

MAPPING VULNERABILITY TO NATURAL HAZARDS IN MONDULKIRI



Final Report



IOM International Organization for Migration



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Foreword

With a core purpose of identifying ways to reduce vulnerability to hazards in rural Cambodia, IOM carried out the nine-month research project *Mapping Vulnerability to Natural Hazards in Mondulkiri*. This project supported the Cambodian government's efforts to extend Disaster Risk Reduction (DRR) efforts into the North-Eastern provinces of the country. The project also is driven by IOM's participation in the International Strategy for Disaster Reduction (ISDR) and its commitment to the goals and guiding principles of the Hyogo Framework for Action (HFA), including the objective of working with governments and communities to build resilience to natural hazards.

The project drew attention to the specific vulnerabilities and resilience of Cambodia's indigenous communities who, alongside other ethnic minority groups, comprise a large majority of Mondulkiri's population. These communities rely upon natural resources for their sustenance requirements and ways of life. With changes to these resources being driven by fluctuations in climate, natural hazards, restrictions on access to traditional lands, and man-made hazards including deforestation, the indigenous groups of Mondulkiri are now finding themselves increasingly facing threats to food security and livelihoods.

The project supported a regional interest in the more remote and traditionally marginalized provinces of Cambodia's North-East, and, as such, was conducted in parallel with a similar research project in the neighboring province of Ratanakiri. The research also supports the IOM's global responsibility within the Inter-Agency Standing Committee (IASC) to ensure that assistance is provided to those affected by natural disasters.

Both research projects reveal IOM's global commitment to addressing the complex interaction between disasters, the environment and climate change from a human mobility perspective. They also reflect the finding that environmental degradation, when combined with rapid development and economic growth, can pose a serious threat to the sustainability of livelihoods, the integrity of ecosystems and levels of food security. These processes may also limit the capacity of communities to prepare for and respond to natural hazards.

This final report presents the main findings of the research project, which was undertaken in partnership with Cambodia's National Committee for Disaster Management (NCDM) and funded by the government of Finland. The report also outlines conclusions on the vulnerability levels of surveyed villages to the identified hazards and highlights the occurrence of more unexpected and extreme natural events, driven by unpredictable and frequent shifts in climate trends, supporting IOM's commitment to the UN Framework Convention on Climate Change.

We strongly hope that governmental and non-governmental actors will use findings from this research to move DRR policies and strategies forward in Cambodia, and specifically, to work together with the communities of Mondulkiri to better prepare for, mitigate, respond to, and reduce overall risk levels to disasters in the province.

IOM Phnom Penh, September 2009

Abbreviation

AAH	: Action Against Hunger
ADB	: Asian Development Bank
ADPC	: Asian Disaster Preparedness Center
CARERE	: Cambodian Area Rehabilitation and Regeneration
CBDRR	: Community-Based Disaster Risk Reduction
CCDM	: Commune Committee for Disaster Management
CIYA	: Cambodian Indigenous Youth Association
CLEC	: Community Legal Education Center
CRC	: Cambodia Red Cross
CRDT	: Cambodian Rural Development Team
CUZ	: Community Use Zone
DANIDA	: Danish International Development Agency
DCDM	: District Committee for Disaster Management
DPA	: Development and Partnership in Action
DRR	: Disaster Risk Reduction
DRM	: Disaster Risk Management
EEPSEA	: Economy and Environment Program for Southeast Asia
ETZ	: Ecotourism Zone
FA	: Forestry Administration
FWUC	: Farmer Water User Community
HFA	: Hyogo Framework for Action
HVCA	: Hazard, Vulnerability and Capacity Assessment
IASC	: Inter-Agency Standing Committee
ICC	: International Cooperation in Cambodia
IDRC	: International Development Research Centre
IMF	: International Monetary Fund
IOM	: International Organization for Migration
IPCC	: Intergovernmental Panel on Climate Change
IRAM	: Indigenous Rights Active Members
IRRI	: International Rice Research Institute
ISDR	: International Strategy for Disaster Reduction
JICA	: Japan International Cooperation Agency
LAMC	: Law of Administration and Management of Commune/Sangkat
MLMUPC	: Ministry of Land Management, Urban Planning and Construction
MAFF	: Ministry of Agriculture, Forestry and Fisheries
MOE	: Ministry of Environment
MOP	: Ministry of Planning
MOU	: Memorandum of Understanding
MOWRAM	: Ministry of Water Resources and Meteorology
MPF	: Mondulkiri Protected Forest
MRD	: Ministry of Rural Development
NCCC	: National Climate Change Committee
NCDM	: National Committee for Disaster Management
NAPA	: National Adaptation Programme of Action to Climate Change
NRM	: Natural Resource Management
NSDP	: National Strategic Development Plan
NTFP	: Non-Timber Forest Product
PCDM	: Provincial Committee for Disaster Management
PDA	: Provincial Department of Agriculture

PDOWRAM	: Provincial Department of Water Resource and Meteorology
PIF	: Provincial Investment Fund
PLG	: Partnerships for Local Governance
PLUP	: Participatory Land Use Planning
PSDD	: Project to Support Democratic Development through Decentralization and Deconcentration
RGC	: Royal Government of Cambodia
RUA	: Royal University of Agriculture
RUZ	: Regulated Use Zone
SBCA	: Seima Biodiversity Conservation Area
SNAP	: Strategic National Action Plan for Disaster Risk Reduction
SPZ	: Strict Protection Zone
SRI	: System of Rice Intensification
3S	: Sekong, Se San and Sre Pok
VFG	: Village Focus Group
UNFCCC	: United Nations Framework Convention on Climate Change
WCS	: Wildlife Conservation Society
WWF	: World Wide Fund for Nature

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Thuon Try
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Executive Summary

Cambodia is one of the most disaster-prone countries in Southeast Asia, as it faces the risks of multiple forms of hazards compounded by communities with low adaptive capacity. The percentage of the country's population affected by natural disasters annually is significant, leaving the livelihoods, security and well-being of villagers exposed to risk throughout the year.

Mondulkiri is the largest province of Cambodia, and is characterized as remote, rugged and diverse in natural resources. The province has become increasingly important to the economic development of Cambodia, and its location in the North-East section of the country, bordered by Viet Nam and Lao PDR, also makes it of interest to international partners in trade. Recently, the integrity of Mondulkiri's resources has been threatened by rampant logging and mining activities, leaving the landscape of the province fragmented. The communities that live in the province, mainly comprised of ethnic minorities and indigenous groups, are strongly reliant upon these resources, making these villages increasingly vulnerable to the impacts of more frequent hazards and further environmental degradation.

Though rich in tradition and heritage, shifts in both the political and physical climate of Cambodia have had strong impacts on the lives of indigenous populations. Facing changes in the way they can access and use resources which have been central to their livelihoods, these communities have continued to be marginalized by decisions which have been made regarding developments in the management of provincial forests and other natural assets. The recent implementation of policies and laws promoting sustainable resource management practices and disaster risk reduction (DRR) efforts, however, have the potential to positively include these communities in decisions which impact their well-being. These institutional initiatives are further supported by the current context of decentralization reforms and the distribution of mandates at the sub-national and community levels now on-going in Cambodia.

Statement of the problem and main findings

This research project, 'Mapping Vulnerability to Natural Hazards in Mondulkiri Province', was driven by the International Organization for Migration's interest in supporting disaster risk reduction activities in the most traditionally marginalized communities of Cambodia – those located in the North-East sections of the country.

Project fieldwork was undertaken in 26 villages, spread over 4 districts of Mondulkiri, from February to June 2009. Research focused on identifying the vulnerability and capacity levels of these villages, and collecting testimonies on indigenous coping mechanisms, disaster history, people's perception of disaster risks, and documentation of the impacts of past events, as well as highlighting ways in which communities and local institutions could better prepare for, mitigate, respond to and recover from future hazards.

This report presents these research findings, including an overall social, economic and environmental review of the province, to highlight its current and future vulnerabilities to hazards, including flood, drought and insect infestation. Communities were often found to be at either medium or high risk to hazards, which were perceived to be driven by

practices including environmental degradation as well as other dynamic pressures, and compounded by changes in climate trends across the province as indicated by village testimonies. However, these villages and their supporting institutions were also found to be motivated to build their resiliency from the community upwards, and to shift current activities from response to prevention, in anticipation of future events.

Though not included in the Strategic National Plan for Disaster Risk Reduction for 2008-2013 (known as SNAP, Cambodia's national plan on DRR) or the National Adaptation Programme for Action (the NAPA, which is an action plan on climate change), the province has become, over the past few decades, increasingly vulnerable to the hazards of flood, drought, insect infestation and changes in climate trends. Mondulkiri has the lowest population density of all provinces in Cambodia, despite its having the largest land mass. More than fifty percent of the province is comprised of the *Phnong* indigenous community, a small percentage consisting of other ethnic minority groups, and a growing number of Khmer in-migrating from other areas.

The province is rich in forest and wildlife conservation areas which have been traditionally managed and used by indigenous communities, but it has the lowest human development indicators in Cambodia, with most communities having very poor access to infrastructure and social services. Findings from this project highlighted, often due to rising economic and environmental pressures faced across the province, significant changes in resource availability, land use, migration patterns, and livelihood and food security. Deforestation activities were identified by the communities as having an impact on water resources, as well as on hazard frequency and severity.

This project report presents the following core findings:

Vulnerability levels of the province

This assessment indicated high levels of vulnerability to flooding in Mondulkiri, with a total of 65% of surveyed villages found to be at a high risk for flooding. Villages facing a medium risk of flooding comprised a total of 27% of at-risk areas, therefore, over 90% of surveyed villages in the province were found to be at either medium or high risk to floods. Communities surveyed were found to be at risk for not only seasonal, slow-onset flood events, but also for flash flooding, which can occur in a swift and severe manner.

A total of 74% of surveyed villages were found to be at high risk of drought, with those at medium risk comprising an additional 23% of surveyed areas. Drought affects the agricultural outputs of communities, as well as the health of both villagers and animals alike, as well as the availability of water resources for personal consumption and household use.

Insect infestations, though often unreported to officials by villagers, were found to be a high risk hazard to a striking 92% of villages surveyed. The remaining 8% of communities included in this research were identified as being at medium risk for infestations, therefore, all villages covered by this project were found to be at either medium or high risk to the hazard of insect infestations.

All identified hazards were found, in varying degrees, as annually threatening the livelihoods and food security of surveyed communities.

Environmental degradation and disaster risk

Dynamic pressures, such as those of deforestation activities, were highlighted by many villages as driving increases in the intensity and frequency of all hazards, as well as exacerbating the impacts of changes in climate patterns, including the time of onset and duration of rainy and dry seasons. Environmental degradation in Mondulkiri has had documented impacts on reductions in ground water, often used for drinking and household consumption. Forest clearing was also identified as driving insect infestations, leaving even upland crops vulnerable to more frequent and severe attacks. The use of chemical pesticides in plantations and industrial farms further degrades water sources, exacerbating the loss of crops.

Drought and flooding (particularly flash flooding), both increasing in frequency and duration, had negatively impacted crop outputs and quality in numerous villages. Flash floods were thought to now be occurring more frequently and, also, due to environmental degradation, turning normally manageable amounts of rain into torrents and water surges, which impacts community resources.

Livelihoods were perceived to be limited due to a lack of access to resources traditionally used for harvesting products and food. This lack of access was often identified as being driven by land loss as well as forest access restrictions. Secondary livelihood activities, such as fishing, were also perceived to be threatened, particularly in communities which were settled near rivers and streams that had been affected by dams. The increased impact of flash floods has also resulted in the loss of community's ability to plant along the banks of streams or establish rice fields in any available lowland areas.

Natural resource management and community vulnerability

Changes in access to and the use of natural resources in Mondulkiri has limited villagers' livelihood options, as well as increased their vulnerability to hazards. This has resulted in some communities facing annual food shortages and threats to their well-being and health. Villagers often expressed interest in becoming more involved in participating in the management of natural resources, a step which may become more realistic with the passing of new policies relating to the rights of indigenous communities. However, a lack of awareness of laws, rights, and responsibilities presented obstacles to effective engagement with natural resource management processes in many surveyed villages.

Possible opportunities for increased community engagement in natural resource management include recent interests in the promotion of community-based disaster risk management, as well as community-based natural resource management. The establishment of community forests and protected areas was recognized by both local and institutional actors as being central to preserving indigenous ways of life, and for coping mechanisms during times of disasters. In order for these processes of engagement to be effective, however, consideration must be given for ways to involve communities, district and provincial actors in a sustainable manner, which also allows for building trust and respect between stakeholders and institutions.

Existing indigenous practices and knowledge relating to coping mechanisms

Some surveyed communities have developed household-level coping capacities in response to hazards, which are often supported at the village level and manifests into informally recognized community-based disaster risk management activities. These practices can include shifts in the location of fields, the movement of communities to upland areas during months prone to flooding, and the adoption of secondary livelihood practices in times of food insecurity.

Most surveyed villages respected traditional knowledge and indigenous warning signals relating to hazards, and these practices were considered by communities to be established and trusted ways to predict the onset of hazard events. However, with changes in climate, as well as increase in the frequency and severity of disasters, these practices are now losing their effectiveness as they are better suited to slow-onset events.

Changes to livelihood, food, water, and social security driven by hazards

Changes in climate trends and the frequency of disasters have forced changes in the traditional livelihood practices of indigenous communities, which were often focused on rain-fed agriculture, shifting crop cultivation activities and long fallow periods for chamkar (plots used for crop cultivation). However, the capacity of villagers to pursue these activities has been limited both by hazards and changes to both land availability and access.

These agricultural practices, though the cornerstone of these communities for income and sustenance, have traditionally low yields. However, an increase in incidences of infestations, longer periods of drought and extreme rainfall patterns have resulted in increased amounts of crop failures and less harvest amounts across all the surveyed villages. The conversion of large forest areas into plantations and industrial farms has impacted the access of villagers to secondary livelihood sources such as the collection of non-timber forest products, which serve as an important food and livelihood resource for indigenous communities.

Farmers have been forced to change their practices to cash crop farming which, although more resistant than rice crops, is also vulnerable to natural hazards as well as to market price fluctuations. In some places, these practices have left communities with no choice but to abandon their traditional ways of protecting the integrity of the land, such as rotating crops or leaving lands to fallow for at least five to seven years before replanting new crops in those same plots. Large concessions to businesses and greater demands for land to accommodate a growing population have forced villagers to limit traditional cultivation techniques in favor of more modern, yet more risky, agricultural practices.

All hazards have impacted food security levels in surveyed villages through a loss of agricultural outputs and quality. They have also limited community access to safe water sources in times of disasters or hazard events, which have frequently cut off or isolated villages and community members from social infrastructure and services, as well as caused damage to the health of both human and livestock populations.

Hazard risk, particularly flooding, was also identified as often being driven by the running of hydropower dams in the Sre Pok River. The damming of streams and rivers which feeds into the province was an immediate concern for communities who blamed this practice for causing the observed increase in the number of flash floods. The construction of new dams was a practice considered by surveyed villages to be a future concern, as they felt that this would further impact water and fisheries resources as well as the frequency and severity of hazards.

Effectiveness of DRR in the province in a decentralized context

Mondulkiri is still new to the concepts of DRR and decentralization of governance. Cambodia's promotion of mechanisms for decentralization and deconcentration should foster the building of support for DRR at the sub-national levels. As such, the creation of the Provincial Committee for Disaster Management (PDCM) presents a positive step in the promotion of community-inclusive activities and more efficient linkages between the levels of line departments in Cambodia.

Currently, however, the PDCM has no formal program on DRR in the province, and risk reduction is not included in development planning at the provincial, district or commune level. Many local government officials were found to not be aware of national mandates or policies relating to DRR, and past efforts in disaster management focused solely on emergency relief and response activities. Provincial line departments have limited resources to build programming beyond the already-partial support mechanisms developed. Support is therefore needed in both human and financial forms, to allow the PDCM and relevant partners to fulfill their mandates, and promote the effective decentralization of responsibilities and tasks.

The effects of environmental degradation and disaster risk on migration patterns

Surveyed villages noted that hazards, as well as restrictions on land use, limited their mobility and capacity to either move in times of hazard or before events in order to decrease their vulnerability levels. Some villages noted practices of shifting the location of their rice fields, where possible, away from hazard risk, as well as leaving communities for seasonal labour to compensate for shortages in food production.

Villagers noted that in-migration was placing stress on their settlements and resource use in some cases, and has led to conflicts over land management, use and access. Villagers who live inside or in the bordering areas of protected reserves and conservation areas remarked that, though they would like to relocate away from rivers at risk of recurring flooding, they were unable to do so due to a lack of available land.

Some villagers noted that they annually relocated to their rice fields in higher areas, returning to lowland settlements only after seasons of flooding were perceived to be over. Again, however, these settlements were identified as becoming lower in number due to the selling of land and increase in population. Those who did seasonally resettle in higher areas remarked that these locations were often far from water sources, making it difficult for villagers to engage in day-to-day activities.

Linkages between environmental preservation, disaster preparedness, and population stabilization

Mondulkiri is facing pressures of in-migration, hazards, and changes in access levels to traditionally utilized resources. Villagers noted that growing populations limited their traditional crop rotational practices, which increased the environmental pressures on their already-vulnerable land resources. They suggested that these pressures were further compounded by hazard threats and a changing climate.

Communities felt that where DRR activities could be linked to resource management, particularly forest resources, the frequency and severity of events would be decreased. It was clear that surveyed villages were open to pursuing community-based disaster risk management activities, as these were similar in nature to the current and respected practice of community-based natural resource management activities. If these types of inclusive, relevant approaches are promoted in at-risk areas of the provinces, communities noted that they would participate and build upon their indigenous knowledge and practices to increase the resiliency of their villages to future events.

Conclusions and Recommendations

This research used a disaster risk ranking model to identify and prioritize areas vulnerable to disasters. Surveyed villages were identified as less prone, prone, or very prone to identified hazards, according to the likelihood of the hazard striking the community. Vulnerability and capacity levels were then ranked by village according to the material, social and behavioral characteristics of the communities relevant to resiliency and risk, using the categories of low, medium and high. Based on the likelihood of a hazard event to cause damages, losses and disruption of community functioning, villages were then classified as at low, medium, or high risk to disasters, in relation to flood, drought and insect infestation.

Recommendations for proposed activities relating to all stages of DRR, from mitigation and preparedness efforts to prevention and response activities, were developed based on assessment findings, as well as on data validation and action planning activities conducted with surveyed villages. These initiatives, sorted as being either institutional or operational in focus, are presented in the final section of the report as short-, mid- or long-term recommended activities.

Chapter 1: Research Aims, Design and Implementation

1.1 Objectives

The overall purpose of this research study was to identify ways and means for rural and indigenous communities, as well as local institutions, to better prepare for, mitigate and respond to natural disasters in Mondulkiri.

In the framework of this overall purpose, the study had the following objectives:

- a) Identify the vulnerability levels of the province to natural hazards;
- b) Assess the linkages between environmental degradation and increased vulnerability to natural hazards;
- c) Identify any current issues surrounding natural resource management in the province which may have a negative impact on existing vulnerabilities of communities to natural hazards;
- d) Analyze existing indigenous practices and knowledge relating to coping mechanisms for natural disasters and identify strategies for building resiliency;
- e) Identify changes to climate trends, livelihood, food, water and social securities which have been driven by either or both natural and/or man-made hazards;
- f) Assess the efficiency and effectiveness of decentralization and deconcentration processes with reference to disaster management and preparedness;
- g) Analyze the environmental, economic, and livelihood impacts of environmental degradation in relation to disaster risk;
- h) Document the impact of environmental degradation and disaster risk on migration patterns;
- i) Analyze the potential linkages between environmental preservation, disaster preparedness, and population stabilization.

1.2 Methodology

Along with semi-structured interviews with key informants at both the governmental and non-governmental levels, primary research data were collected using the Hazard, Vulnerability and Capacity Assessment (HVCA), a participatory methodology which focuses on the analysis of hazards in connection with communities' vulnerability and capacity. The selection of the HVCA as the main research tool for this study was due to its highly community-centered approach, which allowed for the consideration of vulnerability and capacity at the community level, and is essential to capturing the needs of often-marginalized populations such as the indigenous groups of this province.

1.2.1 HVCA

The HVCA process is comprised of four steps: a) Hazard Assessment; b) Vulnerability Assessment; c) Capacity Assessment; and d) Action Planning.

a) Hazard Assessment

The Hazard Assessment Matrix was used to gather and validate data through plenary discussions, during which communities identified the nature and behavior of hazards by looking at the following elements: forces, warning signs, speed of onset, frequency, time of occurrence, and duration. Factors affecting the hazards were also identified in order to deepen the hazard analysis, and evaluate the impact of man-made hazards (i.e.,

environmental degradation, changes in climate trends, etc.) as contributing to the increased exposure to natural hazards as perceived by the participants.

Table 1.1: Sample of Hazard Assessment.

<u>Hazard</u>	<u>Forces/ Factors</u>	<u>Warning Signs</u>	<u>Speed of Onset</u>	<u>Frequency</u>	<u>Timeline</u>	<u>Duration</u>
Floods	Heavy Rain	Polluted Water	1 week	Every year	July-Aug	5 days
Drought	Rain shortfall	Soil Cracks	1 month	Every two years	June-Sept	2-3 weeks

A review of disaster history among the surveyed villages was conducted from both a temporal and a spatial perspective, with the latter being facilitated by the use of a Community Hazard Mapping tool. Participants were first grouped by gender and asked to create a graphic visualization of their village topography and resources, and to identify locations at risk, such as areas prone to flood or drought. Community mapping allowed both men and women to illustrate their experiences and knowledge of hazards, as well as their perception of disaster risk. The two groups were then invited to present and comment on their own maps as a means of increasing engagement and interest in the research activities for the day. Very often, maps drawn by groups of women illustrated different resources, priorities, interests and problems than those drawn by groups of men.



Photo 1.1: Villagers in Memong drawing a map of the village



Photo 1.2: Hazard Mapping in Mondulkiri

Where possible, depending on the topography and the level of accessibility, a Transect Walk through the community was performed by the research team to observe the people, the surroundings and resources in the areas which had been pointed out on the community maps as being most at risk.

b) Vulnerability Assessment

The Vulnerability Assessment was conducted within focus group discussions, which resulted in a highly participatory process and helped participants identify the elements-at-risk per hazard type, root causes, external dynamic pressures, and the unsafe conditions in which the elements-at-risk reside.

The elements-at-risk were identified as the people, households, property, crops, livelihoods, community facilities, and environments which may be adversely affected by the hazard. The vulnerability of these elements was assessed using three core categories of analysis:

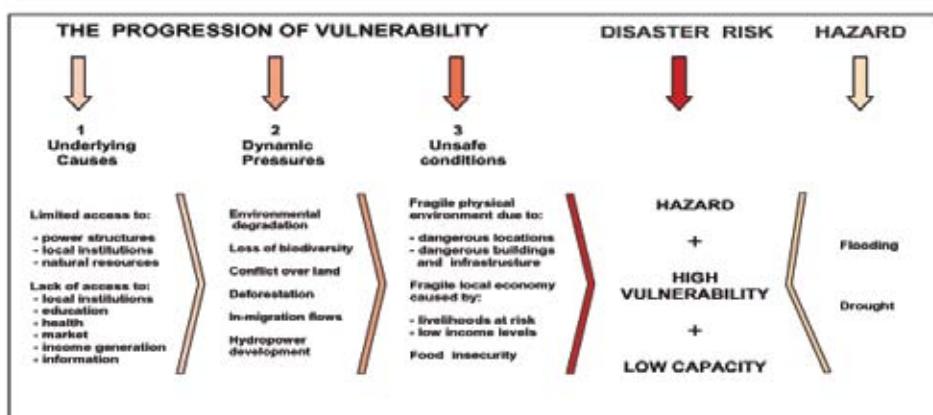
1) Physical/Material; 2) Social/Organizational; and 3) Attitudinal/Motivational.

Root causes, particularly economic, demographic and political processes, which determine the allocation and distribution of resources among different groups of people, were taken into account in connection with dynamic pressures. Dynamic pressures, both internal and external, are processes that channel the effects of root causes into unsafe conditions. Overexploited, degraded natural resources, and other hazard factors driven by human activity, resulting in the increase of the occurrence and severity of the natural hazard, were also analyzed in the context of this vulnerability analysis as dynamic pressures. The Pressure Model¹, illustrated in *Figure 1.1*, was used by the research team to analyze the progression of vulnerability toward the risk of a disaster, which would be triggered when the interaction or combination of a community's state of high vulnerability and low capacity is met with the occurrence of a natural hazard.

Table 1.2: Sample of Categories of Vulnerability Analysis

Physical / Material	Social / Organizational	Attitudinal / Motivational
Weak housing material	Isolation	Fatalism

Figure 1.1: The Pressure Model (Adapted from Wisner et. al. 2004)



¹ First published in 1994 by Blaikie et al (1994:23) and then again in 2004 (by Wisner et al, 2004:49-52), the Pressure and Release Model (PAR) has become the internationally accepted model for the explanation of the progression of vulnerability and the progression to safety.

c) Capacity Assessment

The Capacity Assessment was conducted within focus group discussions in order to understand how people cope with and survive during times of crisis by identifying resources which can be used to prepare for, prevent and/or reduce the damaging effects of hazards.

Table 1.3: Sample of Categories of Capacity Analysis

Physical / Material	Social / Organizational	Attitudinal / Motivational
Houses built at higher level	Connectedness	Cohesiveness, unity, solidarity, cooperation

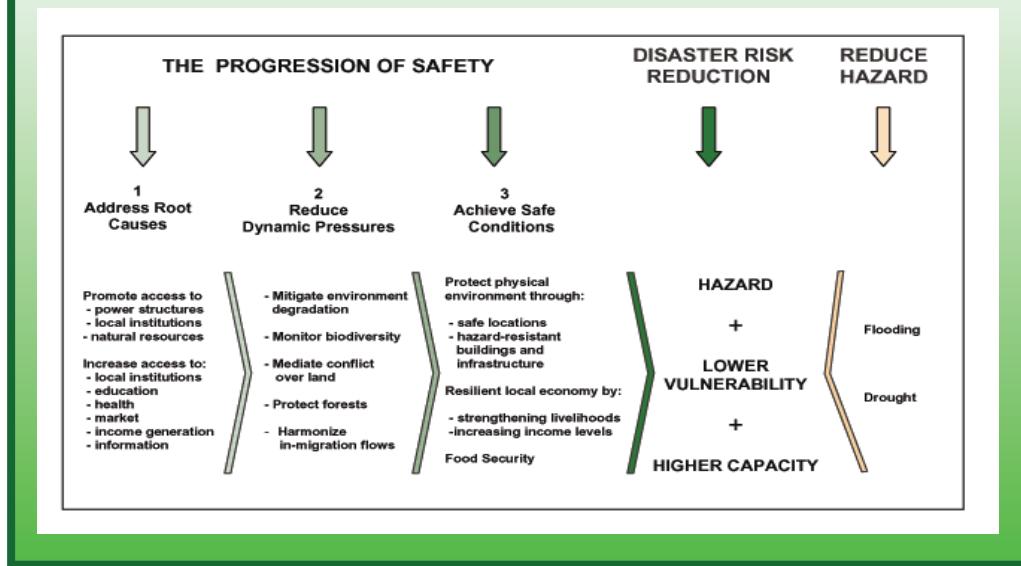
disaster preparedness, mitigation and prevention activities. Capacities were also categorized as Physical/Material, Social/Organizational, and Attitudinal/Motivational.

d) Action Planning

As a final step of the HVCA, action planning was carried out by the community during data validation. Participants in plenary sessions were encouraged at the end of the daily activities to plan and prioritize risk reduction measures which would help reduce vulnerabilities and increase capacities in order to prepare and respond to disasters.

The Release Model, illustrated in *Figure 1.2*, was adapted by the research team to analyze the progression of safety toward the reduction of a disaster risk by identifying means to address root causes, reduce dynamic pressures, and achieve safe conditions.

Figure 1.2: The Release Model (Adapted from Wisner et. al. 2004)



Actions planned and suggested by the participants contributed to form the basis of the final recommendations of the present report.

A disaster risk ranking model was developed in order to prioritize geographical areas of intervention. Villages were first categorized as being *Prone*, *Less Prone*, or *Very Prone*

to the identified hazard according to the likelihood of the hazard striking the community (see *Table 1.4* for the developed risk ranking of categories). Their vulnerability and capacity were ranked as low (1), medium (2), or high (3) in relation to material, social and behavioral characteristics of the communities which either make them susceptible to the damaging effects of hazards or enable them to prepare for and cope with the adverse conditions of a hazard. Findings from this coding were plugged into the following formula:

$$\text{Disaster Risk} = \frac{\text{Hazard} \times \text{Vulnerability}}{\text{Capacity}}$$

Table 1.4: Risk Ranking Process

1 - 2.9	Low Risk												
3 - 5.9	Medium Risk												
6 -- 9	High Risk												
<table border="1"> <thead> <tr> <th>Hazard</th><th>1 = Less Prone</th><th>2 = Prone</th><th>3 = Very Prone</th></tr> </thead> <tbody> <tr> <td>Vulnerability</td><td>1 = Low</td><td>2 = Medium</td><td>3 = High</td></tr> <tr> <td>Capacity</td><td>1 = Low</td><td>2 = Medium</td><td>3 = High</td></tr> </tbody> </table>		Hazard	1 = Less Prone	2 = Prone	3 = Very Prone	Vulnerability	1 = Low	2 = Medium	3 = High	Capacity	1 = Low	2 = Medium	3 = High
Hazard	1 = Less Prone	2 = Prone	3 = Very Prone										
Vulnerability	1 = Low	2 = Medium	3 = High										
Capacity	1 = Low	2 = Medium	3 = High										
Risk Ranking Formula $\text{Risk} = \text{Hazard} * \text{Vulnerability} / \text{Capacity}$													

Based on findings from this formula analysis, villages were finally categorized as being at low, medium, and high risk of disaster in relation to floods, drought, and insect infestation based on the likelihood of the hazard causing damages, losses and disruption in community functioning (see *Table 1.5: Sample of Risk Ranking by Village*).

