent of PONREPP funds were allocated to the subject, and almost none of this was spent. GOUN's plan was to focus on this sector with assistance from others such as JICA.

Table 11.3 Actual Expenditure (\$US) on DRM and Environmental Protection against PONREPP 2008-2010 ²⁷⁹

	Planned	% of Total PONREPP	Actual	Variance	% of Plan
Disaster Risk Management	32.0	5.0	10.2	-21.8	-68.1
Environment Protection Vulnerable Groups	2.0	0.3	0.0	-2.0	-100.0
	23.1	3.6	4.0	-19.1	-82.8

Expenditure on vulnerable groups was seen as important under PONREPP with 23.6 per cent of PONREPP funds allocated to this, but to date actual expenditure has been only 82.8 per cent of that planned as in the Table 11.3.

The PR IV report accordingly deals with Vulnerable Group recovery and Disaster Risk Management to some extent, but does not consider Environmental Protection.

Vulnerable Groups

PR IV reports:

'Current situation (April 2010)

Progress is uneven across sectors and across geographic areas impacted by the Cyclone. Although the situation has stabilised in many respects, conditions are at a level lower than prior to the disaster. Health sector indicators stabilised, particularly in maternal and child health. These efforts now appear ready for transition to the longer-term development phase.

However, water and sanitation interventions have yet to reach many households in need, and the potential for the spread of water-borne disease remains. Food security remains a goal rather than a reality in at least one quarter of households, which reported not having enough food to eat during the seven days prior to the assessment.

Maintaining momentum in maternal and child health, however, depends on the fundamental capacity of households to meet basic needs of food, clean water and shelter. Turning around depressed livelihoods is essential to re-building capacity for household-driven development. This calls for increased efforts to achieve recovery of livelihoods and to build back better in housing.

As this summary and report indicate, households, which suffered a complete loss of housing are among those in greatest need. Single-parent and female-headed households, elderly widows and other elderly persons living without household members of working age, and those with a disability, also remain in need. Those among these vulnerable groups who lost housing to Cyclone Nargis require a particular focus.

Needs remain greatest in the most affected areas defined in the PONREPP of the Ayeyarwady and Yangon Divisions. On a range of measures, from water and sanitation to schooling of children and to occupations, these households remain at a marked disadvantage.'

The SIM series of reports all consider social cohesion to have remained strong in spite of difficulties, and this includes care of vulnerable family members and religious support for others. Remarriage of widows and widowers has been significant while education has become more of a burden for

the poor, religious institutions have taken this on, notably for boys. Recovery of livelihoods has been most difficult for the vulnerable and poor and the reduction in availability of credit has been the most significant difficulty.

Another issue that has acted to increase vulnerability has been the difficulty obtaining documentation that was lost in TC Nargis. This was noted as an issue in PONJA and PONREPP, and PR II noted that some 13 per cent of surveyed households had lost documentation during Nargis. By the time of PR IV this situation had improved but was still a problem;

'The Cyclone left many people without documents, such as national registration cards (NRCs). In particular, households that had their dwellings completely destroyed were still, two years on, more likely to be without these cards compared to those whose dwellings had not been completely destroyed.'

Among the consequences of these losses, the most serious was that of obtaining legal rights to housing and agricultural land, as well as travel rights. It did not significantly affect access to services such as health and education.

Disaster Risk Management

PR IV reports:

'Since Cyclone Nargis, the Government of the Union of Myanmar along with international and local organisations and agencies undertook interventions to improve disaster preparedness. Despite this, only 1 per cent of household

heads indicated they were completely prepared or felt completely safe in the case of another disaster. That assessment largely coincides with the reality of dwellings inadequately constructed to withstand severe wind and rain, in an area where such storms, though of less destructive power than the Cyclone, are a frequent occurrence.'

As has been discussed in both PONJA and PONREPP this difficulty had as much to do with community involvement with Disaster Risk Preparedness as it is about the standard of shelter and the standard of embankments, mangroves and other protection. An integrated approach was called for as is discussed below under Environmental Management where lessons from UNEP are reviewed.

SIM III did not specifically address Disaster Risk Management but did comment indirectly through its observation that planning tended to be undertaken by aid planners with little involvement by the community. In particular it concluded;

'In order to provide sustainable and effective support for the communities, aid providers need to involve villagers more intensively in planning and implementing projects, and build a longer-term vision of local development than has been the case hitherto. Despite some important attempts to do so, there remains significant scope to develop the capacities of community organisations as active partners in aid provision. Developing the capacity of the existing leaders, as well as other potentially active members of the community, is likely to be another important factor in enabling communities to respond to the pressures and opportunities that are placed upon and

before them. Participatory planning and local level coordination of aid provision, both of which enhance transparency and accountability at the village level, are two important—and feasible—ways to achieve this.'

The conclusion was that the Disaster Risk Management component of PONREPP had not yet achieved the success it anticipated; this is analysed further below.

Environmental Management

As discussed, PR IV did not report on progress with environmental management. This is partly because it was to be carried out by GOUM assisted by others such as JICA, and partly because environmental management is not seen as urgent in a disaster context. As PONREPP pointed out in its sector strategy for restoring and protecting the environment:

*'lack of understanding of the synergy between environment and development is all the more visible in recovery efforts where there is an urgency to restore livelihoods, and issues of sustainability (of livelihoods as well as the environment) are at times perceived to be secondary.'*²⁸⁰

It was concluded that environmental management was treated as secondary, and from achievements observed consideration of the reasons for these successes and failures is discussed in the next chapter.

