MAPPING VULNERABILITY TO NATURAL HAZARDS IN RATANAKIRI

Final Report

IOM International Organization for Migration

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IOM Phnom Penh Report (English)

Cover Photo: Dug well in a river sandbar – Lumpat Village, Ratanakiri - © IOM

MAPPING VULNERABILITY TO NATURAL HAZARDS IN RATANAKIRI

Final Report

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Foreword

Mapping Vulnerability to Natural Hazards in Ratanakiri was a nine-month research project carried out by IOM in support of the Cambodian Government's efforts to promote Disaster Risk Reduction (DRR) in the North-Eastern provinces of the country. To this end, a parallel research project was also conducted in the neighboring province of Mondulkiri. The project reflects the IOM's global commitment to address the complex interaction between disasters, the environment, and climate change from a human mobility perspective.

The overall purpose of the project 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 Ratanakiri. This purpose is in line with the IOM participation to the International Strategy for Disaster Reduction (ISDR) and its commitment to the principles and goals of the Hyogo Framework for Action (HFA) to work with governments and communities to build resilience to natural hazards.

This final report illustrates the main findings of the research study, which was carried out jointly with the National Committee for Disaster Management (NCDM), with funding provided by the Spanish Agency for International Cooperation and Development (AECID). The report aims to provide an overall view of vulnerability and resilience levels of communities to multiple types of natural hazards, in particular floods, drought and insect infestation. The report fulfills the IOM's global responsibility within the Inter-Agency Standing Committee (IASC) as a Global Cluster lead for Camp Coordination and Camp Management (CCCM) to ensure that assistance is provided to those affected by natural disasters.

IOM's experience indicates that regions affected by environmental degradation are more prone to the risk of natural disasters. This is the case of Ratanakiri, where environmental degradation, mainly expressed by the loss of forest cover, further exacerbates the existing vulnerability levels of communities to natural hazards. The large majority of the population is composed of indigenous people and other ethnic minority groups who directly use the forest for their sustenance requirements. In times of floods and drought, these communities strongly rely on the forest resources to cope with food shortages.

Environmental degradation, combined with a rapidly changing economy, can pose a threat to the sustainability of livelihoods, ecosystem integrity, and food security, as it decreases the capacity of communities to prepare for and respond to natural hazards.

The report also highlights the increased vulnerability levels to the occurrence of more unexpected and extreme natural events, driven by frequent and unpredictable changes in climate trends. IOM is active in the context of the UN Framework Convention on Climate Change to promote the inclusion of migration under the adaptation pillar.

It is our hope that both government and non-government actors will benefit from the findings and recommendations of our assessment and work together to help the most vulnerable communities better prepare for, mitigate, respond to, and reduce overall risk levels to disasters in Ratanakiri.

IOM Phnom Penh, September 2009

Abbreviations

AECID	Spanish Agency for International Cooperation and Development
CARERE	Cambodia Area Rehabilitation and Regeneration
CBDRM	Community-Based Disaster Risk Management
CBDRR	Community-Based Disaster Risk Reduction
CBNRM	Community-Based Natural Resource Management
CBO	Community-Based Organizations
CC	Commune Council
CEDAC	Cambodian Center for Study and Development in Agriculture
CEPA	Culture and Environment Preservation Association
CFA	Community Forest Agreement
CPA	Community Protected Area
CCCM	Camp Coordination and Camp Management
CCDM	Commune Committee for Disaster Management
CHR	Commission on Human Rights
DRR	Disaster Risk Reduction
D&D	Decentralization and Deconcentration
DPA	Development and Partnership in Action
EIA	Environmental Impact Assessment
EWS	Early Warning System
EYS	Education, Youth and Sports
FA	Forestry Administration
GAA	German Agro-Action
HA	Highlander Association
HFA	Hyogo Framework of Action
HU	Health Unlimited
HVCA	Hazard, Vulnerability and Capacity Assessment
IASC	Inter-Agency Standing Committee
ICC	International Cooperation Cambodia
ICSO	Indigenous Community Support Organization
IMS	Incident Management System
IOM	International Organization for Migration
ISDR	International Strategy for Disaster Reduction
IYDP	Indigenous Youth Development Program
JICA	Japan International Cooperation Agency
3SPN	3S Rivers Protection Network
LAMC	Law on Administration and Management of Commune/Sangkat
MLMUPC	Ministry of Land Management, Urban Planning and Construction
MRC	Mekong River Commission
MW	Megawatt
NAPA	National Adaptation Programme of Action to Climate Change
NCCC	National Climate Change Committee
NCDM	National Committee for Disaster Management
NPCA	Nature Protection and Conservation Administration
NPRS	National Poverty Reduction Strategy

NRM	Natural Resource Management
NSDP	National Strategic Development Plan
NTFP	Non-Timber Forest Products
PCDM	Provincial Committee for Disaster Management
PDAFF	Provincial Department of Agriculture, Forestry and Fisheries
PLG	Partnerships for Local Governance
PRDC	Provincial Rural Development Committee
RGC	Royal Government of Cambodia
SNAP	Strategic National Action Plan for Disaster Risk Reduction
SOP	Standard Operating Procedures
TOT	Training-Of-Trainers
UNDP	United Nations Development Programme
VDC	Village Development Committee
VDMT	Village Disaster Management Team
VSO	Volunteer Service Overseas
WCDR	World Conference of Disaster Reduction
WFP	World Food Programme
WHH	Deutsche Welthungerhilfe e. V.

Acknowledgements

I would like to acknowledge the assistance and contribution of many people involved in the successful completion of fieldwork and research in Ratanakiri. My sincerest thanks to the IOM Chief of Mission, Ms. Iuliana Stefan, and to my project manager, Mr. Giuseppe Crocetti, whose vision for this project made it possible to do an otherwise daunting task within a short time. I am also grateful to the IOM team members in Phnom Penh for their contribution and hard work - Mr. Uy Akhara, who assisted us in all logistical arrangements during and after field work, and Ms. Maipham Vang, IOM intern from the US, who provided substantial editing inputs for this report. From the National Committee for Disaster Management, thanks to Khun Sokha whose feedback during the field test helped refine our key questions and field strategy. Likewise, my appreciation and gratitude to Mr. Josep Vargas, Country Representative of the Spanish Agency for International Cooperation and Development (AECID), for his support to this research. My research team members - Pok Sophak, Nun Sokunthea and Choung Phea, and eight field assistants from HA and IYDP – braved with me difficult and unpredictable terrains through mudslides, scorching summer heat and long boat and motorbike rides, rain and long nights to reach our targeted villages and conduct the assessment, and whose translation and documentation bridged us to the local and indigenous communities whom this research is largely for.

In Ratanakiri, I have to thank the PCDM and, in particular, Mr. Nap Bun Heng, Chief of Provincial Cabinet, with the able assistance of his deputy chiefs Heng Kin San and Mong Sineat, for the effective coordination of fieldwork with relevant local authorities at the commune and district levels and provincial departments. Among NGO partners, I thank the HA Director, Ms. Dam Chanty, for closely coordinating and supporting us at every critical stage of field work and Mr. Long Serey of NTFP for assigning us talented young field assistants from their IYDP project. 3SPN, headed by then-director Kim Sangha, and now by Mr. Mech Mean, has provided valuable insight on the flooding situation in Ratanakiri and shared their work and findings from past studies. At the local level, my sincerest thanks to the District Governors of Lumphat and Veun Sai and the Deputy Governors and commune councilors of Ta Veaeng and Andoung Meas, as well as to the commune chiefs and officials in the 19 communes and village officials in the 26 villages that we assessed. Many thanks to government officials from Provincial Departments of Water Resources and Meteorology, Planning, Agriculture, Forestry and Fisheries, Social Affairs, Environment, Land Management, Forestry Administration, and NGO staff from CARE, CEPA, ICSO, HA, Ockenden, CEDAC, WHH, HU, VSO, NTFP and JICA who took time to discuss development issues here in the province and their intervention.

Lastly, I sincerely dedicate this research study to the women, men and children of Ratanakiri whose stories and experiences kept me engaged as a researcher, as I asked more questions to further understand how poverty and insecurity exist alongside abundance, and whose lives and oneness with their lands, environment and identity tell me not just of their survival, but also of their great courage and strength to live and carry on one day at a time. Orkun Charoeun!

Kathlyn Kissy Haynes Sumaylo
IOM Field Researcher for Ratanakiri

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Executive Summary

In terms of the percentage of population affected by natural disasters, and the relatively low adaptive capacity of communities, Cambodia is one of the most disaster-prone countries in Southeast Asia. Every year, a significant number of people are exposed to natural hazards, which threaten their security, livelihood and well-being.

Ratanakiri, a province vital to the political and economic interests of Cambodia, is located in the North-East section of the country, bordered by Viet Nam and Lao PDR. Ratanakiri used to be known as a densely forested province. Today, large swaths of the province have been logged, leaving the ecological integrity of the region frail at best. A large majority of the population is composed of indigenous groups and other ethnic minorities who directly use the forest for their sustenance requirements. Their marginalization, compounded by a strong reliance on natural resources, leaves these communities particularly vulnerable to the effects of environmental degradation and natural hazards.

Changes in the political climate and legal context of Cambodia can have far-reaching implications on the lives, traditions and livelihoods of indigenous populations who have traditional claims to, and make use of, natural resources in Ratanakiri. The post-conflict economic opening of the province highlighted several development challenges threatening these claims as indigenous peoples remained largely marginalized from decisions affecting ongoing developments in the province. However, the passage of several important laws, decrees, sub-decrees, and policy documents in recent years, provides new opportunities for the interaction of natural resource management policies and disaster risk reduction strategies, particularly in the context of decentralization reforms and distribution of mandates at the sub-national and community levels.

Statement of the Problem and Main Findings

Although Ratanakiri is not listed as a priority area of intervention within Cambodia's *Strategic National Action Plan (SNAP) for Disaster Risk Reduction for 2008-2013*, over the last fifteen years the province has been increasingly exposed to floods, droughts, insect infestation, and to unpredictable changes in climate trends. This study provides an overall view of the vulnerability levels of Ratanakiri to natural hazards based on an institutional, legal, and policy analysis of the province in relation to key issues surrounding DRR planning and implementation as well as on the outcomes of the community risk assessments conducted in 26 villages across the four districts of Andoung Meas, Lumphat, Ta Veaeng and Veun Sai. The study also demonstrates how environmental degradation and other man-made hazards contribute to the increasing of existing vulnerability levels of local communities to the risk of natural disasters.

The assessment yields the following main findings:

High vulnerability levels of the assessed communities to natural hazards

Three major natural hazards – flood, drought and insect infestation – were identified and investigated during community risk assessments. Nearly all surveyed villages experienced flooding with at least one of the following characteristics: 1) Seasonal slow onset and flash floods during the rainy season; 2) Flash floods induced by the release of water from hydropower dams at any time of the year, and regardless of rain patterns, and; 3) Flash floods caused by the combination of heavy rainfall and water released

from hydropower dams. Most of the identified at-risk populations are those living near the Se San and the Sre Pok rivers, and, to a certain extent, those living near streams. In 1996, a key year for floods, the combined flood characteristics of rapid onset, longer duration and high water levels, compounded by an absence of knowledge in response strategies and preparation by families, contributed to heavy losses of both primary agricultural and household assets. Prior to 1996, floods in the province were considered rare or manageable, and rice fields and chamkars (special fields cleared for crops) were not considerably damaged. From 1996 onwards, however, floods began occurring on a yearly basis, causing damages to houses, livestock, crops, and health.

Drought in Ratanakiri has disrupted traditional cycles of farming and ways of living, exposing communities to higher risks of crop failure and food production gaps, and leaving families with few options to diversify access to secured food and water sources. Increased water-borne diseases, livestock deaths and insect infestations during times of drought further weaken communities' coping capacities.

Insect infestations, though often not researched or voiced as a primary concern by communities, also have a strong impact on many assessed villages. The study found that infestations, particularly when compounded by other hazards, threaten the livelihoods and food security levels of affected communities.

Linkages between environmental degradation and exposure to natural hazards

The research identified the overexploitation and degradation of natural resources, as well as other hazard factors driven by human activity, as factors in the increase of the occurrence and severity of natural hazard events.

Threats to livelihoods are largely determined by reduced access to alternative livelihood options. In most of the assessed villages, livelihood strategies in times of floods or drought are heavily dependent upon the forest for non-timber forest product (NTFP) collection and the hunting of wild game. However, access to these resources and activities, which had in the past supplemented the sustenance levels of communities in times of crises, were reported as being heavily reduced due to land loss and forest access restrictions.

There are concerns among assessed communities living alongside the main rivers regarding the adverse impacts of hydropower projects, either completed or planned, on biodiversity and livelihoods. Rapid and radical water level changes have occurred since the construction of hydropower dams, combined with reduction of fish spawning grounds, river bank erosion, and a loss of food sources, as crops and vegetations are constantly threatened or can not survive along the river. Mining exploration activities were reported to cause changes in the quality of the river and stream water, which have resulted in negative impacts on health and fisheries. Assessed villages located in areas that experienced past deforestation demonstrated higher vulnerability levels to both flood and drought due to the depletion of topsoil, watershed and a lack of access to non-timber forest products.

Current issues surrounding natural resource management in the province and their impact on vulnerabilities of communities to natural hazards

The opening of the Province to economic development brought about several pressing developmental challenges which threaten indigenous access to natural resources. Four

issues surrounding natural resource management in the province were identified as predominantly challenging to/for indigenous communities: 1) Land tenure; 2) Forestry; 3) Community Protected Areas and; 4) Water management.

The rapid loss, depletion and degradation of common natural resources is a central consideration to the understanding of threats and changes to culture, livelihood, security and well-being of indigenous communities. With limited options to diversify livelihood and food sources, pressures rising from natural resource management exacerbate their vulnerability levels.

Assessed villages expressed their concern over the changes to their access to natural resources following the passage of new laws and the enforcement of new development schemes, of which not all communities seemed to be fully aware or thoroughly informed. Traditional forest management and the promotion of community-based natural resource management entail the participation of local and indigenous communities in the management of natural resources. A lack of awareness and clarity of laws, rights, and sub-national responsibilities, therefore, present obstacles to the full participation and empowerment of indigenous populations.

The establishment of community forests and protected areas is key to preserving the traditional knowledge of, and access to, indigenous coping strategies and remedies for hazards, provided that the access to forest and wildlife is ensured in a sustainable manner, which also builds ownership, trust, and participation of indigenous populations. Villagers expressed their strong interest to protect the forest, and some are in different stages of progress in establishing their community protected areas and forest with governmental agencies and non-governmental organizations.

Indigenous practices and knowledge relating to coping mechanisms for natural disasters

Traditional knowledge and indigenous warning signals are present and considered by local populations to be reliable mechanisms for predicting the onset of hazards. Adaptive behavior through the recourse of social networks amongst surveyed villages manifested in basic, but effective, community-based disaster risk management initiatives. Ethnic affiliation also proved to be a powerful resource for community mobilization within indigenous peoples' societies during the event of disasters. However, increasingly unpredictable changes in climate trends, and prolonged and more frequent periods of drought, often also compounded by unexpected changes to the tides and flows of rivers, are a cause of concern and threat to security for villagers, whose knowledge, understanding, and perception of disaster risk, passed on for generations, is now rendered less relevant to current shifting conditions.

Changes to livelihood, food, and social securities driven by environmental degradation and their impact on vulnerability of communities to natural hazards

Swidden agriculture, a rain-fed practice traditionally performed in upland areas, is based on shifting cultivation and slash and burn farming practices and is the foundation of the indigenous people's livelihood. Villagers traditionally moved to new chamkars (areas used for swidden agriculture) every two to three years once soil became less fertile in order to allow it to fallow for at least five to seven years. However, with less land now available for chamkar use due to large concessions to businesses and plantations and

greater demand for land to accommodate a growing population, villagers have no alternative but to shorten fallow periods, which increases the risk of soil infertility. Land pressures driven by a rapidly changing economy, combined with restrictions on cutting trees for purposes other than housing as part of the establishment of community forest and protected areas, are also limiting traditional rotational cultivation.