Table 1.5: Sample of Risk Ranking by Village

	Hazard	Vulnerability	Capacity	Ranking
1 - O'Rang District				
Pu Chorb Village				
Flood	1	2	1	2
Drought	3	3	2	4.5
Insect Infestation	3	3	1	9

This ranking process is intended to be referred solely to the specific context of Mondulkiri Province. The extent to which the selected ranking criteria can be applied to other provinces in Cambodia is not known, with the exception of the Ratanakiri Province where the same ranking model was adopted as part of a parallel mapping exercise conducted by IOM in partnership with the Cambodian National Committee for Disaster

Management (NCDM). The research team is aware that there is a need to ensure a national level of uniformity for research methodologies and ranking models in this type of research initiative. This assessment, however, is one of the first ever of its kind to be conducted in Mondulkiri, therefore, the research team highly encourages the possibility of scaling up the proposed data collection and analysis model in other provinces so as to offer an open and comparative basis to the present data.

The HVCA Matrix, as illustrated in *Table 1.6*, was used to compile the full set of data, including the type of hazard, the vulnerability and capacity in relation to the identified hazard, the disaster risk ranking, and the action plan.

Table 1.6: HVCA Matrix

Hazard	Elements at Risk	Vulnerability			Capacity			Risk Rank	Action Plan
		Physical/ Material	Social/ Organiz.	Attitudinal/ Behavioral	Physical/ Material	Social/ Organiz.	Attitudinal/ Behavioral		

1.2.2 Key Informants

Semi-structured interviews were conducted with key informants in the following government departments at the provincial level: the Provincial Committee for Disaster Management; Provincial Departments of Water Resources and Meteorology; Planning, Agriculture, Forestry and Fisheries; Forestry Administration Social Affairs; and Land Management, and Environment. The format and guided content of interviews is available in *Annex I*.

Meetings were also carried out with non-governmental actors, local NGOs, and CBOs who were involved in programs of support to key sectors such as agriculture, education, food security, forestry, land management, advocacy and awareness, health, environment, and natural resources management.

1.3 Study Site

The research project was conducted in 26 villages, distributed among 14 communes within the four districts of Koh Nheik, Keo Seima, O'Rang, and Pechreada. The targeted districts are located in both the lower southern and upper northern regions of Mondulkiri Province.

1.3.1 Criteria for Selection

Following consultations with key NGOs, commune and district officials, the selection of research sites took into consideration the following elements: a) the diversity of eco-zones (upland, lowland, riverside, or a combination of these); b) the reported exposure to multiple natural hazards; c) the proximity to the major tributary of the Mekong River, the Sre Pok River; and d) existing dynamic pressures, such as loss of forest and other forms of environmental degradation. The remoteness of villages was also considered during the selection process, as some of the targeted communities were chosen due to

their being the farthest from the provincial town of Sen Monorom, requiring a full day's travel by car, motorbike, and/or both. The data source provided by the selected villages has proved, in the course of the assessment, to be adequately representative of the dynamics experienced by the province as a whole.



1.3.2 Research Team Composition

The field research duty station was located in Sen Monorom and the research team consisted of seven (7) members: one research team leader, two (2) supporting research assistants, and four (4) field assistants. The research assistants were selected from qualified final-year university students from the Faculty of Agriculture Economics and

Rural Development of the Royal University of Agriculture in Phnom Penh – one was a Khmer student, and the second was a Phnong indigenous student from Mondulkiri and an active member in the Cambodian Indigenous Youth Association (CIYA). The research team received field support from the Village Focus Group NGO, a local organization having extensive and well-established experiences in Mondulkiri within the education support sector, and offered a key contribution to the research by nominating the four field assistants who worked together with the core team.

Indigenous languages spoken by the researchers and field assistants, a key element for the success of any studies in Mondulkiri, were Phnong and Khmer. On-site interpretation and translation deskwork was done from the local language into Khmer, and then into English. Researchers and field assistants took notes during the assessment, which were then compiled and compared after the daily field work was completed.

1.3.3 Field Work Preparation

A week-long intensive training on the HVCA methodology was conducted in Phnom Penh prior to the deployment of the field research team to their duty station in Banlung. The research team conducted additional onsite briefings on research objectives, orientation, and practical training on research methodology and tools for the four field assistants in preparation for the field work.



Photo 1.4: Mr. Khun Soka, Director of Training Department, NCDM, during the field test conducted in Pu Antreng Village.

Box 1.1: Field Test

A pilot field test was carried out by the research team in Pu Antreng Village, Dak Dam Commune, O'Rang District, with the participation of a representative from the National Committee for Disaster Management (NCDM) to assess the effectiveness of the research methodology and tools in promoting the participation of the villagers during the different stages of the HVCA process.

A pilot field test was carried out by the research team in Pu Antreng Village, Dak Dam Commune, O'Rang District, with the participation of a representative from the National Committee for Disaster Management (NCDM), to assess the effectiveness of the research methodology and tools in promoting the participation of the villagers during the different stages of the HVCA process. This pilot test also provided an opportunity to address unanticipated constraints and methodological gaps. The pilot test served to inspire confidence and team-building within the research team, as well as within the community.

1.3.4 Time Frame

The research study was carried out over a period of six months, with the district field work conducted in three months. The study involved a total of 536 participants, of whom approximately 50% were women.

Table 1.7: Field Work Schedule

Date	Village	Commune	District	Main Ethnicity	Participants
02 March	Andoung Kraloeng	Sen Monorom	O'Rang	Phnong/Khmer	21
03 March	Pu Rang	Sen Monorom	O'Rang	Phnong/Khmer	15
05 March	Pu Tru	Sen Monorom	O'Rang	Phnong/Khmer	26
14 March	Pu Chhorb	Dak Dam	O'Rang	Phnong	23
15 March	Pu Andreng	Dak Dam	O'Rang	Phnong	15
18 March	Pu Ngorl	Memong	Keo Seima	Phnong	20
19 March	Pu Char	Memong	Keo Seima	Phnong	15
20 March	Khneng	Chong Plas	Keo Seima	Phnong	17
21 March	Pu Hung	Chong Plas	Keo Seima	Phnong/Khmer	20
25 March	Gati	Sre Preah	Keo Seima	Phnong	18
26 March	O'Çhrar	Sre Preah	Keo Seima	Phnong	16
06 April	Mean Chey	Sre Sangkum	Koh Nhek	Khmer	31
07 April	Chhuol	Sre Huy	Koh Nhek	Phnong	32
08 April	Sre Huy	Sre Huy	Koh Nhek	Phnong	16
19 April	Chi Miet	Nang Khi Loek	Koh Nhek	Khmer/ Tumpoun, Jarai, Lao	18
20 April	Ro Yor	Ro Yor	Koh Nhek	Phnong, Kroal,Khmer	23
21 April	Ro Vaek	Ro Yor	Koh Nhek	Phnong/Khmer/ Kroa/Jarai/ Thmon	32
25 April	Ou Boun	Or Buonlue	Koh Nhek	Phnong/Khmer	10
26 April	Andres	Or Buonlue	Koh Nhek	Phnong/Khmer	9
29 April	Pu Teut	Bou Sra	Pechreada	Phnong	15
30 April	Pu Lu	Bou Sra	Pechreada	Phnong	19
02 May	Tram Kach	Krang Tes	Pechreada	Phnong/Khmer	18
03 May	Pu Rapet	Krang Tes	Pechreada	Phnong/Khmer	33
08 May	Pu Kreng	Sre Ampom	Pechreada	Phnong/Khmer/ Cham	30
09 May	Pu Chrchang	Pu Chrey	Pechreada	Phnong/Cham/ Khmer	24
10 May	P. Chongphang	Pu Chrey	Pechreada	Phnong/Khmer/ Cham	20
	Total				536

1.3.5 Data Validation

Representatives from the 26 targeted villages, together with the village chiefs and commune chiefs, participated in a 1-day workshop organized by the research team in Sen Monorom upon completion of field data collection and analysis. The purpose of the meeting was to discuss and validate the findings and recommendations of the study with direct beneficiaries, before data were presented at the governmental and non-governmental level, and incorporated into the final report. Data validation represented a key step for the communities, allowing them to take ownership of the course of future natural disaster action planning, and raising awareness for the particular opportunities, capacities and constraints identified for their communities.

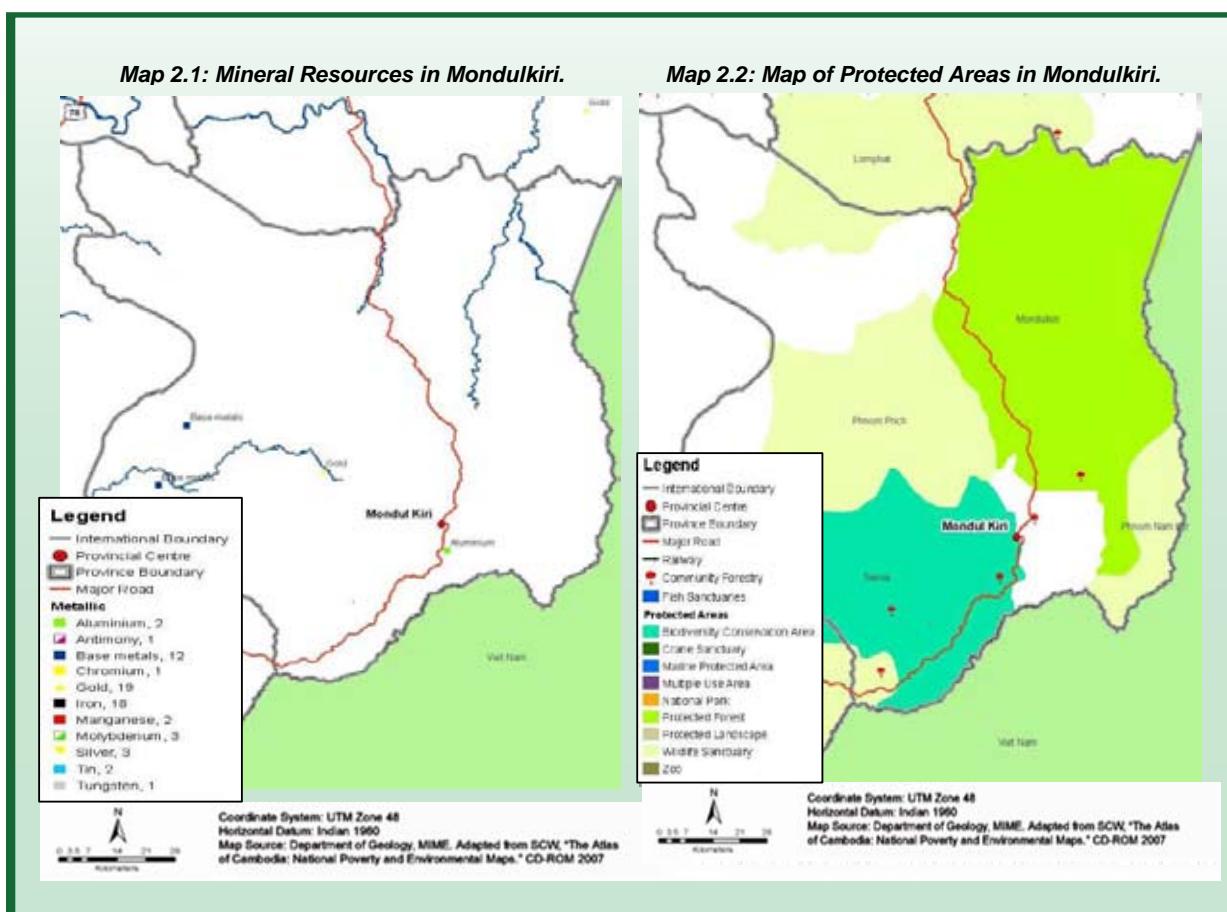
Chapter 2: Mondulkiri Province: *The Overall Context*

2.1 History

Located in North-East Cambodia, Mondulkiri is one of the most remote provinces in the country. Mondulkiri is bordered by Ratanakiri and Kratie provinces, as well as portions of Viet Nam, and was established as a separate province from Chhlong Leu District in Kratie Province in 1962. Economic and national policies established after Cambodia's independence in 1953 had important consequences for the opening of the province to migrants from low-land provinces who wished to pursue rice cultivation, forestry, border trade, and mining activities. Political developments from the 1960s through to the 1980s led to severe disruption of the social and cultural life of indigenous communities living in Mondulkiri. Many of these communities were forced to resettle to other communes and lowland areas in the province, or to Lumphat and Veun Sai districts in the neighboring Ratanakiri Province, particularly during periods of ruling by the Khmer Rouge. Most indigenous peoples were able to resume their practices of swidden cultivation in the 1990s, when security in the province improved. At this time there was a surge of economic interest towards Mondulkiri. However, only once road construction activities commenced in 2002, improving travel and access routes between Cambodia's national capital of Phnom Penh and the provincial capital of Sen Monorom, did a new period of economic changes begin for the province.

2.2 Physical and Ecological Features

Mondulkiri has the largest land area of all provinces in Cambodia (with an area of 14,682 km²), but is the least populated province. It constitutes a core area of Cambodia's 'Eastern Plains', a priority conservation zone within the Lower Mekong dry-forest eco-



region, comprised of a mosaic of *Deciduous Dipterocarp Forest*, mixed deciduous and semi-evergreen forests and savannah grassland.² The province is also characterized by fertile red soils and varied mineral resources.

Table 2.1: Protected Areas and Wildlife Sanctuaries in Mondulkiri

No	Name of Conservation Area	Area (ha)	Location
1	Phnom Prech Wildlife Sanctuary	222,500	Keo Seima district
2	Nam Lear Wildlife Sanctuary	47,500	Pechreada district
3	Mondulkiri Protected Forest	429,438	Koh Nheik district
4	Seima Biodiversity Conservation Area	305,440	Keo Seima district (shared with Kratie Province)

Source: World Wide Fund for Nature (WWF) and Wildlife Conservation Society (2009)

There are four major conservation areas in Mondulkiri: the Seima Biodiversity Conservation Area, the Mondulkiri Protected Forest, and the Phnom Prech, Lumphat and Nam Lear wildlife sanctuaries. The Seima Biodiversity Conservation Area has a total of 305,440 hectares, with some portions shared with Kratie Province, while the Mondulkiri Protected Forest covers 429,438 hectares. Both conservation areas were created by a ministerial decree in 2002 and are managed by the Forestry Administration under the jurisdiction of the Ministry of Agriculture, Forestry and Fisheries. The Phnom Prech and Nam Lear wildlife sanctuaries were declared protected areas by a Royal Sub-decree in 1993. Mondulkiri also shares some portions of the Lumphat Wildlife Sanctuary with Ratanakiri Province and the Snoul Wildlife Sanctuary with Kratie Province. All four wildlife sanctuaries are under the jurisdiction of the Ministry of Environment.³

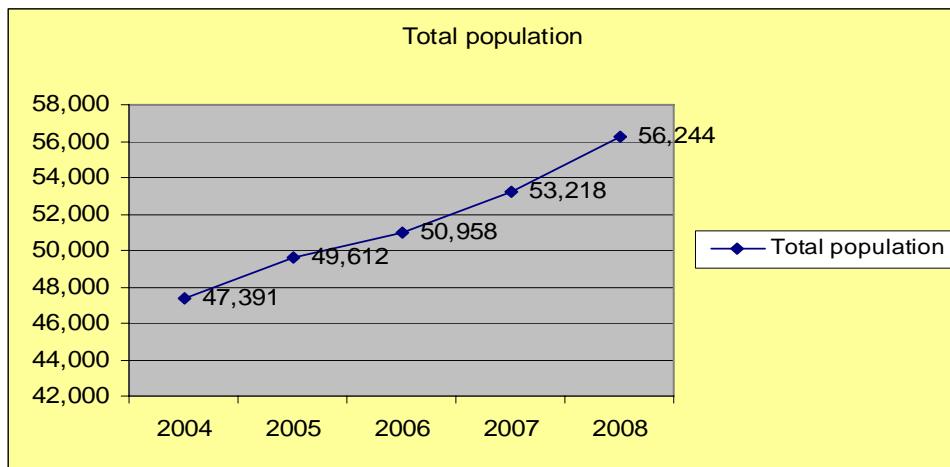
2.3 Population and ethnic composition

According to the Provincial Department of Planning, the total provincial population as of 2008 was 56,244 people, comprising 11,455 families, with women constituting 48 percent of the population. Provincial population statistics from 2004 show an 80 percent population growth in the last five years, mainly due to the influx of Khmer populations into the province. Despite a steady increase of in-migration rates, the province still has the lowest population density of all provinces in Cambodia, with 3.6 persons per km² as of 2008.

² McInnes (2007) and Maling (2007)

³ Provisions for declaration and list of protected areas are in the Annex of the Protected Areas Law of 2008, Royal Decree for Protected Area in 1993 and Royal sub-decree No. 75 in 2002.

Figure 2.1: Population Trends in Mondulkiri

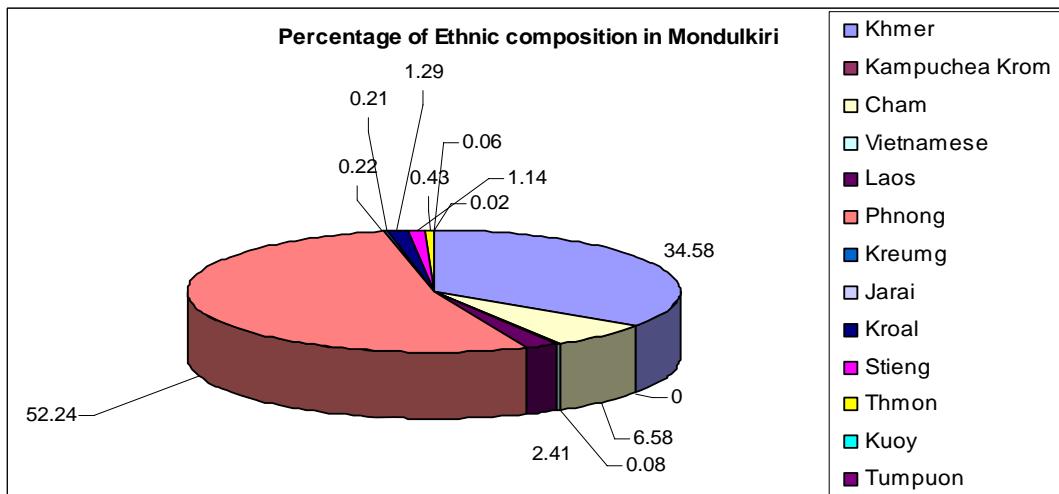


Source: Department of Planning, 2004 – 2008 Annual Reports

2.3.1 Ethnic Composition

Traditionally, the *Phnong* have been the largest indigenous group in Mondulkiri. Provincial statistics in 2008 number this community at 29,382 which represent 52 percent of the total population. There are small concentrations of settlements of *Stieng* and *Kraol* indigenous groups in other parts of the province. The Khmer composition is the second largest group, comprising 34 percent of the population, followed by the *Cham* at 7 percent. The rest of the population is comprised of other ethnic and indigenous groups, such as *Kampuchea Krom*, *Vietnamese*, *Lao*, *Kreung*, *J'arai*, *Kraol*, *Thmon*, *Kuoy* and *Tumpuon*.

Figure 2.2: Percentage of Ethnic Composition in Mondulkiri



Source: Provincial Department of Planning, 2008

The expanding proportion of the Khmer population in the province, which is expected to continue to grow, is not a recent development. As early as 1998, in-migration of people from other provinces already accounted for 18 percent of Mondulkiri's population, and the trend of an increase of in-migration is likely to continue.

2.3.2 Traditions and Beliefs

Phnong indigenous groups are traditionally close-knit, with a typical settlement having anywhere from 50 to 200 people spread in 10 to 40 households, usually separated by several kilometers of forest from the next settlement. Many households are related by kinship or marriage, and collectively farm their land, sharing food and income. They tend to have two houses: one in the main settlement and a smaller one at the rice fields, or *chamkar*, where they temporarily reside during the farming season. There are pockets of solidarity linked to the traditions of sharing and extending interest-free loans between family and close neighbors, which is often used as a coping strategy in times of flood and drought. Traditionally, land in the province is communally owned. The concept of selling individual parcels or retaining ownership of the land after leaving the village is, therefore, new to the *Phnong*.

Mondulkiri's indigenous groups are mostly animist. They believe spirits inhabit elements of their natural landscape, such as trees, mountains, and rivers. Many traditional ceremonies are performed to maintain harmony with these spirits. They also believe that spirits communicate to them through dreams. One type of ceremony is conducted during the rice harvest when families assemble in the rice fields to make an offering of chicken blood and rice wine at a sacred tree that has been transplanted from the forest into the village. After making these offerings, the older women of the family sing to the 'soul of the rice,' asking for a good harvest and harmony among the family as they all work together in the rice field. After a small feast, the rest of the day is spent harvesting.

Many people fear the loss of protection by their spirits, as large parts of forest areas have been cleared for development, and river water polluted by mining operations. This fear often influences their perception of disaster risk, as the loss of spirits is seen as a leading factor of increasingly severe and unexpected natural hazards events.

Village elders play an important role in traditional decision making as well as maintaining practices and customs in the village. Their community functions range from adjudicating village conflicts and planning farming sites to leading traditional ceremonies which link the community to the 'spirit world'. However, the introduction of government structures at the village level, with the appointment of a village chief, has resulted in the decline of the village elder's role.

2.4 Economics and Livelihoods

The *Phnong*'s traditional livelihood is based on non-irrigated shifting cultivation where upland rice and other crops are grown. Upland farms, also known as *Miir*⁴, are located several kilometers away from the settlement and are scattered throughout the forest. They are characterized by multi-crop planting, having several varieties of rice which are grown in one field to minimize risk of crop failure. After about two to six years of farmint, these fields are then left to fallow for 10 years or longer before they are cleared again for use by either the same family or another village family, according to customary use rights. Secondary food and income sources, such as cassava, yams, beans, corn, squashes and leaf vegetables, are often inter-cropped with upland rice. Depending on the terrain, lowland rice is also grown by villagers. The annual farming calendar begins in April to May, with clearing of new upland fields and plowing of paddies, followed by

⁴ *Miir* is the Phnong word for chamkar, the traditionally cultivated areas in Ratanakiri Province.

planting of rice and other crops, in June. In December and January, rice harvesting takes place.

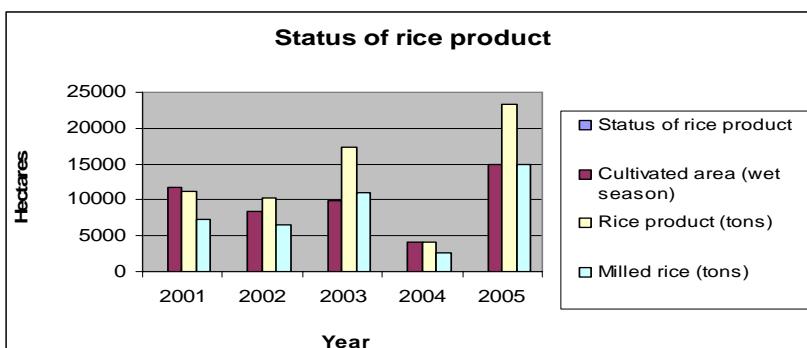
As the rice production from upland farming is rarely enough for the whole year, the *Phnong* supplement their food and livelihood with non-timber forest product collection and hunting. Non-timber forest products (NTFPs), such as vines, bamboo, vegetables, fish, wild meat and medicinal plants, provide household food and sustenance, particularly in times of crises. Fish from the rivers and streams serve as a main protein source.

Most households raise small livestock, however, these rarely eaten as they are traditionally used for special occasions or emergencies (e.g., weddings or a ceremony for a serious illness). Wealthy households may also own a few cattle, one or two buffaloes, and/or an elephant, to be used as working animals.

2

The provincial economy is largely based in agriculture, with 85 percent of the population engaging in primary and secondary agricultural activities. Upland rice cultivation continues to be the primary source of livelihood for many of the indigenous groups. Total cultivated area of wet season rice is more than 20,000 hectares, with an average rice annual yield of 1, 100 kg per hectare. Total land area for cash crop cultivation by cash crop farmers is 15,333 hectares.

Figure 2.3: Rice Production in Mondulkiri



Source: Provincial Department of Agriculture Annual report (2001-2005)

2.4.1 Changes in Livelihoods: Cash Crop Farming

The shift from traditional upland farming to cash crop farming has made major changes in the provincial economy, whose area of cultivation is increasing. Until five years ago, there was little interest in cash crop production as there was no market for these products. Major cash crops in the province include cashews, cassava, coffee and soybeans. These crops are commonly grown at a smaller family scale on land previously used for upland rice. Increasingly, commercial farms with large landholdings having paid farm workers are now found along the main roads throughout the province. Chemical inputs and use of modern agricultural machines and techniques are commonly used for this type of cultivation. Large areas of forest land have been cleared around the province for planting cash crops, rubber and other commercial plantations. At present, most of the proposed agricultural areas for this type of development overlap with designated conservation areas, such as the Mondulkiri Protected Forest (MPF).

Since the 1980s, resin tapping has become the most important source of household cash income in the surveyed villages. Once tapped by villagers, resin is then traded in market chains which include local traders, wholesalers, transporters, domestic retailers and exporters. Since 2006, non-governmental organizations have been providing financial, material and technical support to local resin tappers to form a resin association in order to reduce the monopoly of wholesalers and make prices more competitive. Despite the improvement in prices, a reported decrease in resin production in Mondulkiri was attributed to the expansion of economic land concession areas which restrict the villager's access to resin tapping areas.

Large scale cultivation of rubber plantations began in early 2000. Many villagers in the study areas converted, or are in the process of converting, their upland rice cultivation farms into rubber plantations and planting other cash crops inside their farms, such as corn, peanuts, green beans and cassava. The *Cham* were said to have introduced cash crop farming to indigenous villages in 2001. The *Cham* ethnic groups are not traditional rice growers but mainly rent out land to plant cash crops within rubber plantations. Some of the surveyed villages have stopped wet rice cultivation to do cash crop cultivation as it was expected to provide better cash income.

2.5 Governance

Mondulkiri is divided into five (5) administrative districts, 21 communes and 90 villages. Provincial level administration (*Khet*) is headed by a Governor appointed by the central government. The *Khet* is then supported by 11 Deputy Governors who are appointed to a four-year mandate.

The Districts (*Srok*) do not have enough resources to support their own development activities. Since the 1980s, the districts have focused on maintaining security in the rural areas, while development initiatives lagged behind. Since 2006, the *Project to Support Democratic Development through Decentralization and Deconcentration* (PSDD), a multi-donor initiative led by the United Nations Development Programme (UNDP), has given funds to three pilot districts for natural resource management and livelihoods activities.

The commune's power and functions are described in the Law of Administration and Management of Commune/Sangkat (LAMC), which also identifies their role in linking villages to the government. Communes are formally involved in the day-to-day affairs of the villages and in the implementation of small projects, such as village roads and bridges. The commune chief mediates inter-village conflicts. The commune offices are responsible for identifying priority areas of intervention at the village level for the preparation of community development plans. In 2002, each commune council member was elected to a five-year term. Of the total 107 councilors elected for that term, more than 90 percent of the 107 commune councilors were *Phnong*.

At the village level, the village chief is appointed by the commune council based on guidelines set by the Ministry of Interior. The village chief has the responsibility of reporting village issues and problems to the commune. Along with institutionalized roles in local governance, however, traditional leadership, especially in the most remote villages, continues to be predominantly exercised by village elders in day-to-day community decisions. This is an important feature of indigenous groups' identity, as well as providing a means for their cultural preservation, as elders share information about traditions and pass on indigenous knowledge to younger generations.

The National Policy on Indigenous People of 2009 recognizes indigenous traditional governance as the main means for dispute resolution mechanisms at the village level. The policy also entails the recourse to the national justice system through national courts for cases where the traditional resolution mechanism fails.

2.6 Status of Natural Resource Management

The economic development of Mondulkiri poses multiple threats to indigenous communities' traditional access to and management of natural resources. Three predominant challenges surrounding natural resource management in the province were identified as: 1) Land tenure; 2) Forestry; and 3) Water management.

2.6.1 Land Tenure

Indigenous land tenure is a pressing issue in the province, particularly in two conservation areas, namely the Mondulkiri Protected Forest (MPF) and the Seima Biodiversity Conservation Area (SBCA), which have been traditionally inhabited, used and managed by the *Phnong* indigenous group. At present, there are 28 villages living inside the core zone and within the buffer and the bordering areas of SBCA, and 34 villages in the Mondulkiri Protected Forest. The field study covered twenty of these villages in the two conservation areas.

The main threats to indigenous land tenure are massive land clearing for cash crop farming and agro-industrial plantations, as well as logging and mining activities conducted within and outside the conservation areas. Indigenous communal land rights were recognized and guaranteed by the Land Law of 2001. Articles 24 and 25 of the law defined communal lands as those areas where indigenous communities have established their residence and practice their traditional agriculture, including reserving lands for rotational farming.

The Forestry Administration led the process of participatory land use planning (PLUP) in partnership with organizations like the Wildlife Conservation Society (WCS). The PLUP process has taken place with communities in the Seima Biodiversity Conservation Area and help communities identify different land uses which are supportive to the management of the conservation area. This process is formalized through the issuance of a PLUP agreement with the community. It is expected that land use planning can facilitate better understanding of land and forestry laws, establish trust between government implementers and communities, and ascertain clearer land rights by identifying the boundaries of village communal lands, as well as land uses and claims within the village. For instance, Gati Village, one of the surveyed villages located in the core zone, has undertaken the participatory land use planning coordinated by the Forestry Administration (FA). Under the PLUP agreement with the FA, each family from the village will be allocated five hectares to use for their residence and farming activities.