Chapter Twelve

What Worked, What Didn't, & Why

In this chapter the results of the evaluation in the case study based on TC Nargis are presented and lessons learned postulated. Before discussing specific findings, it can be clearly stated that much remained to be done in all areas to recover even the resilience that existed prior to the cyclone. In the words of final Social Impact Monitoring report;

*'It appears as if the shock of Nargis has moved the Delta economy to a new equilibrium that is lower in welfare terms. Without significant external assistance and a favourable environment the Delta economy will likely not reach its pre- Nargis level in a long time to come.'*²⁸¹

Although this statement applied to support to vulnerable populations, that same may be said of the evaluated situation with regard to most other aspects of Delta life, and particularly its natural resource base. The following is drawn from the foregoing chapters expressed as capital.

Produced Capital

The physical capital (boats, draft animals, ploughs, tools, seeds, productive land, transport, and processing plants) had

not been sufficiently restored, as the final Progress Review report concluded.

Although agriculture had recovered to a significant extent, this was uneven, yields and production were still down around 30 per cent in 26 out of 40 impacted villages surveyed and some ten per cent of pre-cyclone land remained out of production because of salt incursion, according to the last Social Impact Monitoring report.²⁸²

Financial Capital

Sufficient financial capital (micro-credit, commercial loans, cash grants and conditional cash transfers such as cash for work, insurance) was unavailable. Lack of credit had been identified as a serious restraint at the time of PONJA, PONREPP and in each Social Impact Monitoring report since. The study found that the situation was worsening although the reasons for its continuation as a problem were not clear. US\$50 million in cash grants for work was taken out at the start and one report indicated that credit had been taken out of the PONREPP plan during the second year. The final Social Impact Monitoring report also indicated that credit and micro-credit was by far the most significant need reported in interviews.

Natural Capital

The natural capital (fisheries, mangrove and land) had not been rehabilitated and was not yet being managed sustainably. This key factor to future resilience is discussed in more detail below but, with regard to the re-

establishment of livelihoods, its importance was been made clear in the final Social Impact Monitoring report, which noted the partial collapse of the fishery base in the second year after the cyclone, exacerbated by a decline in investment in fisheries.

Human Capital

The human capital (vocational training, management of technologies, community-level organizational skills for production and self-help) was not sufficiently strengthened. The Nargis reports²⁸³ notes that school attendance had improved since the end of the emergency period (although it remains the third most requested form of assistance), but there was little evidence that community-level organisational skills had improved, which is a notable deficiency for disaster preparedness.

Social Capital

The pre-existing social capital (levels of cooperation, trust, and mutual help) has largely survived. Many Nargis reports, beginning with PONJA, had commented on the strong social capital that exists in the Delta. The following reports indicated that this had, if anything, been strengthened through the adversity brought about by TC Nargis.

Other aspects of PONREPP under both the Healthy and Protected Lives programmes have contributed to social and human capital restoration to various extents. Investments by both Government and PONREPP including NGOs such as the

Red Cross contributed to improvements under the 'Healthy Lives' programme. The final study indicated that health had stabilised, access to schooling had improved, access to water and sanitation had increased and food security had been enhanced, albeit all unevenly.

Nevertheless, most people considered that the standard of housing remained unsatisfactory in terms of protection from storms. Indeed, although aid had gone to the most impacted areas as intended, the people most affected by the cyclone were still worse off in many respects than people elsewhere in the Delta. This was direct consequence of insufficient financial assistance.

Under the 'Protected Lives' Programme progress was less apparent, the vulnerable sectors of the population were being again taken care of by the previous providers, such as extended family and religious institutions, but there were still significant shortcomings in areas where housing was most impacted, even though aid levels were relatively high in these areas.

Disaster risk management was identified in PONJA and PONREPP as a significant requirement for the recovery period and some five per cent of PONREPP funds were allocated for this purpose. However, the study revealed that this had not been treated seriously in implementation, with a reduction in actual expenditure to just 70 per cent of that planned.

The final Progress Review reports:

'only 1 per cent of household heads indicated they were completely prepared or felt completely safe in the case of

another disaster. That assessment largely coincides with the reality of dwellings inadequately constructed to withstand severe wind and rain, in an area where such storms, though of less destructive power than the Cyclone, are a frequent occurrence.'

More problematic still has been the lack of attention to environmental protection. Both PONJA and PONREPP had emphasised the importance of this but only 0.3 per cent of PONREPP funds were allocated to the sector, and almost none of it was spent. Government's plan was that it would apply focus on mangrove and forestry re-establishment, with assistance from others such as JICA, but the study and Forestry Department reports found that less than five per cent of the planned program had been initiated to be completed by 2011.

As PONREPP pointed out in its sector strategy for restoring and protecting the environment, attention to environmental protection is commonly underemphasized in disaster responses:

*'lack of understanding of the synergy between environment and development is all the more visible in recovery efforts where there is an urgency to restore livelihoods, and issues of sustainability (of livelihoods as well as the environment) are at times perceived to be secondary.'*²⁸⁴

Difficulty obtaining documentation was another issue that acted to increase vulnerability in TC Nargis. This was noted as an issue in PONJA and PONREPP and the second Progress Review specifically noted that some 13 per cent of surveyed households were so affected. By the time of the final

Progress Review²⁸⁵ PR IV this situation had improved but was still a problem;

‘The Cyclone left many people without documents, such as national registration cards. In particular, households that had their dwellings completely destroyed were still, two years on, more likely to be without these cards compared to those whose dwellings had not been completely destroyed.’

The consequences of not having personal documents was most serious with regard to obtaining legal rights to housing and agricultural land; it also impacted on travel rights, although it did not change access to services such as health and education.