Assessed villages located in areas that experienced past deforestation show higher vulnerability to floods and droughts because of the depletion of topsoil, reduced rainfalls, and reduced water retention capacity of the soil. These features, compounded by climate variability as reported by the communities, contribute to increase the negative impact of hazards.

Food shortages resulting from floods are a central feature of food insecurity in Ratanakiri villages. Significant damage to rice fields and riverbank chamkars due to flooding is a major contributor to crop failure, leading to higher harvest loss and larger food production gaps. Decreased soil fertility, the reduction of fish spawning grounds, and riverbank erosion were also reported. Significant changes in fish and plant populations, both being sources of protein and food for most families along the river, negatively affected household diets and contributed to declines in fishery resources.

Drought is also closely linked to food insecurity, particularly where agricultural production is vulnerable to crop failure and smaller harvests. Drought is reported to not only affect rice production, but it also impacts other types of crop, which further limits alternative options for filling gaps in food production. Insect infestation becomes intense during agricultural drought. Although the nature of drought in Ratanakiri is predominantly agricultural, during the dry season, most of the assessed villages also experience hydrological drought, which leads to water-borne diseases, especially among children. An increase in livestock disease and deaths were also identified as occurring during the dry season.

Decentralization and disaster risk reduction policies

Decentralization and disaster risk reduction (DRR) policies are very new concepts in the context of governance in Ratanakiri Province. Decentralization and deconcentration reforms promise significant inroads for the mainstreaming of disaster risk reduction at sub-national levels. The establishment of the Provincial Committee for Disaster Management (PCDM) in 2002 presents a positive direction for community-based DRR and stronger institutional linkages between line departments that are members of PCDM. However, the PCDM in Ratanakiri currently has neither a disaster risk reduction plan nor projects on DRR, limiting its intervention options to only crisis response.

Since its establishment, the PCDM's organizational capacity for disaster management in the province has remained weak. An effective decentralized disaster risk reduction strategy is presently lacking, as the Disaster Committee for Disaster Management (DCDM) and Commune committee for Disaster Management (CCDM) were perceived, during research, to be isolated and disconnected from the PCDM. Challenges identified on mainstreaming DRR into local development planning point to a lack of institutional support for the new mandates on DRR and decentralization at the district and commune levels, as well as an absence of local level capacities, both human and financial, to fulfill these commitments and mandates.

The effects of environmental degradation and disaster risk on migration patterns

A history of migration patterns among surveyed villages is reflected in forced movements away from the river, and divisions of single villages into multiple sub-villages located away from each other, as mainly driven by floods and their consequent pressures on livelihoods. These movements and resettlements can be either temporary or permanent.

Resettlement impacts have been mixed, with some communities experiencing either positive or negative effects from the move, depending on the new village location, its proximity to roads, access to water sources, soil type and available land for new chamkar. In order to secure lands located in higher areas, as well as access to larger areas of land for chamkars, communities are often forced to resettle in areas located a great distance away from rivers, making access to these vital resources for drinking water and household use a long and difficult task.

In times of drought, some villagers noted that they were left with no option but to move and pursue off-farm seasonal work. This employment was located outside of their current villages and often within other districts or in the provincial capital.

Linkages between environmental preservation, disaster preparedness, and population stabilization

Land pressures driven by a rapidly changing economy, combined with restrictions as part of the establishment of community forest and protected areas, are limiting traditional movements of villages within the province.

Several villages surveyed across the four districts, particularly those living along rivers, have expressed fear from the constant threat of annual occurrences of floods, and from the growing physical and social insecurities from water surges and fluctuations. The same villages also expressed concerns over increasingly unpredictable changes in climate trends, which often left them unprepared for alterations in planting and harvesting timings.

Community-based natural resources management (CBNRM) is perceived and regarded by indigenous people as a means to preserve their identity. These communities have maintained and passed on for generations a culture of communal ownership to ensure that their livelihoods are secured and protected. CBNRM also has the potential to sustain social cohesion within the indigenous society in times of rapid economic and development changes. Community-based disaster risk management (CBDRM) should learn from past and present experiences of CBNRM in Ratanakiri before being integrated into local development planning.

Conclusions and recommendations

A disaster risk ranking model was developed in order to prioritize geographical areas of intervention. Villages were first categorized as *less prone, prone, or very prone* to the identified hazard according to the likelihood of the hazard striking the community. Their vulnerability and capacity were ranked as *low, medium, or high* in relation to material, social and behavioral characteristics of the communities, which either make them susceptible to the damaging effects or enable them to prepare for and cope with the adverse conditions of a hazard. Villages were finally categorized as being at low, medium, or 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.

Recommendations, as outlined in the final section of this report, are based on the findings of the assessment, as well as on data validation and action planning with the assessed communities, and are sorted into short-term, mid-term, and long-term initiatives at both institutional and operational levels. They include proposed activities relating to all stages of DRR, from mitigation and prevention to preparedness and disaster response.

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 Ratanakiri.

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 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 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) as contributing to the increased exposure to natural hazards as perceived by the participants.

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.

Table 1.1: Sample of Hazard Assessment

Hazard	Forces/ Factors	Warning Signs	Speed of Onset	Frequency	Timeline	Duration
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*

Where possible, depending on the topography of the assessed villages and their 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.

Photo 1.1: Woman drawing the map of Dei Lou Village.

Photo 1.2: Hazard Mapping in Ratanakiri.

b) Vulnerability Assessment

The Vulnerability Assessment was conducted with 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.

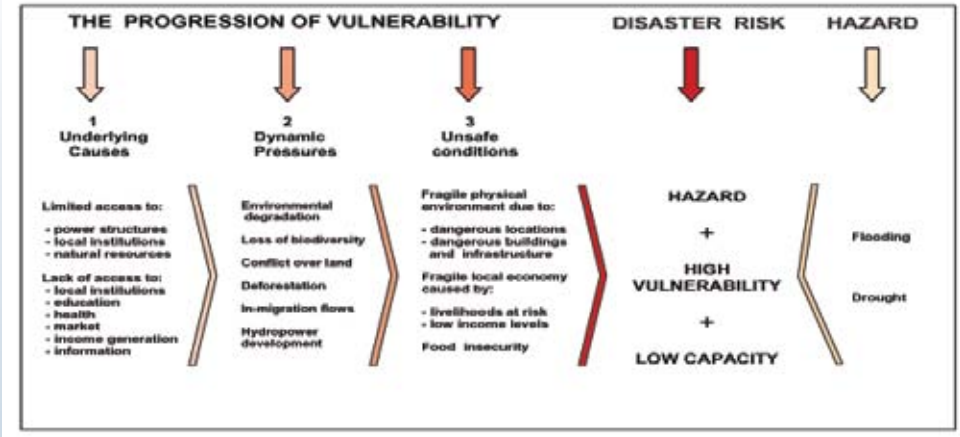
The elements-at-risk were identified as the people, households, property, crops, livelihoods, community facilities, and the environments which may be adversely affected by the hazard. The vulnerability of these elements was assessed using three core categories of analysis: 1) Physical/Material; 2) Social/Organizational; and 3) Attitudinal/Motivational.

Table 1.2: Sample of Categories of Vulnerability Analysis

Physical / Material	Social / Organizational	Attitudinal/ Motivational
Inadequate building codes	Isolation	Fatalism, hopelessness

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 are conditions which channel the effects of root causes into unsafe conditions. Overexploited, degraded natural resources, and other hazard factors driven by human activity and 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 Model[1], illustrated in Figure 1.1, was adapted 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.

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 of safety.

c) Capacity Assessment

The Capacity Assessment was conducted with focus group discussions 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	Motivational / Attitudinal
Houses built at higher level	Connectedness	Cohesiveness, unity, solidarity, cooperation

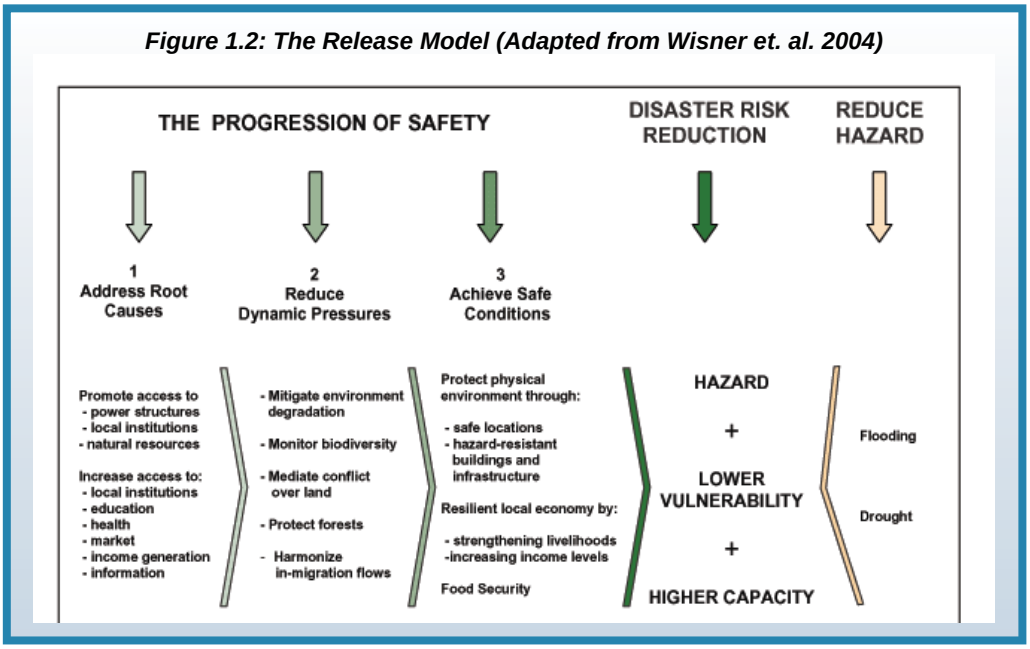
All of the assessed communities proved to possess resources, strengths, local knowledge and practices that could be used for disaster preparedness, mitigation and prevention activities. Capacities were also categorized as Physical/Material, Social/Organizational, and Motivational/Attitudinal.

d) Action Planning

As a final step to 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 to 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 *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 hazards). 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 a hazard 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:

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

Table 1.4: Sample of Risk Ranking Model

1 - 2.9	**Low Risk**
3 - 5.9	**Medium Risk**
6 -- 9	**High Risk**

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 **Risk = Hazard * Vulnerabilty / 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 to cause damages, losses and disruption in community functioning (see Table 1.5: Example of Risk Ranking Final Matrix).

Table 1.5: Example of Risk Ranking Model by Village

Andong Meas District	**Hazard**	**Vulnerability**	**Capacity**	**Ranking**
Dal Leng Village				
Flood	2	3	2	**3**
Drought	2	3	1	**6**
Insect Infestation	2	3	1	**6**
Ka Chut Krom Village				
Flood	2	3	1	**6**
Drought	3	3	2	**4.5**
Insect Infestation	1	2	2	**1**

This ranking process is intended to be referred solely to the specific context of Ratanakiri 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 Mondulkiri 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 these types of research initiatives. This assessment, however, is one of the first ever of its kind to be conducted in Ratanakiri, 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 action plan.

Table 1.6: HVCA Matrix

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

1.2.2 Key Informants

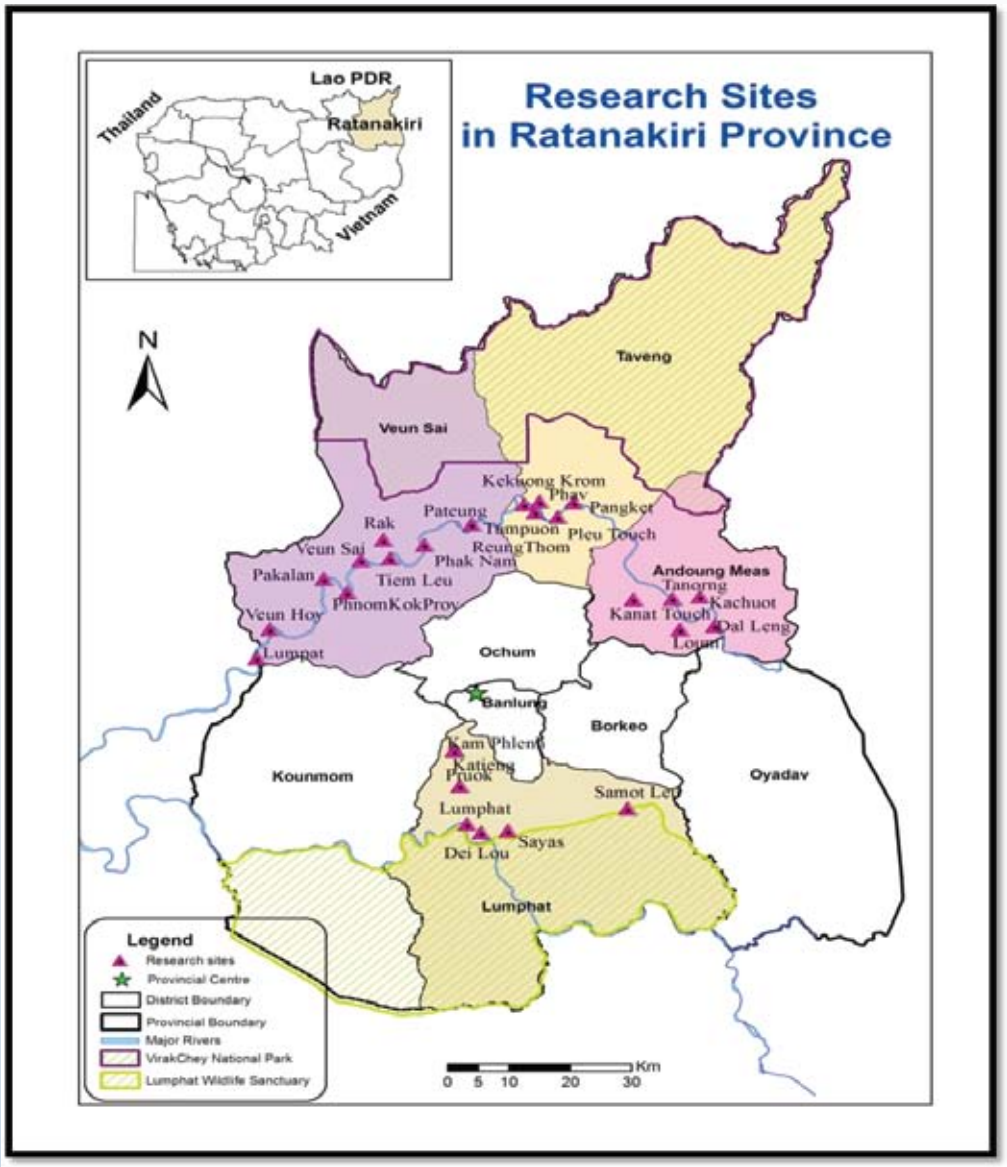
Semi-structured interviews were conducted with key informants within the following government departments at the provincial level: the Provincial Committee for Disaster Management; Provincial Departments of Water Resources and Meteorology; Planning; Agriculture, Forestry and Fisheries; Forestry Administration;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

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 19 communes and representing 25% of the total number of villages within the four districts of Ta Veaeng, Lumphat, Andoung Meas and Veun Sai. The targeted districts are located in the lower northern and upper southern portions of Ratanakiri Province. Veun Sai, Andoung Meas and, Ta Veaeng, located 70 – 110 kilometers south from the Yali Falls Dam in the Se San River, and Lumphat District, downstream of the Sre Pok River, where hydropower dams are operational, being built or planned. These dams have been identified as a major contributing factor to flash floods and negative impacts on people living downstream alongside the Se San and Sre Pok rivers.

Map 1.1: Location of 26 Targeted Villages in Ratanakiri.