The PLUP process complements the piloting of legal identity registration as a prerequisite for indigenous communal land ownership as provided by the Land Law of 2001. Before communal lands can be titled, however, legal identity of indigenous groups has to be registered through a set of guidelines set by the Ministry of Interior. The Sub-Decree on Procedures of Registration of Land of Indigenous Communities, which will provide the basis for communal land titling, has just been approved by the Council of Ministers in June 2009. In Mondulkiri, one legal identity has been registered for the *Phnong*

indigenous community in Andoung Kraoeleng Village. The village covered 25,000 hectares located inside the core zone of the Seima Biodiversity Conservation area.

As of 2009, WWF estimated that a total land area of 126,700 hectares had been allocated or identified for economic land concessions in Mondulkiri, mostly for rubber plantations. Most of these concessions are found in the core zone of the conservation areas. Many of the villages assessed claimed that there was little or no consultation on the operations of these concessions, especially in O'Rang and Pechreada districts, despite what was stated by the Sub-Decree on Economic Land Concessions in 2005. The Sub-Decree notes that, in relation to the need for an environmental impact assessment before the concession is granted, such an assessment is to be conducted through public consultations with all relevant stakeholders, including villages and civil society groups.

2.6.2 Forestry

Land and forest management issues are closely linked, as most of Mondulkiri's forest and land areas are located in the conservation areas. Two conservation areas, SBCA and MPF, are categorized as Protection Forests and are part of the Permanent Forest Reserve under the Forestry Law of 2002. Protection forests are those maintained primarily for protection of forest ecosystems and natural resources. Customary user rights to NTFP collection are allowed as long as they have minor impacts on the forest. The law requires that a National Forest Management Plan be approved by the Forestry Administration to determine appropriate use and management of forest resources at all levels.

2.6.2.a Mondulkiri Protected Forest (MPF)

In 2007, the Mondulkiri Forestry Administration Cantonment and the World Wide Fund for Nature (WWF) drafted and approved a Forest Management Plan 2008-2012 for Mondulkiri Protect Forest (MPF). The forest management plan provides a 20-year long term vision for the protected forest, a five-year management plan and a zoning plan to facilitate forest management. Based on the management plan, the MPF has four zoning classification system:

1. Strict Protection Zone (SPZ), or core zone, is primarily designated for conservation of natural resources and wildlife, including river species within the dry forest mosaic. Hunting, logging, wildlife collection, and fishing in the Sre Pok River are prohibited. All forms of agriculture, permanent structures and cattle grazing are prohibited. Registered tree owners will stop resin harvesting within three years from the signing of the MPF management plan.
2. Regulated Use Zone (RUZ), or buffer zone, is an additional area for conservation, serving as a buffer zone between the core zone and the community use zone. This zone also provides a wildlife corridor to and from adjacent protected areas. Restrictions are similar to those set for the core zone, but all NTFP collection is granted upon issuance of a special permit which also allows for fishing through legal and authorized methods in the Sre Pok River and its tributaries.
3. Community Use Zone (CUZ), or bordering zone, provides for designated communities to graze cattle, conduct subsistence agriculture and harvest NTFPs on a sustainable basis. Commercial plantations are not permitted and expansion of settlements is permitted only with the approval of the Forestry Administration.

4. Ecotourism zone (ETZ) is designated as areas for tourism, infrastructure development and intensive ecotourism use. Uses in this zone shall be detailed in the Ecotourism Management Plan, which is currently being drafted.

2.6.2.b Seima Biodiversity Conservation Area (SBCA)

The Seima Biodiversity Conservation Area used to be the site of former logging concessions before it was declared a protected forest in 2002. In 2004, the Forestry Administration led the finalization of the conservation management strategy for the Seima Biodiversity Conservation Program.⁵ The Wildlife Conservation Society is mandated to provide technical and financial inputs to this strategy, and co-manages the conservation area as well. The strategy provided directions on legal enforcement, monitoring, capacity building for implementers and an administrative structure to support enforcement. Its ten year goals emphasize the need for defining customary forest user rights and indigenous land titles for local communities. The promotion of environment preservation through reduced dependence on degraded natural resources is expected to help local communities stabilize, while allowing both forest resources and wildlife to recover and be restored.

Despite the increased efforts of local authorities in support of natural resource management, different zone management systems often overlap and there is low awareness and weak enforcement of the new laws and management plans. Local communities identified deforestation as major threats to sustainable forest management and their customary forest use rights, including logging and land clearance, over-harvesting of economically important products like resin, bamboo and malva nuts, and growing mining interests in or adjacent to the protected areas.

2.6.2. c Protected Areas

Mondulkiri is home to Phnom Prich and Narm Lear wildlife sanctuaries, which were declared as protected areas by the Royal Decree on the establishment and designation of protected areas in 1993. Phnom Prich wildlife sanctuary covers a total land area of 222,500 hectares, while Phnom Narm Lear covers 47,500 hectares. Mondulkiri shares portions of Snoul Wildlife sanctuary with Kratie Province, and Lumphat Wildlife Sanctuary with Ratanakiri Province. The passage of the Protected Area Law of 2008 provided a framework for the management, conservation and development of protected areas. The wildlife sanctuary is among the eight categories of protected areas identified by the Royal Decree. Four zoning systems apply to each of the eight protected areas:⁶

1. Core zone are areas of high conservation values containing threatened and critically endangered areas, and fragile ecosystems. Access is only permitted for scientific and nature studies for conservation and protection of biological resources and natural environment;
2. Conservation zone are also areas of high conservation values containing natural resources, ecosystems, watershed areas and natural landscape located adjacent to the core zone. Small scale community used of NTFP for ethnic local minorities' livelihood may be allowed under strict control;
3. Sustainable use zones are areas for national and economic development, and conservation of protected areas for local communities and indigenous ethnic

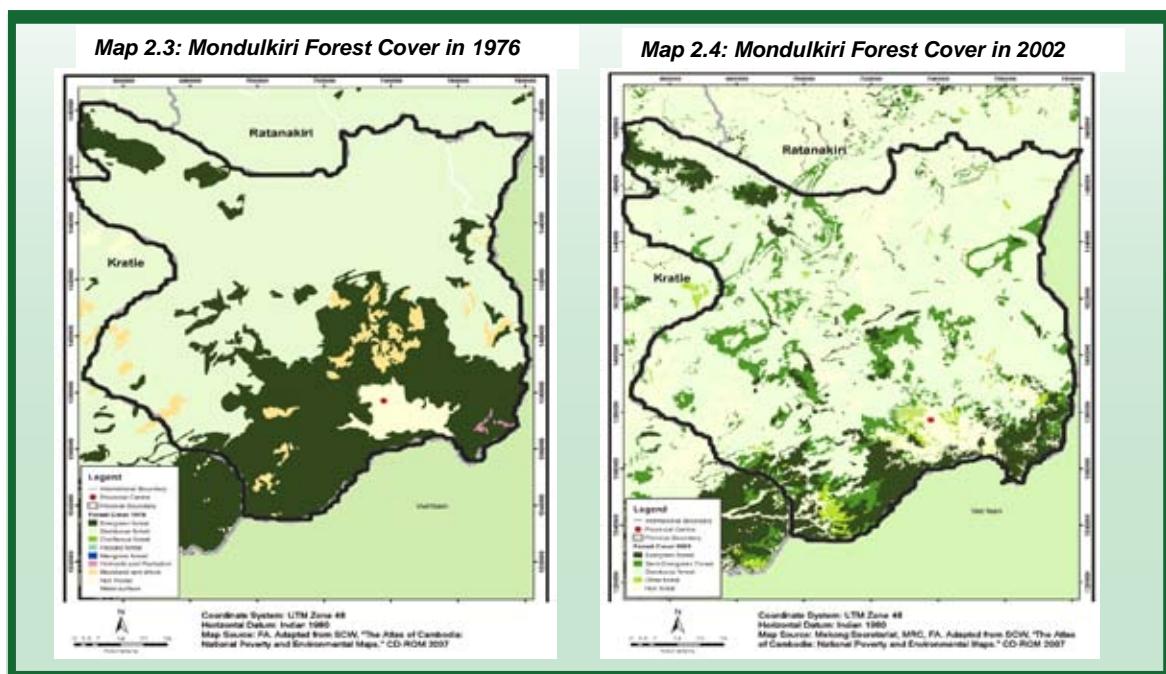
⁵ For the full report on the conservation management strategy for SBCA, see Antony J.Lynam and Men Soriyun (2004). *A Conservation Management Strategy For The Seima Biodiversity Conservation Area, Southern Mondulkiri: Guidelines for Law Enforcement and Administrative Structure*. WCS.

⁶ Chapter IV on Zoning of the Protected Area Law of 2008.

- minorities. Sites under this zone are those allocated for national cultural heritage, ecotourism, wildlife preservation and recreation, biological rehabilitation, community protected area, and infrastructure development (irrigation, reservoir, hydro-electricity), mining and sustainable resin exploitation;
4. Local community zone are areas reserved for socio-economic development of local communities and indigenous ethnic minorities as well as areas where existing residences, paddy fields or swidden farms are located.

The research has shown that the protected areas of Mondulkiri face management challenges. These challenges include unmonitored exploitation of resources (timber poaching, the harvesting of wood for fuel, charcoal production, wildlife hunting and trading) and habitat changes as forest lands are converted for agricultural, settlement and agro-industrial purposes, as well as mining exploration activities inside the forest. The construction of a road from Mondulkiri to Viet Nam is expected to cut through the northern section of the protected forest. The Provincial Department of Environment also highlighted during individual interviews with department officials how forest clearing, within and outside the forest state land, and economic land concessions are putting environmental and economic pressures on these resources. These developments encourage the expansion of land markets and changes in agricultural practices and land use.

Although it is difficult to quantify the loss of forest cover experienced by the Province over the past decades, assessed villages fear that continued deforestation of areas used not only for their traditional agriculture, but also for burial grounds and areas considered to be sacred and inhabited by spirits will continue to lead to loss of natural habitat and biodiversity, the erosion of their cultural identity, and restrictions to their livelihood options.



Deforestation in the protected areas is a growing problem. Certain parts of the Phnom Narm Lear Wildlife Sanctuary and the MPF had been separated for economic purposes.

Assessed villages claimed that the proposed lands for concessions overlap with lands for rotational farming. Issues related to economic land concessions in the surveyed sites are very sensitive, as villagers report that they have not been adequately informed about the size of the lands to be developed by the concession company. Issues of conservation and protection in the province highlight emerging tensions between traditional use and management of forest, access to wildlife resources, and conservation authorities who enforce the law.

Conservation organizations in the province are helping to establish 21 community protected forests inside and close to conservation zones to be managed by local residents, which are currently in the process of community consultations and boundary demarcation.

2.6.3 Water Resource Management Issues

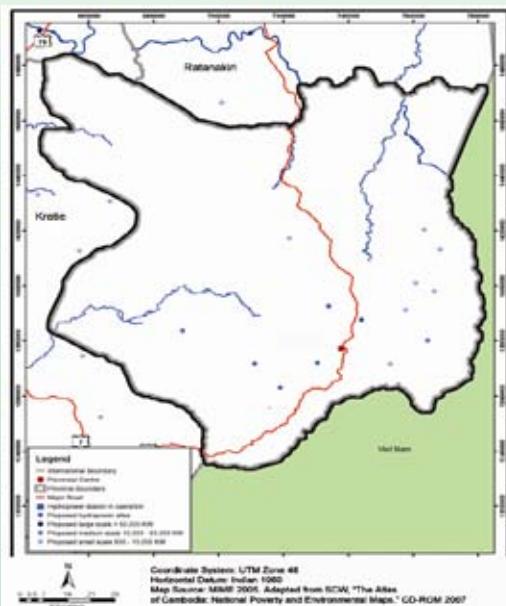
The 1995 Agreement on Cooperation for the Sustainable Development of the Mekong River Basin provides the current foundation for cross-border cooperation in water resource management in the Mekong River Basin among the governments of Viet Nam, Cambodia, Lao PDR and Thailand. The agreement's focus is on promoting cooperation to support the sustained development, use, management and conservation of water resources (as well as other related resources) of the Basin. These activities are to be conducted in a way that optimizes multi-state use, while still minimizing the harmful effects of any natural or man-made hazards. This Agreement has further been supported through the signing of MOUs and Action Plans between Viet Nam and Cambodia to further strengthen cooperative water resource management.

Mondulkiri is part of the 3Ss (Sekong, Se San and Sre Pok) river sub-basin where the Sre Pok River flows across. The Sre Pok River is a major tributary of the Mekong River Basin, and covers an area of approximately 30,900km², of which 12,650km² lies in Cambodia. It originates from Central Highlands of Viet Nam before joining the Se San River in Ratanakiri, the Sekong River in Stung Streng, and the Mekong River. The river is high in biodiversity and home to hundreds of different fish species. Several deep pools in the river serve as an important dry season refuge for fish stocks, thus contributing to the fishing industry of Cambodia. A total of 29 streams that discharge water into Sre Pok River in Mondulkiri and Ratanakiri were identified, of which 10 streams are in Mondulkiri.

A number of hydropower projects are either in operation, planned or under construction in the Sre Pok River in Cambodia and in Viet Nam. In Viet Nam, four dams – Buon Tuah Srah, Buon Koup and Sre Pok 3 and 4 – are under construction, and two dams, the Drah Hinh 1 and 2, are in operation. In Cambodia, two dams, the Lower Sre Pok 3 and 4⁷, with a projected installed capacity of 330 and 235 MW, respectively, are being planned. The Ministry of Industry, Mines and Energy identified 29 hydropower projects in Cambodia that are under study. Three proposed dams, Prek Por I, Prek Ter II and Sre Pok 4, will be located in the Sre Pok River inside Mondulkiri.⁸

⁷ Mekong River Commission map of existing, under construction, and planned/proposed hydropower projects in the Lower Mekong Basin as of September 2008.

⁸ Regional Multi-stakeholder Workshop on MRC Hydropower Program in Vientiane, Lao PDR, 25 -26 September 2008.

Map 2.5: Hydropower Development in Mondulkiri.**Map 2.6: Hydropower Development in the Region.**

There are growing concerns among local communities that these developments will have significant impacts on the hydrological cycle of the river. These impacts can result in increased soil erosion, siltation and the sedimentation of deep pools that are the spawning grounds of fish and other aquatic species, as well as cause more frequent flash floods, particularly when water is released from these dams in conjunction with heavy rainfall patterns. Furthermore, fish migration is dependent upon predictable water flow regime. The operations of hydropower dams in Viet Nam have been pointed also as a major source of flooding in the Sre Pok River.

2.7 Human Development Issues

Lack of access to education and primary health care are key human development concerns in the Province. Widespread malnutrition was observed during the assessment, although no updated data were found.

2.7.1 Education

The 2008 provincial planning data shows that of the 8,966 primary school-age children, only 66 percent are attending school. Among the school age children from 12 to 14, the provincial attendance rate is only 70 percent.

Field observations indicate that these attendance figures may be lower, as many of the primary schools in remote villages do not have complete grade levels. Low attendance rates among indigenous children, especially those in remote villages are attributed to combinations of factors that include a lack of teaching materials, an obstructive learning environment, poor infrastructure, absence of classrooms and constant absence of teachers who mainly come from outside the village. Many children miss classes to assist their families in farming activities during the rice-growing months, attend to livestock and help with the collection of non-timber forest products. Distance and the financial costs of living away from their villages are major considerations for students who wish to

continue their high school in the provincial town. Only a few students receive government scholarship for their studies.

The illiteracy rate is composed of 40 percent of adults aged 16 to 60, of which 51 percent are women, with illiteracy mainly affecting the indigenous population. Khmer is not a language widely spoken among the *Phnong*. The Provincial Department of Education, Youth and Sport (POEYS), in collaboration with NGOs in the province currently conduct 62 literacy classes. These informal education classes are held in villages, where formal education is not always accessible.

2.7.2 Primary Health Care

Levels of access to basic health and social services were low in the studied areas as a result of inadequate facilities and poor health service quality. Some of the ailments commonly reported in the surveyed villages were water-borne diseases, malaria, dengue, diarrhea, and tuberculosis. Maternal and child health status is very poor, and deaths from giving birth and birth complications were reported to be high.

In the research locations, people expressed that they expected that health facilities would provide free health services. In available health centers, however, people had to pay for medical services, such as the bandaging of wounds (which would cost around 10,000 riel) and 500 riel for each visit, including some medicines. Only pre-natal check-ups were reported to be free of charge. Some districts have an adequate supply of medicine while some do not. In many cases there is no accounting for medical supplies by the staff.

The villagers' reluctance to use health services was found to be due to the absence of health posts and/or medical staff in the village, as well as the lack of financial resource to afford health services and medication. Some villagers did not know where the locations of health posts were and showed a tendency to not seek medical attention if they regard their illness as mild. Certain traditional beliefs also played a role in the attitude towards health services.

Box 2.1: Illness and Black Magic

Many *Phnong* villagers believe in 'black magic', which is used on a victim to induce sudden death or illness. Black magic is believed to be disguised in the form of a tiger in the forest whereby those who encounter this tiger become petrified and get sick right after.

Those accused of witchcraft are brought into the presence of the village elder who performs certain ceremonies to prove whether the person is guilty or not. If the person is not proven guilty, the accuser will have to compensate the accused.

2.8 Conclusion

Mondulkiri's historic, economic and geographic isolation is reflected in its weak governance, poor infrastructure development, and low human development indicators, which highly contribute to levels of low adaptive capacity of communities to respond to and recover from the impact of natural hazards and climate variability.

Since its creation as a province, Mondulkiri has undergone several political, economic and social changes that have opened the province to lowland migration, economic

interest in its natural resources, cash crop and other commercial farming, and large businesses and plantations.

Mondulkiri is facing enormous natural resource management pressures, mainly in relation to indigenous land tenure, forestry, and water resource management. Deforestation has been widely reported across the province, with even many of the conservation areas experiencing massive clearing and habitat changes resulting in rapid wildlife and biodiversity loss. The expansion of land markets as a result of demand for Mondulkiri's land and forest resources is putting even more environmental and economic pressure on communities. The local government and line departments have weak institutional capacity and insufficient resources to effectively enforce national laws on land and forestry or monitor violations in the province, particularly in the conservation areas.

Aside from its forest and land resources, Mondulkiri's water resources are also under threat. The Sre Pok River is the target of hydropower development as a response to demands for energy generation in the region. Hydropower dams operating in Viet Nam and proposed dams inside Cambodia continue to have a significant impact on the hydrology of the river, affecting biodiversity and migration of river species and the quality of the water. There are grounded fears among surveyed villages that further construction of hydropower dams in the Mekong tributary will contribute to more severe flooding in the Sre Pok River and affect their sources of food and livelihood.

The passage of several important national laws and policies on land, forestry, protected rights and indigenous rights provide a framework for sustainable land and forest management, protection of customary rights of indigenous ethnic minorities to land and forest resources, and participation in formal decision-making processes at the local levels.

There is already some headway in the implementation of the provisions of these laws on community-based natural resource management and communal land rights. Although still limited, community-based mechanisms such as participatory land use planning, recognition of community protected areas, and legal identity registration for communal land rights have strong potentials for empowering communities to participate in decision-making for communal land rights and sustainable natural resource management. A clearer operational mechanism for the implementation of communal land titling is urgently needed.

Chapter 3: DRR and Decentralization in Mondulkiri Province

3.1 Decentralization Reforms in Cambodia

Decentralization reforms in Cambodia started in the early 1990s after the signing of the Paris Peace Accord that led to the election of a new government in 1993. The first phase of the reforms focused on helping Cambodians re-integrate back into society through the delivery of rural development services and the piloting of local planning processes and structures in a few selected provinces. The pilot led to the formation of provincial rural development structures, commune and village development committees, and the construction or rehabilitation of roads, school buildings, water and sanitation and health facilities. In 1996, the *Seila* program was launched as the Royal Government of Cambodia's policy efforts to alleviate poverty and develop rural economies using decentralization mechanisms at the provincial and commune levels. The first phase of this decentralization 'experiment' lasted from 1993 to 2000 and was technically and financially supported by CARERE (Cambodia Area Rehabilitation and Regeneration), a multi-donor support programme led by the United Nations Development Programme (UNDP).

3

The second phase of the *Seila* programme, from 2001 to 2005, focused on developing national policies that would reflect the lessons learned in the first phase. The Law on Administration and Management of Communes/Sangkat (LAMC) attempted to define roles and responsibilities of the communes in development planning. The law also vested to the commune certain legislative and administrative powers, as well as resources to enable it to manage local affairs effectively. It has also provided administrative links to villages, whose formal authority, the village chief, is chosen through appointment by the commune council.

A sub-decree was issued in 2002 providing for the elections of commune councils to a five-year term. Another sub-decree was passed in the same year providing for the decentralization of powers and functions of communes, as well as consultation mechanisms for villagers and stakeholders, and broad directions for linkages between ministries and communes. The commune fund was also established to cover administration and local development, and investment expenditures sourced from national government transfers and contributions from loans and grants by donor agencies and international financial institutions. This phase was supported by *Partnerships for Local Governance* (PLG), another multi-donor programme that succeeded CARERE led by the UNDP.

Towards the end of this phase, the Royal Government of Cambodia led the development of a National Strategic Framework for Decentralization and Deconcentration (D&D) in 2005 with an emphasis on harmonizing management systems for all sub-national government levels and operating on five decentralization reform principles (outlined in Box 3.1).

Following these strategic goals, a landmark legislation, *the Law on the Administrative Management of Capitals, Provinces, Municipalities, Districts and Khans*, was signed in 2008. A major provision of the law is the establishment of a council at each level of

governance, with legislative and administrative powers issued through a *deika* or by-law.⁹

The council shall be actively involved in the development and implementation of development plans with particular provisions to assess the priority development needs of women, men, youth, children and vulnerable groups including poor people and indigenous people. The law also provided that the councils develop a land and natural resource management framework, as well as a disaster management plan, as part of their planning responsibilities. Also in 2008, the Law on Elections of Capital Council, Provincial Council, Municipal Council, District Council and Khan Council was enacted and the first council elections were held in May 2009.

Box 3.1 Five Pillars of the D&D Strategic Framework.

Representation: expanding powers, duties, responsibilities and resources of councils at all levels in accordance with the principles of democracy.

Participation: enabling people, especially women, vulnerable groups and indigenous minorities to participate in decision-making at all levels.

Accountability: strengthening accountability at all levels of public administration by citizens' access to and oversight of the administrative and financial affairs.

Effectiveness: bringing public services closer to users by allowing citizens to participate in planning and monitoring public services in order to meet local needs and priorities.

Poverty Reduction: enhancing local capacity in using resources to support poverty reduction activities, especially vulnerable groups, indigenous minorities and women and children in order to achieve the Millennium Development Goals of Cambodia.

3.2 Disaster Risk Reduction in Decentralized Cambodia

In 1995, the government of Cambodia established the National Committee for Disaster Management (NCDM), an inter-ministerial body under the presidency of the Prime Minister, to serve as the national-level mechanism for the planning and implementation of disaster management, preparedness and mitigation activities, accompanied by an effective emergency response program.

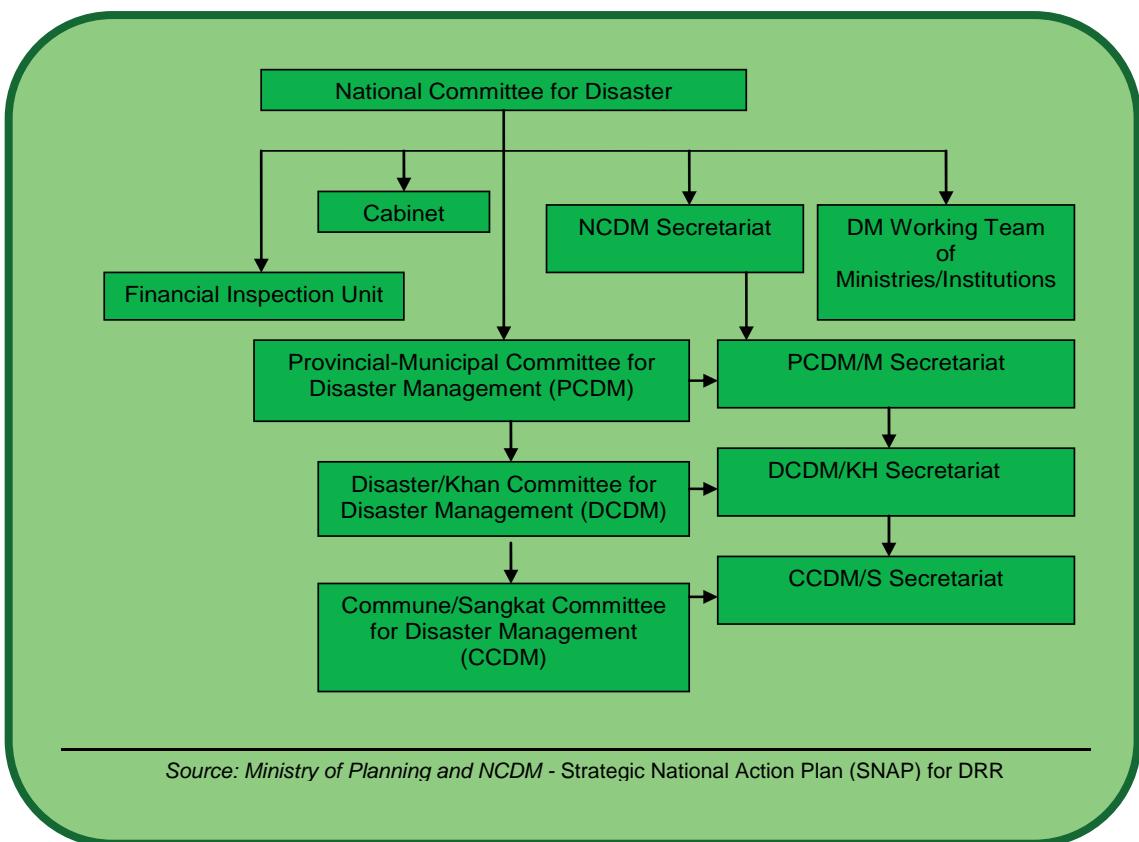
In 2002 a royal decree was approved, outlining NCDM's tasks to coordinate and advise the government and stakeholders on all relevant policy and programs areas of disaster management, including raising the awareness of communities and developing human resources for disaster management. A sub-decree in the same year defined its roles and processes and structure, and committees for disaster management at the municipal-provincial and district levels were created; while a later sub-decree passed in 2006 provided for the establishment of the commune committee for disaster management (CCDM). The NCDM structure and its coordination mechanism of line committees are illustrated in Figure 3.2.

The creation of the CCDM has the important potential to give impetus to the shift from emergency response to disaster risk reduction, which was lacking in earlier policies, laws and committee responsibilities.

⁹ Chapter 3 of the 2008 law defines a by-law as a legal rule approved by the council and has scope to determine, prohibit or oversee activities, procedures, or any works under the scope of functions, duties and resources of the council.

As part of its commitment to the *Hyogo Framework for Action (HFA) 2000-2015*¹⁰, the NCDM led the drafting and adoption of the Strategic National Action Plan (SNAP) for Disaster Risk Reduction for 2008 – 2013, which gives a strong emphasis on ‘sub-national level capacities, particularly at the community level’.

Figure 3.1: NCDM Structure and Coordination Mechanism.



High priority was given by the SNAP to capacity building, integration of disaster risk reduction at sub-national development planning, and the promotion of community-based disaster risk management at provincial, district and commune levels. While pending the approval of the Disaster Management Bill, the SNAP contributes to build upon the National Strategic Development Plan (NSDP) for 2006-2010, which stated the need for community disaster preparedness and protection of rural communities from disaster risk as a high developmental priority, and upon the National Poverty Reduction Strategy (NPRS) where natural disasters were identified as a trigger to the increased socio-economic vulnerability of rural communities.

Another important policy document that complements the SNAP is the Cambodia National Adaptation Programme of Action (NAPA) to Climate Change signed in 2006. The document reflects Cambodia's national commitments to the United Nations Framework Convention on Climate Change (UNFCCC), and it falls under the responsibility of the Ministry of Environment and the newly created National Climate Change Committee (NCCC).

¹⁰ Adopted during the World Conference on Disaster Risk Reduction held in Hyogo, Japan in 2005.

More recently, the 2009 National Policy on Indigenous People¹¹ includes, amongst other key development sectors, the participation of indigenous people in policy formulating, planning, implementing and monitoring activities in the area of disaster management.

3.3 Decentralization in Mondulkiri Province

Mondulkiri's decentralization experience is very recent, as the implementation of the *Seila* program only began in the province in 2003, when a participatory local planning process was introduced at the district and provincial levels. The Provincial Strategic Development Plan for 2006-2010 aims to: 1) increase rural development through decentralization and deconcentration in order to improve people's livelihood through the sustainable management of the environment and natural resources; 2) mobilize economic resources to improve access to water, land, power, and road; 3) facilitate the privatization of investments; and 4) promote technical and vocational trainings. Commune councils lead the development of a 5-year commune development plan where stakeholders and villagers are expected to be consulted. Annually, priority projects for a three-year commune investment plan are presented and deliberated during the District Integration Workshop, facilitated by the Department of Planning. The workshop is attended by line departments and non-governmental organizations that can support investments in specific projects. The Provincial Planning Department is charged with the task of channeling all investment and project data into the Commune Development Plan Database.

The communes and provincial line departments receive both government and non-governmental funds. Since 2003, three districts have annual budgets from the National Resource Management Project as part of the Project to Support Democratic Development through Decentralization and Deconcentration (PSDD). The Provincial Government receives an annual budget from the national government, which is disbursed through the Provincial Investment Fund (PIF) and made available to line departments for proposal bidding. The proposed projects must be in line with the commune investment plan. The line departments must also have a full implementation structure required to carry out project implementation. The Executive Committee of the Provincial Rural Development Council (PRDC) oversees work plan implementation and donor support. All 23 line departments are members of this committee.

Under the decentralization strategy, attempts are made to avoid overlap in implementation of line departments, communes and NGOs through the investment planning process and the PRDC. Prior to 2003, line departments worked with the Province and communes based on their sectoral mandates with limited coordination of projects.