In addition to the findings of the research herein, a UNDP Case Study Report also offers some conclusions from TC Nargis, which are integrated in the following sections to provide an overview of lessons learned.²⁸⁶

Some Lessons

While the preceding discussion has introduced specific lessons and findings, the overall context of disasters as introduced at the beginning of this thesis emphasizes that environmental damage can increase vulnerability to natural hazards that result in disasters, and which in turn cause further environmental degradation.

The UNDP lessons and conclusions of the evaluation were:

1. Promoting an integrated approach to sustainable livelihood development, environmental management and disaster risk reduction

Integration was built into both plans but livelihood initiatives were only been partially successful, while there was no evidence that Natural Resource Management had been implemented and little evidence that Disaster Risk Management systems were appreciated.

2. Developing alternative livelihoods

Neither plan addressed new forms of livelihood, and although alternative energy sources such as biogas were mentioned, there was no evidence of uptake.

3. Establishing an enabling policy and legal environment

Although there were reports on the MIMU web site discussing new and better implementation of regulations covering land use, land leasing etc., there was no evidence that any of this had resulted in action.

4. Raising awareness and building capacity for improving environmental management and risk reduction

There was little evidence to suggest that natural resource management or disaster risk management awareness or capability had been built

5. Developing a robust information base to guide decision-making

An information base was established and maintained by MIMU although this was not used to report on environmental change. The conclusion was that with regard to these lessons that a 'vicious cycle' in the Delta remains a serious danger to the community and needs to be addressed with remaining funds, particularly rehabilitating the fishery

base, which can be a community assisted activity to address both mangroves and constructed fish habitat.

Learning from the Lessons

In order to provide guidance for future disaster funds allocations and time inputs further detailed analysis of achievements to date was undertaken. This included additional strategies to reduce the risks posed by future disaster impacts and to prepare communities for such eventualities.

The study focused on activities that would support and strengthen disaster risk management objectives and the risk reduction strategy identified in PONJA and so adopted a wider perspective than covered in the descriptions of achievements under PONREPP. Disaster Risk Reduction is discussed as; preparedness, warning systems and evacuation planning. Underpinning each stage is research, information and analysis within the assumption of an open system as described in the conceptual framework under which this work was undertaken.

Preparedness: It is apparent from the TC Nargis reports that a significant effort was undertaken to gather information on which to base plans and assess results but that this was hampered by lack of reliable information, such as a demographic data. While early Progress Review reports referred to the distribution of preparedness kits, the most recent viewed concluded that:

'the majority of household heads indicated that they were unprepared for a future disaster. Over a third (n=1,400) of

the respondents said that there was a safe building in their village, distinct from being 0.5 miles from their homes, where they could evacuate to. Often this would be a place of worship. Only 12 per cent (n=1,400) of the household heads indicated that they had a plan for an emergency; 6 per cent stated that there was a village emergency protocol; and 3 per cent of household heads reported community drills had occurred to prepare for a future emergency.

Granger's²⁸⁷ index of community disaster preparedness that combines householder responses and maps the result by Township using GIS data obtained from the MIMU web site indicated that, for example, the Township of Bogale was clearly the best prepared and Maubin the least.

There was little public reporting on the upgrading of the warning system proposed in PONJA and there were problems providing adequate warning for the storm tide or subsequent riverine flooding that caused most fatalities. In March 2010 the Department of Meteorology and Hydrology (DMH) outlined a plan to install storm detection radars, tide and river gauges and GIS-based flood hazard modelling. This would improve the ability to provide warnings about approaching storms but not about the impact of these on land. To do this a far more comprehensive array of information is needed than appears to exist anywhere in the Bay of Bengal. For adequate flood modelling, topographic and bathymetric data with a resolution of 0.25 – 0.5 m is required. Such survey work is expensive and may have security considerations but modern technologies such as airborne laser terrain profiling, high resolution satellite imagery and differential GPS are available to enable such mapping to be undertaken rapidly and accurately. Without such mapping and the risk modelling that can be derived

from it, appropriate risk reduction strategies remain impossible.²⁸⁸

There would be significant benefit to be obtained by establishing a Bay of Bengal-wide storm surge-modelling program similar to those established in Vietnam, the USA, Australia and China.

With respect to evacuation planning, six key principles can be considered, viz;

1. Are the people living in the at-risk location aware of their potential exposure to inundation and prepared to respond?

It was clear that residents were aware and this improved in each survey. To maintain this awareness, a programme of periodic evacuation plan rehearsals is recommended.

2. Are residents able to relate the inundation depth forecasts contained in warning messages to their own locality?

Inundation warnings are typically given as a height relative to a specific point or gauging station, since few people can translate this to their own location, it is suggested that heights be marked on prominent buildings in each village (as was done in many cases) to facilitate making sense of warnings. In addition, community maps that are colour coded according to risk zones could be provided to all residents in areas at risk.

3. What warning time can be expected before inundation levels could require evacuation?

Since this is a site-specific issue that depends on local landform and buildings, a program of research is needed to improve this knowledge.

4. How are warnings communicated to the public?

It is clear from surveys that 75 per cent of households receive warnings by radio and that early warning kits distributed have radios and batteries. It is recommended that a special warning is developed for radio warnings.

5. Is there a safe evacuation route available between the dwelling and a location that would be suitable as a safe haven during the predicted inundation event?

This needs to consider flood depths in different size storms and the vulnerability of evacuation routes to inundation. Further research was recommended to improve the knowledge of storm impacts on land.

6. Is there an appropriate refuge available to shelter evacuees until such time as it is safe for them to return to their homes?