1.3.1 Criteria for selection

Following consultations with key NGOs, and 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 two major tributaries of the Mekong River, the Se San and Sre Pok rivers; and d) existing dynamic pressures, such as the loss of forest and forest/land concessions. 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 Ban Lung, requiring a full day's travel by car, motorbike, and/or both. The data source provided by the selected villages has proven, 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 Ban Lung and the research team consisted of 12 members: one research team leader, three (3) supporting research assistants, and eight (8) field assistants. The research assistants were selected from qualified final-year university students – two were Kreung indigenous students from Ban Lung and Ou Chum districts in Ratanakiri and active members in the Cambodian Indigenous Youth Association (CIYA), and one was a Khmer student from the Faculty of Land Management at the Royal University of Agriculture in Phnom Penh. The research team received field support and guidance from the Highlander Association and the Non-Timber Forest Products Organization (NTFP). Both of these local organizations were identified as having extensive and well established experiences in Ratanakiri, and offered a key contribution to the research by nominating the eight field assistants who work together with the core team.

Indigenous languages spoken by the researchers and field assistants, a key element for the success of any studies in Ratanakiri, were Prao, Kreung, Tumpuon, Ja'rai, Kavet, Lao, and Kachok, in addition to 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 Ban Lung. Once onsite, the research team conducted additional briefing on the research objectives, orientation and practical training on research methodology and tools for the eight 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 Ka Tieng Village.

Photo 1.3: Research assistants discuss the study site during pre-field work training in Ban Lung.

A pilot field test was carried out by the research team in Ka Tieng Village, Lumphat 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 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 establish trust within the community.

1.3.4 Time frame

The research study was carried out over a period of six months, with the provincial field work conducted in the first three months. The study included a total of 818 participants, of whom 50.6 % were women.

Table 1.7: Field Work Schedule

Date	Village	Commune	District	Main ethnicity	Participants
3 March	Ka Tieng	La Bang Pir	Lumphat	Prao/Tumpuon	51
13 March	Pleu Touch	Ta Veaeng Leu	Ta Veaeng	Prao/Kreung/Khmer	33
15 March	Pang Kit	Ta Veaeng Leu	Ta Veaeng	Prao	31
17 March	Ke Koung Krom	Ta Veaeng Krom	Ta Veaeng	Prao	27
18 March	Tumpuon Reung Thum	Ta Veaeng Krom	Ta Veaeng	Prao	29
19 March	Phav Village	Ta Veaeng Krom	Ta Veaeng	Prao	40
22 March	Dei Lou	Chey Utdom	Lumphat	Khmer/Lao	31
23 March	Lumphat	Chey Utdom	Lumphat	Lao/Khmer	32
25 March	Kamplegn	La Bang Muoy	Lumphat	Kreung	29
26 March	Pruok	Patang	Lumphat	Tumpuon	30
28 March	Sayas Krom	Ka Laeng	Lumphat	Tumpuon/Khmer	24
30 March	Samot Leu	Seda	Lumphat	Tumpuon/Khmer	29
06 April	Lorm	Malik	Andoung Meas	J'arai	29
08 April	Dal Leng	Gnang	Andoung Meas	J'arai/Khmer	20
09 April	Ka Chout Krom	Gnang	Andoung Meas	Kachok/J'arai	26
11 April	Kanat Touch	Ta Lav	Andoung Meas	Kachok	23
12 April	Tanong	Ta Lav	Andoung Meas	Kachok/J'arai/Tumpuon	59
20 April	Phak Nam	Kaoh Peak	Veun Sai	Kreung/Kachok/Lao	22
21 April	Rok	Kok Lak	Veun Sai	Kavet	16
23 April	Lumpat	Hat Pak	Veun Sai	Prao	21
24 April	Veun Hay	Hat Pak	Veun Sai	Lao	30
26 April	Phnom Kok Prov	Phnom Kok	Veun Sai	Prao	53
28 April	Pateng	Kaoh Pang	Veun Sai	Prao/Khmer	36
29 April	Pa Kalan	Pa Kalan	Veun Sai	Lao	30

02 May	Veun Sai	Veun Sai	Veun Sai	Lao	34
03 May	Tiem Leu	Ka Choun	Veun Sai	Kreung	33

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 Ban Lung 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: Ratanakiri Province: *The Overall Context*

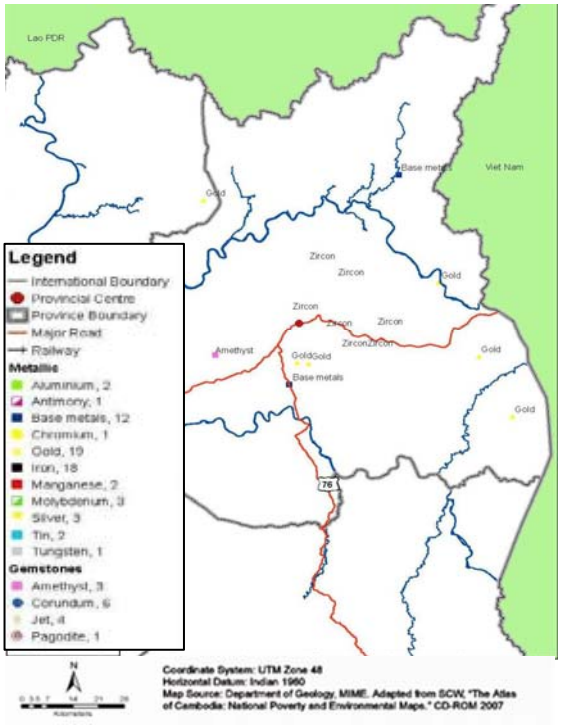
2.1 History

Ratanakiri Province was created in 1959 from the eastern part of Stung Treng Province as part of government efforts to develop the long neglected region of the North-East. The entire region was placed under the authority of the Royal Khmer Armed Forces in an attempt to restore relations between the Khmer society and the hill tribes, as little interaction had taken place prior to this time. As a result of these development efforts, the ethnic distribution of the region changed significantly with substantial in-migration flows of Khmer lowlanders. Newcomers arrived with the intention to utilize Ratanakiri's natural resources and establish industrial plantations, particularly for raw rubber which could be processed and used for a range of industrial purposes. However, remnants of the Khmer Rouge resistance continued to threaten travel and security in the province up until the 1990s, limiting its development. Road inaccessibility further rendered local communities isolated and underdeveloped. Over the past decade, however, due to its geographic location and an increase in interest by local and foreign investors, the province has rapidly become a strategic gateway for trade.

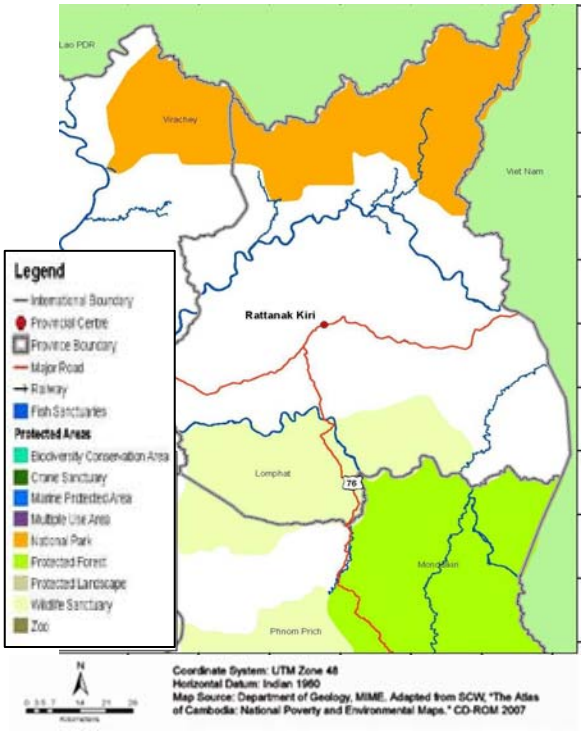
2.2 Physical Features

Located in the North-East section of the country, and bordered by Viet Nam and Lao PDR, Ratanakiri is characterized by fertile red soils, varied mineral resources and abundant water bodies. Two nationally protected forests, the Virachey National Park and the Lumphat Wildlife Sanctuary, are rich in biodiversity and home to many wildlife species endemic to the region. *Maps 2.1* and *2.2* show Ratanakiri's protected areas and mineral resources.

Map 2.1: Map of Mineral Resources in Ratanakiri

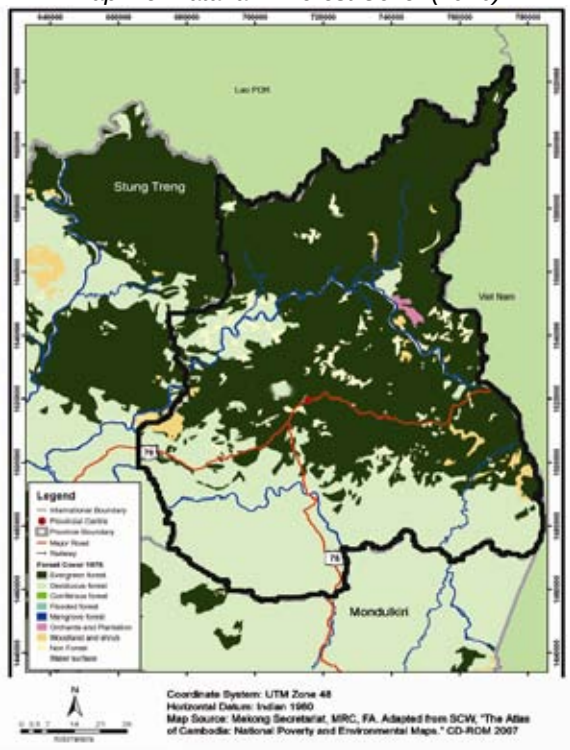


Map 2.2: Map of Protected Areas in Ratanakiri

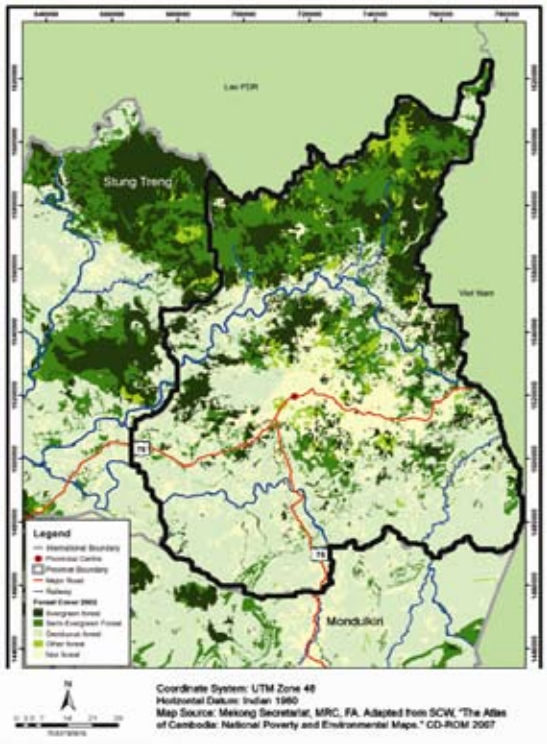


Ratanakiri used to be known as a densely forested province, however, due to past war events and political instability, large swaths of the province have been logged, leaving the ecological integrity of the region frail at best. *Maps 2.3* and *2.4* present a comparative view of forest cover loss between 1976 and 2002, suggesting a significant loss of forest cover and land use.

Map 2.3: Ratanakiri Forest Cover (1976)



Map 2.4: Ratanakiri Forest Cover (2002)



The Se San, Sre Pok and Sekong rivers together contribute significantly to the total annual flow of the Mekong River, with numerous fish species and migration routes for fish to the Tonle Sap Lake as a major source of livelihood for communities living along the rivers. Over recent years however, the fishery sector has been increasingly affected by hydropower development, with communities claiming negative impacts n their livelihoods.

2.3 Socio-Demography

Based on the 2008 General Population Census of Cambodia, the provincial population grew from 94,243 to 149,997 between 1998 and 2008, with 88% of the population residing in rural areas. Its former population growth index of .08%, ranking it 19th out of 24 provinces, has increased nearly 60% in ten years, making Ratanakiri one of the fastest growing provinces in Cambodia. A main factor of this increase is the influx of lowlander Khmers who have mainly settled in the provincial town of Ban Lung. Still, the province remains one of the most sparsely populated provinces in the country with a population density of 14 inhabitants per square kilometer in 2008 (up from 9 inhabitants per square kilometer in 1998).

Ratanakiri is a multi-ethnic province, with local communities comprised of various indigenous groups and collectively known as Khmer Loeu: Tumpuon, J'arai, Kavet, Ka chok, Prao, Kreung and Lun. Ethnic minority groups include the Lao, Cham, and Viet Namese. The indigenous groups each have their own ethnic language, with a very small proportion speaking Khmer.

Table 2.1: Distribution of Indigenous Groups in the Province

Indigenous Groups	Number of Families	Age 0-17		Age over 18		Total Population
		Male	Female	Male	Female	
Tumpuon	6,612	8,132	8,146	7,489	7,803	31,570
J'arai	4,542	5,421	5,521	5,205	5,458	21,605
Kreung	4,452	4,978	4,557	4,859	5,045	19,439
Kavet	469	678	724	502	1,371	3,275
Lun	81	80	130	68	87	365
Kachok	590	1,065	913	812	801	3,591
Prao	1,815	2,040	1,968	1,901	2,026	7,935
Phnong	5	6	6	4	5	21
Kuoy	1	0	4	0	1	5
Stieng	2	3	2	2	2	94

Source: Department of Planning, 2008 Province Profile

Table 2.2: Ethnic Minority Groups in the Province

Ethnic Groups	Number of Families	Age 0-17		Age over 18		Total Population
		Male	Female	Male	Female	
Lao	2,000	2,660	2,726	2,656	2,923	10,965
Cham (Islamic Khmer)	269	325	279	286	260	1,150
Viet Namese	68	128	19	68	63	278
Other groups (Khmer)	6,635	8,590	8,771	9,073	9,026	35,460

Source: Department of Planning, 2008 Province Profile

2.4 Traditional Customs and Belief

The predominant religion of the indigenous people of Ratanakiri is Animism. Animist traditions influence nearly all important family and village activities. These traditions are strongly linked to the forests, which are believed to be governed by spirits (called *Arachs*) who reside in sacred parts of the forests and guide villagers in their daily lives. Large parts of these sacred forests have been cleared for development, which has led many local people to fear the loss of protection by *Arachs.* This fear often influences the perception of disaster risk by villagers, as the loss of spirits is seen as a factor leading to the increase of more severe and unexpected natural hazard events.

Prayers, animal sacrifices, and wine jars are often offered to *Arachs* during ceremonies led by recognized village elders. Other ceremonies are performed to commemorate events such as births and deaths, and to please or appease spirits who are perceived as having the power to cause crops damage and illness. During these ceremonies and rituals, which often vary in nature among indigenous groups, communities recognize roles that they feel the spirits can play in their well-being and livelihood, including asking for rain for crops or giving thanks for a substantial harvest.

Within each community, village elders play a significant role as the traditionally recognized authority figures. The elder is usually the most respected person in the village, and is often a male figurehead of a family or family line within the community. The elders mediate conflicts within the village, often resolving them communally by helping the parties reach a mutual agreement. The emphasis of such mediation is on restoring harmony and maintaining good relations within the community. Traditionally, elders also decide which appropriate areas to clear for farming, using premonitions about whether the spirits are happy or angry. They play the important role of holding traditions and knowledge, and passing on both of these to the next generation.

2.5 Economics and Livelihood

Ratanakiri's economy is predominantly dependent on its agricultural sector. According to the 2008 Provincial Profile published by the Provincial Department of Planning, 24,041 families (85,3%) rely on primary agricultural activities. Upland and lowland farming comprises 78.38% of all agricultural activities, followed by the farming of long-term crops (4.14%) and short-term crops (1.76%). Other agricultural activities are fishing, raising of livestock, and collection of non-timber forest products (NTFP).

Photo 2.5: Typical chamkar where a variety of food and cash crops are planted.