3.4 Decentralization and DRR in Mondulkiri

Efforts towards the interaction between decentralization policies and disaster risk reduction strategies in Mondulkiri are found in the establishment of the Provincial Committee for Disaster Management (PCDM) as the sub-national structure for DRR. The PCDM in Mondulkiri is chaired by the Provincial Governor and vice-chaired by the Deputy Provincial Governor. Its members include directors of relevant provincial line departments and the Red Cross. However, no committees for disaster management at

¹¹ Adopted on April 24, 2009 by the Council of Ministers.

the district and commune levels have been institutionalized nor is there any disaster management plan in the province.

When faced with natural hazards, villagers usually report the incidence to the commune chief who then submits a report to the district, and then to the province where the appropriate provincial line department is to review the request. This incidence report mechanism seems to operate out of a formal CCDM-DCDM-PCDM chain. At the line department level, deployment of external assistance depends on availability of technical and human resources.

Some disaster response activities activated by the PCDM members include:

- **The Provincial Department of Water Resources and Management** is mainly responsible for the construction and maintenance of irrigation schemes, water management for drought, cooperation with district and commune offices in establishing farmer water user community (FWUC), and inventory of existing irrigation schemes.
- **The Provincial Department of Agriculture** provides technical assistance to farmers through its 40 staff stationed throughout the province and based on request from the communes. No specific program is in place for insect infestation and requests for assistance on insect infestation are generally forwarded to the Ministry of Agriculture, Forestry and Fisheries (MAFF). The technical team from MAFF decides on the assistance and action to be given.
- **The Provincial Department of Environment** works on awareness raising and education programs on environmental regulations and laws for communities living inside the conservation areas. The Department has forest rangers working inside the conservation areas under the direct control of the Department of Environment, namely the areas of Narm Lear, Lumhat and Phnom Prich Wildlife Sanctuaries. They also oversee waste and pollution management, and monitor the enforcement of laws within 21 communes located in protected areas.
- **The Provincial Branch of the Red Cross** distributes relief assistance to victims of wild fires, drought and floods in coordination with other provincial line departments, and promotes the establishment of a volunteer networks with related training activities.

3.4.1 Challenges

3.4.1.a Disaster Risk Reduction to Natural Hazards is Not Considered a Development Priority

Natural hazards are acknowledged by commune, district, and provincial officials to have an impact on people's livelihoods, but there is no corresponding program to support demand for emergency response and relief activities and post-disaster recovery. While they are considered to contribute to people's vulnerability, there is nothing in the commune development plan that addresses people's coping capacity to these hazards.

3.4.1.b Institutional Capacity Response to Natural Hazards is Fragmented and Weak

There is no disaster risk reduction strategy for institutional response and capacity to hazards. At the local level, attempts are made during the local planning process to harmonize priorities of different line departments, stakeholders and communes. Commitments made by line department on sections of the commune investment plan are only those that are in line with their mandates. The current reporting and feedback mechanisms for incidents, made at the local level, are vertical, and feedback is not timely.

Some overlaps in the mandates of certain line departments were found during the study. For instance, the Department of Agriculture, the Department of Water Resources and the Department of Rural Development were reported to distribute water pump machines during drought, and requests are processed according to each departmental procedure.

Research found that there is no systematic collection of data that could inform disaster preparedness measures. Key departments do not have enough human resources and technical capacity to fill these data gaps. Research findings also reveal that no early warning or notices have been issued for any of the natural hazards identified, which is particularly dangerous in the context of flash floods.

Among non-government organizations, most DRR efforts involve emergency response and relief. Limitations include accessibility to very remote villages, human and technical resources for a medium to large-scale emergency response, and a lack of capacity to manage multiple hazards occurring concurrently or simultaneously, as well as a lack of capacity to adapt to future shifts in climate.

3.4.1.c Lack of Trust Between Government and Communities

While decentralization in Mondulkiri is leading to increased involvement in local decision-making, many local villagers are still wary to work with the government. Many villagers expressed feelings that their local government leaders are not working in their best interest. There is also perceived and actual duality in the implementation of community-based natural resource management (CBNRM) in conservation areas by department officials as ethnic minority groups, primarily the *Phnong*, become the focus of enforcement of laws that they do not fully understand. The rapid pace of deforestation to give way to large-scale plantations is affecting people's land tenure, security, livelihoods and beliefs, and there is no systematic link between community-based natural resource management and disaster risk reduction in light of the threats of environmental degradation.

3.4.2 Opportunities

3.4.2.a Potentials for Mainstreaming DRR into Community-Based Natural Resource Management

With a large part of the province managed as conservation areas, disaster risk reduction strategies can be linked to community-based resource management where community-based disaster risk management (CBDRM) can complement current policies, with more focus on strengthening people's adaptive capacities to the impacts of both natural

hazards and environmental degradation. However, it is important that there is recognition for community based natural resource management as a means to preserve indigenous people's identity, as these communities have always maintained a culture of communal ownership in which they see their livelihood secured and protected. This recognition is a key element for building consensus for action on CBDRM at all levels, including within local communities and community-based organizations.

3.4.2.b DRR in Commune and Provincial Development Planning

There is space to raise awareness of local government councils on disaster risk reduction. The process of consultation with villagers for commune development planning and commune investment planning can be used as a venue to raise disaster risk reduction as a development priority of the communes. With DRR as a development priority, there are more opportunities to get line departments, the province and other stakeholders to commit support for DRR activities.

At the provincial level, a similar process can be initiated in order to formulate a Provincial Disaster Risk Reduction Plan. This is in line with the provision of the 2008 Law on Administrative Management of the Capital, Provinces, Municipalities, Districts and Khans, which emphasizes the role of the newly-elected councils in formulating a development plan that responds to the needs of vulnerable groups including indigenous peoples, and the development of disaster management plans.

Fieldwork findings pointed towards very strong interest levels among villages to form a village disaster management team (VDMT) that could monitor different hazards. This interest is crucial as ownership of a process is important for community based disaster risk management.

3.4.2.c National Policies Supportive of DRR and Indigenous People's Rights

Two national actions plans, the Strategic National Action Plan (SNAP) for Disaster Risk Reduction for 2008 – 2013 and the Cambodia NAPA, support community-based disaster risk management, and strategic adaptation projects that can be the basis for CBDRM Programs and DRR plan for the province. The passage of the National Policy on Indigenous People of 2009 covers key sectors of environment, health, land, agriculture and water resources, energy, infrastructure and justice which are all crucial components of adaptive capacity to disaster risk for natural hazards and climate change. The policy provides strong directions towards respect for and recognition of indigenous people's rights and their role in the sustainable management of natural resources. There are also provisions for participation in planning and decision-making at all levels, as well as on the need to strictly enforce environmental impact assessments and to address issues of displacement and resettlement for affected indigenous groups.

3.5 Chapter Conclusion

The introduction of decentralization in Mondulkiri through the *Seila* program has brought changes to local governance in the province by bringing decision-making processes closer to villages. While some changes have been made in terms of bringing more accountability into local government administrative systems, people's participation in development planning is still limited. National policies providing for the mainstreaming of disaster risk reduction and indigenous people's rights in sub-national government levels present both challenges and opportunities in the province.

Decentralized governance in the province is evolving in a context where institutional capacity is weak and fragmented and that there is distrust between the government and villagers. The Provincial Committee for Disaster Management does not have the capacity or the resources to perform its mandate, and is dependent upon member line departments, which are in themselves limited by their own sectoral mandates and responsibilities. Furthermore, natural hazards have been acknowledged to have an impact on people's lives but have not been highlighted as a local development issue.

Lastly, tension between government and villagers become intense as communal natural resource rights are threatened and disaster risk levels resulting from environmental degradation become higher. However, local governance does provide strong potential for community-based disaster risk management initiatives. The commune development and investment planning processes are formal platforms for mainstreaming DRR as a local development and natural resource management priority. Community-based disaster risk management can complement community-based natural resource management provided that local ownership and protection of indigenous rights are secured in order to build people's resilience in a sustainable manner.

Chapter 4: Hazards, Vulnerabilities, Capacities

This chapter presents the key findings on the types of hazards identified during the course of the study, and the vulnerability and capacity analyses of the assessed communities in their response to and recovery from these hazards. The findings are presented using the three categories of analysis used to collect and analyze data – physical/material, social/organization and attitudinal/behavioral.

4.1 Floods

Mondulkiri has historically experienced annual flooding events, with findings from research surveys highlighting risks for both slow onset and flash flooding. Three broad types of flooding were identified to be affecting Mondulkiri: 1) Flash floods triggered by torrential rains and resulting in the overflowing of streams and tributaries; 2) Flooding caused by seasonal water level variations and, where relevant, the operation of the hydropower dam in the Sre Pok River in Viet Nam; and 3) Seasonal flooding resulting from heavy rainfall during the wet season.

The National Committee for Disaster Management has defined flash floods as resulting from the flowing of heavy rainfalls from the mountainous areas into streams and tributaries. These floods often occur swiftly and last for short periods, however, they have the potential to cause severe damages to village crops and infrastructure.

In Mondulkiri, most floods described by communities are characteristic of flash floods, resulting in part from the province's landscape of mountainous regions and streams and small tributaries inside valleys. Certain districts surveyed for this research noted that they experience flash floods annually, with these events typically lasting for two or three days. Villagers believed floods were caused by large amounts of rain, compounded with water surges, and that settlements along streams were more vulnerable to these events than those located in higher areas. A history of flash floods in surveyed districts is outlined in *Table 4.1*.

Mondulkiri is most prone to flooding during the rainy season, when villagers are often working in their paddy fields or upland farms. When flooding occurs in a slow onset and seasonally predictable manner, villagers only experience low to mid levels of risk. However, when driven by torrential rains, water surges from surrounding streams or hydropower dam operations, such as the dam in the Sre Pok River of Viet Nam, flash flooding can occur, having severe impacts on the well-being and livelihoods of communities, as was the case of the recent 2007 floods.

Table 4.1: Flash Flooding History in Surveyed Districts of Mondulkiri

District	Year
O'Rang	1996, 1997, 2007
Keo Seima	2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, and 2008
Pechreada	1993, 1994, 2007, 2008
Koh Nhiekk	1973, 1980, 1983, 1992, 1993, 1994, 2002, 2003, 2004, 2006, 2007, and 2008

Source: IOM 2009, HVCA, Village Summary, Mondulkiri

Table 4.1 illustrates that the frequency of flash flooding, which is shown to have increased in both the Koh Niek and Keo Seima districts. Whereas all districts experienced some level of annual flooding, flash flooding was observed particularly to be increasing in severity and frequency.

The deforestation in Mondulkiri was often referred to as the major cause of flash floods within the province. The loss of forest cover was noted to have put more pressure on the quality of the soil, and decreasing the absorptive capacity of tree roots. It was also noted that a loss of forest cover was allow water to flow over landscapes faster, leading to further soil degradation, the erosion of river banks and hills and, at times, triggering landslides.

4.1.1 Vulnerability

Despite a noted history of risk to flooding, Mondulkiri was not identified in the SNAP as being one of the Cambodian provinces vulnerable to flooding, as prepared by the National Committee for Disaster Management (NCDM).¹² However, findings from the report demonstrate that villages in Mondulkiri are at risk to not only seasonal and slow onset flood events, but also to flash flooding, which can occur in a swift and severe manner.

4.1.1.a Physical/Material

Geographic exposure to flooding

Provincial villages most prone to flooding are those located in lowland areas near the Sre Pok River and streams. Flooding can affect these areas several times during a single rainy season, especially during the peak wet months of August and September.

From the surveyed districts, two areas, namely Keo Seima and Koh Nhieк, were identified as being especially prone to flash flooding. Koh Nhieк District's topography is marked by different streams which flow within Mondulkiri, as well as water resources from the Sre Pok River, which is shared with Viet Nam. Much of the district is comprised of lowland areas and is prone to seasonal flooding. However, villagers within the district expressed a greater concern over the increased intensity of flash floods experienced by their villages between 2002 and 2008. Villagers also noted that dam operations in Viet Nam had changed the hydrology of the river. Increased operations upstream due to dam management, combined with forest clearing activities along main roads and streams within the province, have increased the vulnerability levels of at-risk villages to both slow and fast onset events. Koh Nhieк District communities further noted that flash floods had left them vulnerable to recurring crop failures, livestock losses and damage to infrastructure.

¹² In the Strategic National Action Plan (SNAP) for Disaster Risk Reduction 2008 - 2013, flash floods were identified as the second major type of flood in Cambodia. Flash floods have been reported in the provinces of Ratanakiri and Kandal, Kampong Speu, Kampot, Pursat, Battambang, Kampong Chnang, Preah Vihear, and Odor Meancheay. Mondulkiri was not identified as either vulnerable to or affected by any of the hazards mentioned in the publication, including drought, flood, storms, and forest fires.

Testimonies from two villages in Or Buonleu Commune reveal the vulnerability to flooding experienced by villagers living alongside streams. Villagers who lived along the O'Chbar stream, close to the O'Nom dike, experienced flooding in 2002, 2004, 2007, and 2008. Villagers perceived that flash floods were caused by the frequent breaking of the dike, as well as by water surges from the higher part of the O'Chbar stream. Damages to properties and food stock often result during floods, when villages become inundated. The location of village rice fields also makes them susceptible to flooding, causing severe damages to rice crops and resulting in food shortages in the community. The Andres Village, from the same commune, also noted a risk of flooding caused by the collapse of the O'Nom dike. Flash floods resulting from the collapse of the dike was said to severely impact the livelihoods of the community.

The Meanchey Village in the Sre Sangkum Commune, Koh Nheik District, is surrounded by numerous streams, including the O'Yes, O'Chbar, O'Klorb, O'Chhok Dek and the O'Trav. As many of these streams are prone to flooding, particularly in times of heavy rainfall, which can last from one to three weeks, the village becomes heavily impacted by floods. The overflowing of streams surrounding the village destroys rice seedlings as well as other agricultural crops of the village, including corn, melon, cucumber and pumpkin. When paddy and agricultural fields become flooded, water often sweeps in tree branches and leaves, further impacting crops and degrading the soil quality. During times of flood, the village also experiences damage to infrastructure, including to the covering of the local road, which blocks the flow of traffic to the commune and district centers.

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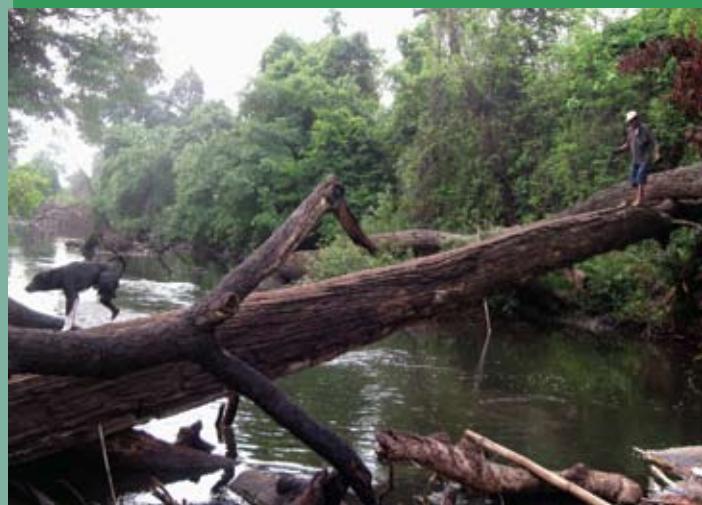


Photo 4.1: Villager in Memong using a fallen tree as a bridge to cross the stream

Box 4.1: Isolation Due to Floods

Forced isolation from transportation networks threatens the well-being of communities, both in times of flooding, and in the aftermath of events when relief and assistance for related conditions (such as diseases in humans as well as livestock) is most needed.

Flash flooding was cited as frequently impacting the rice yields of communities, particularly when rice was planted in lowland areas. In Ro Vaek Village in the Ro Yor Commune, for example, flash floods occurring in 2007 led to substantial crop failures. The village was able to only salvage one third of its normal yield, leaving the community to face both food shortages and economic instability.

Ro Yor Village is located alongside the O'Chbar and O'Ro Yor streams inside the Mondulkiri Protected Forest, where the community has little land available to move to

when existing settlements and agricultural plots are impacted by frequent floods. The two streams often create flash floods during the wet season, cutting off road access to areas outside of the villages, and destroying paddy fields.

Box 4.2: Flood Damage to Boats

Villagers in Ro Yor reported that the flash floods which occurred in 2006 and 2007 were the most severe they had ever seen, with crops and infrastructure being destroyed and livestock, including pigs and chickens, being swept away. Currents from the floods were so strong that some boats were also lost to stream surges.



Photo 4.2: Traditional bamboo raft and wooden boat in Koh Nhek

Chi Meat Village, in Nang Khi Loek Commune, was identified as being most prone to flash flooding in the province due to its close proximity to both the O'Chbar and O'Chi Meat streams, as well as the Sre Pok River. Communities located near multiple streams and rivers must monitor the water levels of these sources concurrently and develop evacuation routes for the most extreme cases when all water bodies are flooding. In villages such as Chi Meat, this is a challenging task.

Villages prone to repetitive events find it challenging to monitor shifting water levels and plan for mitigation and response activities. Villagers of Khneng Commune, in Keo Seima District, reported that, in 2007, flash floods occurred in their village seven times during the rainy season. Each event ranged in speed of onset, from three hours to overnight.

Testimonies collected using research surveys in Chimeat Village included reports of flash flooding from 2007. During these events, water levels reached up to 1.5 meters in the village, inundating houses and killing livestock, including hundreds of chickens, a few cows and several pigs. Infrastructure used by villagers for their livelihoods, including five rice mills and two generators being used to provide power to the community, were also flooded. Families who had chosen to store rice stocks in the village rice barn lost their entire supplies, as the building storing their rice stocks was completely inundated with flood water. Villagers also had a difficult time evacuating from the village, as few families in the village owned motorboats.

In Keo Seima District, villages in Memong and Chong Plas communes were identified as being prone to flash flooding, with villagers noting that these occurrences began in 2002 and had increased in intensity each year through 2008. Flash flooding caused livestock deaths, destroyed paddy fields and household gardens, and covered paths used to cross streams, making the village unable to access external assistance.



Photo 4.3: Bridge made of wood and bamboo connects two villages

Box 4.3: Demand for Bridge

Villages in Memong and Chong Plas communes expressed a need for building bridges that would be strong enough to withstand water surges from surrounding streams.

Villages, such as Pu Lu Village in Bou Sra Commune, often noted that families who lived along streams despite knowledge of the recurrence of these events and risk levels were the most vulnerable to both flash and seasonal flooding. These families often lost their rice crops annually to the flooding of streams, as well as to debris dragged over their fields by water torrents. Flash floods, in particular, were categorized as sometimes carrying dead trees or branches into fields and villages, further eroding landscapes such as agricultural land and river banks, polluting drinking water sources, and destroying crops and gardens.

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Flash floods were noted to vary in intensity throughout the districts which were studied, however, almost all communities affected by these events noted that, during times of flooding, roads and transportation networks were typically limited or completely severed. This loss of access to surrounding areas also occurred in some areas with seasonal flooding, illustrating a need to upgrade infrastructure that considers the impacts of hazards.

Box 4.4: Search for Safe Evacuation

Some villages also expressed that, due to their geographic location and vulnerability to floods, assistance was needed to develop evacuation plans, which would allow even women and school children to safely cross streams to reach designated areas.



Photo 4.4: Dead trees and branches on a stream after floods

The village of Pu Teut¹³, in Bou Sra commune, is an example of a village surrounded by numerous streams, with at least one stemming from Viet Nam. Located along the banks of the O'Pure, Pu Teut is surrounded by seven additional streams and rivers. Although, this village is vulnerable to flash flooding which destroys rice paddies and infrastructure, it currently does not receive information from relevant authorities, either in Viet Nam or Cambodia, on changes in water levels. The village is, therefore, a clear example of a community with multiple physical characteristics of being at risk for flooding, and requires not only local but also cross-border support to mitigate and reduce risk levels.

Changes in location of rice fields

During the research surveys for this project, some villages noted that, due to exposure to flooding, they had either moved or planned to move their rice fields to areas considered to be less vulnerable to hazards. However, communities noted that this initiative could be challenging due to a lack of access to different lands, the vulnerability of areas surrounding their villages, particularly those located near more than one stream or river, and the loss of land purchased by 'outsiders'.

Testimony from villages in Nang Khi Loek Commune illustrated the need for, and challenge of, relocating rice fields due to hazards. Communities in this commune noted that they had been forced to stop gardening in traditional plots located along the Sre Pok River due to its tendency to flood multiple times during the rainy season. The same communities noted that they were not only losing rice crops to these floods, but had also lost household assets including small power generators, rice barns and livestock. Some villages noted that they were forced to abandon over 8 hectares of rice fields due to constant flooding.

Some villagers in Nang Khi Loek Commune had to abandon their rice plots and move to another family plot within their village, as villagers tended to have more than one plot of land. However, it was noted that many villagers are now selling their land to outsiders, limiting their ability to shift to new areas. As the increase of in-migration of outsiders was expected to continue, and villages did not directly express plans to stop selling plots of land, it is expected that areas where communities can shift their rice plots to will continue to be limited. This can have severe consequences on food, economic security, and livelihoods within flood-affected communities.

Flood dikes

Some streams running through or near villages in Mondulkiri have had, or still have, flood dikes installed to control the flow of water. In the past, the O'Chbar stream had a dike which was used to store water for irrigation and control downstream levels of water to mitigate flooding. However, villagers expressed concern and frustration at the number of dikes which are either broken or require maintenance and upgrading. Communities in the communes of Ro Yor, Nang Khi Loek, Or Buonleu, Sre Sangkum and Sok San all noted that dikes in water sources around their villages were in need of maintenance or rebuilding assistance, some even requiring extensive work.

¹³ Pu Teut is a Khmer name; the Phnong call the village Bu Antoeut.

This need demonstrates that support for the physical mitigation of flooding cannot be 'one off' or short-term. Infrastructural support needs to be offered alongside sustainable financial and social resource support to train individuals in dike management and maintenance, and to ensure that, once built, these structures are monitored and upgraded as necessary.

Houses and infrastructure

The structural integrity of houses in some villages was observed to be weak and vulnerable to damage in the event of flooding. While some families in various communities were able to build houses out of more sturdy materials such as wood and raise them on higher posts to decrease the inundation of water in the houses, the homes of most villagers were still made of thatched roofs and bamboo walls. These types of houses, though being traditional and making use of readily-available materials, were not regarded as safe or sturdy structures which could withstand the onset of floods.

During field research, many houses were observed to have structural posts made out of young trees, which were often small and of poor quality. In the village of Nang Khi Loek, the losses suffered from flooding in 2007, when waters reached 1.8 meters high and destroyed rice banks as well as the local road, villagers decided they would save money and invest in stronger housing structures. Since the 2007 floods, villagers have slowly been investing, whenever possible, in building raised houses, approximately 2.5 to 3 meters high, made of 'good' wood. Villagers who were not able to afford new and more structurally sound homes tried to restore what remained of their old homes after each flood instead, using whatever money was available to them.



Photo 4.5: House under construction in upland Miir

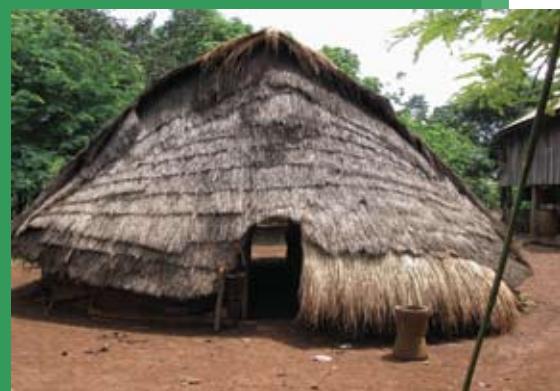


Photo 4.6: Thatched roof and bamboo walls house in Pu Rapet

This lack of financial capacity to save and invest in stronger, more flood-resistant infrastructure was emphasized by various villagers in numerous communes. It was suggested that this lack of capacity, rather than a lack of will or knowledge, was what limited communities from building more appropriate structures.

Houses were not the only structures noted by communities to be vulnerable to flooding. In some villages, rice barns or storage huts, often built close to the ground, are also at risk of flooding. Found in the communes of Nang Khi Loek, Sre Sangkum and Or Buon Leu, as well as various other villages surveyed, these storage structures are often

inundated with water once floods reach a height of one meter. Communities again expressed a desire to invest in more flood-resistant structures for storing rice, but often noted a lack of financial capacity to do so.

Effects on human health and livelihood

Villagers in many communes noted that, as a result of flooding, communities experience an increase in outbreaks of water-borne diseases. Villagers spoke of the outbreak of diarrhea, malaria and dizziness during and after flooding. Aside from the increased risk of diseases carried by mosquitoes, such as dengue and malaria, villagers were also at risk of disease caused by drinking flood waters, or water that had been contaminated by surges. While villagers in some areas, such as in Pu Ngorl, reported that they knew they should not drink this water, they said that they had no choice, as the wood typically used to fuel fires which could be used to boil and treat water was often lost in floods.

Box 4.5: Risks Associated to Floods

Some villagers, primarily in communes with forest cover, reported that, in times of flooding, poisonous or dangerous animals and reptiles would come into their communities and homes to escape the water. They noted that this was a clear threat to their health, particularly the well-being of the elderly and children.



Photo 4.7: A child kills a snake in Koh Nhieck

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Villagers presented many examples for the loss of livelihood stability due to flooding, as well as the loss of traditional coping strategies that were used in times of hazards. When food was needed during hazards, families traditionally used available forests to harvest NTFP, resin, and hunt wild animals. However, the loss of forest land has reduced village access to these resources.

Where communities still had access to forestry resources, this access was often prevented during flooding events, making it difficult for villagers to collect products, move to upland farms and paddy fields, or visit markets. Flooding also often had negative impacts on livestock, with many surveyed villages sharing similar stories on the deaths of pigs, chickens, and even larger livestock during times of more severe flooding. The loss of these resources sometimes became a hazard in itself, with carcasses of animals causing illnesses in the village, or people risking their own safety in the process of trying to save them during flooding. Among the villages of the Chong Plas and Memong communes, cases were recorded where men had attempted to save livestock that were

being swept away by floods, and, as a result, had either drowned or been seriously injured by these efforts.

Villagers also believe that they had lost their livelihood or fallen into poor health because they could not perform traditional rights and prayers to their spirits. These spirits were perceived as providing them protection, but the ceremonies used to pray to them often could not be conducted during floods, as the areas where they were traditionally held were flooded. These ceremonies often take place in designated special forests and burial grounds.

4.1.1.b Social/Organizational

DRR activities relating to flooding in Mondulkiri are only now beginning to become a priority area, in spite of the clear risk levels of villages. Limited local efforts in disaster management have focused on disseminating emergency relief rather than on supporting awareness or preparedness activities. Three NGOs – Development and Partnership in Action, Wildlife Conservation Society and Action Against Hunger – were identified as having previously supporting various communities in emergency response efforts. One community also noted that there was another NGO working on disaster risk reduction activities, but was not able to provide further specific information.

Surveyed areas noted that they had not received external assistance from districts during or after flooding events. It was expressed that villagers were not sure if this was due to inaccessibility, or a lack of information and awareness about the risk levels of villages to flooding. The villages had no early warning systems in place to alert them to floods. Communities could be more closely supported by other organizations and governmental authorities if they were given ways to engage in information feeds about risk levels and the occurrence of events. Community-based organization was perceived to be limited, primarily due to a lack of external assistance in the form of information, social, and physical support to mitigate and build resilience to flooding.

In some cases, community cohesion was also mentioned as being fragmented by flooding, as villagers sometimes had different levels of coping capacity to manage the floods. Those who had access to resources such as boats, savings, or additional lands to temporarily relocate to, were in a much better situation of managing floods than those with minimal resources or savings, even if both were located in the same community. Villagers spoke of cases where families with boats only helped their own relatives rather than others in the village. But this was often expressed more as a case of a lack of time and resources to help others, rather than a lack of will.

Communes reported that when they could, they reported incidences of flooding to the Provincial Department of Social Affairs, particularly when the impacts of flooding were prolonged or severe. Commune authorities in Ro Yor and Nang Khi Loek reported that, wherever possible, they would disseminate information on possible threats of floods, but that this information would only reach villagers if they listened to national radio broadcasts. It was unclear if this flow of information had been organized in such a way that communities knew where they could learn of flood risks. All villages were in clear need of social and organizational support to both monitor risk levels and disseminate information on events, damages and needs.

4.1.1.c Perceptional/Motivational

Many villagers expressed frustration at their inability to adequately prepare for and manage the impacts of flooding, even though they suffered from property and agricultural losses annually. Communities said that they needed more external support to deal with flooding, particularly flash floods. Some communities, such as Memong Village, noted that they needed support in pursuing their normal coping strategies, such as being given assistance in moving livestock to paddy fields where they conducted wet rice cultivation and lived in during times of flooding.

Perceptions of most villagers focused on the need for outside assistance to prepare for flooding, but suggested that they required more immediate physical and financial resources, rather than longer term developmental or social assistance. During surveys, villagers stated that they were unable to provide adequate materials to cope with flooding, and requested the provision of medical supplies and ways to purify water. However, they also expressed interest in receiving support on learning modern agricultural techniques as well as receiving related tools, and required support for the cost of visits and treatments by animal health workers.

As local authorities reported that they could only inform villagers on weather forecasting conducted at the national level, communities said that they could only rely on limited information from these channels. Some communities have built locally proactive mechanisms to disseminate any information received on flooding, as in the case of Nang Khi Loek Village. This village has set up a local mechanism to share information gained from alerts broadcasted over either radios or the television to other communities. However, it was noted that not all communes had access to the same type of technology as this village; therefore, other similar methods of dissemination used only what infrastructure was available, whether it was a single radio or a mobile phone.

Information disseminated to villagers on risk must come from a trusted source to be perceived as relevant. In Ro Veak Village, for example, the village chief monitored weather forecasts and informed community members of alerts when they were broadcasted. Villagers noted that they trusted information that came from the chief, and followed his advice on what actions to take, such as staying home or staying away from streams.

With the telecommunications service becoming increasingly availability in the province, and improving drastically since 2008, authorities have been disseminating information on flooding to commune chiefs. While all chiefs have been provided with a phone, some communes still are unable to receive mobile signals (e.g., Ro Yor Commune). Therefore, information dissemination strategies still requires more support if they are to become effective and timely.