The surveys indicated that safe havens have been established in only six of the 40 villages surveyed. It is likely that many more are needed. This is discussed further below under risk reduction in reconstruction and 'building back better'. It was recommended that the balance of these havens be constructed with appropriate designs to be further determined.

Risk reduction in reconstruction was articulated by the Government in a policy of 'build back better', mainly for physical structures. It was recommended that this should be extended to non-structural items to include all aspects of the

community recovery process to go well beyond the simple recovery to pre-disaster levels.

The UNDP (2004) definition of disaster risk was used as a basis for calculating multi-hazard indices for the TC Nargis event to maximise reductions in of risk. Indices²⁸⁹ include; risk, frequency, seriousness, manageability, awareness, urgency, growth and outrage.

On the notional evaluation of TC Nargis undertaken here it is clear that the most effective risk reduction efforts should consider:

- Frequency: nothing can be done to influence hazard frequency.
- Seriousness: any strategy that reduces the levels of exposure and vulnerability will reduce the seriousness of impact of similar hazards, though a target of zero risk is unobtainable.
- Manageability: all improvements in warning systems and their associated communications systems will improve the degree to which cyclone disasters can be managed.
- Awareness: improving community awareness and fostering household disaster planning can achieve significant reductions of cyclone risks in the Delta.
- Urgency: it is difficult to sustain the sense of urgency to take steps to reduce future risks the longer time passes after a major disaster impact. The pace of recovery activity in the Delta has already slowed and there is a risk that the sense of urgency demonstrated in the first year after the impact is diminishing.
- Growth: much can be done through the redevelopment and planning process to limit the

growth of risk posed by severe cyclones in the Delta. Redevelopment projects should take account of the potential effects of climate change such as sea level rise – this is an area in which the precautionary principle²⁹⁰ should always be followed.

- Outrage: community engagement, rather than government control in the disaster management process is critical. There is clear evidence that most of the response and early recovery following TC Nargis was undertaken by the civil society supported by government agencies. An enhancement of this situation would be beneficial.

These factors were discussed in terms of the principle of ‘as low as reasonably practical’ (ALARP). It was observed that this principle has been applied to date in the ‘build back better’ principle, although perceptions of reasonableness differ between providers and recipients. The extent to which investments can be made is dependent on capital availability. The study data showed that 84 per cent of all households consider that their shelter is worse than before despite of the fact that 46 per cent had been fully repaired (and 64 per cent in a later survey). Quality of housing remains a concern.

‘Building back better’ is a key to achieving safer and more sustainable communities. To guide this process, the detailed survey information per Township was analysed to provide indications of changes in vulnerability of each of the assets to the identified risks and this led to some conclusions for each of the elements at risk identified in the study as is summarised in the following:

Setting: The 'at risk landscape' is inherently risky. It is especially prone to all inundation hazards and these have been exacerbated by inappropriate clearing of mangroves and riparian vegetation to obtain more agricultural land and for timber and charcoal production. There was no survey data with which to analyse the results of actions to date and so provide more targeted recommendations than those expressed in PONREPP and discussed below. The apparent failure to replant enough mangroves and other plantations is a serious constraint on re-establishing resilience to future storm events.

Shelter:

Dwellings: The results analysed by Township and severity of previous damage indicate that some success has been achieved in repairing the most affected housing in the worst impacted areas.

Safe havens: The survey data indicates that safe havens have been provided in only six out of 40 villages surveyed, which indicates many more may be required. *Access:* The survey data indicate significant unmet boat needs even after considering road access.

Sustenance: Communities are reliant on their utility and service infrastructure and these are dependant on each other and on the supply of food, clothing, medicine and other personal items. These have been heavily surveyed throughout and although there has been significant progress in meeting these immediate needs during the PONREPP period there are still significant needs to be addressed.

Security: Access to medical services and medical supplies has improved with more than 60 per cent of most villages being

within one hour of a service or having medical supplies available, with some local variations.

Consolidated indexes: Consolidating indices provides an overall estimate of risk. By this measure, three Townships emerged as having a score of more than 60 per cent of the possible maximum, Twantay 64 per cent Maubin 62 per cent and Myaungmya 60 per cent while there are five Townships that score less than 50 per cent; Kungtongan, 42 per cent, Kayan 44 per cent, Kayauktan 48 per cent and Labutta 49 per cent.²⁹¹

Applying the Lessons Nationwide

To provide some guidance in applying the lessons of TC Nargis nationwide the key elements of the risk-based approach are discussed²⁹² for the different hazards that would apply. All areas of Myanmar are potentially exposed to the impact of natural hazards although these vary across regions. Floods, storm tides and tsunami are a potential threat in all areas of less than ten metres above sea level, with the possibility of risks increasing with climate change. Landslides are a threat in steeper areas, especially where vegetation cover has been removed. Droughts and the associated threat of fires are also issues. Earthquakes are a significant risk in some areas.

It is clear from PONREPP and the actions taken since that GOUM is committed to disaster risk reduction as a framework for action and that it sees this as an integral part of community governance rather than a separate action to engage in once a disaster strikes. The same basic considerations can be applied to other risks to human

livelihoods, such as inappropriate land and water use, which can seriously impact on agricultural productivity, water quality or drainage.