Swidden agriculture is a practice based on shifting cultivation and slash-and-burn farming practices. It is traditionally performed in upland areas and entirely rain-fed, and serves as the foundation of the livelihoods of indigenous communities. The central feature of swidden agriculture is the chamkar, which is a field used for farming that has been created after the clearing of an area of forest. Rice is the primary crop that is planted in chamkars. According to the Department of Planning as outlined in their 2008 report, the total amount of chamkar land used for rice cultivation in 2007 was 16,703.65 hectares, with an average harvest of 0.8 tonnes per hectare. Chamkars are typically located outside of the village and used from between one to four years before being left fallow to regenerate. A farmer may have up to eight or ten different chamkar sites in his lifetime. Very few crops are grown inside the village and livestock animals are usually allowed to roam free. Some chamkars can also be located in the lowland where cash crops such as cashew nuts and soybeans, vegetable gardens and fruit trees are planted.

Agricultural production in Ratanakiri remains low, which can be partly attributed to a lack of access to agricultural resources, such as seeds, improved farming techniques, and irrigation. Irrigation practices are mainly used for lowland rice fields, while upland chamkars rely heavily on rainfalls, an element that makes the effects of climate variability even more severe on the population.

Indigenous people have increasingly experienced agricultural insecurity. Numerous drivers of insecurity have been identified, which include longer dry periods, flooding, higher population growth within indigenous communities, limited agricultural lands, shorter fallow periods resulting in soil infertility, and a lack of access to irrigation, agricultural resources and new agricultural techniques. Agricultural insecurity is closely linked to an increase in food insecurity, as largely reported by both governmental and non-governmental sources. In 2006, the NGO CARE conducted a survey, which noted that over a quarter of ethnic groups in their research reported experiencing food shortages lasting from 4 to 6 months. Preventative measures, such as the rice bank credit program of the International Cooperation Cambodia (ICC), have been created to provide affordable food relief in times of shortage. However, in the course of the research many villagers explained the very high default of rice loan repayment to such programs due to low production levels driven by damage to crops caused by drought, floods, and insect infestations.

2.6 Human Development Issues

Ratanakiri has some of the lowest human development indicator levels in Cambodia. These indicators need to be considered when conducting vulnerability and capacity assessments, as they hamper the capacity of community to cope with and respond to the occurrence of extreme natural events. In the context of climate change analysis, they are commonly factored together with technology and infrastructure in the adaptive capacity index.[2]

2.6.1 Health

Child health and mortality rates are a strong concern in Ratanakiri. National poverty maps relating to stunting rates for children under five years old range between 40% an 60% for the most part of the province, while the rate of underweight children is predominantly above 60 percent.[3] Commonly reported diseases are water-borne (diarrhea, hemorrhagic fever, typhoid and stomach), respiratory (tuberculosis), and malaria.

Barriers to health access include the low quality of health care in health centers and posts (where available), language and cultural barriers, or the compounded challenge of high costs of transportation and the length of time it takes to reach health centers. Public health services are delivered through one referral hospital in Banlung, 10 health centers at the district level, and 17 health posts based in communes. Cultural and traditional practices may also delay proper medical attention, as decision-making to access modern primary health care services is affected by low confidence levels for modern medical remedies and medical staff capabilities.

Guided by the Millennium Development Goals, recent undertakings in Cambodia's renewed commitment toward the development of indigenous people are revealed in the National Policy on Indigenous People, approved by the Council of Ministers in April 24, 2009. The policy document further outlines directions for health and education, among other key sectors such as culture, vocational training, environment, land, agriculture and water resources, infrastructure, justice, tourism, industry, mines and energy. The Policy

[2] Climate Change Experts Consultation Meeting, Bangkok, 2008 (cited in Climate Change Vulnerability Mapping in Southeast Asia – IDRC 2009).
[3] Ministry of Planning & WFP, 2003: 8 – 11.

provides specific steps to provide access to financial resources for various services, including primary health care systems.

2.6.2 Education

In Ratanakiri, only half of children between the ages of 6 – 11 attend primary school, while 59.14% of children between the ages 12-14 attend secondary school, with higher dropout rates for girls than boys (according to a 2008 study undertaken by CARE). The highest illiteracy rates amongst adult indigenous population are identified in Veun Sai and Ta Veaeng districts. Factors affecting educational participation and achievement include the far distance to schools from village locations, heavy domestic duties for children, low health status, lack of school infrastructure and facilities, and a lack of trained human resources available at the village level.

The National Policy on Indigenous People holds strong potential for the way that education systems are made available and accessed in Ratanakiri. The policy includes steps to provide an education system that aims to integrate indigenous education and teaching in both Khmer and indigenous languages.

2.7 Governance

Sub-national political administration in Ratanakiri is undertaken by the provincial government, headed by the Provincial Governor and supported by three deputy vice-governors. A Provincial Chief of Cabinet supports the Governor in provincial administration. The Province is divided into nine rural districts – Andoung Meas, Ban Lung, Bar Kaev, Koun Mom, Ou Ya Dav, Ou Chum, Lumphat, Ta Veaeng and Veun Sai – with Ban Lung as the provincial capital.

Districts (*sroks*), which are each headed by a District Governor, are further subdivided into 47 communes. The commune council is the highest administrative body in each commune, and is led by a presiding councilor, who is the Commune Chief (*Mé-Khum)*. The Commune Chief functions with delegated legislative and administrative powers, and is directly elected by citizens to a five-year term (based on a system of proportional representation, as mandated by the Law on Administration and Management of Commune/Sangkat (LAMC) and the Law on the Election of Commune/Sangkat Council, both passed in 2001.

Communes are further organized into 240 villages which are each headed by a village chief. This chief is appointed by the commune council as provided by LAMC and in accordance with the guidelines for appointment provided by the Ministry of Interior. The village chief supports the implementation of commune-related development activities in the village, and makes village or local-level recommendations. Unlike the commune chief or the commune councilors, however, the village chief has a limited mandate provided by law.[4]

In May 2009, Ratanakiri Province held its first indirect elections of the provincial and district councils, as mandated by the new Law on Elections of Capital Council, Provincial Council, Municipal Council, District Council and Khan Council (passed in 2008), to a five-year mandate. The implications of these elections and the role of different sub-national structures in the province are analyzed in Chapter 4.

[4] Articles 30-31 of the Law on Administration and Management of Commune/Sangkat (LAMC).

Along with formal government systems, governance at the village level is supported by traditional indigenous authorities led by a committee of community-elected village elders. Village decision making is communal. While the strength of traditional authorities and their role in formal governance often differs from village to village, elders in most villages continue to play an important role in fostering long-held community traditions on respect and value for their lands and their identity.

The value of indigenous authority is not only illustrated within the communities themselves, but also within national-level governance practices. The 2009 National Policy on Indigenous People formally recognizes indigenous traditional governance as part of the national justice system by enabling the recourse to justice through national courts for cases where the traditional dispute resolution mechanism at the village level fails.

2.8 Natural Resource Management (NRM)

The opening of the Ratanakiri Province to economic development brought about several pressing developmental challenges which threaten indigenous access to natural resources. Four issues surrounding natural resource management in the province were identified as predominantly challenging to indigenous communities: 1) Land tenure; 2) Forestry; 3) Community Protected Areas; and 4) Water management.

The rapid loss, depletion and degradation of common natural resources is a central theme to the understanding of threats and changes to culture, livelihood, security and well-being of indigenous communities. With limited options to diversify livelihood and food sources, pressures rising from natural resource management exacerbate their vulnerability levels.

2.8.1 Land Tenure

Rapid environmental degradation has resulted from several factors, one of these being the growing demand for land by developers and private investors.

The Land Law of 2001 is very significant for the protection of indigenous people's land rights, as it provides the legal framework for the recognition of communal land ownership, as enshrined by the Cambodian Constitution[5]. Communal lands are those where indigenous communities have established their residences and where they carry out their traditional agriculture, which includes not only cultivated lands but also lands reserved for swidden cultivation. Collective ownership rights for indigenous peoples, however, are dependent on a concomitant recognition of legal registration and legal identity through a process that is not fully clear yet, as the Sub-Decree on Procedures of Registration of Land of Indigenous Communities has only been approved by the Council of Ministers in June 2009.

This lack of clarity felt among villages attempting to comply with the requirements of legal identity registration as a prerequisite to communal land titling has provided an inroad for non-governmental organizations (NGOs) to pursue the implementation of new activities. Within the context of the Land Law, several organizations are currently providing support through awareness raising, legal education and advocacy with a focus on indigenous people's land rights and protection of natural resources. In Ratanakiri, two

[5] Article 44 of the Constitution of the Kingdom of Cambodia states that, 'All persons, individually or collectively, shall have the rights to ownership.'

legal entities have been registered for La Eun Kraen Village (Ou Chum District) and in La En Village (Koun Mom District). The Ministry of Interior has already issued legal identity certificates to Tumpuon for these two villages in 2007.

Land is one of the key areas of intervention listed within the 2009 National Policy on Indigenous People. The policy document contributes to reinforcing the principles of communal land registration and mechanisms for implementing communal land titling as stated by the Land Law. It also ensures that indigenous people cannot be removed from their lands unless on grounds of national interest where resettlement and fair compensation are provided, thus, reinforcing the relevant principles of international law pertaining to indigenous peoples.[6]

Economic land concessions were reported by almost the totality of the assessed villages as a great pressure. These concessions were granted for areas traditionally used for fallow lands and sacred forest sites, leading to problems of land encroachment and extensive forest clearing. Economic land concessions were analyzed in the context of this assessment as an external dynamic pressure, contributing to limited access of resources (e.g., NTFP, medical plants, bamboo shoots, etc.), which indigenous communities mainly rely upon in times of drought or floods.

The 2005 Sub-Decree on Economic Land Concessions provides for land to be used for economic or social purposes, with an upper maximum limit of 100,000 hectares to be used. An environmental and social impact assessment, in which public consultations are to be conducted with all relevant stakeholders, including the communities, is also to be completed for all concessions. The 2009 Ratanakiri Forest Administration Report (No. 56 dated 20 March 2009) estimated that a total land area of 105,889 hectares had already been allocated or identified for economic land concessions. The majority of the assessed villages claimed that land concessions granted to date have occurred with poor or no prior consultations.

2.8.2 Forestry

The loss and degradation of forest cover in Ratanakiri has led to rising tensions over access to forests. The Forestry Law of 2002 represents an important step towards the recognition of communal resource rights for traditional forest use and management. Under the category of Permanent Forest Estates, the law recognizes the presence of Permanent Forest Reserves, which are held by the state for the protection of cultural heritage and sustainable forest management and include those traditionally used by indigenous peoples for their livelihood sustenance (Production Forests) and those which are central to their beliefs (Protection Forests). Production Forests include multiple use forest, such as existing chamkar and fallow fields, bamboo and NTFP collection forests, concession forests, as well as reserved forest lands for reforestation and forest regeneration. Protection Forests include sacred forests, burial ground forests, village shelter forests, wildlife forests and forests for eco-tourism. Production Forests and Protection Forests are equally important for indigenous peoples, because, under these forest categories, the law recognizes, under Chapter 9 the traditional ‘user’ rights of indigenous peoples to non-timber forest collection and use of forest products for housing

[6] Article 10 of the UN Declaration on the Rights of Indigenous Peoples states: ‘Indigenous peoples shall not be forcibly removed from their lands or territories,’… ‘no relocation shall take place without the free, prior and informed consent of the indigenous peoples concerned and after agreement on just and fair compensation and, where possible, with the option of return.’

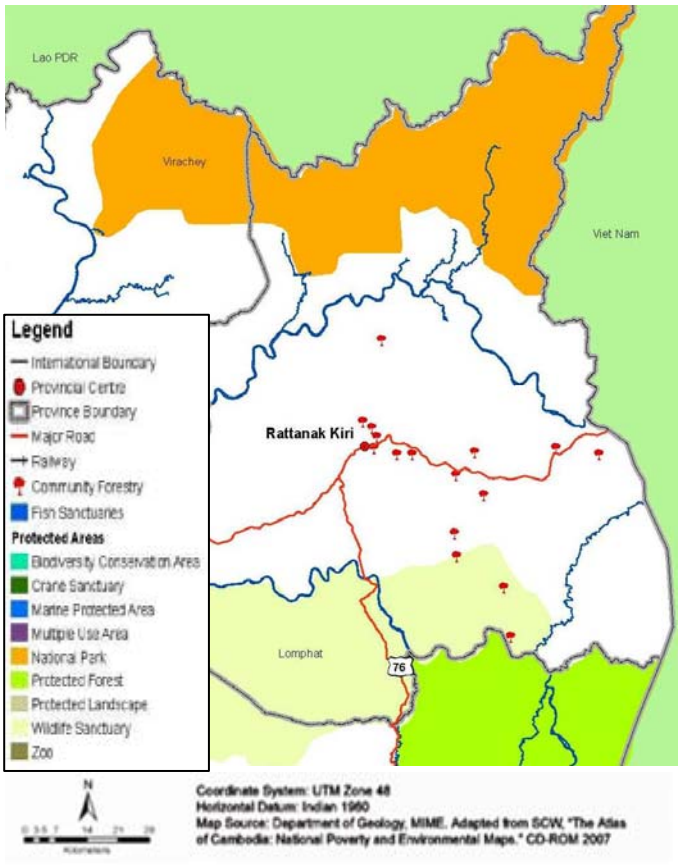
and other household purposes, as well as access to their spirit forests, which they consider to be sacred.

The 2002 Forestry Law provides the basis for the successive establishment of community forestry, which was embodied in the sub-decree on community forestry management passed in 2003. The Ministry of Agriculture, Forestry and Fisheries has the right to allocate parts of the Permanent Forest Reserve for community forestry. A core provision of the 2003 sub-decree is the establishment of community forestry, which can be either initiated by the community living within or near a permanent forest reserve, or by the Forestry Administration. Under either process, a Community Forest Agreement (CFA) binds the community and the government, accompanied by a Community Forestry Management Plan, to comply with forestry guidelines. As of 2008, 31 areas covering 41,886 hectares in 100 villages in Veun Sai, Lumphat, Ou Ya Dav, Koun Mom, Ou Chum Bokeo, and Ban Lung districts have been identified for the establishment of community forestry initiatives. NGOs in the province work closely with the Ratanakiri Forestry Administration (FA) Cantonment, which monitors compliance to FA guidelines on community forestry establishments. Challenges in the implementation of community forestry include the required presence of FA personnel in every activity, which can contribute to delays when Forestry Administration staff is not available.

2.8.3 Protected Areas

Ratanakiri is home to two nationally protected areas, the Virachey National Park, which comprises 30 percent of the total forest area in the province, and the Lumphat Wildlife Sanctuary, both under the jurisdiction of the Ministry of Environment. Local jurisdiction is held by the Provincial Department of Environment, while forests outside the protected areas are under the jurisdiction of the Forestry Administration.

Map 2.5: Community Forestry Establishments in Ratanakiri



The passage of the Protected Areas Law of 2008 provided the legal framework for the management, conservation of biodiversity, and sustainable use of natural resources in protected areas through the creation of four management zoning systems, namely the core zone, conservation zone, sustainable use zone, and community zone.

The management of protected areas falls under the jurisdiction of the Ministry of Environment, with its Nature Protection and Conservation Administration (NPCA) responsible for the four management zoning systems. The Department of Environment works closely with the Provincial Government and commune councils in implementing their mandates, as provided by the Protected Areas Law of 2008.

Within core zones, the only allowed activity is scientific research intended to sustain and protect these areas. Conservation zones are given high conservation value and only small-scale community uses of NTFPs to support livelihood may be allowed. These activities occur only under strict control, and only when they do not present serious adverse impacts on biodiversity within the zone. Sustainable use zones are areas of high economic interest where development and investment activities (i.e., mining exploration) can be authorized with approval from the Ministry of Environment. These zones can also contain Community Protected Areas (CPAs) which are monitored by local communities and allowed solely for limited local use. Community Zones are meant to recognize socio-economic development of the local communities and indigenous ethnic minorities by containing existing residential lands, paddy field and swidden cultivation (chamkar), but allowing no new lands to be cleared.