Perceptions on the flow of information relating to knowledge of the state of water in the Sre Pok River are varied. Villagers said that, sometimes, commune chiefs receive information about water levels, but that this knowledge comes too late or without recommendations on what actions communities should take. Based on the type of current systems for information dissemination, villagers were left with no time to prepare for events, even if they did eventually receive warnings. Perceptions on the flow of information relating to the state of dams were also low, with communities saying that

there was little or no awareness whether dams in the Sre Pok River were to be opened or closed, and suggesting that local authorities did not consult villages about how the dams were impacting their flood risk levels.

4.1.2 Capacity

4.1.2.a Material/Physical

Many villagers living in districts that are prone to annual floods have two houses: one located at the village settlement and one near their paddy field. During wet rice cultivation periods, villagers move to their houses in the paddy fields, taking with them food and household materials for the duration of their cultivation. During the flood, village houses can be flooded from 1 to 1.5 meters. Villagers who are able to move to different settlements in areas less prone to flooding, therefore, have a much stronger capacity to cope than families who remain in the village.

Many villages located along streams, particularly O'Chbar stream and the Sre Pok River, have bamboo trees planted along the stream banks to decrease soil erosion, and prevent or lessen water overflows during the rainy season. The planting and maintaining of bamboo in this way demonstrates an important component of villager's coping capacity for flooding. The importance of maintaining these natural barriers is included in local knowledge on hazard management, and passed down from village elders to next generations. As discussed during research with villagers from Nang Khi Loek, the bamboo trees planted along riverbanks were protected, and were perceived to slow water overflow, stop riverbank erosion, and prevent any debris that floods might carry (such as tree branches) from damaging infrastructure and fields.

Some villages located along streams built bamboo rafts which were kept moored along river banks.

Research findings show that villagers identified 'safe places' to evacuate to during times of flooding. The locations of these places varied depending on the geography of the village. In some areas, Buddhist pagoda compounds were used as relocation sites for families as well as for animals, as pagodas were generally built on higher ground or hills



Photo 4.8: Bamboo rafts along the Sre Pok River in Nang Khi Loek Commune.

Box 4.6: Bamboo Rafts During Floods

These rafts are tied to sturdy trees to ensure that they are not swept away by flooding, and are used in times of flooding to move between river banks. The rafts are useful even between the occurrence of floods, as they can serve as moorings for boats and provide a platform to work from when fetching water, selling agricultural products, washing and bathing, and moving between different villages.

surrounding the villages. Villagers in Memong and Chong Plas communes used local pagodas as temporary shelters for cattle when villages were flooded. Villagers in Nang Khi Loek Commune, located on the Sre Pok River, also emphasized pagodas as perceived places of safety during flooding, even with high inundation levels. Families and groups who were not Buddhist still noted that they would go to the pagoda during times of flooding, and villagers said that they were welcomed to use this space whenever it was needed.

Other varied forms of support for coping with floods were also highlighted by some villagers, such as expanding agricultural practices and supplementing food sources through fishing. Both Pu Chhrichang and Pu Rapet villages in Pechreada District noted that they grew cash crops, as well as rice, to exchange in times of food shortages with villages which grew additional supplies of wet rice. Villages inside of the Mondulkiri Protected Forest noted that they were able to use fishing to provide food sources, even in times of flooding. Villages, such as Khneng, noted that even during years when they could harvest enough rice and food crops to survive, they supplemented their diet through fishing activities using the surrounding streams of the O'Te, the O'Ronus and the O'Khnegn, as well as natural ponds.

Some villages noted that they were hoping to expand their physical assets which they could use to cope with during flooding, including the purchasing of boats to cross streams during the wet season or flooding, and the building of sustainable roads with raised bridges to maintain community access to external villages or markets, even during times of heavy rains. Villagers also noted that the practice of rain harvesting could be encouraged, but communities required more containers to store water. Some households noted that they had their own containers which they were using on a small scale to hold water, but these efforts needed to be scaled up in order to be effective for longer periods of time.

4.1.2.b Social/Organizational

A small number of villages surveyed, Sre Huy being one example, reported that their homes and infrastructure was situated higher than normal flood levels, and had not been reached by water in the past. However, Sre Huy villagers noted that they still listen to forecasts on heavy rains, and have identified the commune pagoda as a place to evacuate to, in case the village is affected by flooding in the future. This foresight in planning for cases of climate variability and changes in flood risk levels is positive, and should be encouraged to be undertaken in communes across the province.

Villagers are often worked together in times of flooding, first assisting direct kin and neighbors, and then, where possible, extending support to other families requiring additional assistance. In communities where villagers are grouped together for larger tasks, such as relocating livestock or rebuilding homes, coping capacity was much higher throughout the entire village. Traditionally, building and repairing homes in indigenous communities is a communal activity. Support for these activities is often offered as payment 'in kind', with homeowners providing those working on their houses with food as payment for their assistance. Communes not having traditional support mechanisms in place for moving livestock during times of flooding were Memong and Chong Plas. Both of these communes noted that families worked individually to move

their livestock, but that the process was challenging and not an effective coping mechanism as it is not timely.

Some families noted that they relied on the assistance of external organizations as part of normal organizational activities. The Red Cross was highlighted in various villages as a trusted source of support in times of flooding, making its role in post-disaster communities as established as the roles of villagers themselves. NOMAD was also noted by different communities as an organization that had assisted with creating coping mechanisms for flooding, teaching villagers how to identify safe drinking water and how long to boil water before consumption, and the need to use mosquito nets to prevent diseases such as malaria and dengue.

Indigenous warning signals

Villagers often rely on indigenous warning signals to organize responses to the onset of flooding. Communities noted that reliable warning signals include the observing the color of the tail of a *Trokut*, a monitor lizard, and the nest of a *Trech*, a big red ant. The monitor's tail is also used for predicting drought, and is observed during April or May. When the *Trech* chooses to builds its nest higher in trees, villagers believe that it will flood.

Box 4.7: The Lizard's Tail

When the tail of the monitor lizard is black, a long, heavy rainfall and possible floods are expected; if the tail is white, villagers predict drought.



Photo 4.9: Water Monitor Lizard

Other indigenous prediction methods include observing where roosters choose to perch their nests, if built on higher grounds or tree stumps, floods are predicted. During the 2007 flood, the community in Pu Tru Village noted that they knew floods were coming as they could hear changes in the squawking of chickens. The community knew from past experience that this warning signal meant heavy rains would soon come.

While villagers noted that they had strong faith in the reliability of these signals, research also found that these indigenous methods of prediction were only perceived to be reliable to slow onset flooding. Faster floods or swift flash inundations do not allow for observing indigenous signals, which are often only evident after a certain period of time. Therefore, with an increase in the occurrence of flash flooding, as well as fluctuations of water patterns being driven by the influence of hydropower dams as well as shifting climatic conditions, indigenous communities are noting that their traditional knowledge is not as effective as it once was.

Wildlife and forest protection

Many villagers believed that an increased protection of forests could lead to a decrease in the severity of floods. As such, communities often expressed support for any efforts in which they could work with to protect forests and wildlife from the threat of further economic land concessions and plantations. Villagers were often supportive of the development of community forests and protected areas in cooperation with Forestry Administration and the Department of Environment within conservation areas. These efforts have also drawn the support of the World Conservation Society (WCS) and the World Wide Fund for Nature (WWF).

In Kheng Chong Plas Commune, over 1000 hectares of forest has already been recognized as community protected forest, under the new law on protected areas of 2008. This commune, alongside others, noted that they hoped the establishment of protected forest areas would limit the amount of logging activities which have sometimes been supported by forest rangers and local authorities. Villagers also noted that it was important to pursue proper methods of fishing and hunting in order to decrease the rapid depletion of fish and wildlife resources.

Villagers of O'Chrar believe that the establishment of community forestry and supporting regulations may lessen the occurrence of flash floods. While waiting for further support through the passing of regulations at the Ministerial levels for the protection of land, they expressed trust for existing forestry programs and biodiversity conservation projects, suggesting that communities were willing to participate in these programs when they felt these were also supported by governmental authorities. O'Chrar villagers also expressed interest in participating in the development of land use planning programming within their community, as conducted by the Wildlife Conservation Society, the Forestry Administration and DPA. The land use programming will allow for a five hectare allocation per family, and the support for the proper management and use of resources by villagers.

Villages who relied on fishing to supplement their diets and/or livelihood suggested that fish stocks should also be protected. This view was strongly supported in villages, including in Mean Chey where almost every household practices fishing in the surrounding streams and reservoirs. Villages noted that flooding and changes in water levels resulting from heavy rains, the opening of dams, and flows from upstream also impacted their fishing capacity. Current programs on the sustainability of fishing in Mean Chey do not address the impact of flooding on fish stocks, but only on the use of inappropriate techniques, such as electro-fishing. Therefore, villagers suggested that programs on wildlife protection must also include the consideration of man-made hazards, as well as natural events.

4.1.2.c Perception/Motivational

Villagers believed that coping with floods requires a combination of strategies at both the village and household levels. They noted that, aside from immediate family members, other relatives and neighbors can be relied upon for help as long as they are not also at high levels of risk. Indigenous communities noted that traditional ways of working together strongly increased their capacity to cope with, and recover from, hazard events.

Villagers believed that, while some external actors had been involved in disaster response in their communes in the past, they are not able to rely upon external support for future events, although such support would be welcomed. Villagers in remote areas, such as those in Nang Khi Loek and Ro Yor communes, mentioned that they would try to create their own preparedness programs using traditional means, but that they still needed support for flash floods, particularly in effective emergency relief efforts to meet the demands of evacuation and rebuilding community infrastructure.

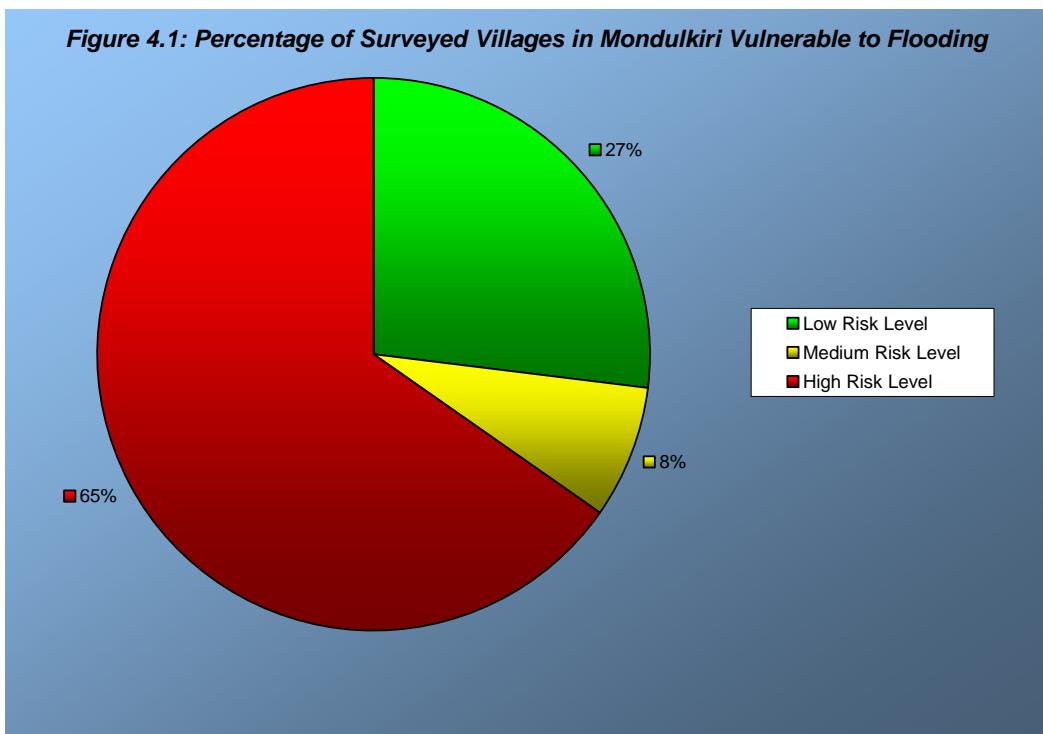
Traditional methods of coping were thought to be effective for slow onset events, but not flash flooding. Communities said that they would be more motivated to participate in early warning activities if it included some of their traditional knowledge. They also reported feeling more confident about alerts and information on hazards if they arrived in a more timely manner and came from locally trusted sources, such as commune chiefs.

Some villages believed their own coping mechanisms were useless without the support of external partners, particularly those living along the Sre Pok River, and expressed that, without timely and thorough information on the functioning relevant hydropower dams in Viet Nam, they could not appropriately prepare for flood events. Communities also reported that coping strategies should include not only hazard response activities, but also preparedness and mitigation programs. Villages expressed that receiving assistance to start these programs and clear guidance on how to respond accordingly to different types of floods, they would be motivated to participate in order to strengthen the capacity of their community in addressing current and future levels of risk.

4.1.3 Conclusions

This assessment indicated high levels of vulnerability to flooding in Mondulkiri, with a total of 65% of surveyed villages found to be at high risk for flooding (see *Figure 4.1*). Villages facing a medium-level risk of flooding comprised a total of 27% of villages. Altogether, over 90% of surveyed villages in the province were found to be at either medium or high risk to flood. Communities surveyed were found to be at risk for both seasonal, slow-onset flood events as well as flash flooding. Villages found to be vulnerable to flooding in Mondulkiri are ranked and illustrated in *Table 4.2*.

Provincial villages most prone to flooding are those located in lowland areas near the Sre Pok River and streams. Flooding can affect villages several times during a single year, particularly during the peak rainy season months of August and September. Villagers expressed a rising concern over the increased intensity of flash flooding, which were more difficult to prepare for and respond to than slower seasonal floods. Villagers also believed that dam operations had changed the hydrology of rivers, and that increased dam use, combined with forest clearing activities along main roads and streams within the province, increased the vulnerability levels of villages to both slow and fast onset events.



Villagers noted that flooding threatened their crops, livelihood, livestock and infrastructure, and increased vulnerability to food insecurity. Areas prone to repetitive events were found to be challenging to monitor risk, as they were still attempting to recover from past events. Villagers also reported that, as a result of flooding, communities often experienced outbreaks of water-borne diseases. This was due in part to the consumption of contaminated flood water.

Villagers reported that, due to exposure to flooding, they had either moved, or were planning to move, their rice fields to areas less vulnerable to hazards. However, this was a challenging endeavor due to limited access to new lands, the vulnerability of the surrounding areas of villages to flooding, and the loss of lands purchased by 'outsiders'. An increase of in-migration of outsiders to these village areas also limited capacity to shift fields to new locations. This has resulted in severe consequences on food and economic security, as well as on livelihoods.

It is hoped that the resilience of infrastructure to flooding can be increased, through fixing, maintaining and upgrading of dikes, as well as installing new dikes where necessary, and providing funds for communities to build houses and resource storage buildings using more sturdy materials and on raised platforms. Support is needed for infrastructure and sustainable financial and social resources, training for individuals in the management and maintenance of these resources, as well as for monitoring resources after flooding for weakness or damages.

Villages highlighted local mechanisms for coping with flooding, which includes expanding agricultural practices, and supplementing food sources with activities such as fishing. Many villagers believed that increased protection of forests could lead to decreases in the severity of flooding.

Communities reported that they currently relied on indigenous warning signals to organize disaster response for the onset of flood, however, these prediction methods were only perceived to be reliable for slow onset flooding. Therefore, with an increase in the occurrence of flash flooding, as well as water patterns fluctuations driven by the hydropower dams and shifting climatic conditions, indigenous communities noted that their traditional knowledge and practices needed support from external assistance in order for their risk levels to be decreased effectively.

Table 4.2: List of Surveyed Villages in Mondulkiri Vulnerable to Flooding

Villages Prone to Flooding	Hazard	Vulnerability	Capacity	Ranking
Chhuol	3	3	1	9
Chi Miet	3	3	1	9
Khneng	3	3	1	9
Orbuon	3	3	1	9
Pu Char	3	3	1	9
Pu Hong	3	3	1	9
Pu Lue	3	3	1	9
Pu Ngorl	3	3	1	9
Pu Teut	3	3	1	9
Ro Vaek	3	3	1	9
Ro Yor	3	3	1	9
Sre Huy	3	3	1	9
Andres	2	3	1	6
Mean Chey	2	3	1	6
O'Chrar	2	3	1	6
Pu Kreng	2	3	1	6
Pu Tru	3	2	1	6
Andoung Kraloeng	2	2	1	4
Pu Rapet	2	2	1	4
Gati	1	2	1	2
Pu Andreng	1	2	1	2
Pu Chorb	1	2	1	2
Pu Rang	1	2	1	2
Puchri Chang	1	2	1	2
Puchri Chongphang	2	2	2	2
Tram Kach	1	2	1	2

In spite of the clear risk levels of villages, DRR activities relating to flooding in Mondulkiri are only now becoming a priority area. Communities have noted that efforts for disaster management in the past have been focused on relief. It was hoped that support mechanisms, including timely responses from local officials, could be enhanced.

4.2 Drought

Mondulkiri faces two types of drought: agricultural drought during the wet season and hydrological drought during the dry season. Typical rainfall occurs from May to October,

with heavy rainfall from August to October, with a short dry period of about one to three weeks in between. Longer dry spells can lead to agricultural drought, as experienced in Mondulkiri between May and June, July to August, or November to December, lasting from 15 days to few months. These characteristics of drought are marked by unpredictable and erratic variations in rainfall onset during the wet season, an increased amount and duration of rain, and an early ending of rain, and resulting in farmers being unprepared to plan their farming calendars.

Most of the assessed villages reported to be increasingly more severely affected by agricultural drought, which destroys upland and cash crops. Recent annual droughts occurred from 2002 to 2008. *Table 4.1* shows the history of drought in the study areas.

Table 4.3: Drought History in Surveyed Districts of Mondulkiri

District	Critical Year
O'Rang	1967, 1996, 2004, 2005, 2007, 2008
Keo Seima	1998, 1999, 2005, 2006, 2007, 2008
Pechreada	1991, 1994, 2003, 2004, 2005, 2006, 2008
Koh Nhiekk	1996, 1998, 1999, 2002, 2003, 2004, 2005, 2006, 2007, 2008

Source: IOM 2009, HVCA, Village Summary, Mondulkiri

Table 4.3 shows an increase in the frequency of critical drought from 2002, with all four districts experiencing drought in consecutive years. Villages in Koh Nhiekk District experienced the highest number of consecutive droughts from 2002 to 2008. The most dramatic change in frequency of drought was in O'Rang District, where the most recent incidences of drought prior to 2004 occurred in 1967 and 1996.

Villagers attributed the frequency and intensity of drought in the last seven years to the effect of past and on-going deforestation, which was believed to play a role in changing rainfall patterns and watersheds in the province. Villagers also mentioned more unpredictable climate variability, including changes in regular rainfall patterns during the wet season. The irregularity of rainfall patterns has been affecting the availability of ground water for drinking as well as household and livestock use, and the soil moisture of cultivated lands.

Deforestation, considered by villagers to be the primary contributing factor to drought, was reportedly accelerated by the conversion of forest land to large-scale agro-industrial plantations and logging activities in all four districts studied. In Krong Tes Commune, for example, a majority of the area has been cleared for economic land concessions. Villagers in Pu Chorb, in Dak Dam Commune, pointed out that the clearing of the forest along the main road and in their taboo forest, where spirits are believed to reside, since early 2000 have partly contributed to the intense droughts experienced in 2004 and 2005.

The second type of drought, of a hydrological nature, is experienced annually during the dry season when natural water sources, such as streams, ponds and canals, become shallow or dry up, resulting in a shortage of ground water. Major streams where most villagers collect their drinking water are ‘emptied’ during the drought period, as well as many wells, which become unusable during this period as they do not contain enough water, or the water quality becomes unsuitable for drinking.

4.2.1 Vulnerability

4.2.1.a Physical/Material

Physical and material vulnerability during drought periods is experienced due to a lack of water available for drinking, household consumption and agricultural use.

Upland rice cultivation is highly vulnerable to agricultural drought as it is entirely rain-fed. There are very few alternative sources of water in the upland areas and villagers do not have water pump machines to draw water from natural water sources, such as river, streams and ponds. This affects rice yields annually, contributing to prolonged food shortages. Cash crops, such as corn, soybeans, green beans and peanuts, although more resistant to drought than rice plants, are intercropped with rice in *chamkar* and also become damaged, leading to lower yields and a loss of income for farmers. Farmers also reported that drought affects the productivity of rubber sales, as they can only extract small amounts of sap.

Villages whose upland rice crops were heavily destroyed by drought included Andoung Kraloeng, Pu Rang, Pu Tru, Pu Chorb, Pu Andreng, and most villages in Pechreada District. The case of Pu Chrlichang Village, in Pu Chrey Commune, has shown how the destruction of cash crops can lead to significant losses in income for farmers. For villages, cash crop farming is an important source of cash income, as the majority of the farmers are engaged in cash crop farming of peanut, soy bean, green bean and cassava, with only 30 percent of the villagers relying solely on traditional farming crops of rice as their primary livelihood. This has led to extreme food shortages as a result of damaging effects of drought on areas where there was little or no diversification of crops.

Droughts also affect family home gardens, which also contribute to food insecurity as they are used as supplementary food sources. This exacerbates the impacts of recurrent food shortages, which can occur five to six months every year, though some villages endure up to ten months of food shortages, especially in O’Rang District. Food shortages put additional pressure on families, who have to buy rice to be able to sustain

Box 4.8: Drought and Longer Food Shortage.

In Pu Tru Village, O’Rang District, annual drought was experienced from 1996 to 2007, often three times per year: in April, November through December and in January. Drought had destroyed most of the rice crops and led to animal deaths. The villagers said they did not have enough food for ten months and that they could only keep enough seeds for the next planting season.

them until the next harvest. Villagers that are faced with annual drought face longer periods of food shortage, as in the case of Pu Tru Village (see Box 4.8).

In 2006, villages in Sre Ampon Commune had their rice crops destroyed by drought and also had poor yields due to the late transplanting of rice in the paddy field. The villages lost most of their upland rice seeds reserved for the next planting season.

Most lowland rice fields are primarily rain-fed. However, most of the irrigation systems built during the Pol Pot regime are broken, and, though a few are being rebuilt, they have not yet been made operational.

To date, only few communes in the districts studied have supplementary irrigation resources, which are stored in a reservoir during the wet season. These irrigation schemes were found in Krang Tes, Srey Som Khom, Orbuon Leu and Sre Huy communes, to name a few. These irrigation systems are only able to serve a limited number of paddy fields, and villagers have to pump water into the rice fields before they can be irrigated. Thus, those who do not have access to water pumps cannot use the water from the reservoirs to irrigate their fields.

In Memong Commune of Keo Seima District, the majority of paddy fields lack irrigation schemes to store water for rice farming. In Pu Ngorl Village, for example, most paddy fields are rain-fed and many households do not have access to water pump machines. They also report that the water from the wells becomes is reduced during the dry season, forcing most of the villagers to fetch water form the O'Te stream. This stream, however, is located far away from the village, making it difficult for elders and single-headed households to fetch water. In Ro Veak Village, most settlements are located on both sides of the O'Peay stream, where crops and fruit trees are grown, and where the majority of paddy fields are located. The village has one irrigation system which was built during Pol Pot regime, the *Kro Peu* dike, but it is broken and cannot be used for irrigation.

Unlike in the past, where agricultural assets such as *Miir*, or *chamkar* in Phnong, and elephants were collectively owned, new assets such as water pump machines are now family-owned, as they require cash investment and maintenance. Individually-owned assets are new to the Phnong villagers and can affect the traditional communal way of life because only family members and relatives may have access to and benefit from them. In Chong Plas Commune, for example, villagers from Pu Hong reported that they need to rent the water pump machines for 20,000 riel (5\$) a day from another villager, also a Phnong, but that they often cannot afford to pay this amount to irrigate their rice fields. In some communes such as Memong, the Phnong have been introduced to trading and the use of cash, with the influx of ethnic minorities such as the Vietnamese, the Chinese and lowland Khmer. The development of trade and the introduction of a cash economy reveal a change in the concept of ownership, from communal ownership toward family ownership.

Impact on human health

Many incidences of water-borne diseases like diarrhea, stomachaches and typhoid were reported to happen during drought periods. Most of the assessed villages reported that aside from water shortages, the quality of the water from the hand pumps was poor and

should not be used for drinking or cooking. Despite the poor quality of water, people continued to use existing water sources.

Different sources for drinking water are hand pumps, open concrete wells and dug wells near the stream or river. There are also holes dug in the paddy fields where water is collected during rainfall. Many wells cannot be used throughout the whole year, especially during the dry season, and some are in need of repair. In O Char Village, one of the two pumping wells built with the support of non-governmental organizations is now broken and the water collection points of the pumping well are located far from the villager center, making access to these difficult and time consuming. During times of drought many children in this village get sick with fever, diarrhea and skin diseases.

In terms of sanitation habits, boiling water is the only means of purifying water available for all the districts, though not all families who take water from the stream do this before consumption. Some villages collect rain water, however, most families do not have large water containers and can only store enough to last one to two days. Some families can afford to buy large water jars that can be used to store water year-round. *Phnong* traditional houses are not fit to harvest water. A limited number of water filters/purifier have been distributed by Red Cross and other NGOs.



Photo 4.10: Children fetch water along the O'Te stream



Photo 4.11: Villagers store water in jars from O'Schbar stream

The lack of safe drinking water in the province is compounded by the expansion of gold mining, which poses risks of water pollution with chemical substances used for mining. The full range of these impacts is not yet determined, but the continued expansion of operations in gold mining was reported to have led to a further decline in fish resources, a decreased in water quality due to mine tailings, and challenges to social integration as more immigrants come to the province to work in these mines. In the past two to three years, villagers in Chong Plas and Memong Communes (Keo Seima District) reported that the mining workers used explosives to catch fish in O'Te stream, which is frequently used as an important source of water for families and livestock.

The lack of access to adequate and safe drinking water exacerbates existing poor health conditions, with many villagers in the assessed districts suffering from malaria and tuberculosis. Health is also affected by rapid weather and temperature changes. Children are especially affected and frequently fall ill because of temperature fluctuations. In Chimeat Village, the majority of the villagers complain of the worsening

and increased incidence of tuberculosis, fever, malaria and blisters. However, people rarely go to health posts for medical treatment unless their condition becomes serious. Distance and the lack of available medical staff are also major obstacles for villagers in seeking medical service. When a family member gets sick, families must spend a considerable amount of their income on medication, which is compounded by a loss of labor that can contribute to farming and household income.

Impact on livestock health

Livestock disease and deaths have also been attributed in part to drought, as there is not enough water and grass for livestock during the dry season. In Memong, Chong Plas and Sre Preah Communes, villagers face water shortage every year and reported increases in livestock diseases during times of drought each year. Ro Yor Village, for example, reported a rapid spreading of animal diseases, such that cattle, pigs, ducks, and chickens deaths are linked to rapid changes in weather, from rain to heat. Cattle suffer from diseases such as *satak* and *otkadam*, or foot and mouth disease, before the start of the rainy season.

Pu Char Village reported another type of animal disease, called *boshkyal*, manifesting either during the dry season or at the peak of the rainy season. *Boshkyal* affects mainly cattle, whose body parts become swollen and, when not treated immediately, can lead to death within a week. Most villages have animal health workers, but they do not have sufficient training or medicine to treat the animals. In An Dres Village, Koh Nie District, at the time of this study a large number of animal deaths were reported, with 40 buffalos and 50 pigs dying of unknown diseases that were attributed to early rainfall during the dry season. Because of the large number of sick animals, the village health workers could not treat all affected livestock. On average, villagers have to pay at least 10,000 riel (2.5\$) for one animal injection in order to treat or prevent a specific disease.

Buffaloes and cows remain the most important tools used by most farmers in rice cultivation. Deaths of these animals can seriously affect farmers who often have only one cow or buffalo to assist with farming. Very few indigenous villagers have agricultural machines that can help them perform farming work. The differences in ownership of agricultural assets have a big impact on agricultural productivity, as is the case in the Cham and the Phnong indigenous groups in Pu Chrey commune, Pechreada District, where the Cham own a ploughing machine. The *Phnong* can rent the machine from the Cham for 200,000 to 400,000 (100 \$) riel per hectare. The increasing claim of private ownership by families of material assets, such as water pump machines and ploughing machines, and the exchange of cash for use and service of these assets, represent a change in community relations and may lead to the weakening of social cohesion amongst different ethnic groups.

4.2.1.b Social/Organizational

There is no systematic drought management program in the province. Most irrigation schemes are broken and cannot be renovated because of the lack of funds. Only three irrigation systems in Nang Khi Leok Commune, Koh Nie District are being renovated under a multi-donor initiative, which complements the disbursement of some commune funds.

The Provincial Department of Water Resources and Meteorology (PDOWRAM) in Mondulkiri does not have sufficient financial and technical resources to respond to all the requests for irrigation by the communes and to perform all its mandated tasks, including the construction and renovation of irrigation systems, a provision of meteorological services and management of water resources. In the past, the department has provided water pump machines and gasoline as support to communities affected by drought.

Parallel support is provided by the Provincial Department of Agriculture which also supplied in the past water pump machines upon requests from the communes and districts. However, a typical water pump machine used by the department consumes a minimum of 12 liters of gasoline per hour. In Or Buon Village, Koh Nieb District, the water pump machine consumes an average of 200 liters of diesel for only 20 hectares of paddy field, creating resentment among the villagers due to its high costs. The department has also given limited support for the distribution of rice seeds and vaccinations for animals. There is a limited number of trained animal health workers who can respond to cases of livestock disease and death in the villages. The agricultural office mainly collects agricultural information, including animal deaths and crop losses, at the commune level, but, due to a lack of resources and the distance of each commune, not all personnel can regularly visit communes and villages to collect comprehensive data on the agricultural situation or attend to all agricultural concerns. More systematic information on agricultural techniques was found to be disseminated to one of the four districts, Pechreada, which is located near the provincial town and has some of the largest rubber plantations.