It is clear that further research is required to effectively integrate disaster risk reduction into its whole-of-government arrangements at National, Division/State and Township levels. This is as relevant for elsewhere in Myanmar as it is for the Delta, and can be broken into stages. Improved research and information resources are required as a precursor to such a multi-hazard risk assessment. This would include:

- An updated digital topographic mapping program at a minimum nation-wide scale of 1:100,000 (preferably 1:50,000) and 1:25,000 to 1:10,000 in areas susceptible to coastal inundation and riverine flooding; and an ongoing program of maintenance to incorporate new or changing development and infrastructure.
- A national census to provide detailed demographic, housing and socio-economic data on which to base a detailed community vulnerability analysis.
- Compilation of detailed hazard impact histories and palaeo-evidence on which to develop a better understanding of the relationship between hazard occurrence frequency and severity.
- Research to develop a better understanding and modelling of current and future cyclone and severe monsoonal conditions in the eastern Bay of Bengal.

A range of structural and non-structural risk reduction strategies are also indicated to improve community safety by reducing the exposure and vulnerability of those elements

that could be exposed to a hazard impact. Amongst the key structural strategies should be:

- Replanting of mangrove and riparian vegetation to reduce the impact on coastal and estuarine settlements of storm tide and riverine flooding, the planting of bamboo groves to better protect villages from destructive winds and the placement of fish habitat to re-establish fisheries.
- Construction or reconstruction of levees to protect settlements and agricultural land from seawater inundation.
- Development of further flood detention basins at strategic locations in the Ayeyarwady and other major catchments.
- Ongoing improvement in cyclone and flood warning systems including enhancing emergency communications down to the village level.
- Continued construction of multi-purpose safe places in inundation-prone areas that are also resistant to destructive winds.
- Design and construction of a series of dwellings from traditional building materials that are engineered to be resistant to severe winds and promote their adoption in cyclone-prone areas.
- Design and construction of water storage systems for rural areas that can resist inundation and destructive winds.
- Design and construction of road networks to be as free as possible from inundation and the risk of landslide during periods of intense rainfall.
- Design of critical infrastructure elements such as power supply, telecommunications and civil infrastructure such as hospitals to be located in areas

that have greater than 100-year average recurrence intervals of severe hazards.

The key non-structural community safety strategies that are suggested include:

- The review and possible restructuring of the disaster management system to place greater emphasis on risk reduction rather than response. In considering a restructuring attention should be given to the role of the Tatmadaw (armed forces) and the Fire Service and the potential to establish and equip a 'civil defence'-type of organisation to have primary responsibility for local search and rescue and disaster reduction promotion activities.
- Development and promotion of an ongoing community education program using a wide range of media targeted at those hazards that are identified as posing the greatest threats at the local level.
- Include within the curriculum of all schools, lessons on the history of the impact natural hazards in Myanmar, the forces involved and what students can do to make their communities and families safer and more resilient.
- Establish a standard warning tone to precede all emergency warning messages broadcast over both radio and TV.
- Establish a program of annual disaster exercises at National, Division/State and Township levels to test and refine administrative arrangements and communications systems. Such exercises are beneficial in encouraging cooperation and coordination between organisations and responsible individuals that is essential in a real emergency situation.

- As part of these exercises, engage communities in inundation-prone areas to conduct actual evacuations to test communications effectiveness and the viability of evacuation response plans.
- In consultation with in-country NGOs and international organisations such as the World Bank investigate the creation of a post-disaster micro-credit scheme to improve the rate of restoration of businesses at village level following disaster impacts.

This same basic approach can then be taken in other regions of Myanmar for both natural hazards and human-induced hazards as a risk-based framework for natural resource management. The overarching objectives of the disaster risk reduction strategies that flow from this analysis are to foster safer and more sustainable communities. Without safe and sustainable communities it is not possible for prosperity or other Government programs to flourish.

This advice is derived from the DRM system discussed in Chapter One and should inform policy makers on a general strategy for DRM nationwide. The next chapter will extend this into the natural resource management realm where most slow acting disasters are played out. As a conclusion to the study, this final chapter will show how a system for managing natural resources can emerge from this risk-based approach to address the many threatening factors facing Myanmar as it enters a period of rapid agricultural development.

Chapter Thirteen

A Risk-Based Approach to Natural Resource Management

'Look deep into nature, and then you will understand everything better.'

- Albert Einstein

Disasters come in many forms; social, physical, natural, financial – and they may come fast or slow. This Chapter acknowledges all these forms and the speed of a disaster's arrival, and in using the analyses of the preceding work it seeks to link these to better enable communities, governments and concerned agencies to adapt.

Disasters in Context

This work has proposed a conceptual model for envisioning disasters and has discussed the key concepts underpinning disaster risk science and disaster risk reduction (DRR). Disaster is described as the impact of hazardous events on humans, property and the natural systems upon which humans rely. Risk is defined as the probability of a hazardous event occurring and the importance of vulnerability in understanding the significance of risk; often expressed as *Risk = Hazards x Vulnerability*. It is postulated

that although disasters are usually imagined as fast acting events, the most serious in terms of impact on livelihoods are more often slow acting and that these two types of disasters often compounded one another. This suggestion gave rise to the idea that attention to the vulnerability of a region to slow acting disasters can be at least as important as the attention more often given to the potential for fast acting disasters. In the case study examined herein, the background slow acting disaster related to the changes in the natural resource base. Hence this final chapter discusses the natural resource base as the essence of resilience against future disasters.

Systems-thinking was earlier introduced as a conceptual framework for addressing the many interlinking factors that are involved in reducing vulnerability to risk and so building resilience. Within this construct, resilience was seen as a broad biophysical and social construct that may build on the systems models used in ecology and in social and governance domains. Building resilience in this broad way is seen from this study to be fundamental to the objectives of DRR.