The 2008 Protected Areas Law has important potential for the promotion of community-based natural resources management as it entails local and indigenous people to participate in a newly created mechanism, the CPA Committee. The CPA Committee acts to protect natural resources and is composed of community representatives and relevant authorities. The 2008 Law also aims to give communities a voice through their participation in the co-development of a CPA Management Plan.

At present, there are no defined boundaries between protected area zones, though five areas have already been designated as community protected areas. These areas cover resin and malva nut (*samrong*) tree areas and allow for old chamkars to be used, but prohibit the clearing of new areas.

Some of the assessed villages expressed their concern over the changes of their access to natural resources following the passage of the new law, of which not all of them seemed to be fully aware or thoroughly informed. In 2008, mining exploration activities started inside the Virachey National Park, but only some of the villagers understand to why these types of research activities were allowed, while their access to the same protected areas was denied. The preservation of the environment and biodiversity, as promoted by the new law, is certainly a breakthrough in national environmental policies for Cambodia. However, it is still important to identify ways for improving the existing mechanisms for local participation in the co-management and co-development of CPA Plans, and to increase awareness of the new law among all the concerned communities. The 2009 National Policy on Indigenous People supports movement in this direction by encouraging competent institutions and authorities to provide knowledge and disseminate national legislation and policy directives to indigenous people, so as to increase their awareness of rights and obligations within the Cambodian society.

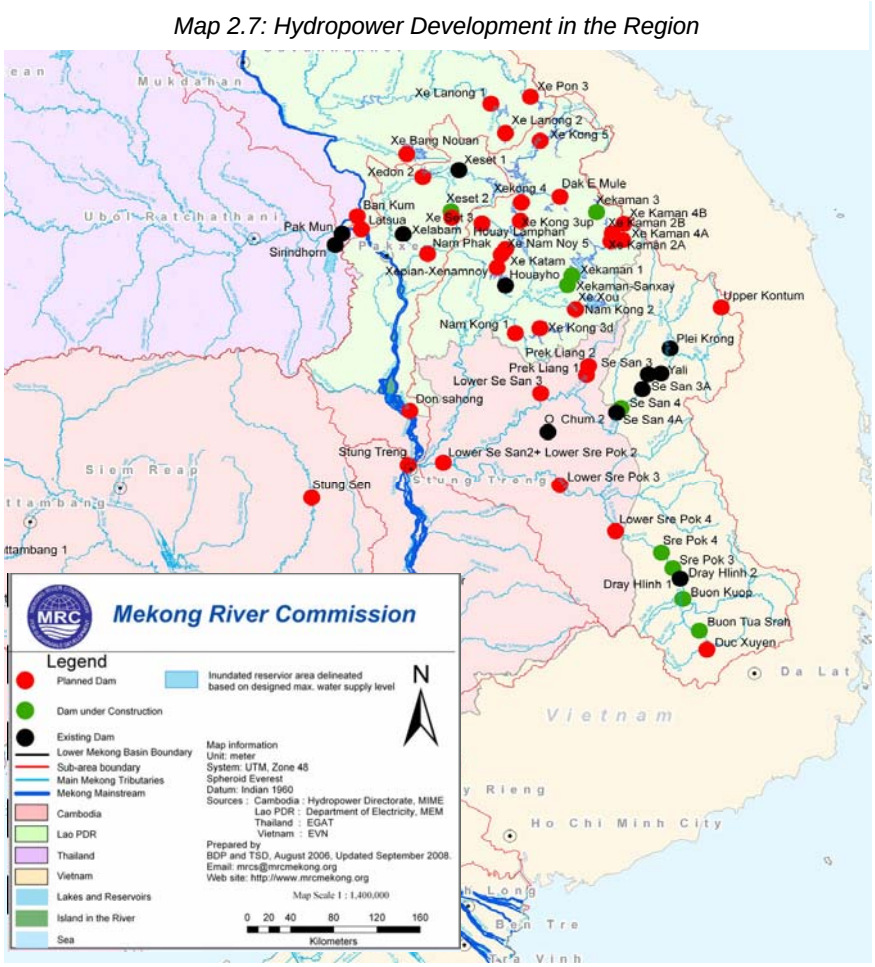
This assessment identified villages with a history of resettlement following the establishment of protected areas in 1993. Environmental preservation and restoration has a high potential for community stabilization of these villages if promoted with due attention to the needs of the most vulnerable groups.

2.8.4 Water Resources Management

At present, the 1995 Agreement on Cooperation for the Sustainable Development of the Mekong River Basin provides the basis for cross-border cooperation on water resource management in the Mekong River Basin among the governments of Viet Nam, Lao PDR, Cambodia and Thailand. This regional agreement aims to promote cooperation in order to ensure the sustainable development, utilization, management and conservation of

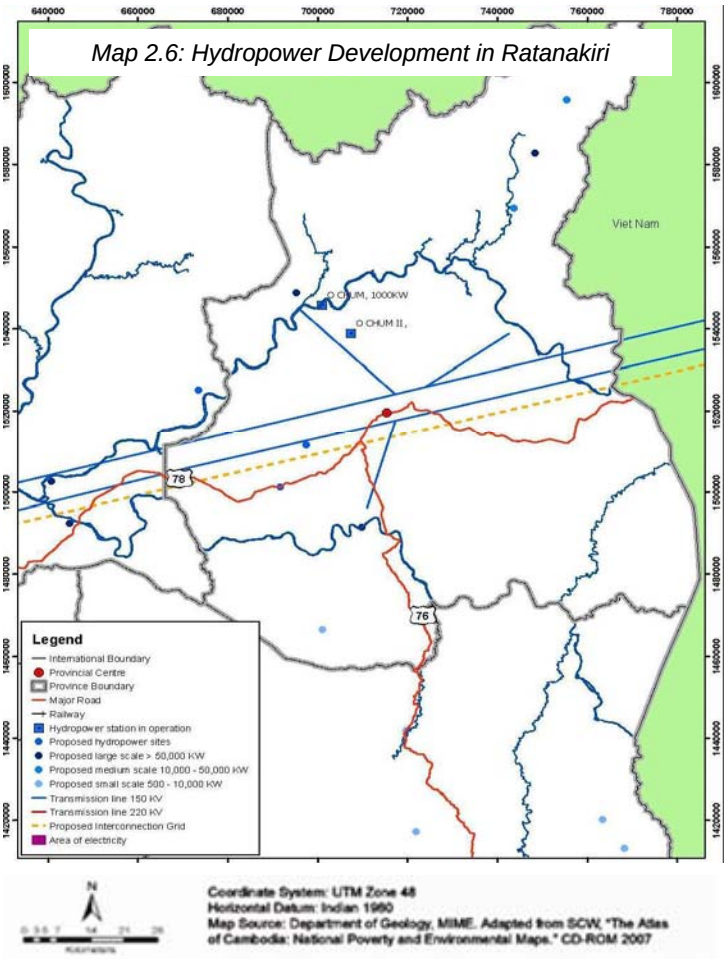
water and related resources of the basin in a manner that would optimize multi-state use and mutual benefits, while at the same time minimize the harmful effects that may result from natural hazards and man-made activities.

Map 2.7: Hydropower Development in the Region



Hydropower development is intensely pursued in the Mekong River Basin, as estimates of its hydropower potential are 30,000 MW (megawatts). Hydropower development in Cambodia will serve the growing demand for electricity, as its estimated hydropower potential is 10,000 MW. Currently, 29 sites are being studied in Cambodia as potential locations for new hydropower projects, with eight in the Se San and Sre Pok rivers located near or within Ratanakiri.

Much concern has been expressed by assessed communities about the adverse impacts of hydropower projects on biodiversity, local communities and livelihoods. The construction of the 720-megawatt Yali Falls Dam, built in 1993 on the Se San River in the Gia Lai Pronvince in Viet Nam, has had far-reaching negative consequences for communities living downstream of the dam, especially in the northeastern provinces of Cambodia. Rapid and radical water level changes have occurred since its construction, combined with a reduction of fish spawning grounds, an increase in river bank erosion, and a loss of food sources as crops and vegetation, which were previously planted along the river can no longer be grown there.



Map 2.6: Hydropower Development in Ratanakiri

Hydropower development strategies in the region recognize the challenges associated with competing water uses in the basin, the possible adverse impacts on ecological balance and land use, including flooding in the Lower Mekong Basin, and the lack of public consultation on environmental impact assessments. In addition to the 1995 Framework Agreement, efforts have been made by the respective National Mekong River Committee of Cambodia and Viet Nam through the signing of Memorandum of Understanding (MOU) and Action Plan to further strengthen cooperation in water resources management and development in the border areas between Viet Nam and Cambodia.

The emphasis is on prioritized activities in three key areas of cooperation, namely: 1) Facilitating Integrated Water Resources Management within the MRC cooperation framework and other regional initiatives; 2) Enhancing the roles of each Committee in the implementation of activities within the country context as well as the integration of national plans into regional programme and initiatives, and; 3) Strengthening capacity of the respective Committee in organizational management through a series of activities, including seminar/training activities, exchange visits and technical forum/ workshops that are jointly organized.

Most of the assessed villages reported a lack of institutional support in receiving timely information on water release from the Yali Falls Dam. This information is a fundamental component for the establishment of an effective Early Warning System (EWS) between neighboring countries and within communities. Enhanced regional cooperation in cross-border water management can be key in mitigating the negative effects which hydropower dams cause to communities living alongside of the main tributaries in Ratanakiri, particularly along the Se San and Sre Pok rivers, through the implementation of cross-border EWS, as well as water resource management

While recognizing the relevance of hydropower development as a means to meet increasing national and regional energy needs, prior consultation with, and the dissemination of information to, concerned communities is required. Chapter 6 of the Indigenous Policy Document on water resources promotes the planning of small, medium and large hydro-electric dams only in accordance with favored geographical areas, but there is more need to engage in consultative processes with relevant

communities, especially in the context of developing resettlement plans and compensation policies.

Some of the assessed villages were located along the Se San river bordering the Se San District in Stung Treng Province, where the Lower Se San II Dam, with an installed capacity ranging between 200 MW[7] and 400 MW (Baird, 2009), is planned to be built. When built, this dam is expected to be one of the largest hydroelectric projects in Cambodia to date. Socio-environmental impacts of the dam could include a substantial loss of forest cover, village resettlements, damages to land, properties and natural water sources, and the loss of main sources of livelihood to the affected communities (such as fishing or agricultural activities).

The possibility of alternative and renewable energy should be further explored when evaluating the environmental and social impacts of hydropower projects. Chapter 10 of the Indigenous Policy Document calls for institutional support to enable the development of renewable energy projects, including solar, bio-gas and other efforts. Although this aspect of the policy document refers to the development of indigenous people's well-being and does not necessarily refer to all of the provinces in Cambodia, it shows the commitment of the government in considering alternative energy policies.

2.9 Chapter Conclusion

As a result of developmental efforts, the ethnic distribution of Ratanakiri has changed significantly with the substantial influx of Khmer lowlanders, becoming one of the fastest growing provincial populations within the past 10 years. The province has rapidly become a strategic gateway for trade due to its geographic location, and the increased interest of local and foreign investors in its resources.

Ratanakiri's economy is predominantly dependent on its agriculture sector, though agricultural production in Ratanakiri remains low due partly to a lack of access to agricultural resources and irrigation techniques for indigenous agriculture (chamkars), which rely heavily on rainfalls and make the effects of climate variability even more severe on the population. Indigenous people have increasingly experienced agricultural insecurity, closely linked to an increase in food insecurity due in part to a decline of production levels after the occurrence of natural hazard events, such as drought, floods, and insect infestation.

Ratanakiri has one of the lowest human development indicator levels in Cambodia, which hampers the capacity of communities to cope with and respond to the occurrence of extreme natural events. Guided by the Millennium Development Goals, recent undertakings in Cambodia's renewed commitment toward the development of indigenous people are revealed in the National Policy on Indigenous People, adopted by the Council of Ministers in April 2009.

The opening of the Ratanakiri Province to economic development brought about four core themes that are challenging to natural resource management: 1) Land tenure; 2) Forestry access and use; 3) Protected areas; and 4) Water resources management. These issues were identified as being predominantly challenging for indigenous communities. The rapid loss, depletion and degradation of common natural resources are central to the understanding of threats and changes to culture, livelihood, security

[7] Presentation of the Cambodian Ministry of Industry, Mines and Energy at the Regional Multi-Stakeholders Workshop on MRC's Hydropower Program, 25-26 September 2008, Vientiane, Lao PDR.

and well-being of indigenous communities. With limited options to diversify livelihood and food sources, pressures arising from natural resource management needs exacerbate the vulnerability levels of communities to hazards. Economic land concessions, mining exploration activities, and hydropower dams, compounded by recent observed changes in climate, further create pressures on local villages.

Traditional forest management practices and the promotion of community-based natural resource management entail the participation of local and indigenous communities in the management of natural resources. A lack of awareness and clarity of laws, rights, and sub-national responsibilities present obstacles to the full participation and empowerment of indigenous populations.

Areas providing for further development of a sustainable and participatory management of natural resource include the co-management and co-development of a Community Protected Area management plan. Further areas for engagement include renewable energy efforts, cross-border cooperation efforts such as that of the Mekong Basin regional agreement, and in-roads for NGOs to pursue the implementation of future activities in order to further both new and existing mechanisms, and activities for local participation.

Chapter 3: Disaster Risk Reduction in a Decentralized Context: *Challenges and Opportunities in Ratanakiri Province*

3.1 The Institutional Context of Decentralized Governance

Cambodia's first efforts towards decentralized governance started in the early 1990s and led to the formulation of a core program called *Seila* (a Khmer word for 'foundation stone') to link parallel development efforts on poverty reduction. The Seila program was conceived as a policy experiment in decentralized planning, along with financing and management of local development, with results and lessons learned contributing to the foundation of the subsequent formulation of a longer-term policy on decentralization.[8]

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 among vulnerable groups, indigenous minorities and women and children in order to achieve the Millennium Development Goals of Cambodia.

The first phase of local governance reforms was supported by the CARERE (Cambodia Area Rehabilitation and Regeneration) project, with the auspices of the United Nations (UN) and Donor countries, following the 1991 Paris Peace Agreement. Decentralized governance and poverty alleviation were promoted through the creation of Provincial Rural Development Committees (PRDC) with line committees at the district, commune, and village levels. Ratanakiri was one of the first provinces where these rural development structures were initially formed and piloted. The Partnerships for Local Governance (PLG) initiative succeeded the CARERE project and focused on provincial and local administration, closely working in Ratanakiri with the Department of Planning and other provincial departments.

Experience gained from almost ten years of decentralization culminated into the adoption of the Law on Administration and Management of Commune/Sangkat (LAMC) in 2001. This law has given the commune, as the most basic level of sub-national government, a more definitive role in governance by clearly stipulating its role in the promotion of social and economic development, conservation of the environment, management of natural resources, and protection of culture and heritage[9]. The Law on the Election of Commune/Sangkat Council was also passed in 2001, along with a royal decree creating the National Committee for Support to Communes/Sangkat to oversee the implementation of these new laws. The first commune council elections were held in 2002, with councilors being elected to a five-year term.

[8] SEILA Programme, Objective 4: National Policy for Local Governance.
[9] Article 43 of the Law on Administration and Management of Commune/Sangkat.

In 2005, the Royal Government of Cambodia (RGC) approved the 'Strategic Framework for Decentralization and Deconcentration Reforms', which aimed to provide the platform for participation in governance reform at the provincial, municipal, district/khan and commune/sangkat levels. This process was to be reached through both the delegation of responsibilities, and the devolution of funds. The law on administrative management of sub-national levels, as espoused in the D&D strategic framework, was passed in 2008 and provided for the mandates and functions of the sub-national levels of government to embody principles of democratic development.[10] It also entailed the councils, who were to be indirectly elected with a mandate of five years, to perform crucial roles in formulating their own development plans where multiple sectors of intervention could be channeled, from social development to natural resource management, poverty reduction, and other needs of vulnerable groups.

In the context of the decentralization of disaster risk reduction (DRR), it is relevant to highlight that the development of disaster management plans are specifically listed amongst the newly mandated roles and functions of the councils.