The absence of exact records on paddy field measurements makes it difficult for the PDOWRAM and the Provincial Department of Agriculture to systematically plan their support. In Kohn Nhieb, Or Bouenleu and Srey Sang Kum communes have received water pump machines from the Provincial Department of Agriculture, but this not enough to irrigate all rice fields, as there was no canal to distribute the water. There was also a lack of collective management of irrigation among villagers as the machine needed to be transferred from one paddy field to another.

Among ethnic minority groups in the assessed villages, there has been a noted erosion of social cohesion in times of drought. Phnong villages close to the district centers and provincial town tended to have more individual and family-based coping strategies to drought, with assistance being limited to family members and relatives. Those in more remote villagers were observed to have stronger solidarity, as they tended to stick together and help each other.

4.2.1.c Perception/Motivational

The field survey suggested that most villagers do not always request for assistance in times of drought, as villagers have very low expectations that their requests will be granted. In the past, they have requested support during drought, but did not hear back from authorities. People felt there was a lack of support from local authorities. Even when water pump machines were made available, people were not willing to pay the cost, as they did not expect to get higher yields and the cost of running the machines was very high.

Among provincial officials, there is a lack of knowledge of the extent of damage caused by drought to villages. There is underreporting of these damages due to a lack of human

resources to conduct regular visits to villages, and of effective communication and collection of information between local authorities. People stated that feedback on their requests, if they received any at all, comes very late. The absence of clear mechanisms for response contributes to a lack of trust between villagers and local authorities and creates resentment among communities who feel excluded from local decision-making.

4.2.2 Capacity

4.2.2.a Material/Physical

Livelihood strategy

Villages used a number of coping strategies during drought. Alternative livelihood activities provided needed cash income and supplementary food during and after drought.

Tapping and selling of resin product is common among villagers in O'Rang, Keo Seima and Koh Niek Districts, and in Pechreada District, though here it is less common as most resin trees have been cut. Villages inside the conservation areas like Gati and O'Chra in Sreah Preah Commune can harvest more resin and, at the same time, cultivate cashew nuts which they can sell to a local cooperative initiated by the NGO Development and Partnership in Action (DPA).

Villages who grow upland crops or whose upland rice crops have been destroyed by drought can sell their cassava and cashews for cash, which is then used to buy rice for consumption. Cassava and cashew are more resistant to drought than most food crops, as they are not water-intensive and harvested during the dry season.

In some villages, men work as seasonal laborers to earn cash and buy food. Secondary agricultural activities, like non-timber forest product collection, supplements food supply collected from the rice fields and *chamkar*. Raising livestock also increases the family income.

The diversity of livelihood activities among villagers is crucial for protecting households and assets during periods of drought. In order to continue relying on alternative livelihood options as coping mechanisms to droughts, it is important to ensure that communities, particularly those living inside the conservation areas, are enabled to engage in a mix of livelihood activities such as working on paddy fields, upland farming, non-timber forest product collection, hunting for household consumption, and resin collection.

Access to water

Mineral licks (*toek chrob*) are underground water sources from the mountains. There are two types of mineral licks: wet licks, which contain water year round, and dry mineral licks, available only during the wet season. Some villages, like Andoung Kraoleng and Pu Chrey Chom Pang, have access to four or five mineral licks which can provide relatively safe drinking water year round, provided they have dikes to store water. They also provide a source of water for drinking to wild animals such as *sambar* (a type of bear), wild pigs and elephants.

In Andoung Kraoeleng, villagers have a communal water collection system where spring water, available throughout the whole year, is collected through a water basin containing a purifier system. Half of the village can access water for drinking and household purpose. The project is supported by a multi-donor initiative promoted by UNDP, Wildlife Conservation Society and CRDT.

Currently there is no complete inventory of irrigation schemes by PDWRAM. This study found several communes across the four districts with a high potential for the creation and renovation of irrigation schemes. However, the lack of financial resources at the provincial level often hampers the delivery of irrigation works and is mainly dependent on external assistance. For example, Or Buon Lue and Sok Sam Communes, with external support from DANIDA, are coordinating the building of dikes which can serve 5000 hectares of paddy fields in Or Buon Commune. In Sre Huy, irrigation is being renovated with the support of JICA and implemented by PDWRAM.

Irrigation schemes built during the Pol Pot regime can be renovated and used for irrigation. In Nang Khi Loek Commune, there are three irrigation schemes that can be potentially used, currently broken down due to lack of maintenance. If these schemes are restored, they can potentially irrigate thousand hectares of paddy fields in three of the surveyed villages: Ror Bei, Nong Bur, and Sre Chrey.

Table 4.4: Villagers Recall External Interventions

Organization Name	Service
Red Cross	Water and Sanitation, Wells
My Village	Rice Bank, Community forest, Home gardening
Caritas	Multi-purpose farming
Cedac	System of rice intensification
NTFP-EP	Wild honey
CRDT	New varieties of rice
DPA	Water and Sanitation, Wells, Community forest, Resin cooperative
JICA	Irrigation, Agricultural support
Oxfam Australia	Agricultural inputs
WCS	Conservation, Land use planning

4.2.2.b Social/Organizational

Indigenous warning signals

Villagers have traditionally relied on natural warning signals to predict drought. In the beginning of April, villagers observe changes in the *Bengal* monitor lizard's tail color. If the tail appears whiter in color, people know there will be drought during the wet season.

Other local warning signals include the observation of the following:

- King cobra's eggs hatch on the stream bed;
- Wild rooster's eggs are laid directly on the ground or on tree stubs in the paddy fields;

- Crying of deer during the early morning;
- *Trech* (a type of ant) nests by the stream or river;
- *Som Puncg* (a large spotted civet cat) is no longer seen in the forest.

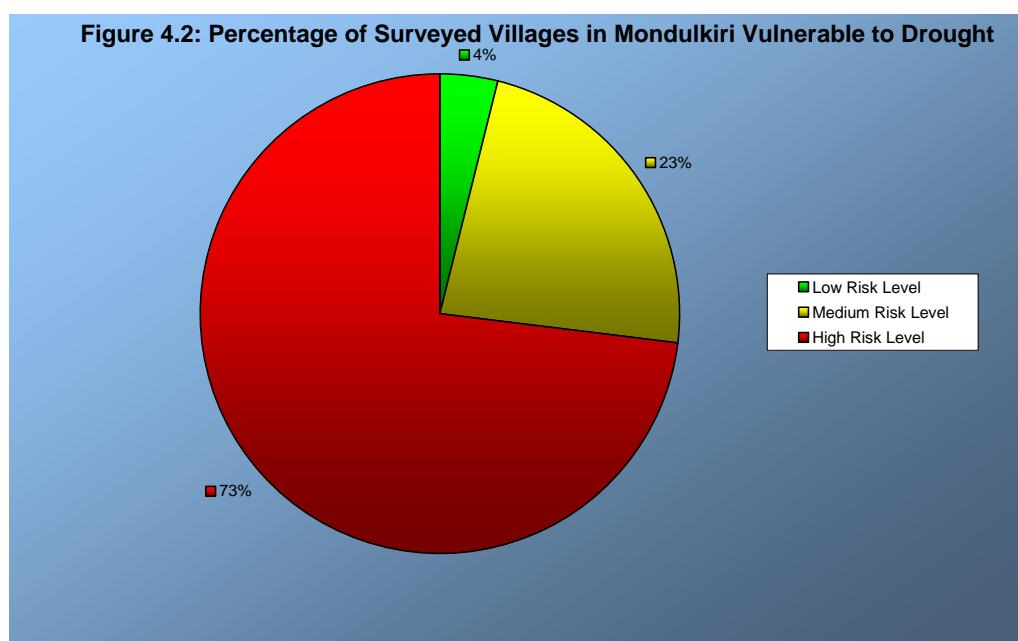
4.2.2.c Perception/Motivational

All of the villages assessed expressed strong interest to build water systems to help them store water during drought. They are very willing to contribute their labor to build dikes in order to store water near the streams, mineral licks, and ponds to store water in the rice fields. Some communities expressed an interest to construct a canal to shift water into the paddy fields using streams around the village, while some want to ask for external support to renovate old or broken irrigation schemes built during the Pol Pot regime.

Many communities are also interested in trying new livelihood activities such as fish farming, which can provide them with both food and livelihood, or procure new seed varieties which are resistant to drought. To do this, villagers need institutional support through training and practical demonstrations in their villages. However, villagers feel that local authorities have left them behind and have not adequately facilitated these processes.

4.2.3 Conclusions

The percentage of villages in Mondulkiri found vulnerable to drought during this research, illustrated in *Figure 4.2*, reveals a striking 73% of villages at high risk of drought. Villages facing a medium level of risk to drought comprised 23% of villages, thus, over 95% of surveyed villages in Mondulkiri was determined to be at either medium or high risk to drought. *Table 4.5* offers a list of all surveyed villages in Mondulkiri found vulnerable to drought.



Villagers attributed the recent increase in frequency and intensity of drought to the effects of deforestation, exacerbated by both logging and the conversion of forest areas

into large-scale plantations, and highlighted as playing a role in changing rainfall patterns and watersheds in the province. Villagers also mentioned more unpredictable climate variability, including changes in regular rainfall patterns during the wet season. The irregularity of rainfall patterns affected the availability of ground water for drinking as well as household and livestock use, and the soil moisture for cultivated lands. Communities noted that their vulnerability during drought primarily impacts their ability to secure enough water for drinking, as well as household and agricultural uses. Villages emphasized their agricultural resources, particularly upland rice crops, as highly vulnerable to drought. This vulnerability was worsened by a lack of alternative sources of water in upland areas and a lack of access to water pumps for drawing water from surrounding natural sources.

Table 4.5: List of Surveyed Villages Vulnerable to Drought

Villages Prone to Drought	Hazard	Vulnerability	Capacity	Ranking
Khneng	3	3	1	9
Pu Andreng	3	3	1	9
Pu Kreng	3	3	1	9
Pu Ngorl	3	3	1	9
Pu Rang	3	3	1	9
Pu Rapet	3	3	1	9
Pu Tru	3	3	1	9
Puchri Chang	3	3	1	9
Puchri Chongphang	3	3	1	9
Ro Vaek	3	3	1	9
Ro Yor	3	3	1	9
Tram Kach	3	3	1	9
Andres	2	3	1	6
Gati	3	2	1	6
O'Chrar	2	3	1	6
Pu Hong	3	2	1	6
Pu Char	2	3	1	6
Pu Lue	2	3	1	6
Pu Teut	3	2	1	6
Andoung Kraloeng	3	3	2	4.5
Chhuol	3	3	2	4.5
Orbuon	3	3	2	4.5
Pu Chorb	3	3	2	4.5
Mean Chey	2	2	1	4
Sre Huy	2	3	2	3
Chi Miet	2	2	2	2

Impacts of drought on rice fields often result in prolonged food shortages in many villages. Communities which have attempted to diversify crops in the past have also reported that their cash crops, such as corn, soybeans and peanuts, which are typically more resistant to drought, are also damaged and produce lower yields.

Drought also threatens the health of communities, with assessed villages reporting that drought causes water shortages and decreases the quality of water which was still available, leading to cases of water-borne diseases such as diarrhea and typhoid. Villagers felt that the degradation of clean water sources in the province was further

exacerbated by the expansion of mining activities. Health levels of communities were also affected by rapid weather and temperature changes, occurring more frequently than in the past, leaving children particularly affected by various illnesses.

The health of livestock was also identified as being threatened due to a lack of water and grazing areas during times of drought. Some villages noted that livestock diseases could be expected annually in times of drought. Livestock diseases were also reported to increase in severity with rapid weather changes from rainy to hot.

Surveyed communities use a number of coping strategies during drought, including pursuing alternative livelihood strategies to procure income and food supplies, such as working as seasonal laborers or conducting secondary agricultural activities. Villagers also relied on their traditional warning signals to predict the onset of drought. Still, villagers expressed strong interest in expanding on these strategies by building water systems to store water for use during droughts, as well as a desire to receive training on new livelihood activities in order to better prepare for – and not only respond to – future events.

In spite of having high levels of vulnerability, there is no systematic drought management program in Mondulkiri. Broken irrigation schemes often could not be repaired due to a lack of funding. Institutions responsible for assisting in managing resources for communes, including the Provincial Department of Water Resources and Meteorology, lack the financial and technical resources necessary to respond to areas in need. This deficit was compounded by the underreporting to authorities about drought impacts experienced by villagers due to a lack of confidence in having their requests granted, which, in turn, leaves district and provincial officials unaware of the extent of impacts to villages caused by drought.

4.3 Insect Infestation

The province has a long history of experiencing annual seasonal insect infestations. Common insects that infest rice plants in Mondulkiri are the *Nhuy* (brown plant hopper), the *Sreung* (mealy bug), the *Kra Toek*, an insect attacking the roots of the rice plant, and the *Kra Ploeung*, which eats the germ of the rice. Of these insects, the *Nhuy* and the *Sreung* were reported as being the most destructive. The *Nhuy* eats the rice flower and milk, while the *Sreung*, a winged insect known for its bad smell, brown color and egg-laying patterns, destroys the rice stems and milk. This type of insect is commonly found in upland and rain-fed environments but is not typically seen in irrigated rice. They appear in large numbers during the rainy season, in the early morning and at noon. A high density of more than 100 *sreung* per hill can cause plants to wilt and die.¹⁴ Another insect that damages rice plants is a green-horned caterpillar, which eats rice plants during their nursery and fruit-bearing stages, causing poor grain germination. White worms were also reported to destroy the rice in paddy fields from September to October.

Since 1982, villagers observed that insect infestations had become more frequent and severe, damaging larger parts of upland rice cultivation, particularly short-term rice crops

¹⁴ The International Rice Research Institute (IRRI) reports similar heavy crop losses from mealy bugs in India and Bangladesh.

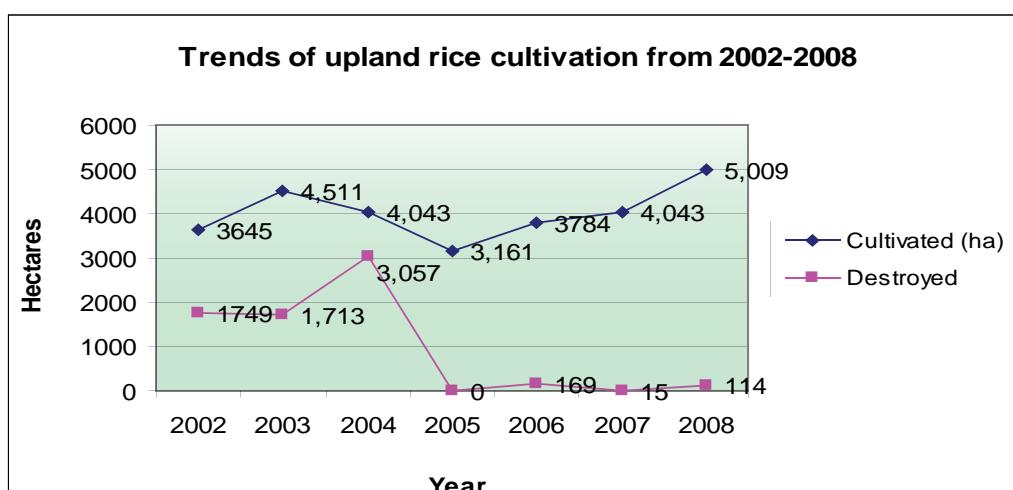
which are harvested in mid-October. In the last six years, however, the scale of infestation, and its resulting damage, has been increasing. Both upland rice and cash crops have been heavily affected. From 2005 to 2008, most of the surveyed villages reported heavy losses resulting from brown plant hopper infestations.

Box 4.9: Villager Recalls Insect Infestation

'We have been affected by insect infestation for a long time but never as severely as in 2005, 2007 and 2008, when the N huy came to destroy our rice to the extent that no one in the village could harvest any upland rice. It looked like we boiled water and poured it on our rice crops.'

Villager from Andoung Kraloeng

Field interviews indicated that most families suffer regularly from critical crop losses as a result of insect infestations, with some areas losing all their crops completely. The massive losses reported by villagers correspond in part to provincial data on agricultural crop damage from 2002 to 2008. Figure 4.3 shows the trend in agricultural crop damage vis-à-vis total cultivation areas for agricultural crops from 2002 to 2008.



Source: Provincial Department of Agriculture

Annual damages from insect infestation vary, but critical years ranged from 2002 to 2004. The worst year for damages across the province was 2004, when nearly 76% (or 3,057 hectares) of the 4,043 hectares of agricultural crops were damaged by insect infestation.

There was no data available for 2005, which was considered to be a year of serious insect infestation by the villagers. Inconsistencies were also found between information reported at the community level and provincial data in relation to insect infestations experienced from 2006 to 2008.

4.3.1 Hazard Factors

Most of the villages pointed to the loss of forest cover, and its destruction of these insects' natural habitat, as a main factor for the increase in scale of insect infestation. Climate variability leading to longer periods of drought, changes in weather and temperature fluctuations have all been indicated as being contributing factors to increasing infestations. The degradation of forestland and grassland within the village territory further contributes to soil erosion and changes in rainfall patterns, thus, exposing more agricultural crops to insect infestation.

A more systematic and widespread use of chemical pesticides was observed by the communities in Mondulkiri over the past few years and was indicated as the reason for the appearance of new types of insect never seen before. Since 2005, many industrial plantations started using chemical pesticide used to spray on grazing land in the province and affecting the surrounding villages.

Insect infestation can happen any time during the year and lasting for two to three months during the reproduction stage of rice crops. Infestations can attack both lowland and upland crops, throughout different stages of the growing seasons. They can also impact specific crops or even portions of a crop, with different insects targeting crop flowers, leaves, stems, or even the entire plant. *Table 4.6* lists the identified causes of insect infestation and critical infestation years in the districts studied:

Table 4.6: Droughts History and Reported Contributing Factors in Surveyed Districts

District	Critical Years	Identified Causes of Insect Infestation
O'Rang	2000, 2004, 2005, 2006, 2007 and 2008	<ul style="list-style-type: none"> Environmental changes Changes in soil conditions Changes in natural resources and climate conditions and patterns Degradation of forestland and grassland within village territory Pesticide spraying on grassland and savanna areas
Keo Seima	2000, 2001, 2002, 2003, 2004, 2006, 2007, 2008	<ul style="list-style-type: none"> Long periods of drought Degradation of insect's natural habitat Deforestation Changes in the environment
Pechreada	1982, 1994, 1996, 1997, 2003 2004, 2005, 2007, 2008	<ul style="list-style-type: none"> Changes in the natural resources Emerging use of chemical pesticide in Viet Nam Longer periods of drought during the rain season The use of pesticide to kill grassland in the areas surrounding villages Shifts in weather and temperature
Koh Nhek	2004, 2007, 2008	<ul style="list-style-type: none"> Changes in weather Longer periods of drought Longer periods of continued rain during the wet season Forest loss Environmental changes Increased use of chemical fertilizers in the villages

Source: IOM 2009, HVCA, Village Summary, Mondulkiri

4.3.2 Vulnerability

4.3.2.a Physical/Material

Food security is heavily threatened by insect infestations, especially in villages dominated by upland rice cultivation and short-term rice crops, which are harvested in mid-October. Many villages reported shortfalls in rice production as a result of the damage caused by insects, and were, in many cases, able to only keep enough seeds for the next planting season. Paddy field rice was also affected, though not to the same extent as upland rice. Villages with larger areas of paddy fields were still able to harvest enough for the year.

Annual food shortages were commonly reported in most of the villages. The Provincial Department of Agriculture reported in 2003 that the four districts facing the worst rice shortage were those practicing upland rice cultivation, corresponding to areas where the largest *Phnong* settlements are located. In 2005, farmers in some districts said they could not harvest rice crops because of insect infestation. A growing number of villagers are now forced to buy rice from outsider traders who bring in truckloads of rice that are generally exchanged for resin and cassava, traditionally supplements to the *Phnong*'s diet in times of food shortages.

The use of herbicides by pine plantation companies to kill weeds were pointed to as being a factor for the pollution of village water, the decline of fish in streams, cow and buffalo deaths, and hazardous to villagers' health, as chemical substances from these pesticides flow into streams, which are sources of water for both villagers and livestock. This practice suggests the need for enforcing and monitoring clean practices for the waste management of chemical products.

4.3.2.b Social/Organizational

Institutional and community responses to insect infestation control were found to be very weak or rare. Agricultural inputs have been brought in by agencies, but no clear integrated strategy for insect control was found in the course of the assessment. The Provincial Department of Agriculture has no formal program on insect infestation, and they wait for requests made by local authorities for insecticides or relevant equipment before forwarding such requests to the central level. The present mechanism requires that villagers report insect infestation incidences to the village chief, who then passes it on to the commune chief. The report is then sent to the district office, and then on to the Provincial Department of Agriculture. Villagers' requests often do not receive timely feedback, if they receive any at all, and the procedure was reported to take too long before the request for assistance would be taken in consideration.

The failure to adopt natural insecticide methods of control is partly due to the lack of periodical demonstrations and practices, which cause trained villagers to forget what they've learned. There is also a lack of follow-up and monitoring activities by agricultural extension workers on the adoption of new techniques. In some villages, information on insect control for rice crops is limited to posters disseminated to the villages without any prior orientation or briefing on the significance of the guidelines set by provincial authorities. Commune and village officers who received training on agriculture and insect control from non-governmental organizations appeared to be ineffective in transferring this knowledge to villagers, mainly due to a lack of resources and full understanding of the extent of the problem.

There are also indications suggesting that local authorities do not have confidence the villagers will be able to apply new knowledge on natural insecticide methods. Some districts which have received training from NGOs on using natural means for insect control expressed that many new practices taught to indigenous peoples require time for adoption, as some are not part of their traditional agricultural practices. For instance, fencing livestock when insecticides are sprayed to prevent them from ingesting chemical substance is a new practice for indigenous families as they usually let them roam freely. They also have vegetable gardens in their *chamkar* and not near their homes. These indigenous agricultural practices, therefore, have to be taken when deciding the intervention on insect control.

4.3.2.c Perception/Motivational

Many villagers feel there is no support for managing insect infestations, particularly from the Provincial Department of Agriculture. Widespread hopelessness was found among those who, facing regular insect infestation and suffering from yearly losses, have no choice but to continue practicing upland rice farming even if they face the prospect of not being able to harvest that year. Some villagers prefer to look for other means or help each other rather than seek out support from external institutions, which further increases their isolation from the rest of the community in the province.

4.3.3 Capacity

4.3.3.a Physical/Material

The practice of rotational farming among the *Phnong* provides a safety net from crop failure caused by insect infestations. Four principal crops that are grown and intercropped in upland rice, which are rotational farms, include hill rice, corn, cassava and yams. Several minor food crops are also planted in these farms. Although rice and corn are heavily affected by insect infestations, these crops are more insect resistant and farmers generally have successful harvests in the upland farms, even in periods of severe insect infestation. Districts like Koh Niek, with more paddy field farms, may have some surplus during the harvest and can assist neighboring districts in times of rice shortages.

The expansion of cash crops such as rubber plantations, cassava, corn, peanuts, soybeans and green beans in upland cultivation, and the collection and selling of resin products serve as coping responses to rice shortages caused by insect infestations. These activities are important sources of cash that families can spend for food. However, the conversion of upland farms into cash crop farming can lead to the reduction of areas that used to plant basic food crops necessary for household food sufficiency among indigenous communities. The conversion of areas into cash crop farming should, therefore, be considered in relation to the broader food and livelihood needs of communities.

Other methods of coping with rice shortages include the cultivation of paddy rice, to which some districts already show high potential. Some families move to other villages to cultivate wet rice, when necessary. Others remain in their own village, but are supported by provisions from relatives who cultivate rice in upland farms.

4.3.3.b Social/Organizational

Villagers first use local knowledge to control insect infestations. Although overall capacity for insect control is weak, villagers are vigilant and try very hard to protect their crops. In the case of Nang Khi Loek Village, where most paddy fields are scattered in plots of approximately 8 to 20 hectares with some up to 50 hectares, this requires much effort. In these areas, insects tend to attack the rice plantations during the milk and flower stages. When this occurs, villagers create home-made insecticides using a mixture of detergent powder and water, working together to spray the infested areas.

The Cambodian Rural Development Team (CRDT) provided training to selected villages on sustainable agriculture and home gardening, and introduced the System of Rice Intensification (SRI) in the upland rice cultivation areas. They also provided a venue for farmers to exchange agricultural information by bringing indigenous farmers from Mondulkiri to visit farmers from the lowland provinces of Pursat and Siem Reap. Other organizations like Development and Partnership in Action (DPA) were also reported to support similar activities. Villagers reported external assistance in terms of livelihood improvement activities such as raising chicken, fish pond farming and home gardening to mitigate the negative effects of agricultural losses in times of drought and insect infestations. Key informants mentioned that JICA, for example, provided agricultural development training on animal raising and insect control, which had involved village chiefs, deputy village chiefs, commune chiefs and council members. In the past, the Provincial Department of Agriculture disseminated posters on types of insects which attacked rice crops as well as methods for insect control, but some of the surveyed communities were never reached by, or had not seen the replication of, similar awareness initiatives.

Women farmers and widows face greater livelihood pressures from drought and insect infestations, especially when they do not have enough able-bodied household members to work on the land, or when the market prices of cash crops fluctuate. Assets such as lands and resin trees can provide a source of food and income to support other domestic needs, but timely institutional and external support for mitigating the impacts of income loss and crop failure on these vulnerable populations was believed to be most urgent.

The case of Meung Cheut (discussed in Box 4.10) demonstrates that a mix of household livelihood strategies, ownership of assets, and external assistance can help the poorest and most disadvantaged cope with the impacts of insect infestations.

Box 4.10: Coping with Insect Infestation at the Single Household Level

Mrs. Cheut is a widow with five young children – one daughter and four sons. She owns a bamboo house, a second hand motorbike, a hectare of rice field and cassava, and 60 liquid resin trees in the deep forest of Dak Huch. Almost the totality of her rice field is damaged yearly by insects such as *kra*, *nhuy* and *kra toek*. To cope with food shortages, she combines agricultural livelihood, off-farm work and access to external institutions to help her family. She is able to harvest and sell cassava for 50 to 100 riel per kilogram in December or January. From February to April, she collects liquid resin products and sells about 15 liters every week for 60,000 riel while during the wet season the price goes down to 40,000 to 45,000 riel for the same quantity. In 2008, she received food relief from the Department of Womens Affairs through the Sen Monorom Commune. Her eldest daughter who is attending the eighth grade received an annual scholarship for school materials and clothes, 4000 riel (\$ 0.5 a month), a bicycle, and 12kg of rice. This assistance makes Mrs. Cheut hopeful that her daughter can proceed to the 9th grade and eventually attend high school.

A widow woman in Pu Rang Village

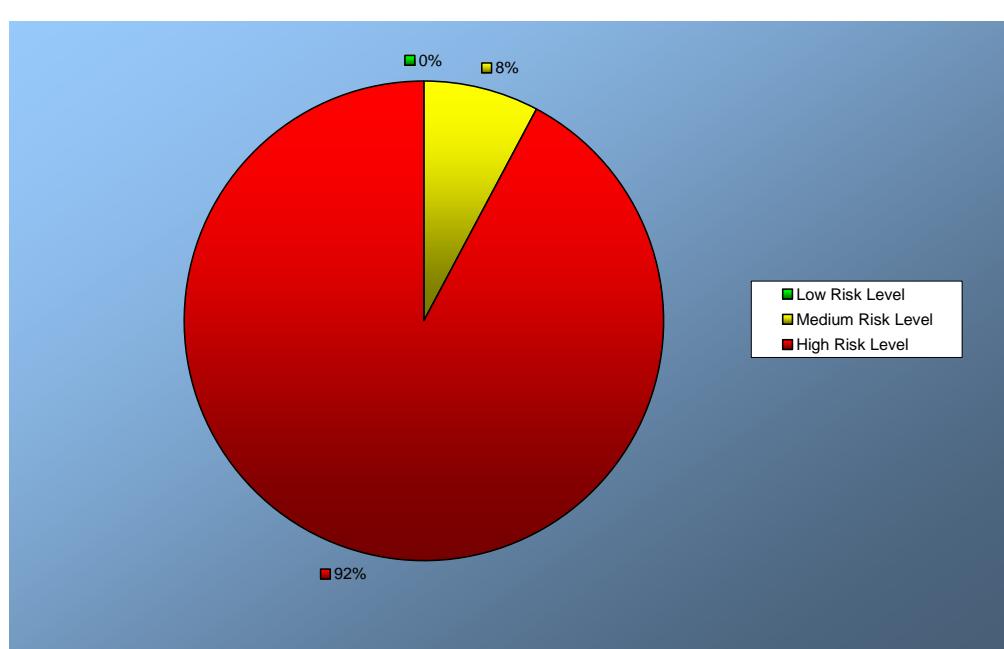
4.3.3.c Perception/Motivational

Despite the risk of crop failure, indigenous families are not willing to shift away from traditional agricultural practices of upland rice cultivation. All villages expressed the need for external support to offer effective insect infestation control with practical and easy-to-understand demonstrations, rather than through technical training. They also expressed their preference for organic insect control instead of chemical pesticides, which they perceived as having negative potential consequences on their health as well as that of their livestock. Local means to control a greater number of insects are not effective for long-term insect infestation management. However, villagers continue to use a variety of indigenous methods for insect control, from natural means, such as the use of decayed crabs and the peel of bamboo shoots to attract insects, to the burning of car tires and spraying detergent powder mixtures onto rice crops as a ‘last resort’ measure.

4.3.4 Conclusions

All of the surveyed villages in Mondulkiri were found to be at either medium or high risk to insect infestation, with a striking total of 92% of villages surveyed found to be at a high-level risk, as is illustrated in *Figure 4.4*. A list of surveyed villages and their hazard risk rankings can be found in *Table 4.7*.

Figure 4.4: Percentage of Surveyed Villages in Mondulkiri Vulnerable to Insect Infestation.