The systems-thinking concept of subsystems that tend to move the whole system in certain directions, and the self-organising systems that operate to favour the continuation of the system have explained the importance of the free movement of information and resources. The concept of emergent properties has been introduced to illustrate how a human system to address risk can, if it is open to information and resource flow, evolve other systems to address new or changed risks in a changing world. The particular system for DRR as utilised internationally was described as a concrete example of a system open to

information flow through research and risk assessment. Having introduced the idea that human impact on its natural systems is not necessarily negative, a conceptual pathway can be developed to manage the natural resource base can have a positive outcome over time.

This study has shown how the impact of TC Nargis was much more serious than it might have been because the Delta and community had been more vulnerable to the cyclone event by a slow acting disaster was already in train. Moreover, the community was not prepared with sufficient information and resources to develop its own disaster risk reduction strategy. The consequences of this included;

- a collapse of the fisheries base two years after the cyclone because of inappropriate recovery action,
- much greater flooding and salt incursion onto farm land because of the destruction of the mangrove and forestry barrier
- far greater death and disruption because of lack of adequate shelter, the natural mangrove barrier and a communication and warning system.

The study also shows that although the humanitarian response to this disaster was mounted on a significant and effective scale, it did not resolve these problems. This has resulted in the community and the Delta resource base being more vulnerable now that it was before TC Nargis and there still being no effective system for information and resource flow that will enable the community to develop its capacity to address its manifold difficulties. A particular deficiency that impacted on the response to TC Nargis was that lack of a formal institutional system for managing the disaster response and to give disaster warnings once the cyclone was first detected.

Addressing the background slow acting disaster that continues to make coastal Myanmar vulnerable is now of paramount importance as it embarks on a rapid expansion in food production. It needs to avoid the types of poor practice that increased vulnerability to disasters in other countries as their agricultural systems embraced industrial world processes. Slow acting disasters in the natural resources realm have occurred in many populous areas, exacerbating the effects of unforeseen events; recent flood management in Thailand is a case in point in which lack of preparation and an early warning system to indicate vulnerability exacerbated the consequences of what was a foreseeable flood event into an economic catastrophe that is estimated to have reduced world industrial output by 2.5 per cent.²⁹³ Such experience indicates the need for disaster risk management to link with the field of natural resource management.

Natural systems have always changed and reacted to each other, and outside events have always occurred, such as tectonic movements, climate changes and volcanic events. Sometimes these outside events overwhelm the natural buffering capacity leading to sudden phase changes followed by an adjustment to a new system that has a buffering capacity sufficient to maintain the system. With their rapid increases in population and technological capacity, humans can be considered a new 'outside event' capable of overwhelming the buffering capacity of the natural systems that have prevailed apparently homeostatically since adjustments after the last ice age. It is assumed by many that humans now have the capacity to detect at least some approaching 'external' potentially phase-changing events induced by humans, and so to react and to either reduce

their potential to occur or their effect and to so reduce vulnerability. To do this effectively requires an open flow of knowledge and resources as in the Capra diagram discussed in Chapter One. Knowledge of how key parts of a system are evolving that inform how close a system is to a point where it is vulnerable to a sudden phase change. With such information the community is able to assess whether the cost of taking remedial action is reasonable compared with the cost of not doing so.

Returning to the example of the recent Thai floods, the vulnerability of the Bangkok region to naturally occurring floods has been increasing due to changes in drainage from irrigation systems and now built environments. Had the stakeholders been aware of just how far this process had gone and so understood the risks of catastrophe, they might have been able to invest resources to change this particular drainage system and so reduce that subsequent cost of the rain event. Had the community in the Myanmar Delta been aware of just how far reductions in forest cover had increased their vulnerability to damage from a natural storm event such as Nargis they might have invested resources required to reverse this trend.

Seen in this way, there is congruence between established Disaster Risk Reduction and natural resource management and monitoring. A good early warning system for natural events can enable vulnerability to be reduced. The natural resource system that underpins life where an early warning of changes in the natural buffering capacity informs of rising vulnerability is thus consistent with the reserve as described by Tongway²⁹⁴ and discussed in Chapter Two.

It is neither practicable nor possible to attempt to monitor all variables in a system. However, an adequate picture of the key systems can reveal the points of vulnerability to catastrophic change from natural or man-induced events. It is around these events that a monitoring system needs to be developed so that it can adequately inform investment and so reduce vulnerability. It can also inform understanding of the system dynamics to refine the elements to be monitored.

Slowing the Slow Background Disaster

This final section introduces a means of addressing the long-term vulnerabilities of the natural resource base to both natural and man-made hazards. The system proposed is a composite of two systems discussed in Chapter Two informed by the risk-based approach of DRR. These are:

- i) the capital model to facilitate investment for livelihood improvement, and
- ii) the ecosystem functional analysis model to facilitate the identification of vulnerabilities to the natural resource base so the risk of disastrous impacts can be reduced in an informed way.

Under such an approach, ecosystem boundaries are analogous to the setting, shelter, sustenance, security and society²⁹⁵ classifications from the risk factor classifications under the ISDR Framework for DRR discussed in Chapter One. This provides an assemblage of factors in the natural world where certain actions might be expected to have common impacts across the ecosystem areas. Analysing the landscape in this way facilitates identification of vulnerability to risk and allows development of a strategy to

minimize that risk and to monitor actions and appreciate the resulting changes in vulnerability. It is now common for groups cooperating for a particular purpose to have a common vision of their future, which is the direction in which a self-organising system tends to move. For a NRM system an appropriate vision might be, for example: 'a resilient social and natural landscape producing the ecosystems goods and services it's stakeholders value'

The assets important for the maintenance and improvement of livelihoods classified as capital assets are;

- economic, financial
- natural - resources and ecosystems,
- produced - physical infrastructure,
- human - individual education, training etc. and
- social, trust, mutual understanding, shared values and socially held knowledge

Classifications assist stakeholders used to investing for ecosystems goods to plan. They also suit self-organising systems that are open to information, energy and material.