3.2 DRR and Decentralization

Cambodia is one of the most disaster-prone countries in Southeast Asia. Every year, a significant number of people are exposed to seasonal natural hazards, which threaten their security, livelihoods and well-being. With a rural population accounting for 88 percent of the total population, and having one of the lowest human development indexes, natural hazards have the potential to severely impact communities.

As a response to the country's frequent exposure to natural hazards and the increasing vulnerability of its people, the Royal Government of Cambodia (RGC) created in 1995 the National Committee for Disaster Management (NCDM), an inter-ministerial body under the presidency of the Prime Minister with responsibilities for disaster preparedness, response and mitigation. Over the years, a number of decrees, sub-decrees and orders have further institutionalized its mandate, clarifying roles and functions at the national and sub-national levels. [11] The NCDM holds the responsibility to coordinate mechanisms, which support emergency response and interventions for displaced populations, as well as a facilitative role to mobilize human, financial, and institutional support for preparedness, emergency response, rehabilitation and post-disaster interventions. An equally important task for NCDM, in relation to its mandate, is to raise community awareness on disaster management, strengthen its line committees from the national to the provincial and district levels, and to develop human resources for disaster management.

At the national level, the NCDM structure is comprised of a general secretariat, specialized departments, including a finance inspection unit, and a working group with representatives from each ministry. At the sub-national level, the presence of NCDM is established through the Provincial Committee for Disaster Management (PCDM) and the District Committees for Disaster Management (DCDM). Membership at the provincial

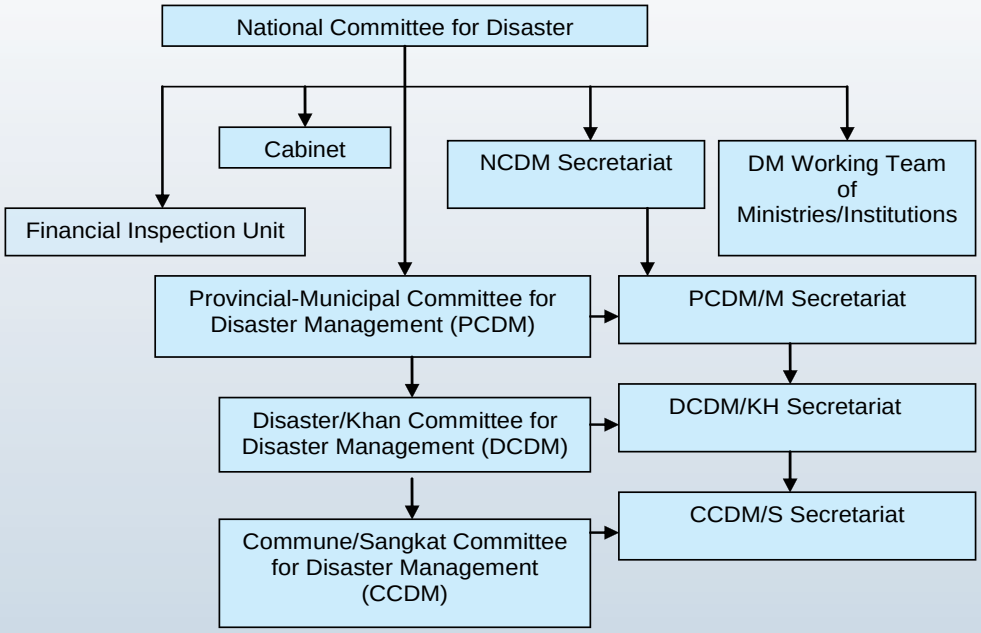
[10] Article 12 of the 2008 Law on the Administration and Management of the Capital, Provinces, Municipalities, Districts and Khans.

[11] Royal Decree No. 0202/040 on the establishment of the NCDM of 2002; Government Sub-Decree No. 30 of 2002 on the Organization and Functioning of NCDM; Sub-Decree No. 61 of 2006 on the Establishment of CCDM; Circular No. 01 of 2002 on Disaster Preparedness and Response; Provincial Order of 2007 on the Establishment of Disaster Management Commissions; Provincial Order of 2007 on the Establishment and Functioning of PCDM.

and district committee is composed of the provincial/deputy governor as chairperson, and the deputy provincial/district governor as vice-chair, while provincial directors of line ministries and the provincial branch of Red Cross sit as members of the PCDM. The functions set for the PCDM include supervisory, technical training, and support roles to the DCDM, which reports damage and needs for operation and rescue, informs of emerging hazards, prepares and disseminates public information on disaster, and facilitates operations through its communes.

It was not until 2006[12] that a Commune Committee for Disaster Management (CCDM) was mandated in Cambodia to provide, at the community level, operational and administrative support in preparation and response to disasters. The creation of the CCDM has the important potential to give impetus to the shift from emergency response to disaster risk reduction that was lacking in earlier policies, laws, as well as committee responsibilities.

Figure 3.1: DRM Coordination Mechanism.



Source: Ministry of Planning and NCDM - Strategic National Action Plan (SNAP) for DRR

While awaiting the approval of the drafted Disaster Management Bill, which will define the precise roles and responsibilities of different actors at both the governmental and non-governmental level before, during, and after a disaster, the NCDM and the Ministry of Planning formulated the Strategic National Action Plan (SNAP) for Disaster Risk Reduction in December 2008. The SNAP holds the objective of complying with the principles of the Hyogo Framework of Action (HFA) for 2005-2015.[13] A key message addressed by the SNAP is the promotion of community-based disaster risk management (CBDRM), thus, recognizing the importance of strengthening the link between the national and provincial levels to the communities, being the primary beneficiaries of any DRR initiatives.

[12] Sub-Decree No. 61 of 2006 on the Establishment of CCDM.
[13] Adopted by the World Conference on Disaster Reduction (WCDR) held in Kobe, Japan, in 2005.

The SNAP builds upon the National Strategic Development Plan (NSDP) for 2006-2010, which already affirmed the need for community disaster preparedness and protection of rural communities from disaster risk as a high developmental priority. Natural disasters were also identified by the National Poverty Reduction Strategy (NPRS) as critical contributing factors to increased socio-economic vulnerability of rural communities.

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

3.3 DRR and Decentralization in Ratanakiri

The experience of decentralization in Ratanakiri under the umbrella of the *Seila* program provided support to the Provincial Rural Development Committee (PRDC) in its efforts to establish and sustain the local planning process in 61 villages distributed among 11 communes. The program culminated in the formation of 61 village development committees and 13 commune development committees, embracing a total of six beneficiary indigenous groups, namely the Kavet, Kachok, Kreoung, Tompoun, J'arai and Prao.

A core feature of these decentralized development efforts was the promotion of community-based natural resource management, with a focus on land protection, land rights and sustainable land use by indigenous communities, with the support of local organizations.

Support for the interaction between decentralization policies and disaster risk reduction strategies in Ratanakiri can be seen in the establishment of the Provincial Committee for Disaster Management. Following the national mandate in 2002, the PCDM in Ratanakiri was constituted in the same year, under the leadership of the Provincial Governor.

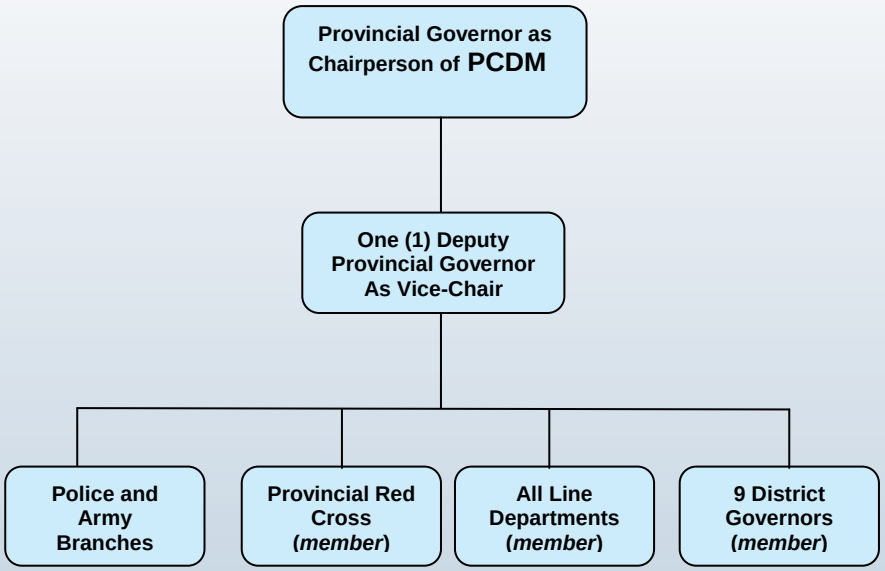
3.3.1 Organizational Features of the PCDM in Ratanakiri

The structure and membership of the PCDM in Ratanakiri were outlined, during discussions with the PCDM focal team, for this research and is illustrated in Figure 3.2. The Provincial Governor serves as chairperson of the PCDM, while one Deputy Provincial Governor serves as vice-chairperson. The Provincial Chief of Cabinet holds a concurrent position as the PCDM focal point, and is supported by two deputy focal points holding positions as Deputy Chiefs of Cabinet.

The PCDM relies heavily on district or commune councils to report disasters and the extent of damage before it proceeds to assess the type of assistance which is needed. Resources are mobilized using the budget of relevant governmental departments, the NCDM and the National Red Cross, as well as from public or philanthropic contributions.

The PCDM does not have a disaster risk reduction plan or projects, which limits its capacity for interventions to crisis response only. The committee has very limited financial and human resources to be deployed during critical stages of disaster. With a minimum amount of resources (including only a few motorboats to use during times of flooding), their capacity for emergency coverage is small. One type of assistance that the PCDM can give for evacuation efforts is in the form of petrol or gasoline to run the boats in the village.

Figure 3.2: Structure and Composition of PCDM in Ratanakiri.



In the event of serious flooding and drought, the Provincial Governor as chair of PCDM calls all line departments in the province to respond to the needs of affected populations. If the disaster situation is serious, requests are made to the National Committee for Disaster Management and the National Red Cross.

Disaster response activities of PCDM members include:

- The Provincial branch of the Cambodian Red Cross supports PCDM on relief assistance during flood and drought, implements projects on health and sanitation and conducts field data collection on damages with the support of local Red Cross volunteers.
- The Provincial Department of Social Affairs provides food relief and cash transfers during drought and flood emergency response consisting of rice, tents, and dry food rations. The amount of relief is normally decided upon after site and field assessment visits. The department receives an annual budget for emergency relief from the Ministry of Social Affairs. For 2008-2009, the operational budget emergency assistance is US$121,952. Previous drought assistance has been given to affected areas in Koun Mom, Andoung Meas, Bokeo and Ta Veaeng, and flood relief assistance to Veun Sai, Koun Mom and Lumphat districts.
- The Provincial Department of Water Resources and Meteorology collects data on flood and water levels, which are transmitted directly to the Ministry using a 24/7 auto-record system from two water stations in Lumphat Village, Lumphat District for the Sre Pok River and Ka Choun Commune, Veun Sai District for the Se San River. However, the data from water stations is utilized only for the Mekong River and not to predict flood or monitor water fluctuations in the two Mekong tributaries. Drought-related activities include the repair and rehabilitation of irrigation dams, with about 57 small and medium irrigation systems in place to date.

3.3.2 Challenges

The experience of Ratanakiri presents emerging challenges in institutionalizing DRR in a decentralized context.

3.3.2a Natural Hazards Not Regarded as a Developmental Concern

Ratanakiri Province is not identified as a priority area for disaster risk reduction in the Strategic National Action Plan (SNAP) for Disaster Risk Reduction 2008 – 2013 based on the results of a hazard mapping exercise conducted in 2003 at the national level by the Ministry of Planning.[14]

In spite of the recognition of the NCDM policy document that disasters can be either natural or man-made, and that the consequences of human activities can eventually lead or contribute to natural disasters, hazard analysis in Cambodia tends not to include man-made hazards. These types of hazards, which include many processes that are documented in Ratanakiri, such as environmental degradation or hydropower development, have been demonstrated to have a significant impact on the hydrology of the Mekong tributaries, and are linked with increased water fluctuations as well, as unpredictable flooding levels in riverside communities.

Although occurrences of flash floods were documented in Ratanakiri and also mentioned in the SNAP, the province still failed to be included as a priority area for disaster risk reduction. This omission furthers existing challenges to Ratanakiri's long-term strategies for development and poverty reduction.

Natural hazards increase the already-high vulnerability levels of indigenous people resulting from rapid forest degradation, increasingly unpredictable climate trends, and development trends, which are leading to the shrinkage of food sources, such as fisheries and traditional agricultural lands. Although they have been detrimental to the livelihood and security of affected populations, and are a contributing factor to the high poverty levels in Ratanakiri, natural disasters still have not yet been factored into provincial development plans. To date, it has, therefore, been difficult to mobilize resources and facilitate coordination among line departments in order to effectively establish and implement DRR mandates in the province.

3.3.2b DRR Resources and Capacities

DRR is a new and important mandate to sub-national governance in Ratanakiri but poses a burden of extra workload on concerned government actors who must try to fulfill mandates while often being under-resourced and under-staffed.

The PCDM holds no budget of its own and is mainly dependent on contributions from single PCDM members or external aid, as well as the Provincial Governor's decision to issue hazard warnings for districts and communes.

Since it was established, the PCDM organizational capacity for disaster management in the Province has remained weak as reflected in the following findings:

- Tendency to one-off emergency response;
- Reliance on imminent hazard threats before mobilization of support;
- Weak communication and broken coordination linkages with line departments implementing their programs at the local level;

[14] With the support of the World Food Programme (WFP).

- Limited human resource capacity with staff already burdened with other provincial administrative responsibilities;
- Lack of awareness of the PCDM mandate among communes and villages;
- Fiscal decentralization has yet to fully take place, although certain provisions have been made for commune councils to generate their own revenues; and
- Delays in the delivery of warning systems to remote districts and communes due to a lack of access to basic communication technology and means of transportation.

3.3.2c Lack of Synergy Amongst Actors

National DRR strategies like the Strategic National Action Plan (SNAP), the National Adaptation Programme of Action to Climate Change (NAPA), the Mekong River Basin Agreement, and other regional cooperation mechanisms which have relevant and potentially vital information, do not have information flows reaching the provincial level, and are not systematically shared with districts, communes or villages.

Current communication channels for flood warnings or notifications of the opening of the water gate of the Yali Falls Dam in Viet Nam emanate from the Ministry of Water Resources, and are distributed to the Province and then down to the district and communes. The timeliness of the delivery of information, including on the opening of the dam, is an issue for community preparedness, given the very short notice and the remoteness of many of the villages. Communes are relied upon to relay notices to villagers, but in the past, in more than one instance, this chain of information proved to be ineffective due to a lack of resources.

Commune development planning often does not adequately reflect the developmental needs of local populations. Hard infrastructures (i.e., roads) tend to be given higher priority than soft infrastructure (i.e., education, agricultural support and natural resource management) and there is neither recognition for, nor documentation of, community-based disaster risk reduction initiatives by the provincial government.

People's formal participation in disaster management, as mandated by law, works mainly through the village chief. The chief is responsible for recording hazard incidences and damages, and submitting the report to the Commune. The Commune then reports to the District, which transmits the information to the Province, and from there to the appropriate provincial line department. Response from departments may take time or, in many instances, assistance can be delayed or insufficient.

Linkage mechanisms between the district, commune and village are, to a significant extent, driven by non-government organizations as part of their program implementation and advocacy initiatives, and often show an apparent lack of synergy between different government actors. In the past, this challenge has been reflected in disaster relief distribution efforts, where the lack of information sharing and ineffective coordination mechanisms were reported to have hampered emergency response operations.

3.3.3 Opportunities

3.3.3a Community-Based Disaster Risk Management (CBDRM)

SNAP emphasizes the need for mainstreaming DRR at the community level, and promotes a community-based disaster risk management policy in a decentralized context. One of its six key DRR components is strengthening sub-national and

community-based disaster risk management by decentralizing responsibilities and resources for DRR, including the implementation of community-based DRR programs.