In spite of the province’s long history of experiencing annual seasonal insect infestation, this hazard is often not flagged as being significant to the hazard profile of villages. However, over the past few decades, villagers have observed that insect infestations have become more frequent and severe, damaging larger portions of crops and occurring in broader spans of time. In the last six years, the scale of infestations has been increasing and the resulting damage has become even more significant to the loss of income and food security of the affected areas.

Challenges in managing insect infestations was partly attributed to a lack of consistent data on the history of this hazard. This leaves authorities unable to plan support activities appropriately, and villagers frustrated with the lack of effective preparedness and mitigation measures.

Most villages pointed to the loss of forest cover as a main factor in the increased scale of insect infestation, due to the destruction of the insects' natural habitats. Climate variability, leading to longer periods of drought, changes in weather as well as temperature fluctuations, were also indicated as contributing factors to the increases in infestations.

Table 4.7: List of Surveyed Villages in Mondulkiri Vulnerable to Insect Infestation

Villages Prone to Insect Infestation	Hazard	Vulnerability	Capacity	Ranking
Andoung Kraloeng	3	3	1	9
Gati	3	3	1	9
O'Chrar	3	3	1	9
Orbuon	3	3	1	9
Pu Andreng	3	3	1	9
Pu Char	3	3	1	9
Pu Chorb	3	3	1	9
Pu Kreng	3	3	1	9
Pu Lue	3	3	1	9
Pu Ngorl	3	3	1	9
Pu Rang	3	3	1	9
Pu Teut	3	3	1	9
Pu Tru	3	3	1	9
Puchri Chang	3	3	1	9
Puchri Chongphang	3	3	1	9
Sre Huy	3	3	1	9
Tram Kach	3	3	1	9
Andres	2	3	1	6
Chhuol	2	3	1	6
Chi Miet	2	3	1	6
Khneng	2	3	1	6
Pu Hong	2	3	1	6
Pu Rapet	2	3	1	6
Ro Yor	3	2	1	6
Mean Chey	2	2	1	4
Ro Vaek	2	2	1	4

Annual food shortages were reported in most villages, often driven by the compounded impacts of multiple hazards, but with insect infestations being a key factor, as it creates disasters that communities can not prepare for. The use of chemical pesticides has expanded in the province, but is not an economically viable choice for many villagers. Also, it is often not used properly or applied with appropriate safety measures .

Chemical pesticides were also blamed for contributing to the pollution of water sources and for the death of livestock, as practices and disposal were often not monitored. Though promoted by some NGOs, and preferred by communities, natural insecticides have not been adopted on a large scale by villages due to a lack of training on how to

create and use the products, as well as a lack of access to the natural resources required to make them.

Overall, both institutional and community efforts to build resiliency against infestations were found to be very weak. Communities often turned to the expansion of cash crops to serve as coping responses to rice shortages caused by insect infestations, thus, they did not manage the infestations themselves, but rather attempted to cope with the hazard's impacts on their livelihood and food security. Indigenous practices used to control insect infestations were present but limited in scope, and often not suitable for the increased duration, severity and scale of current infestations. In order to better prepare for and manage the impacts of infestations, communities require further support for their mitigation activities from actors at the district and provincial levels, particularly in the context of changing climatic conditions.

4.4 Climate Variability as an Emerging Hazard

While assessed villagers faced exposure to seasonal droughts, insect infestation and floods, it has also been observed that there is greater unpredictability in seasonal climate patterns. Significant changes in these patterns have gradually disrupted traditional farming practices, which traditionally were dependent upon predictable rainfall distribution and amounts.

Since 2004, rainfall patterns during the wet season have been observed to be erratic and unevenly distributed. The early onset of rain, now arriving as early as February, is mirrored by a similar pattern of the early end of rain. Compared to the past, there are longer periods of drought in between rainy seasons, which does not leave enough water for rice plants during crucial stages of rice growth. Longer period of water deficits during the rice growth stages mean higher chances of crop failure during harvest. The early onset of the dry season increases the likelihood of hydrological drought as streams, underground water and wells becomes dry or shallow. Competing water use for household consumption and agriculture is felt during drought, as there are not many available and accessible options for water sources among farmers. Furthermore, livestock and humans, especially children, can fall ill during extreme temperature changes.

Since 1982, many villages have experienced more frequent insect infestations. For the last six years, the scale of infestation has also been dramatically increasing and the damage worsening. Provincial data from 2002 - 2008 has shown significant damages to upland rice and cash crops from insect infestations. The increased scale and frequency of insect infestations has been attributed to longer periods of drought and extreme weather changes, particularly too much heat or rain.

Changes in climate trends may also contribute to the intensity and frequency of flooding in the province. Already, many villages have been experiencing annual flash floods since 2002. The rapid onset of this type of flooding leads to higher agricultural losses and negative food and livelihood impacts.

A recent study on climate change vulnerability mapping by Yusuf and Francisco (2009) identified Mondulkiri as the most vulnerable province in Cambodia, and the fourth most

vulnerable province in Southeast Asia. This climate change vulnerability mapping¹⁵ was computed using indicators of exposure to climate change hazards, sensitivity and adaptive capacity. Although Mondulkiri scored low on exposure to multiple hazards and impact of climate change stimuli, it scored very low in adaptive capacity.

4.5 Migration Patterns

Migration patterns in the province are influenced by economic and cultural factors, population growth and natural hazards. The search for suitable lands for farming, settlement and economic opportunities is a major consideration for these movements. Restrictions on traditional rotational agriculture also emerged as a pressing issue in relation to the limitations that the surveyed villages experienced when attempting to move following the ‘fallow seasons’.

Research findings indicate that in-migration and seasonal labor migration in the province are driven by the negative impacts of natural hazards. Some villages whose upland rice crops were damaged by insect infestation would do manual work in the provincial town capital to earn cash to buy food. Other villages facing rice shortage from periods of drought would assist their relatives to cultivate paddy fields and return home with rice after the harvest season. This was the case, for instance, in Ro Vaeak Village where families traveled by oxcart for days to reach villages like Kdoay, near Kratie Province, to help with rice cultivation and participate in the sharing of products.

Rice fields situated near streams and along the main roads had often been abandoned by villagers because of yearly floods, which negatively affected their crops. Although there were few reported cases of migration as a direct result of flooding, crop failure has forced villagers to seek new forest areas for farming. In some cases, villages had resettled because they were constantly flooded by the breaking of irrigation dams which were built during the Pol Pot regime and never renovated. Examples were also given of villages who, in times prone to flooding, would resettle near their upland crops, then return to their villages after the harvests, and the general risk of flooding, were finished.

The search for better economic opportunities, particularly the search for new land to cultivate, was cited as the pull factor for in-migration of lowlanders from other provinces to Mondulkiri. Many of these new migrants came from Kampong Cham and Prey Veng provinces as plantation workers.¹⁶ For instance, a pine plantation company brought in hundreds of temporary workers, starting from 2005, to work in areas surrounding surveyed villages like Pu Rang in O’Rang District.

Internal migration routes within the province comprise of villagers moving from one commune to another in order to be closer to their existing farms, sources of water and food. The need for bigger land for village settlements to accommodate a growing

¹⁵ Taking definitions from the Intergovernmental Panel on Climate Change (IPCC), the 2009 report by ESEA/IDRC assigned functions of vulnerability where: exposure is defined as ‘the nature and degree to which a system is exposed to significant climatic variations’; sensitivity is defined as ‘the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli’; and adaptive capacity is defined as ‘the ability of a system to adjust to climate change (including climate variability and extremes), to moderate the potential damage from it, to take advantage of its opportunities, or to cope with its consequences’.

¹⁶ A recent study by Maling (2007) showed that 59 percent of total migrants in Mondulkiri were from other provinces, predominantly from Kampong Cham and Prey Vang while internal migrants comprised 48 %.

number of families was also a deciding factor for moving into another location, and this usually saw villagers forming sub-groups of families who settled into different parts of the communes. Historically, *Phnong* settlements had shifted repeatedly over distances of a few kilometers, and always within their traditional village boundaries, as a coping response to disease, bad omens or change in farming locations. As part of their traditions, the *Phnong* would move their entire village when many villagers became sick or died, believing that 'bad luck' had befallen the village and it was, therefore, not suitable to live in anymore.

In some communes, migration has been characterized by movements of villagers' relatives to help in farming and to do seasonal labor in areas close to the commune center. Some worked with plantation companies in other communes as seasonal laborers to supplement their income, especially in times of crises. For example, field research documented some seasonal migration of families to work as plantation workers and construction workers in Sen Monorom Commune.

Box 4.11: Off-Farm Work as a Coping Strategy

During the dry season, 30 families in Pu Rang Village worked as seasonal laborers in pine tree and rubber plantations for 20,000 riel (5\$) a day. During the wet season, there are fewer families involved in seasonal labor as most of them are doing upland rice cultivation. Seasonal daily labor activities during this period are performed in pine tree and rubber plantations for 18,000 riel (4.5\$), road construction and weeding of grass for 10,000 riel (2.5\$) each. Off-farm work help these families cope with the effects of droughts and insect infestation

Pu Rang Village, O'Rang District

4

Where communities do not choose to move to adapt to the impact of hazards, they often take on additional work, sometimes as chin roots collectors in the forest, thus, generating alternative sources of income to overcome food shortages resulting from the damaging effects of floods, drought, and unpredictable changes in climate trends.

There are now more limitations to migration of villagers and the clearing of new farms in different locations than previously experienced. Villages in the core zone and buffer zones of conservation areas cannot move into or clear new areas for farming, other than for cultivating their existing farms. Movements into parts of the forest for grazing and NTFP collection is becoming difficult as plantation and mining areas enclose land around the villages. Many villagers expressed the need to demarcate land in the conservation areas which they could freely use for grazing land and farming.

Local government regulations on village boundaries are also putting constraints on village movements into other areas. As a result, villages such as those living in the core zone between Pu Chrey and Sre Huy communes have proposed to designate 200 hectares of the conservation area as areas for cattle, *chamkar* and paddy field farming, so as to be able to migrate to, and do cultivation in, those areas. The proposed areas consist of major streams, such as O'Te and O'Play, which are close to their paddy fields and *chamkar*.

In-migration flows, especially if driven by businesses which have the potential to affect the security of communities and deteriorate the environment, such as gold mining exploration, have led some villages to express their willingness to migrate away from the mining sites and relocate deep within forests.

Changes in country borders were also reported to have implications for farmers whose resin trees were located along streams on the Cambodia/Viet Nam border, as they were not allowed to cross the border to tap resin trees which they had done in the past. Some of those who involuntarily crossed the border had been apprehended by border police.

Chapter 5: Conclusions and Recommendations

This research illustrates the vulnerability of Mondulkiri to natural hazards, specifically flood, drought and insect infestation. While the report outlines the disaster risks that these communities are facing, it also illustrates the unique resiliency and capacity levels of provincial villages. Indigenous practices relating to disaster mitigation, prevention and response are identified, as are community-level coping mechanisms that these areas have traditionally relied upon. Findings from this project were used to rank the risk of each village to the three identified hazard types, as presented in the previous chapters: flood, drought, and insect infestation.

Villages require support to move forward even from low levels of disaster risk. As such, when considering the development of recommendations based on assessment findings, activities were developed to suit villages from low, medium and up to high levels of disaster risk. Often communities faced varying levels of risk for different types of hazard, highlighting the need for multiple recommendations to be undertaken, simultaneously where necessary, in the same villages. The clearly compounded levels of vulnerability in Mondulkiri demonstrated that hazard events, and changes in livelihoods, social, political and economic shifts, as well as an increasingly changing climate, can all quickly move risk levels from low to mid-or high levels. Furthermore, when left without support or attention, communities currently at low levels of risk can find their vulnerability levels increasing faster than their resiliency levels and, therefore, further threatening their security and livelihoods.

The following recommendations are suggestions for action based on the findings of assessments in Mondulkiri and they comply with the specific categories in the Strategic National Action Plan on Disaster Risk Reduction (SNAP: 2008-2013). As a cross-cutting issue of sustainable development, DRR is the responsibility of the RGC at all levels. Hence the Strategic National Action Plan on Disaster Risk Reduction (2008-2013) reflects the variety of priorities and interests and includes a broad range of stakeholders in what is a collective effort involving both those concerned with development and disaster management. A strong emphasis, is put on strengthening sub-national capacities, particularly at the community level, in support of the RGC's priority of poverty reduction as elaborated in national development plans and policies (i.e., NSDP 2006-2010, NPRS, CMDG, NAPA 2006).

The SNAP(2008 -2013) emphasizes with stakeholders that given the overall lack of awareness and understanding of DRR and the scarcity of human and financial resources; disaster risk reduction can only be achieved over the long term, having progressed through a number of stages. Implementation of both the national action plan and the report recommendations therefore requires prioritization and a logical sequencing of identified interventions. Within the context of this long term effort, the SNAP serves as the initial programming tool and the suggested recommendations comply in sequence with the plan's detailed sets of priorities from which government, and a range of actors, from community groups to government authorities can identify those that they can best meet.

Needless to say, some recommendations, in order to be effective, need to be undertaken in coordination with each other by relevant organizations and actors. For example, various activities at the first level priority require the backing of second or third level institutional support in order to be sustainable. Similarly, activities undertaken by

institutions can require the support of communities where their programming will be conducted. See Annex 1 for a comprehensive list of recommendations.

Core Recommendations

5.1 Ensure that DRR is a national and local Priority with a strong institutional basis for implementation: (Priority Level ONE)

5.1.1 Formulate Policies and legislation in Support of DRR

5.1.1.1 Ensure that the rights and concerns of indigenous peoples are included through the inclusion of the 2009 indigenous policy document, in the formulation, development and advocacy to address policy and legislative gaps especially in the drafting of a national disaster management policy and bill.

5.1.2 Creation and Strengthening of a national DRR mechanism

5.1.2.1 Strengthen the capacity of NCDM especially its coordinative and monitoring mechanisms and structures so that it can meet its mandate;

5.1.2.2 Strengthen synergy and partnership between governmental and non-governmental actors during and in preparation of emergency response operations by developing and formalizing information sharing and coordination mechanisms;

5.1.2.3 Include Mondulkiri in the Strategic National Action Plan on Disaster Risk Reduction (SNAP: 2008-2013).

5.2 Strengthen Sub-national and community based disaster risk management: (Priority Level TWO)

5.2.1 Decentralize responsibilities and resources for DRR

5.2.1.1 Ensure that decentralization and deconcentration are reflected in DRR policies and programming at all sub-national levels;

5.2.1.2 Extend the formulation of disaster preparedness plans to multi-stakeholder consultations (including between government and non-government sectors).

5.2.2 Promote implementation of community-based DRR programs

5.2.2.1 Understand roles of CBDRM within the traditional social structure and governance system of the indigenous populations and sensitize communities on structures of DRR in Cambodia, including identifying stakeholders, committees, and organizations that they can approach for assistance and related policies (such as the Strategic National Action Plan on Disaster Risk Reduction (2008-2013)) that are used to guide risk reduction activities;

5.2.2.2 Following consultations and based on the outcomes of community-risk assessments, and with due respect to traditional local governance systems [promote the creation of (pilot) Village Disaster Management teams (VDMTs)].

5.3 Identify, assess and monitor hazard risks and enhance early warning: (Priority Level TWO)

5.3.1 Conduct national and local risk assessment

5.3.1.1 Harmonize risk assessment methodology and risk ranking models among relevant provincial departments and non-governmental actors to move towards a national standard hazard mapping exercise¹⁷;

5.3.1.2 Support provincial, commune and district officials in joint rapid needs assessments and HVCAs.

5.3.2 Establish disaster management information system

5.3.2.1 Support the establishment of a Provincial Disaster Risk Profile Database (DRPD).The database will assist the province, districts, and communes in the formulation of their respective disaster reduction plans and will create the basis for the establishment of a comprehensive EWS by linking up with existing national and regional database (i.e. MRC). The database will also serve as an inventory of the equipment and supplies stockpiled or needed in case of emergency response.

5.3.3 Develop multi -hazard early warning system (EWS)

5.3.3.1 In cooperation with key stakeholders, formulate a provincial contingency plan which adopts a multi-hazard and EWS approach;

5.3.3.2 Create the conditions for a Mondulkiri community-owned EWS by increasing coordination between Red Cross volunteers, formal and informal village authorities, communes, districts and Village Disaster Management teams (VDMTs).

5.3.4 Collaboration with International and regional DRR initiatives

5.3.4.1 Clearly identify human activities that have a potential to lead or contribute to increased risks of natural disasters (i.e., deforestation, mining, hydropower development, etc.) and enhance RGC's participation in the Regional Consultative Committee (RCC);

5.3.4.2 Formalize national bilateral and province to province dialogues and cooperation on disaster-related issues, especially in the context of trans-boundary water management, including dam construction.

5.4 Use Knowledge, innovation and education to build a culture of safety and resilience at all levels: (Priority Level TWO)

¹⁷ This is the overall goal of developing a national multi-hazard vulnerability atlas for Cambodia;

5.4.1 Promote DRR education and training

5.4.1.1 Taking into account the variety of indigenous spoken local languages and access to the formal system, promote DRR in both school curriculum and informal education (for youth who do not attend school).

5.4.2 Promote public awareness

5.4.2.1 Using radio or other reliable communication tools for public awareness, sensitize communities on hazard preparedness, and EWS alerts.

5.5 Mainstreaming DRR into policies and programs of relevant government ministries: (Priority Level THREE)

5.5.1 Incorporate DRR in sustainable environment and natural resource management

5.5.1.1 Advocate for the enforcement of natural resource management and environment protection-related laws as a means for stabilizing communities.

5.5.2 Integrate DRR into Climate Change adaption programs

5.5.2.1 Support National Adaptation Program of Action to Climate Change at the provincial level;

5.5.2.2 Strengthen coordination between NCDM and the National Climate Change Committee (NCCC) at the sub-national levels.

5.5.3 Promote food security to enhance community resilience

5.5.3.1 Promote food security in areas that have been identified as prone to drought and flooding.

5.5.4 DRR integrated into health sector

5.5.4.1 Integrate DRR into provincial health and contingency planning. Include gender impacts of disaster on women and children, as part of the Provincial Disaster Risk Reduction Plan to be implemented at the district, commune and village levels (H).

5.5.5 Promote appropriate structural and non-structural mitigation measures (Provides a set of recommendations for various DRR projects to be implemented by IOs, NGOs , CBOs, especially in relation to flood, drought and insect infestation; see Annex 1)

5.6 Strengthen disaster preparedness for an effective response at all levels: (Priority Level TWO)

5.6.1 Strengthen national and sub-national capacity for preparedness and response

- 5.6.1.1 Ensure that standardized training curricula at the national level are replicated and adapted to the context of Mondulkiri¹⁸;
- 5.6.1.2 Ensure that the required resources, both human and financial, are allocated to conduct training programs at PCDM, DCDM and CCDM levels, and monitor the transparency and use of these resources;
- 5.6.1.3 Develop Standard Operating Procedures (SOPs) for CCDM-DCDM-PCDM to define roles, responsibilities and tasks of each committee in the event of disaster, as well as for preparedness, mitigation and other risk reduction activities;
- 5.6.1.4 Conduct training needs analysis in preparation of the delivery of future training to PCDM;
- 5.6.1.5 At sub-national levels provide capacity building to DCDM and PCDM focusing on increasing general knowledge of DRR laws, policies, and climate change adaptation strategies amongst member line departments.

¹⁸ Ensure that an appropriate methodology and standardized training materials are developed or readapted on existing disaster-management related laws and policies.

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Annex 1 - Comprehensive List of Recommendations

1. Ensure that DRR is a national and local Priority with a strong institutional basis for implementation: (Priority Level ONE)

1.1 Formulate Policies and legislation in Support of DRR

- 1.1.1 Ensure that the rights and concerns of indigenous peoples are included through the inclusion of the 2009 indigenous policy document, in the formulation, development and advocacy to address policy and legislative gaps especially in the drafting of a national disaster management policy and bill.

1.2 Creation and Strengthening of a national DRR mechanism

- 1.2.1 Strengthen the capacity of NCDM especially its coordinative and monitoring mechanisms and structures so that it can meet its mandate;
- 1.2.2 Strengthen synergy and partnership between governmental and non-governmental actors during and in preparation of emergency response operations by developing and formalizing information sharing and coordination mechanisms;
- 1.2.3 Include Mondulkiri in the Strategic National Action Plan on Disaster Risk Reduction (SNAP: 2008-2013).

1.3 Integration of DRR into national development policies and planning

- 1.3.1 Incorporate DRR into national development plans and strategies (i.e. CMDG, NSDP, NPRSP, rectangular strategy) as a cross-cutting development issue.

1.4 Allocate appropriate resources for DRR at the national level

- 1.4.1 Conduct advocacy with major institutional donors (WB, ADB, DFID, UN) to include a DRR perspective in their country assessments (CA) and UNDAF¹⁹.

2. Strengthen Sub-national and community based disaster risk management: (Priority Level TWO)

2.1 Decentralize responsibilities and resources for DRR

- 2.1.1 Ensure that decentralization and deconcentration are reflected in DRR policies and programming at all sub-national levels;
- 2.1.2 Extend the formulation of disaster preparedness plans to multi-stakeholder consultations (including between government and non-government sectors: see 1.3.1);

¹⁹ DIPECHO, AUSAID, USAID, are providing funding for DRR, GTZ, Netherlands, ADB are major donors for MRC.

- 2.1.3 In the context of decentralization of DRR, mainstream the development of disaster management plans, as listed amongst the newly mandated roles and functions of the councils ;
- 2.1.4 Establish a disaster management fund for use in preparedness and mitigation activities and projects of local governments. This should be complemented with the reorientation of village and commune development and investment planning to include disaster risk management;
- 2.1.5 Through institutional support and capacity building strengthen the front line role of the communes in DRR;
- 2.1.6 Conduct participatory needs assessment for communes and districts to determine specific budgets for emergency supplies;
- 2.1.7 Promote and formalize, dialogue, cooperation and collaboration between PCDM, NGOs and civil society through annual DRR Forums;
- 2.1.8 Sensitize authorities on the DRR framework at the PCDM, DCDM, and CCDM levels.

2.2 Promote implementation of community-based DRR programs

- 2.2.1 Understand roles of CBDRM within the traditional social structure and governance system of the indigenous people and sensitize communities on structures of DRR in Cambodia, including identifying people, committees, and organizations that they can approach for assistance and related policies (such as the SNAP) that are used to guide risk reduction activities;
- 2.2.2 Encourage the sharing and documenting of information on indigenous knowledge of disaster risk and coping strategies, including early warning signs and indigenous resources;
- 2.2.3 Develop CBDRM strategies based on past and present experiences and practices of community-based natural resource management (CBNRM);
- 2.2.4 To avoid duplication and promote interest and engagement; mainstream CBDRM into existing mechanisms at the community level;
- 2.2.5 Following consultations and based on the outcomes of community-risk assessment, and with due respect to traditional local governance systems [promote the creation of (pilot) Village Disaster Management teams (VDMTs);
- 2.2.6 Provide training and resources to (pilot) VDMTs to facilitate their start-up and build network with the CCDM and DCDM. Piloted VDMTs will provide data for the suggested Provincial Disaster Risk Profile Database (DRPD).(3.1 below);
- 2.2.7 Define clear roles and responsibilities from village to commune to provincial levels, in emergency supplies distribution and management;
- 2.2.8 In sub-national planning, strike a balance between the promotion and provision of hard infrastructures (i.e., roads) and soft infrastructure (i.e., education, agricultural support and natural resource management) in local development planning.

3. Identify, assess and monitor hazard risks and enhance early warning: (Priority Level TWO)

3.1 Conduct national and local risk assessment

- 3.1.1 Harmonize risk assessment methodology and risk ranking models among relevant provincial departments and non-governmental actors to move towards a national standard hazard mapping exercise²⁰,
- 3.1.2 Support provincial, commune and district officials in joint rapid needs assessments and HVCAs.

3.2 Establish disaster management information system

- 3.2.1 Support the establishment of a Provincial Disaster Risk Profile Database (DRPD).The database will assist the province, districts, and communes in the formulation of their respective disaster reduction plans and will create the basis for the establishment of a comprehensive EWS by linking up with existing national and regional database (i.e. MRC). The database will also serve as an inventory of the equipment and supplies stockpiled or needed in case of emergency response.

3.3 Develop multi -hazard early warning system (EWS)

- 3.3.1 In cooperation with key stakeholders, formulate a provincial contingency plan which adopts a multi-hazard and EWS approach;
- 3.3.2 Create the conditions for a Mondulkiri community-owned EWS by increasing coordination between Red Cross volunteers, formal and informal village authorities, communes, districts and Village Disaster Management teams (VDMTs);
- 3.3.3 Strengthen capacity of local government units to understand and operate a community based flood warning system;
- 3.3.4 Develop an early warning dissemination plan that takes into account the remoteness of areas amongst the different districts;
- 3.3.5 Encourage reporting of hazards, including health and livestock issues, among communities at the village, commune and district levels, to monitor incidence of these hazards and take into account resources and interventions required to address these issues;
- 3.3.6 Ensure that safe areas for evacuation operations are identified, taking into account the different eco-zones and the existing infrastructure levels;
- 3.3.7 Monitor the state of EWS equipment to ensure all tools are functioning properly and being used effectively;
- 3.3.8 Provide equipment for and training on EWS at the district , commune and village levels;
- 3.3.9 Advocate for meteorological services to have a hub for information dissemination on drought and floods in each commune;
- 3.3.10 Utilize media networks for the purpose of conducting DRR awareness campaigns and to disseminate early warning and forecasting information.

²⁰This is the overall goal of developing a national multi-hazard vulnerability atlas for Cambodia;

- 3.3.11 Ensure that the flow of information on weather forecasting to communities is provided responsive to the language and literacy needs of local communities;
- 3.3.12 Sensitize communities to access and interpret information on weather trends, and flood and drought forecasting;
- 3.3.13 Based on risk assessments; establish clear and formalized evacuation plans at the commune and district level.

3.4 Collaboration with International and regional DRR initiatives

- 3.4.1 Clearly identify human activities that have a potential to lead or contribute to increased risks of natural disasters (i.e., deforestation, mining, hydropower development, etc.) and enhance RGC's participation in the Regional Consultative Committee (RCC);
- 3.4.2 Formalize national bilateral and province to province dialogues and cooperation on disaster-related issues, especially in the context of trans-boundary water management, including dam construction;
- 3.4.3 Conduct focus group discussions (FGDS) regarding proposed hydropower development plans with affected communities;
- 3.4.4 Ensure that hydro-power development projects include social concession plans for resettlement and compensation of affected populations;
- 3.4.5 Develop community dam failure or opening plans, including response and alert strategies with trans-border partners, and set up an alert system for sharing of information on flash and slow-onset floods, as well as the opening of dams; EWS strategies should incorporate for dam opening and failure;
- 3.4.6 Use Province-to-Province dialogues with counterparts in Viet Nam on implementation of institutional EWS (support with relevant MOUs and information dissemination activities);²¹
- 3.4.7 Through action planning facilitate periodic meetings between neighboring provinces to share challenges and lesson identify measures to stabilize water resources and assess possible impacts of other dams to be built within Cambodia;
- 3.4.8 Enhance participation and improve access to technical support and expertise from GMS and ASEAN countries.

4. Use Knowledge, innovation and education to build a culture of safety and resilience at all levels: (Priority Level TWO)

4.1 Establish Mechanisms for information exchange and networking

- 4.1.1 Finalize definition of national standard definitions and terminology for disaster management.

4.2 Promote DRR education and training

²¹In particular ensure cooperation between NCDM representatives and their Vietnamese counterparts from the Vietnam Disaster Management Center in the neighboring provinces

- 4.2.1 Taking into account the variety of indigenous spoken local languages and access to the formal system, promote DRR in both school curriculum and informal education (for youth who do not attend school).

4.3 Promote gender and cultural sensitivity training as an integral part of DRR

- 4.3.1 Integrate gender, disability and cultural sensitivity towards indigenous populations into training modules into capacity building programs.

4.4 Undertake DRR technical and scientific research

4.5 Promote public awareness

- 4.5.1 Using radio or other reliable communication tools for public awareness, sensitize communities on hazard preparedness, and EWS alerts;
- 4.5.2 Conduct public awareness campaigns for DRR using a methodology that takes into account the variety of locally spoken languages and the target populations' levels of literacy and traditions, beliefs and values;
- 4.5.3 Build consensus for action on CBDRM at local levels, including community-based organizations, by educating communities on what their rights are in relation to DRR.

5. Mainstreaming DRR into policies and programs of relevant government ministries: (Priority Level THREE)

5.1 Incorporate DRR in sustainable environment and natural resource management

- 5.1.1 Enforce natural resource management and environment protection-related laws as a means for stabilizing communities;
- 5.1.2 Promote integration of Mondulkiri DRR into Lower Mekong Basin, resource management programs;
- 5.1.3 Identify and address needs for CBDRM within the context of environment preservation and ecosystem management;
- 5.1.4 Ensure that environment and natural resource management policies are promoted in a manner that protects indigenous populations' access to traditional coping mechanisms during times of flooding and drought;
- 5.1.5 Strengthen the capacity of law enforcement authorities to prevent, control, and respond to violations of environment-related laws which have negative impacts on the well-being of communities;
- 5.1.6 Identify how land and forest access restrictions hinder the development of traditional insecticides, and promote the sharing of knowledge.
- 5.1.7 Assess the impact of human displacement driven by disasters from an environmental and human security perspective;
- 5.1.8 Promote environmental and natural resources protection to improve vulnerable communities' resilience by building on existing structures (such as village monitoring committees), and through advocacy and dialogues.

5.2 Integrate DRR into Climate Change adaption programs

- 5.2.1 Support National Adaptation Program of Action to Climate Change at the provincial level;
- 5.2.2 Strengthen coordination between NCDM and the National Climate Change Committee (NCCC) at the sub-national levels;
- 5.2.3 Sensitize relevant government officers at the provincial, district, and commune level on DRR, Climate Change Adaptation, and CBDRM;
- 5.2.4 Formulate climate change adaptation measures and guidelines for farmers, as well as communities that rely on vulnerable livelihood strategies, including fishing.