Spotting the Warning Signals

The risk-based approach requires the identification and assessment of the hazards that may disrupt enjoyment of the above 'capital' assets, such as:

- pedological(erosion, soil loss, movement and deposition)
- hydro metrological (climate)
- biological (weeds, disease etc)

- technological (land use etc)
- markets, (as trigger events in this context)
- governance, policies, regulations, spiritual, etc. and
- *force majeure*, natural hazards, cyclones, earthquakes, fire etc.

Another key component of a risk-based approach to planning is the identification and assessment of the vulnerability of these assets to the hazards (or trigger events). Vulnerability is a relative and dynamic concept and the degree of vulnerability can only be assessed by means of monitoring, either by direct observation, (as people who live close to nature do) or through some surrogate. Surrogates include such approaches as vegetation health and species composition, often observable by economical remote means. Decision makers are usually not able to make direct observations, and in any case it is necessary to communicate these in a form that is useful and consistent for planning purposes.

For these reasons it is necessary to derive indicators of change in these assets that are economical to gather and show change across the boundaries of the asset so that their vulnerability to the known important hazards can be monitored. The DRM system has identified indicators of change for most of these asset classes relevant to the social landscape, notably for produced capital – physical infrastructure where much of the obvious damage in fast acting disasters is experienced, and for important areas in human and social capital with regard to training for risk reduction strategies and plans. It is not the purpose of this study to refine these further.

The focus here is on natural capital, the resource and ecosystems base where the damage is often less obvious yet vital in assessing vulnerability to slow acting disasters such as soil and water quality and biodiversity decline. Attention must also focus on the conditions of human and social capital necessary to assess vulnerability to slow acting disasters. In practice it is possible to monitor and manage for both fast acting and slow acting disasters from within similar institutional frameworks. It is contended here that adoption of a risk-based approach can facilitate integration of the two types of disaster, slow and fast acting.

The 5 S's classification developed by Granger as discussed earlier, is relevant to planning for the social landscape, even for changes in the natural setting and reductions, for example in forest cover, that have a significant impact of protection from storm surges and livelihoods. But it is not sufficiently useful for assessing the underlying causes of such decline to enable effective action to be planned. Changes in the built environment, communications or warning systems are readily apparent and actions to improve these can be expected to be useful across these classes. This is not the case for natural systems where other influences and factors may be significantly influencing changes in some parts of the landscape but not others, so that action planned cannot be expected to have similar results across all areas. For example, different approaches are needed according to forest area, soil type, water quality and disease.

The ecosystem functional analysis system overcomes this difficulty conceptually and practically. It may be beneficially used to assess vulnerability by defining the questions that inform planning, which necessarily varies between land

systems. For example, in the Ayeyarwady Delta it is important to understand changes in the marine environment, through indicators such as underwater habitat, reefs and sea grass changes, which may be influenced by sand movement, effluent and harvest intensity. In heavily modified irrigated agricultural landscapes in the Delta and elsewhere in Myanmar indicators such as soil chemical and physical changes (salinity, pH carbon, chemical pollutants, bulk density etc) are vital in understanding the capacity of the landscape to continue to produce the expected product. Once this has been done then the landscape (or marine-scape) can be divided into units where actions can be expected to produce common responses. This approach requires study in each particular location, which is a subject not developed further herein.

Monitoring for landscape change for NRM is a much debated and poorly undertaken activity, often because of attempts to understand all of the factors controlling the resolution of a particular system; as discussed, this is impossible. Thus monitoring processes are often not properly undertaken by the people in the field, as they are usually oriented to other imperatives. For this reason it is essential to look for indicators that serve multiple purposes.

The power of the risk-based approach to using the ecosystem functional analysis to define indicators for useful monitoring is that trigger events to changes within the particular ecosystem boundary can be understood as urgent. General monitoring does not usually produce this result. For example, a search for signs of erosion is much more useful if done at points where phase changes in condition for a particular landscape is likely, such as where rivers intersect and cross a particular geological boundary. Random sample

strategies do not deliver such information consistently. Similarly changes in overall DNA count may be a much cheaper and useful indicator for biodiversity change than detailed surveys that might be planned for completeness. This approach also implies an identification of stakeholders with relevant direct interests in ecosystem change, as such stakeholders are more likely to gather the data and act on the results.

As discussed in Chapter One the ubiquitous nature of the Feigenbaum number suggests that looking for indicators that a key factor, such as systems reserves, is approaching a transition point where a phase change may occur, might be a valuable point for investigators to look for relatively rigorous indicators to be monitored, even where the time to failure cannot be estimated.

Another important part of planning for a system to monitor and manage the natural resource base is to identify concerned stakeholders and develop a strategy to engage them that will also serve their other interests. This ensures that the necessary information for the system to operate reaches the system and is likely to be acted upon. The process by which information is analysed and used in NRM (and DRM) systems is adaptive management. As discussed above an important indicator of impending disaster is depletion of reserves, of capital – natural, built, social, human, financial and spiritual. Each situation will have its own characteristic reserves that need to be discovered and monitored so that concerned persons can act.

The importance of taking a multidisciplinary or interdisciplinary approach to NRM has been long understood, particularly by persons living close to nature.