In the context of Ratanakiri, it is important that CBDRM strategies are based on the five essential prerequisites for action:
1) Identify needs for CBDRM within the specific dynamics and pressures that contribute to increase levels of existing vulnerabilities of indigenous people; 2) Understand roles of CBDRM within the traditional social structure and governance system; 3) Integrate CBDRM into existing mechanisms at the community level to avoid duplications and increase interest and engagement; 4) Analyze the relationship between CBDRM and indigenous traditions, culture, and beliefs; and 5) Build consensus for action on CBDRM at all levels, including local and community-based organizations.

The way forward: Community-based natural resources management (CBNRM) is perceived and regarded by indigenous people as a means to preserve their own identity. These communities have maintained and passed on for generations a culture of communal ownership in which they see their livelihood secured and protected. CBNRM also has the potential to sustain social cohesion within the indigenous society in times of rapid economic and development changes. Community-based disaster risk management (CBDRM) should learn from past and present experiences of CBNRM in Ratanakiri before being integrated into local development planning.

3.3.3b Multi-level Collaboration in Disaster Risk Reduction

Collaborations between the provincial government, district and communes, non-government organizations as well as indigenous/ethnic communities in disaster mitigation and response have proven to be successful in the past.

The case of drought relief efforts of 2005 (an example of which is outlined in *Box 3.2*) illustrates possibilities for joint undertakings. Multi-stakeholder ownership of DRR plans can provide momentum for strategic interventions, which build upon current development efforts in the province, and lead towards the promotion of a disaster preparedness culture if replicated effectively in the future.

Box 3.2: Good Practice in NGO-Government Collaboration:
Ratanakiri Food Aid Project.

In August 2005, CARE, in Ratanakiri led the Ratanikiri Food Aid Project in response to the 2004 drought and consequent food shortage. The situation analysis of the 2004 drought stated, 'During the wet season of 2004, rains stopped early, some areas in September. Communities reported less rice than normal and were likely to run out before the 2005 rice harvest could be grown or harvested.'

A drought relief committee was formed to identify villages severely affected by drought - a total of 21 villages in Ou Chum, Bokeo, Veun Sai and Taveng districts were identified as severely hit by drought in 2004. Over 36 tons of rice (1925 bags) were distributed to 1862 households. Working with CARE were International Cooperation Cambodia (ICC), Community Forest Alliance (CFAC), the Non-Timber Forest Products Organization (NTFP), and staff support from Health Unlimited (HU), CEDAC, IYDP and Highlander Association (HA), with financial support from CARE Australia and Hope New Zealand.

The effort was supported by the Provincial Governor, the Chief of Provincial Cabinet, and the four district governors during food distribution at the villages. The Provincial Police guarded the rice storage at distribution points.

Source: CARE Ratanakiri Food Aid Narrative Report (August 2005)

3.4 Chapter Conclusion

Decentralization and disaster risk reduction policies are very new concepts in the context of governance in Ratanakiri Province. Decentralization and deconcentration reforms promise significant inroads for the mainstreaming of disaster risk reduction at sub-national levels (provinces, districts, communes, and villages). The establishment of the Provincial Committee for Disaster Management in 2002 presented a positive direction for community-based DRR, and stronger institutional linkages between line departments that are members of the PCDM. An effective decentralized disaster risk reduction strategy and implementation plan for Ratanakiri is presently lacking, but there is an urgent need to develop such a strategy. Challenges identified on mainstreaming DRR point to a lack of institutional support for new mandates on DRR and decentralization at the district and commune levels, as well as an absence of synergy between national and international level commitments and local level capacities to fulfill these commitments and mandates. Strong policy statements for CBDRM provided by the Strategic National Action Plan (SNAP) and the National Programme of Action to Climate Change (NAPA) are regarded as opportunities, which can be used as sound bases for policy attention for Ratanakiri.

Chapter 4: Hazards, Vulnerabilities and Capacities

4.1 Introduction

Three major natural hazards – flood, drought and insect infestation – were identified and investigated during the community risk assessments. Overexploited, degraded natural resources, and other hazard factors driven by human activity and resulting in the increase of the occurrence and severity of hazard events were also analyzed as dynamic pressures in the context of vulnerability analysis. The findings are presented and discussed in this report by type of hazard, and include the analysis of vulnerability and capacity in relation to each hazard.

4.2 Floods

Nearly all of surveyed villages experienced flooding with at least one of the following characteristics: 1) Seasonal slow onset and flash floods during the rainy season; 2) Flash floods induced by the release of water from hydropower dams occurring at any time of the year and regardless of rain patterns; and 3) Flash floods caused by a combination of heavy rainfall and water released from hydropower dams.

Most of the populations identified as being at-risk of flooding were those living near the Mekong River tributaries, namely the Se San and the Sre Pok rivers, and, to a certain extent, those living near streams. Many of these villages reported that past and present deforestation has increased their vulnerability to floods. Forest loss is believed to affect the absorptive capacity of the soil for flood water, as lands are being cleared without sufficient time to regenerate soil vegetation. The absence of big trees exposes the villages to an onslaught of storms and floods. Villagers recalled that in the past, flood waters took time to reach their village area because of the thick forest around them and the trees along the river bank, which has served to decrease flow of water. The forest, has served as an evacuation point and a source of food for most villagers during floods, however, it has also been noted that forest is now decreased NTFPs and common wild game for consumption as a result of the forest loss.

A key year for flooding, as reported by villagers, was in 1996 due to the combination of heavy, prolonged rainfall during the monsoon season and the collapse of the Yali Dam in Viet Nam. Three districts under study were heavily affected by the 1996 flood from the Se San River, and one district by the Sre Pok River. These floods were preceded by three to ten days of heavy rain, with river water rising progressively within 24 hours before the riverbank eventually broke, with flood waters reaching both villages and rice fields. The duration of the rainfall leading to the flooding varied in districts, anywhere from 3 days to one week.

The collapse of the Yali Falls Dam in the Central Highlands of Viet Nam, which began construction in 1993, was held mainly responsible for the disaster, as heavy downpour for a week contributed to its eventual collapse. There was structural failure identified in the design of the dam, and it was found that weak, locally-made building materials had been used in its construction. Before the flood, no information was made available to communities in Ratanakiri that a dam was being built in Viet Nam; thus, provincial officials and villagers were not aware that it was even being constructed and had no flood warning information.

Flooding inn 1996, which occurred with characteristics of rapid onset, longer duration and height of floodwater, compounded by an absence of knowledge and preparation by

families for the event, contributed to heavy losses of primary agricultural and household assets. The major documented losses and damages included:

- Loss of livestock: cows, buffaloes, pigs and chicken were killed as not all of the villagers, especially single-headed households, were able to evacuate them in time. In Dal Leng Village (Andoung Meas District) for instance, a total of 300 chickens, 10 cows, 8 buffaloes, and 50 pigs were lost to the flood.
- Damage to rice fields and riverbank chamkar: In Pateng Village (Veun Sai District), all rice plants in their flowering stage were destroyed. In Lorm Village (Andoung Meas District), half of the rice fields located in the lower part of the village was damaged. In Veun Hay, impacts of the flood on crops resulted in very little harvests for the year.
- Physical damages: damage was caused to houses in village areas and rice storage and cottages along the river bank, which were either broken or swept away. Houses were either damaged or smashed down. Household materials (e.g.,pots, plates and jars), boats, and food stocks were also lost to the floods.
- Human deaths: in Kachout Krom (Andoung Meas), one elderly community member and one young adult were reported to have drowned, as they were not able to escape to safety in time.

Before 1996, flooding did not occur in consecutive years. Destructive floods were rare and, when flooding did occur, rice fields and chamkar were not considerably damaged and flooding was slow to reach villages. From 1996 onwards, however, floods started occurring on a yearly basis, with the worst being experienced in 2000 for Ta Veaeng, 2001 for Andoung Meas and Veun Sai, and 2003, 2004, 2005, 2006, and 2007 for Lumphat.

Photo 4.1: Veun Sai School inundated in 1996. Source: Provincial Department of Environment

Box 4.1: Veun Sai District Flood.

In Veun Sai District, 1996 floods were preceded by three to ten days of rainfall, where rivers flooded in one day or less. The flood depth remained stable for a day and then increased dramatically to a peak of 2 meters and lasted for 12 days. While some villages like Veun Hay in Hat Pak Commune were flooded in the very early morning, others like Tiem Leu, were found unprepared as the water level began rising in the evening and, within a few hours, began flooding homes while most of the villagers were sleeping.

The occurrence of floods after 1996 slightly varied across the surveyed districts, which are increasingly experiencing changes in flood patterns and water fluctuations (see

Table 4.1). In Ta Veaeng, major floods were reported in 1998 and 2000. The flood in 1998 was not considered as serious as that of 1996 as it did not reach the village area, but nonetheless, it affected a large portion of the rice fields and chamkar. In 2000, after 6 to 7 days of rain, floods increased the levels of river water by 0.5 meters to 1 meter. Before 1996, flooding had occurred only once every three to five years. While Ta Veaeng did not experience any major flooding after the breakage of the Viet Nam dam, small seasonal floods have still occurred from August to September, with fluctuations in the water levels being observed for longer periods in the Se San River, and affecting fishing and farming activities along the river.

Table 4.1: Flooding History Before and After 1996 (as collected during the study)

District	Worst Floods Before 1996	Frequency of Floods after 1996
Ta Veaeng	1984, 1986, 1987, 1992, 1995	1997, 1998, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008
Andoung Meas	Once every 2-3 years	1997, 1999, 2000, 2001, 2002,2003, 2004, 2005, 2006, 2007, 2008
Veun Sai	1964, 1982, 1987	1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008
Lumphat	1960, 1962, 1979, 1980, 1993	1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008

(Note: Years underlined were considered serious floods.)

In Veun Sai, major floods occurred on a yearly basis from 1997 to 2001. All villages in Kok Lak Commune (La Meuy, Rok and Trak) were affected by the flooding of the Lalay stream, which, from 1997 to 1999, has caused damages to rice fields and loss of livestock. During peak flooding periods, stream water rose to a maximum of 1.5 meters and lasted for up to 15 days. In 1998, Trak Village suffered heavily from a storm and many houses and rice fields were destroyed. Phnom Kok, Pateng and Lumpat villages (Veun Sai District) noted that they had experienced flooding every year, lasting for two to three days, which negatively affected the rice fields and contributed considerably to crop failure.

Lumphat District experiences the most dramatic frequency of floods in the province, and holds a history of severe annual floods from 2003 to 2007. Dei Lou Village, in Lumphat District, noted a change in flooding patterns. Whereas from 2005 to 2007 the village experienced annual floods lasting seven to fifteen days each, before 2005, flooding occurred only once every three years and provided a natural source of water for rice fields. There were two floods in 2006, covering the village area for 3 days and the rice fields for 12 days. During these events, flood waters came during the daytime following a full day and night of rain. The 2007 flood was considered the heaviest and most serious to date, with floodwaters reporting to have originated from the upper part of the river and reaching the village a day. Even while villagers observed warning signals that a flood was coming, however, they did not anticipate the intensity and length of the flood. The duration of the flood was longer than usual, inundating the rice fields for 15 days and the residential area of the village for 10 days. The village pagoda was the only structure not submerged in flood water.

In Lumphat Village, the 2007 flood lasted for seven days, and water levels rose to approximately 3 meters. The flood waters rose slowly throughout the day, while most

villagers were still in their homes, allowing them to evacuate safely to the mountain by boat.

The 2007 floods were caused by the tropical storm *Pabuk*, which resulted in significant damages in the northern and coastal provinces, with Ratanakiri, together with the provinces of Kampong Thom, Kratie and Prey Vihear, being reported as the most affected areas of Cambodia.

Photo 4.2: Lumphat Market inundated in 2007. (Source: Provincial Department of Environment)

Box 4.2: Dei Lou Village Flood

The 2007 flood in Dei Lou Village (Lumphat District) reached a maximum of 7 meters in the rice fields, and 2 meters in the houses. Unlike prior flooding events, the villagers did not have enough time to relocate much of their properties (e.g., boats, livestock and food stock) and the duration of the flood was longer than previous years. The speed of the flood water was considered faster, and its force stronger than any prior floods seen before.

In Andoung Meas, major flooding has been experienced on a yearly basis after the 1996 floods, with the most severe flood reported in October 2000 when the opening of the water gate of the Yali Dam in Viet Nam coincided with heavy rain. In Tanong Village, losses from this event include destroyed chamkars, boats, livestock, and rice storage. Since 2001, most families have stopped river bank chamkar farming due to the risk of flooding, thus, losing a valuable source of food crops.

4.2.1 Migration as an Adaptation Strategy to Floods

A history of migration patterns among surveyed villages is reflected in movements away from rivers. This history is also reflected in divisions of single villages into multiple sub-villages located away from each other as a result of floods and their consequent pressures on livelihoods. These movements and resettlements have been both temporary and permanent in nature, depending on the village.

Temporary resettlement occurs generally for the period of a week to a month, during which villagers are forced to move, either by boat or on foot, to the nearest hill or forest. Evacuation strategies make use of prior established evacuation routes which are known and secure.

Permanent resettlements forced by flooding were recorded in Andoung Meas, Ta Veaeng, and Veun Sai districts. In Andoung Meas, the assessed villages have been very recently established, with one being created as recently as 2002. Out of five villages

surveyed, three villages - Tanong Village, Lorm Village and Kanat Touch – moved to a new location away from the river, driven by fears of flooding.

Two villages in Ta Veaeng District — Kekoung Krom and Tumpuon Reung Thum — moved collectively after the 1996 flood, and resettled away from the river. The movement was reported to be prompted by post-flood diseases, including vomiting, diarrhea, and black fly-induced disease, which led to the illness and deaths of several people within a relatively short period of time. The communal decision to move was founded by the belief that diseases and deaths in the old village made it unsuitable for them to continue living there.

The villages of Rok, Lalay and Trak in Kok Lak Commune, initially living in the highland forest, had moved in 1987 to live near the Lalay stream, where their chamkars were located. During the 1997 flood (which damaged most of their crops and livestock), villagers evacuated to their upland chamkars. After the flood in 1997, Rok Village moved away from the Lalay stream and resettled in a higher area.

Box 4.3: Dal Leng's History of Migration.

Located near the Se San River, Dal Village in Andoung Meas District was sub-divided in the 1980s into three parts along the two sides of the river: Dal Leng, Dal Por and Dal Pok. A year after the 1996 flood, Dal Por moved away from the river. Dal Pok villagers moved away from the river in 2006 and settled upland near the stream. The 1997 and 2006 voluntary resettlement of these two parts, resulting in further physical and social separation of the villages, was primarily driven by fear of flood due to their experience in 1996, and the threat of future floods of the same severity posed by the Yali Dam.

The case of Dal Leng Village (discussed in *Box 4.3*) shows that forced migration driven by disaster has a potential in Ratanakiri for contributing to the erosion of social cohesion. This course, particularly when its process culminates into the creation of sub-villages which become even further isolated from each other, weakens existing ties to traditional family and social networks. It can also fuel land boundary and claim conflicts between indigenous villages.

Villagers in Veun Hay evacuated to the forest using small boats and were only able to take a limited amount of rice with them. Most of their properties were destroyed and their livestock died or was lost, with only some families able to bring their bufaloes with them. Some houses and all rice fields were destroyed, leaving the village with no harvest for the entire year.

The impacts of resettlements were mixed, with positive effects for some and negative impacts for others, depending on the new village location, proximity to roads, access to water sources, soil type and available land for new chamkar. In order to secure a higher area and access to bigger lands for chamkar, communities have often been left with few options but to resettle in areas located a great distance away from the river, which is not only a vital resource for drinking water and fish, but also for household consumption. This had made access to water resources a long and difficult process.

Several villages surveyed across the four districts have also expressed their intention of moving and resettling away from the rivers. This interest was founded not only by concerns of the annual occurrence of floods, but also to growing physical and social insecurity from water surges and fluctuations as well as an increase in unpredictable

changes in climate trends. Communities noted that these changes have left villagers often unprepared to plan for and succeed in their seedling and harvest calendar.