5.3 Promote food security to enhance community resilience

- 5.3.1 Promote food security in areas that have been identified as prone to drought and flooding.

5.4 DRR integrated into health sector

- 5.4.1 Integrate DRR into provincial health and contingency planning. Include gender impacts of disaster on women and children, as part of the Provincial Disaster Risk Reduction Plan to be implemented at the district, commune and village levels (H);
- 5.4.2 Incorporate public health and livestock health issues in the DRR priorities and programming of government line department at province, district and commune levels ;
- 5.4.3 Conduct needs assessment for public health for communes and districts to determine the type of assistance required by communities, and barriers to access and attitude toward quality of health service delivery;
- 5.4.4 Integrate public health concerns into CBDRM, to emphasize on preventative measures, with goal of increasing people's confidence in health services and positive behavior toward health service delivery and institutions;
- 5.4.5 Advocate for the stockpiling of medicines and essential medical supplies to be, made available at the village level, (where possible).

5.5 Promote appropriate structural and non-structural mitigation measures (Provides a set of recommendations for various DRR projects to be implemented by IOs, NGOs, CBOs Implement projects)

Drought and Flood

- 5.5.1 For times of prolonged drought, ensure resources are allocated to provide food aid, emergency supplies and seeds for replanting where necessary;
- 5.5.2 Promote diversified rainwater harvesting activities (e.g., ground runoff tanks for agriculture or livestock, and above-ground tanks for safe drinking water), which increases the supply of water. This practice also saves time on access to resources and, where community members are

- trained in the construction of tanks, can encourage the diversification of livelihood skills;
- 5.5.3 Maintain and update an inventory of the equipment and supplies to be deployed and distributed in the event of disaster;
 - 5.5.4 Ensure that safe areas for evacuation operations are equipped with water and sanitation facilities;
 - 5.5.5 Provide water filtration devices where necessary, and build wells on higher landscapes (for example, on hills used for evacuation) to provide sources of drinking water during floods;
 - 5.5.6 Relief items, including sandbags and boats (where needed), should be ready before flood seasons in all flood-prone districts and communities. Incentives should be provided to communities to allow for the stockpiling and distribution of boats for evacuation, and provision of gasoline for engines. Supplies of life vests, food/rice relief, medicine stockpile, mosquito nets, tents, pots and plates, and sand bags should also be collected and appropriately stored;

Infrastructure

- 5.5.7 Support infrastructure investment for the enlargement and/or building of irrigation canals and dams where deemed necessary, and repair wells where possible;
- 5.5.8 Construct small dams in selected locations with strengthened embankments for water storage. Use the dams to re-charge groundwater levels, thus increasing availability of water in wells, and providing water for animals to drink and, where necessary, to irrigate crops;
- 5.5.9 Invest in higher and stronger roads and infrastructure, such as bridges for streams and road foundations;
- 5.5.10 Promote the construction of appropriate bridges where necessary, to enhance community mobility in times of flooding;
- 5.5.11 Monitor the status of water and sanitation facilities built in identified areas for evacuation operations;
- 5.5.12 Strengthen forecasting infrastructure (both hard and soft) at the MOWRAM;
- 5.5.13 Improve infrastructure for designated evacuation routes and ensure that the infrastructural support takes into account livestock and animals in evacuation strategies;

Agriculture and Livestock

- 5.5.14 Strengthen existing prevention and control of animal disease initiatives, and support (financially or through the provision of other resources) community members in vaccinating their livestock and animals;
- 5.5.15 Establish a calendar of diseases for livestock with the community, to know when to expect certain diseases and take proper preventative measures;
- 5.5.16 Introduce new farming techniques, building upon traditional agriculture practices;

- 5.5.17 Plant appropriate crop mixes and varieties suitable for drought and flood conditions;
- 5.5.18 Identify drought and flood resistant crops and store seeds at the community level for future use;
- 5.5.19 Support the diversification of crops, and plant with space between crops and/or mixed varieties to discourage the movement of insects within the same crop wherever possible. Attention should be paid in adapting indigenous knowledge to more modern farming techniques;
- 5.5.20 Encourage the diversification of both agricultural and livestock resources, and train communities in effective and relevant modern farming practices;
- 5.5.21 Strengthen community seed banks, where members can contribute seeds and retrieve new varieties to diversify crops;
- 5.5.22 Encourage the planting of appropriate trees (with established root balls where possible) along riverbanks and fields to mitigate flooding and to decrease erosion;
- 5.5.23 Where new livelihoods are being explored (i.e., aquaculture, fish farming), ensure that ponds are resistant to both drought and floods;
- 5.5.24 Promote the diversification of livelihood options for communities whose mobility is limited by restrictions in access to land and forest.
- 5.5.25 Identify different drought management responses for mixed agro-eco zones, namely areas which are lowland-upland, riverside – lowland and upland;
- 5.5.26 Emphasize soil moisture management programs (i.e., changing crop patterns, appropriate irrigation techniques);
- 5.5.27 Improve methods to store foods (i.e., smoking, salting drying techniques for meats as well as vegetables);

Insect Infestation

- 5.5.28 Record current knowledge on non-chemical insecticides;
- 5.5.29 Advocate for information dissemination on insect infestation at its earliest possible detection point before infestations begin;
- 5.5.30 Train communities on making and usage of natural insecticides, based on their existing indigenous knowledge and provide practical demonstrations, exercises, and periodical overseeing;
- 5.5.31 Create organic manures and fertilizers using traditional forest products, manure, and leaves to limit the use of chemical pesticides and building upon indigenous knowledge;
- 5.5.32 Set up chemical waste management policies relating to the use of chemical, insecticides, pesticide, and fertilizers;

Climate Change and Others:

- 5.5.33 Collect baseline data for future climate change adaptation programming;
- 5.5.34 Collect local knowledge on changes in climate trends (including shifts in the starting and end dates for rainy and dry seasons);
- 5.5.35 Promote and disseminate information on climate change adaptation to farmers;

- 5.5.36 Conduct evacuation drills for flash flood locations, ensuring that topographic and infrastructure conditions are considered for times of flood;
- 5.5.37 Encourage the development of micro-finance projects to increase savings for times of drought;
- 5.5.38 Train men and women on drinking water sanitation (including for stored water, particularly for children);
- 5.5.39 Promote clean and sustainable alternative energy harvesting and use. Where possible, explore green and sustainable renewable energy options in the context of DRR programming (i.e., support to EWS).

5.6 Incorporate DRR into land use planning and other technical measures

- 5.6.1 Integrate DRR into land use management and planning, including communal land registration procedures , design of new infrastructure and environmental impact assessments of development projects.

6. Strengthen disaster preparedness for an effective response at all levels: (Priority Level TWO)

6.1 Strengthen national and sub-national capacity for preparedness and response

- 6.1.1 Ensure that standardized training curricula at the national level are replicated and adapted to the context of Mondulkiri²²;
- 6.1.2 Ensure that the required resources, both human and financial, are allocated to conduct training programs, and monitor the transparency and use of these resources;
- 6.1.3 Develop Standard Operating Procedures (SOPs) for CCDM-DCDM-PCDM to define roles, responsibilities and tasks of each committee in the event of disaster, as well as for preparedness, mitigation and other risk reduction activities;
- 6.1.4 Conduct training needs analysis in preparation of the delivery of future training to PCDM;
- 6.1.5 Enhance the capacity of PCDM through training activities which are based on the outcomes of the training needs analysis;
- 6.1.6 Build the capacity of PCDM to play supervisory and support roles to the DCDM, including its provision of technical training;
- 6.1.7 Enhance the capacity of DCDM to report to PCDM on event damage and needs for search and rescue operations, to inform of emerging hazards, and to facilitate operations through its communes;
- 6.1.8 Conduct ‘train of trainers’ programs on DRR for provincial, district, commune levels, and record where further training is undertaken;
- 6.1.9 Enhance the PCDM capacities and resources to deliver training to communes and districts on disaster preparedness and response;

²²Ensure that an appropriate methodology and standardized training materials are developed or readapted on existing disaster-management related laws and policies.

6.1.10 Monitor and evaluate the outcomes of all training initiatives; Disseminate relevant reports with stakeholders.

6.2 Develop coordinated regional operational mechanisms and systems for emergencies exceeding national coping capacities

6.2.1 Enhance planning and coordination among regional and national disaster response and other humanitarian relief agencies. E.g. IFRC has capacity and resources for a regional response.

6.3 Prepare and periodically update disaster preparedness and contingency planning

6.4 Promote establishment of emergency funds

6.4.1 Based on multi-hazard disaster preparedness and contingency plans advocate for an increase in the amount of emergency funds for preparedness activities of the sub-national authorities.

Annex II

Glossary*

Adaptation

The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities.

Capacity

The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.

Coping Capacity

The ability of people, organizations and systems using knowledge, skills, resources, abilities, coping strategies, attributes and strengths to face, manage, prevent, mitigate, prepare for and cope with adverse conditions, emergencies or disasters.

Climate Change

A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over a comparable time period.

Disaster

A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts which exceeds the ability of the affected community or society to cope using its own resources.

Disaster Preparedness

The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.

Disaster Prevention

The outright avoidance of adverse impacts of hazards and related disasters.

Disaster risk

The potential disaster losses, in lives, health status, livelihoods, assets and services which could occur to a particular community or a society over some specified future time period.

Disaster risk management

The systematic process of using administrative directives, organizations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.

Disaster risk reduction

The concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment and improved preparedness for adverse events.

Early warning system

The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.

Environmental degradation

The reduction of environmental capacity in order to meet social and ecological objectives and needs.

Hazard

A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption or environmental damage.

Land use planning

The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses.

Mitigation

The lessening or limitation of the adverse impacts of hazards and related disasters.

Natural hazard

Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.

Recovery

The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.

Resilience

The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.

Response

The provision of emergency services and public assistance during or immediately after a disaster in order to save lives reduces health impacts, ensure public safety and meet the basic subsistence needs of the people affected.

Risk assessment

A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm

exposed people, property, services, livelihoods and the environment on which they depend.

Socio-natural hazard

The phenomenon of increased occurrences of certain geophysical and hydro meteorological hazard events, such as landslides, flooding, land subsidence and drought that arise from the interaction of natural hazards with overexploited degraded land and environmental resources.

Vulnerability

The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

**Adapted from the 2009 UNISDR Terminology*

Annex III

Sample of semi-structured interview questions for local government officials in Mondukiri Province

- What are the natural hazards (i.e., floods, drought, insect infestation) faced by communities in the Province?
- What are the impacts of natural hazards to people's livelihoods, properties, and food security?
- What development issues or dynamic pressures are affecting people's vulnerability to natural hazards?
- How are people affected or impacted by these issues in terms of aggravating current vulnerabilities such as low health status, high food insecurity, poor housing structures and lack of social services?
- Does the Province have a disaster risk reduction plan to address these issues?
- What are the responsibilities and activities of the Provincial Committee for Disaster Management with regard to disaster risk reduction?
- What infrastructure, facilities, human and financial resources (e.g., health centers/posts, food stock, and medicine) are available for disaster preparedness, response and recovery?
- How do you work with line departments before, during and after natural disasters?
- Are there programs or projects to mainstream disaster risk reduction in decentralization reforms in the province?
- Did you identify disaster risk reduction to natural hazards as a priority in the commune development and investment plans?
- Are you aware of a committee for disaster management in the districts and communes?
 - If yes, what are its functions and how does each committee for disaster management address actual and emerging disaster management concerns?
- Are there other local organizations or government departments working on or addressing disaster risk management in their projects or programs?
- What are the reporting and feedback mechanisms for disaster risk reduction available to people at the village level?
- What types of assistance has been given so far?
- Are these mechanisms or assistance effective? Why or why not?
- What are the challenges and opportunities in mainstreaming disaster risk reduction in local development planning?

Annex IV**PROVINCIAL WORKSHOP ON PRESENTATION OF RESEARCH FINDINGS**

Tuesday, June 11, 2009, 08:30-17:00
 Sen Monorom, Mondulkiri,

Workshop Minutes

0845 – 0850 Welcoming speech
Mr. Giuseppe Crocetti – IOM Program Manager

Mr. Giuseppe Crocetti welcomed and thanked all the participants for taking time to participate in the workshop. He acknowledged the presence of representatives of non-government organizations and provincial departments, and recognized the support of the Provincial Committee for Disaster Management led by His Excellency Chan Yeorn, Provincial Governor, with the assistance of Mr. Chueng Sochantha, Provincial Chief of Cabinet. After the acknowledgement, he briefed the participants on the purpose of the workshop and the objectives of the research project.

0850 – 0855 Opening speech
Ms. Helena Ahola - First Secretary of the Embassy of Finland in Bangkok

Representing the Government of Finland was Ms. Helena Ahola, First Secretary of the Embassy of Finland in Bangkok, who presented the programs of the Finnish government in Cambodia. She explained the importance of the research project and their interest in selecting Mondulkiri as a research site to map vulnerability to natural hazards within the context of environment protection and community participation to effectively respond to natural disasters.

0900 – 0905 Opening Speech
H.E. Provincial Governor/Representative, Mondulkiri Province

H.E. Chan Yeorn, Provincial Governor of Mondulkiri Province, explained that Mondulkiri was prone to flood and drought, appreciating both the Government of Finland and the IOM for the selection of Mondulkiri as research assessment site for vulnerability mapping to natural hazards. He expressed hope that based on the findings of the assessment, there will be a new disaster risk reduction (DRR) program in Mondulkiri, as he stressed the link between poverty reduction and community's capacity to cope and recover from the negative impacts (among them food insecurity) of natural disasters.

0855 – 0900 Opening Speech
Mr. Pham Huu Hao – Director of Provincial Department of Water Resources Management, Dak Nong Province, Vietnam

Mr. Pham Huu Hao, Director of Provincial Department of Water Resources Management, in Dak Nong Province, Viet Nam, who thanked the Provincial Governor and the National Committee for Disaster Management for the invitation and the IOM for providing support and arrangement for their attendance in the workshop.

0905 – 0920 Role and functions of the National Committee for Disaster Management (NCDM)
Mr. Khun Sokha – Director of Training Department – NCDM

Mr. Khun Sokha, Director of Training Department of NCDM, briefed participants on the role and functions of the National Committee for Disaster Management. He explained the NCDM's structure from the national down to the provincial, district and commune levels through the committee for disaster management. The NCDM also works closely with national line ministries and sub-national line departments for the coordination of DRR initiatives, and with international and non-government organizations, including UN agencies, in the area of disaster risk reduction.

0920 – 0930 Overview of the project objectives and activities
Mr. Giuseppe Crocetti – IOM Program Manager

Mr. Giuseppe Crocetti provided the overview of project objectives and activities, emphasizing that the core of the research objective was meant to enable local and indigenous communities as well as key institutions to better prepare for, mitigate and respond to disasters in Mondulkiri. IOM also collaborated with the University of Agriculture in selecting talented university students to work as members of the research team lead by an IOM researcher. Local NGOs *Village Focus Group NGO* and *the International Cooperation Cambodia* were IOM's partners during the research.

0930 – 1000 Research methodologies and tools
Mr. Try Thuon – IOM Field Researcher

Mr. Thuon Try, IOM field researcher, provided an overview of the Hazard, Vulnerability and Capacity Assessment (HVCA) research methodology and the tools used during the research. He explained how the HVCA tools were used in the context of the field research and how the process generated participation among indigenous communities that were assessed.

1000 – 1010 IOM-NGO partnership in Mondulkiri
Ms. Chey Savin, Director of Village Focus Group NGO

Ms. Chey Savin, Director of Village Focus Group (VFG) NGO, related the organization's partnership with IOM on the research project through the nomination of VFG students who served as field assistants during the field research. She appreciated the training received by the students on HVCA, while underscoring the experience of the students in community mobilization in the villages.

1010 – 1115 Overview of the main findings
Mr. Try Thuon – IOM Field Researcher

Mr. Thuon Try briefed participants on the main research findings arranged by hazard types (floods, drought and insect infestation), capacity and vulnerability assessment in assessed districts using the three categories of analysis (physical/material, organizational/social, and perceptual/motivational) and the dynamic pressures happening within local communities. At the end of his presentation, he described the provincial disaster risk ranking for floods, drought and insect infestation and the identified action plans in the assessed villages, based on the finding of the research were presented.

1145 – 1200 Flood management in Binh Phuoc Province, Vietnam
Mr. Vu Hong Liem – Chief of Provincial Department of Water Resources and Meteorology/Chief of Provincial Disaster Management Center – Binh Phuoc Province, Vietnam

Mr. Vu Hong Liem, Chief of Provincial Department of Water Resources and Meteorology and the provincial representative for the Vietnam Disaster Management Center in Binh Phuoc Province, Viet Nam briefed participants on flood management initiatives in Binh Phuoc Province. He stressed out the importance of flood and water management to reduce the impacts of floods and drought, as he explained the mechanisms for flood control in Viet Nam. As for the flash floods experienced in Mondulkiri as a result of the dams in Viet Nam, he mentioned the need to discuss trans-boundary issues at the regional level and explained that floods in Mondulkiri come from dams in different zones. On this end, he ensured to inform government counterparts in Viet Nam about the findings of this research. Lastly, he thanked the IOM and expressed hope for more cooperation between Mondulkiri and Binh Phuoc provinces in the future.

**1330 – 1345 Drought and insect infestation in Mondulkiri
Director/Representative, Provincial Department of Agriculture**

Mr. Han Sophak, representative from the Provincial Department of Agriculture in Mondulkiri, presented the situation of drought and insect infestation management in the province. He mentioned that Mondulkiri is facing problems as result of its exposure to flood, drought and insect infestation. He identified the lack of infrastructure, primarily irrigation system, as challenge for drought management in the province. Floods in Koh Nheik, known to be swift and strong, originate from upstream of the Sre Pok River, causing crop losses and soil erosion every year. For insect infestation, the brown plant hopper posed the biggest problem to farmers, as there is little knowledge and capacity to cope with this type of insect infestation. He encouraged the use of natural insecticides as a sustainable way of controlling insect infestation, and the need to diversify crops that are resistant to drought.

**1345 – 1410 Drought and forest management in Binh Phuoc Province, Vietnam
Mr. Vu Dinh Truc – Chief of Provincial Department of Agriculture, Rural Development and Forest Protection, Binh Phuoc Province, Vietnam**

Mr. Pham Huu Hao, Director of Provincial Department of Water Resources Management, in Dak Nong Province, Viet Nam, mentioned that both Dak Nong and Mondulkiri provinces in Viet Nam and Cambodia, respectively, experienced deforestation in the borders of O' Rang and Keo Seima districts, which were rich in forest areas. He said it was important to build cooperation between the two provinces on forest and wild life preservation, citing the value of the forests for Dak Nong and Mondulkiri provinces forests, which were currently organization into two main uses: 1)special use forests, where scientific research studies can be authorized and aimed at protecting biodiversity ; and 2) production forests, where trees were planted for commercial purposes. Approximately 30,000 hectares of land had been allocated for reforestation. He called for a joint task force between Mondulkiri and Dak Nong provinces to ensure increased forest and environment protection from further environmental degradation, which had been shown to contribute to more frequent and severe natural hazards.

1410 – 1430 Mr. Pham Huu Hao – Director of Provincial Department of Water Resources Management, Dak Nong Province, Vietnam

The Vietnam provincial government counterpart, Mr. Vu Dinh Truc, Chief of Provincial Department of Agriculture, Rural Development and Forest Protection in Binh Phuoc Province, Viet Nam, mentioned the difficulty of dealing with drought, citing that the best way to know the situation is to collect data from the communities. To deal with drought, it was recommended to do forecasting based on rainfall volume on a yearly basis. Another important point he raised on drought management is the preservation of the forests, which plays an important role in rainfall regulation. At times, it is necessary to measure rainfall levels in different eco-zones. For instance, in Viet Nam, agricultural droughts were mainly caused by very high demand for water irrigation and over-exploitation of water resources, with more areas affected by drought are those that

heavily cultivate cash crop rather than rice. Cash crops are preferred by farmers because they produce more yields per hectare than wet rice, and provide them with better cash income. He added that practical demonstration is needed to show that mixed crops can help mitigate impact of crop failure during periods of drought.

**1430 – 1445 Climate change and environmental policy in Mondulkiri
Director/Representative, Provincial Department of Environment**

Mr. Heng Kheng, representative from Mondulkiri Provincial Department of Environment, informed participants that in the last ten years, soil, water and air have been polluted as a result of human activity, with negative impacts on health, biodiversity and rural development. Because of the rapid changes in climate trends, farmers were not prepared with the unpredictability of rainfall amount and distribution. He encouraged more training and cooperation among stakeholders with the Provincial Department of Environment in Mondulkiri to mitigate the impacts of environmental degradation and rapid changes in climate variability.

1445 – 1500 Presentation of the Video Documentary ‘The Trech’s Nest: Short stories on disaster risk from the indigenous communities of Mondulkiri’

1500 – 1530 Questions and Answers

Most of the questions and responses during the open forum were addressed to representatives of the provincial departments as to how they planned to implement recommendations of the research. Representatives explained the challenges they face in terms of human, financial and technical resources. They said they hope to also cooperate with international organizations like IOM for joint implementation on some aspects of the recommendations.

**1530 – 1545 Recommendations/Action Planning
Mr. Khun Sokha – Director of Training Department – NCDM**

Mr. Sokha presented short-term, medium term and long-term recommendations for flood, drought and insect infestation. For drought, diversification of crops and use of drought resistant crops, water management, creation of seed banks and promotion of micro-finance projects and early warning system were some of the key recommendations. For flood, the main recommendations were setting up early warning system and improving access to meteorological information, stockpiling of food and medicines, building of critical facilities and infrastructures, and the facilitation of dialogues to resolve the issues of trans-boundary impacts of hydropower dams. For insect infestation, crop diversification, the use of natural insecticides, and seed banking were some of the major recommendations presented. The creation of the village disaster management team (VDMT) was proposed as a local level mechanism for disaster risk management. Policy-level recommendations include building the capacities and awareness of local government officials on their mandates on disaster risk reduction mandate, national policies on indigenous rights, decentralization, climate change and DRR, and promoting greater coordination between NGOs and provincial government in developing the Provincial Disaster Risk Reduction Plan.

He expressed that the NCDM can use its experience on flood control strategies as applied in other provinces in Cambodia to the context of flooding in Mondulkiri. The long-term direction to address issues of water resource management is through trans-boundary dialogues and mechanisms. He thanked the IOM and the Government of Finland for their support and affirmed the need to develop the Provincial Disaster Preparedness Plan as a starting point for mainstreaming of DRR in local development planning, as a specific budget could be allocated to address some of the research recommendations.

1545 – 1600 Wrap Up
Mr. Giuseppe Crocetti – IOM Program Manager

Mr. Giuseppe Crocetti concluded the workshop by thanking in particular H.E. Chan Yeorn, Mondulkiri Provincial Governor, who took time despite his hectic schedule to attend the event and gave his full support for the project. He also expressed his appreciation to representatives of the Provincial Departments and participants from various organizations and NGOs, as well as representatives from Viet Nam provincial government counterparts who showed their strong interest to work with the province in the areas of environment protection and disaster management. Mr. Crocetti hoped to continue IOM's cooperation with the Mondulkiri Provincial Committee for Disaster Management and with NGOs in Mondulkiri in the implementation of the next phase of the project.

Annex V

NATIONAL WORKSHOP ON PRESENTATION OF RESEARCH FINDINGS

Monday, June 15, 2009, 08:30-17:00
Venue: Cambodiana Hotel, Tonle Mekong Room
Phnom Penh, Cambodia

Workshop Minutes

I. Opening Remarks

Ms. Iuliana Stefan, IOM Chief of Mission, welcomed workshop participants to the presentation of the main findings of the research project, *Mapping Vulnerability to Natural Hazards in Ratanakiri and Mondulkiri*. H.E. Mr. Peou Samy, Secretary General of the National Committee for Disaster Management (NCDM) addressed the importance of the research findings as Ratanakiri and Mondulkiri provinces are currently not identified in the Strategic National Action Plan (SNAP) for Disaster Risk Reduction. He emphasized the importance of giving attention to Mondulkiri and Ratanakiri as the majority of its citizens are from indigenous and ethnic minority groups and largely dependent upon natural resources, which makes them especially vulnerable to natural hazards environmental degradation.

II. DRR in Ratanakiri and Mondulkiri

After the introductory remarks, Mr. Khun Sokha, Director of the Training Department of the NCDM, highlighted key points on disaster risk reduction which needed to be addressed in the context of the two provinces. First, there tends to be a general assumption that both provinces are not prone to natural hazards compared to other provinces. The information gathered by IOM and the NCDM during fieldwork clearly identified Mondulkiri and Ratanakiri as geographically prone to hazard risk. The second key point is that there is not enough data or knowledge on hazard risks in these areas as the NCDM has not previously worked there. This dearth of data has led to the exclusion of the two provinces from dialogues, policies and action plans for DRR, particularly in the Strategic National Action for DRR for 2008 - 2013. It is hoped that findings from the research assessment would supplement the SNAP to gain institutional support for DRR programming in these two provinces, and to encourage social actors, such as international organizations, NGOs, donors and other DRR implementers, to look into the two provinces as future areas of intervention. The research calls for the need to build upon existing indigenous knowledge and coping mechanisms when developing training curriculum and mitigation and preparedness activities. In Mondulkiri and Ratanakiri, DRR strategies can be integrated into land management and planning and natural resource management policies. By working with multi-stakeholders, NCDM hopes to help address the vulnerability of all at-risks regions in Cambodia, including the most marginalized and remote local communities, such as those in the North-East.

III. Donor's Views

Mr. Josep Vargas, Resident Representative of the Spanish Agency for International Cooperation and Development (AECID), mentioned that the interest of the Spanish cooperation in supporting the assessment is to contribute to the developmental needs of the indigenous communities in Ratanakiri and Mondulkiri. The two provinces have been experiencing rapid loss of natural resources, particularly deforestation, which has had negative impacts on their culture, traditions and livelihoods. IOM's work in the two provinces was intended to understand people's vulnerabilities and capacities in dealing with natural hazards in order to enable local communities, as well as different actors including indigenous communities, to better prepare for, mitigate and respond to natural disasters,

IV. Research Methodology and tools

Mr. Crocetti briefly described the tools utilized during the research which are the Hazard, Vulnerability and Capacity Assessment (HVCA). Mr. Crocetti emphasized the importance of HVCA as a participatory research methodology and how the assessment had ensured that indigenous communities participated meaningfully during the assessment. He proceeded to outline how the disaster risk of hazards was ranked, and which tools were used to help the field researchers identify the priorities for intervention according to the levels of disaster risk.

V. Presentation of Main Findings

Ratanakiri

Ms. Kathlyn Kissy Sumaylo, IOM field researcher for Ratanakiri, presented the main findings on the hazard, vulnerabilities and capacities of the four districts studied. Ms. Sumaylo highlighted that the major types of natural hazards she encountered during her field study were flood, drought and insect infestation, which create vulnerability among the population in Ratanakiri. She mentioned that while people were shown to have some capacities, changes in natural hazard and climate trends suggested that these capacities were lacking and that timely institutional support and external assistance were crucial.

Mondulkiri

Mr. Try Thuon, IOM field researcher for Mondulkiri, shared that most of the assessed villages in the province have high hazard risks to insect infestation, drought, and flash flood. Mr. Thuon proceeded to explain that vulnerability is related to organizational structural and non –structural factors, such as capacity, impact and populace trying to use their own knowledge. After the presentations, a video documentary for Ratanakiri (*Lizards' Tail*) and Mondulkiri (*Trech's Nest*) were shown, eliciting positive responses for action from attending organizations working on DRR

VI. Open Forum – Major discussion Points

- **Criteria for the selection of Mondulkiri and Ratanakiri as research sites**

A question was raised regarding the selection criteria for hazard and vulnerability assessments in the two provinces, as they are not considered as high risk to natural hazards compared to other provinces in Cambodia. The response from IOM pointed to the urgency of environmental degradation in the two provinces which has been increasing their existing vulnerabilities to natural hazards. The change in climate patterns that is experienced and reported by local communities has serious effects on their way of life and livelihoods. No data or similar DRR research has been conducted in the two provinces. A follow-up question was asked on whether IOM will target other provinces outside the northeast, to which IOM replied they will consider the future expansion of HVCA based on its experience in Ratanakiri and Mondulkiri.

- **Comments on HVCA as a research methodology**

HVCA was chosen as the research methodology in the research because it has been tested and used in various risk assessments worldwide. The research assessment is largely qualitative data gathering with carefully chosen tools to assess people's hazard exposure, vulnerability and capacity. The risk ranking at the end of each hazard risk assessment was meant to provide an initial concrete data to reflect the primary data collected during field research. While the availability of scientific data in the province (e.g., rainfall and water levels) was a challenge, the research teams analyzed research data from past research studies looking into such scientific indicators as NDVI (Normalized Differential Vegetation Index) in 2003, showing high vegetation cover in the two provinces, and hydro-meteorological reports on national drought years, which were captured and reported in the research. Scientific data alone does not give us a complete picture, but needs to be complemented by on-the-ground assessment.

VII. Recommendations/ Action Planning

H.E. Peou Samy put forward the following recommendations based from the findings of the research studies in Ratanakiri and Mondulkiri:

1. Building of water basins for irrigation, water storage, livestock and clean water.
2. Using crops that are resistant to land erosion.
3. Proper maintenance of water wells for drinking, cooking and watering.
4. Introduction of water filters for clean water.
5. Encouraging the development of microfinance projects and programmes for the drought season.
6. Provision of resources such as food materials.
7. Encouraging to plant different kinds of crops and training the community how to plant certain crops.
8. Dissemination of information to the communities on preparedness.
9. Setting up of devices for warning single provision.
10. Preparation of sandbags and food materials before floods and droughts occur.
11. Provision of training for women on clean water and sanitation.
12. Establish an environment of information sharing, such as weather forecast among/between communities.
13. Supporting the set-up of the village's disaster management team in selected areas.
14. Building of bridges and roads
15. Regular discussions to take place by the provincial level and NGOs.
16. Encouraging general public's knowledge from community districts.
17. Training of officials from provincial to communal areas and learning to assess.



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