The idea of the interconnection between all things has been with us for millennia, so why do humans keep falling back into 'silos'? Is it because of the undoubted benefits of the reductionist thinking? Is it because specialisation enables skills to be honed? All of these skills are required in a system that retains and enhances these necessary keepers of information, a system that can detect and adapt to the many signals of disaster, slow or fast. Such a system, following the Capra diagram from Chapter One, will be open at each end to a throughput of the information necessary for its maintenance and so enable the mobilisation of resources also essential for this purpose. Such an approach will make use of the natural instinct for preservation, which in turn will spawn new emergent systems for related activities important for life and livelihoods. In modern management terms this might be described as 'adaptive management'.

Adaptive management is essentially an iterative process that involves the collection analysis and use of information about the state of the system being managed. It has the features of a self-organizing system, open at each end to flows of information and resources and an internal subsystem for processing and analysis of the data collected as illustrated in the following diagram (Figure 13.1) developed from the work analysed herein and other previous work.

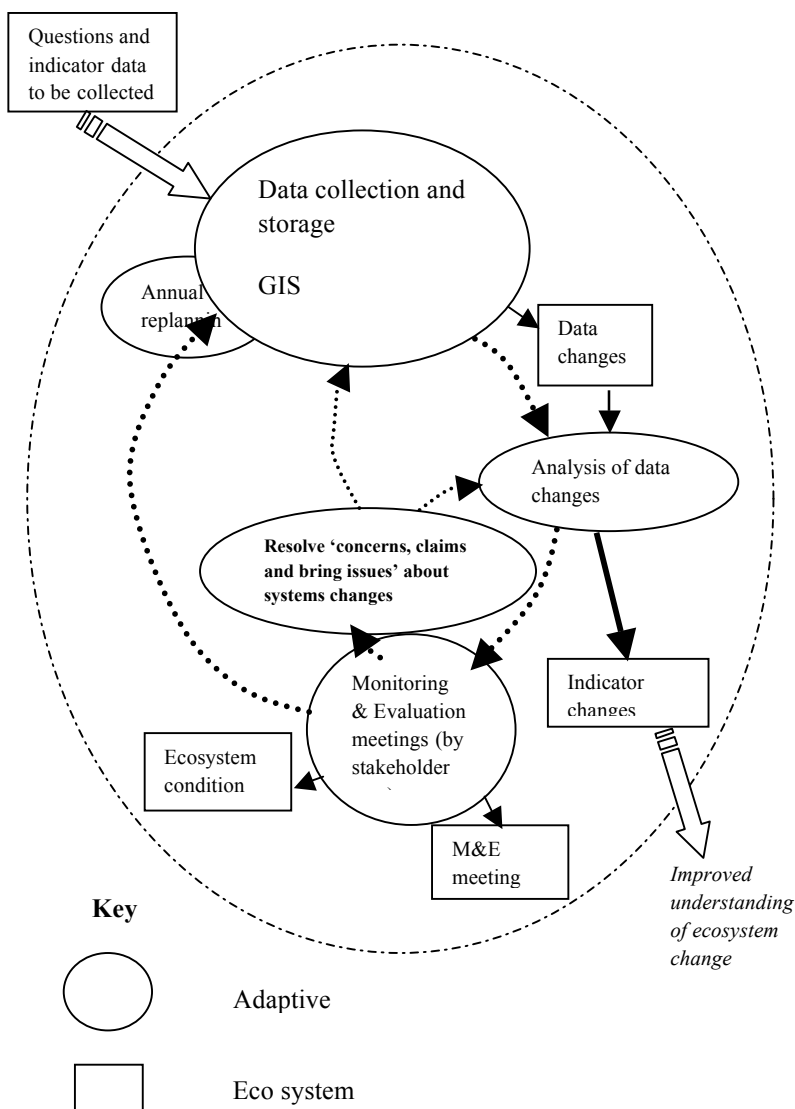


Figure13.1 A System for Adaptive Management²⁹⁶

A system to facilitate stakeholder adaptive management of their natural resource base needs to include representatives of all concerned stakeholders; this includes; regional or local government, regulatory authorities, land or water users, service providers and researchers who need to be involved in discussion and planning that results from processing of monitored data as illustrated in Figure 13.1.

This iterative learning process is the key to a system that can evolve in response to change to achieve some sustainability, and thus meet the broad definition of resilience as discussed in Chapter One:

*‘a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables’.*²⁹⁷

This resilience is achieved at the landscape – natural capital resource scale, and the different forms of information scale – the human and social capital dimensions. A shared sense of predictable ecosystem goods production (risk reduction) will in turn underpin financial capital.

A sustainable landscape then is a set of bioregion (or other ecosystem) sub-units where stakeholders are implementing the appropriate activities to continue to obtain the ecosystem goods and services they expect. The corresponding action in the social dimension is where stakeholders in a region can (have the ability and technology) and are acting to enable their landscape(s) to continue to provide the ecosystems goods and services they are expecting.

It is therefore concluded that taking a risk-based approach to Disaster Risk Reduction in each form of capital reduces the vulnerability of the community and its resource base to losses of all the other forms of capital as it helps stakeholders prioritise activities to suit their purposes. It is most beneficial to implement these approaches for both slow and fast acting disasters.

Based on these findings it is recommended that Myanmar establish a regional administrative system to integrate scientific consideration of the natural systems that underpin livelihoods and social systems to better inform decision-making. In particular, it is recommended that monitoring of the natural resource base be used to inform disaster preparedness, and to guide all development that impacts on that base, especially agricultural development.

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community resilience, a consolidated index of overall risk was produced to show where the areas in most need of further development are needed. The index was constructed by standardising each of the 22 individual indicators and expressing the index as a percentage of the possible maximum index sum score.

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