4.2.2 Vulnerability

4.2.2a Physical/Material Insecurity

Rice shortages resulting from floods are a central feature of food insecurity in Ratanakiri villages. Significant damage to rice fields and riverbank chamkars is a major contributor to crop failure, leading to higher harvest loss and larger food production gaps. A decrease in food stocks is further worsened when rice storage areas are also destroyed. Until 1996, many villages along the Se San River used chamkars and kept rice storage or cottages by the river bank.

'Food along the river bank such as natural vegetables, bird eggs and fish eggs, used to be abundant in the past. When the water was shallow, birds would come and lay their eggs on the sand. Children used to collect these eggs which served as part of our diet. Soil fertility has now decreased. Consecutive occurrence of floods made the land muddy and the soil from the upland covered the mud when the flood water receded. Between 10 to 15 meters of the river bank have eroded and bamboos along the river uprooted.'

(Prao villager from Ke Koung Krom, Ta Veaeng District)

Photo 4.3: Bank erosion along the Se San River

The case of villages in the Hat Pak Commune can be used to illustrate people's vulnerability during and after the flood of 1996. Located three hours away by boat from Veun Sai District, Lumpat and Veun Hay villages in Hat Pak Commune have remained outside the scope of the assistance of provincial authorities and development organizations. After the 1996 flood, villagers in Lumpat had no harvest, as their chamkars and rice fields were destroyed, and no rice had been previously stored. They mainly depended on potatoes and *kadouch* (manioc tuber) during the rice shortage months between July to November. Some village women reported that various families were forced to eat dead animals in order to survive. After the flood, fishing continued to provide a source of food, but, since 2000, the amount of fish caught has decreased significantly.

In villages visited for the research of this report, it was noted that the sudden onset of floods often do not give people enough time to take adequate food supplies with them when they evacuate to the forest or mountain. Since they can remain in these locations for anywhere from a few days up to a maximum of a month, they are forced to mainly rely on forest products, particularly *kadouch* and wild potatoes for their sustenance until they can return home.

Photo 4.4: Village elders in Tanong holding a kadouch root

'During the 1996 flood, we suffered food shortage for four months and depended on kadouch and wild potatoes during those months. Rice harvest that year was reduced to 100 kgs. per hectare compared to our annual harvest of two tons. Again in 2000 and in 2002, we experienced food shortage following floods. Since then, most families have stopped river bank farming, which once provided a good source of food crops such as white beans, cabbage, cucumber and cashew nuts as chamkar soil is fertile.'

(Villager from Tanong Village, Andoung Meas District)

Vulnerable livelihoods are largely determined by reduced access to alternative livelihood options. In most of the assessed villages, livelihood strategies in times of floods are heavily dependent upon the forest for NTFP collection, and the hunting of wild game. However, access to these resources and supplementary agricultural activities, which had supplemented community sustenance in times of crises in the past, was reported as being strongly reduced due to land loss and restricted forest access.

Villages not adjacent to the Sre Pok River but located near streams can be equally vulnerable to food insecurity. In Sayas Krom Village, the Chaloy stream water level rose from low levels to one meter in just an hour. The 2007 flood, which occurred between the end of August and the start of September, destroyed most rice fields, resulting in food shortage in the following months. The rice fields and chamkars near the stream were flooded for 7 days, while the residential area was flooded for 10 days. During the flood, some families chose to remain in their homes, while some moved to their chamkars. The water level rose to 1.5 to 2 meters and only half of the houses withstood the flood inundation.

Decreased soil fertility and the loss of traditional food sources, such as river bank chamkar and fishery, has resulted in an increased competition for food, especially for large households as cultivated lands shrink and crop production decrease after floods. Villages still recovering from the 1996 floods, and again affected by subsequent floods,

are still highlighted as being more vulnerable to food insecurity. Some villages have stopped primary agricultural activities, such as planting in rice fields and along the river bank, because these practices are considered as risky and insecure since they are under the constant threat of flood and crop destruction.

Significant changes in fish and plant populations, a source of protein and food for most families along the river, negatively affected household diets and contributed to the decline of fish stocks.

Photo 4.5: Theung Thnai in her new home

Box 4.4: Theung Thnai's Personal Story.

Theung Thnai, 58, is a Lao widow who has been living in Veun Hay Village since 1979. During the 1996 flood, she was alone in her family thatch house, which was built close to the river. When flood waters started rising, she quickly moved out of the house without taking anything with her. She evacuated with fellow neighbors into the forest where they stayed for three days. When she returned to the village after the flood receded, she found her house destroyed. She was homeless for 2 to 3 years until neighbors and her married children were finally able to pool together enough resources to build her a house.

The remote locations of villages, long distances from population centers, lack of access to roads, and a common lacking of basic assets, such as boats for evacuation, all present barriers to developing adequate coping strategies to floods. Most of the villages surveyed require external assistance to help fill in food shortage gaps during and after floods, such as borrowing rice from other villages. The more vulnerable populations (e.g., women, children, the elderly and people with disabilities) are at a higher risk of suffering from injury, death and displacement, and require additional external assistance in order to escape to safety or to restart their lives after flooding, particularly if they lose their homes to the disaster.

The types of houses built in most communities before 1996 were not made of strong materials. These houses usually had thatched walls and roofs, and shallow house posts. Smaller houses were noted to be more at risk of being easily swept away by the rapid water flow of floods. Building on lessons learned from 1996 floods, efforts were made to improve traditional building structures, where financial resources were available. However, during the assessment, the physical infrastructure of most communities was predominantly identified as being weak, and it was clear through

discussions and observations that most of the houses would barely be able to withstand a consecutive onslaught of floods.

While some families have a second house/cottage in their upland chamkars, many do not, and, in times of evacuations, they must live in the forests without any appropriate protection from the rain until floods recede.

Photo 4.6: House in Ke Koung Krom

Photo 4.7: House in Samot Leu Village

Evacuations using small boats belonging to other villagers often require payment in cash money and/or other assets. For instance, in a previous flood affecting Phak Nam Village, (Veun Sai District) families who evacuated by boat had to pay 1,000 riel per person. One family reported paying 3,500 riel for transportation to the other side of the river. Those with no cash paid with rice and chicken to the boat owners or evacuated on foot, even though the nearest high area (mountains or hills) was located kilometers away.

Unpredictable water level rises can cause substantial damage and lead to human fatalities. In 2002, a woman and her child from Pateng Village reportedly died when their boat capsized due to sudden water fluctuations while crossing the river. In the past, villagers could have slept on 'islands' in the middle of the river while waiting for the next day's fish harvest, because the water levels were once well known, safe and predictable.

Sources of water during floods were identified as often being comprised of a combination of flood water, water from holes dug near streams, and river water. Rain water harvesting is not yet widely practiced as most villagers do not possess large water storage jars. Information about good practices of boiling river or flood water is now widely disseminated to ensure safe water consumption. Villages where river and flood water was purified before drinking mainly depend upon external assistance. For example, in Lumphat and a few other villages, organizations like the Red Cross had in the past, reportedly distributed chloramine tablets during floods for purifying water before drinking.

"Although hand pumps and wells started becoming available in the villages, streams, rivers and ponds remain the predominant sources of water for household consumption."

Photo 4.8: Women in Pang Kit Village fetching water from the Se San River (Ta Veaeng District)

The incidence of water-related diseases has continually increased during and after floods. Villagers reported suffering from vomiting, stomachaches, malaria, typhoid and diarrhea. The villages in Ta Veaeng and Andoung Meas were reported as being heavily affected by these symptoms. In Dei Lou, there were many cases of hemorrhagic fever among children after the 1997 flood and onwards. No doctor visited the village during the flood, so villagers would travel by boat to go to the District Health Center. For hemorrhagic fever patients, the District had to request the Provincial Hospital to arrange for an ambulance and, where possible, medical treatment for the victims.

4.2.2b Lack of Institutional Support

The extent of the damage during the 1996 flood was largely attributed to the absence of any early warning information on either the flood or on the failure of dams, which could have mitigated livelihood and physical losses and allowed people to be better prepared. Findings gathered during field assessments revealed that information was not widely disseminated before the occurrence of flooding, leaving people caught unprepared and forced to evacuate on their own. In most cases, people were forced to leave their animals behind and take little or no food in their journey to the nearest forest or hill. Sources of information regarding the flood were fragmented, reaching only a few villages at best. Some learned of the news of the flooding by radio broadcast, while others were informed by District and commune officials or by other villagers. Dal Leng villagers in Gnang commune knew about the collapse of the dam from J'arai relatives in Viet Nam.

After the 1996 flood, some efforts were made by provincial, district and commune officials to inform the villages about the imminent risks of flooding. However, information on weather forecasts or on the opening of the dams was disseminated in a slow systematic manner or came late, usually after water had already been released from the dam and heavy rainfall or storms had already struck the communities. In Pleu Touch Village, the village and commune chiefs did not receive information on the water release of the dam in time, and were only made aware when they saw a 'green light fired from Viet Nam a few hours before water was released.'

Some improvements were observed in the stability of the water level in 2002 after Viet Namese officials visited Ta Veaeng District in 1999 and 2002, and a more timely notification of water release from the dam was reported by the communes to be initiated. Water gauges were installed in some villages in Ta Veaeng, although most of these were eventually lost during floods. In December 2007, Viet Namese officials were said to have visited Lumphat district to 'evaluate the situation on the Sre Pok River' and 'to apologize for the damages done to the people.'

Two water stations set up by the Ministry of Water Resources and Meteorology, located at Lumphat Village and at Ka Choun Commune in Veun Sai District, currently collect data on water levels along the Sre Pok River. However, it was explained that data gathered from these stations are directly passed on to the Ministry through an auto-recording system. This system is used to forecast flood or rises in water levels not in Ratanakiri, but in the Mekong River basin outside the province. Information regarding flood warning or notification on release of water from the dam in Viet Nam first goes through the Cambodia National Mekong Committee and the Ministry of Water Resources and Meteorology, who then disseminates it to the Provincial Department with a copy sent to the Provincial Governor. The Governor is then tasked to disseminate information to districts, communes and villages, while the Provincial Department makes public radio announcements to broadcast the information. However, few villagers own or regularly listen to the radio, and notification by phone is considered unreliable due to the lack of a secure phone network. These factors all constitute a challenge to the development of early warning systems for flooding.

Lifelines such as power, roads, transportation, medical assistance, and food or medicine stockpiles are crucial mitigation measures in the event of a disaster. However, the provincial government is reported to lack adequate financial or human resources necessary to provide extensive and timely relief assistance during flood emergencies.

An example on a lack of resources for emergency response can be found in the experience of Dal Leng Village, where the district governor was reported to have once used his own motorboat to help evacuate some families in the village. During that time, only two families had boats, and almost all of the villagers had to evacuate on foot to the mountain, located five kilometers away from the village, because the province did not have boats to assist people with evacuations.

Emergency food stock mainly relies on contributions from the Department of Social Affairs and the Red Cross. These actors have proved in the past to be able to ensure a minimum of relief assistance to some of the affected populations, in connection with external assistance from other organizations, where available.

However, unequal relief distribution has been perceived by some assessed villages located in remote areas like Hat Pak Commune, whose villagers feel they do not receive as much assistance as other communes due to their remoteness from the district center, requiring long boat travels for assistance provisions.

A contributing factor to the widespread sense of disconnectedness from the rest of Cambodian society and development planning, as reported by surveyed villages, is that meaningful public consultations have not been conducted to present the consequences and impact of the planned construction of new hydropower dams. These dams, located in the Se San and Sre Pok rivers, such as the proposed Lower Se San II Dam, are proposed to have work starting on them in 2010. Similarly, no consultations were done in

the past for the construction of other dams that are already operational in the two tributaries.

4.2.3 Capacities

4.2.3a Access to Institutional and External Assistance

Increasingly, small roads are being built to connect district and commune centers to remote villages. In some instances, districts implemented food-for-work programs where villages were paid in rice and fish cans to build village roads.

Improved communication signals, together with the growing use of hand phones and the appearance of radios and portable power batteries among some households, are contributing to connect remote areas of the province to the district and commune centers, although, at present, the villages located close to these centers are still the main beneficiaries for relief activities. Motorbikes and motorboats are owned, though in small number, by villagers.

In addition to traditional ceremonies held in the village, people have recently started visiting health centers in districts and health posts in selected communes in the event of illness, which suggests pockets of trust in modern medicine remedies. This in turn suggests that villages may be more open to receiving other forms of assistance, including DRR programming. However, in regards to health facilities, these services remain very basic and are often unable to meet the severe and diverse nature of diseases recorded among the assessed villages, especially in connection with flood emergency and post-flood recovery phases. Villagers also have to pay for medicine every time they visit. Health problems pose a substantial burden on most families as they have to spend their limited cash on medicines and treatment. The inability of one family member to contribute to daily subsistence or work during the farming season can substantially affect agricultural production, food security and household income, particularly in villages where household labor is limited.

Table 4.2: Villagers Recall NGO Interventions.

Name	Service
GAA	Hand pump, Water Filtration, Sanitation, Agriculture Support
ICC	Rice Bank, Wells, Health, Sanitation
HU	Water & Sanitation, Malaria Prevention
HA	Education, Land Rights, Culture
VORT	Tuberculosis Prevention
NTFP	Land Rights/Community Forestry, Advocacy
DPA	Wells, Agricultural Support, Communal Savings, Communal Land Rights
CEDAC	Agricultural Support, Livelihoods
Ockenden	Livelihoods, Community Forestry
CARE	Education
3SPN	Information dissemination and advocacy groups for flood and water level awareness
NTFP	Community Forestry, Land Rights

Access to clean water sources using hand pumps and wells has increased in most villages in Ta Veaeng and Andoung Meas, and for some in Lumphat and Veun Sai districts, mainly through development interventions brought in by non-governmental

organizations. Surveyed villages were able to recall a few names of these organizations by area of intervention, as listed in *Table 4.2*.

Along with the recognition for external assistance supported by organizations active in the surveyed villages, it was noted that most villagers show appreciation and gratitude to the government for the basic support provided in the past. For example, in Pa Kalan Village, it was noted how villagers stressed appreciation for the one-off assistance of 3 kg of rice provided by the Provincial Governor's Office after the 1996 floods, along with the distribution of water filters to villagers by the Red Cross in 2005. Villages in Chey Utdom noted a high respect for the assistance given in the past by way of rice stocks and mosquito nets, as distributed to affected populations by the Provincial Department of Social Affairs and the Red Cross for flooding experienced on a yearly basis since 2004.

There is a marked improvement on the understanding of flood as a hazard and on information dissemination about the release of water from the dams. Two village focal persons for 3S Rivers Protection Network (3SPN) are identified in all riverside villages, who are tasked to monitor the water levels using a very basic means for flood measurement, to warn villagers, especially children, not to go to the river, and to secure their boats and fishing nets when the water is high. They also document losses and report to a district focal person.

Advocacy groups have been formed in villages, demanding for the stabilization of the river water, compensation for past and future losses, delivery of timely information relating to the water release from the dam, and prior consultation in relation to planned hydropower dams in the Sre Pok and Se San rivers.

In some of the assessed districts (i.e. ,Ta Veaeng), villagers reported that, from 2002 onward, they started receiving information from the Viet Namese officials regarding the opening of relevant water gates once or twice per year. This information is channeled through a letter sent by the provincial authorities to the concerned commune chiefs, who would then convene all the village chiefs to further disseminate the information about water release from the dam.

Photo 4.9: Flood sticks measuring water levels in Lumphat District

Photo 4.10: Flood marks installed in Lumphat District

However, no district or commune level committees for disaster management have been formally created as of yet, thus, no systematic coordination mechanism is currently in place.

4.2.3b Community Solidarity and Adaptive Behavior

During evacuation operations, which are spontaneously organized and conducted by villages in response to floods, families pool their food and eat together when they temporarily resettle to the mountains or forests. Often, neighboring households help each other during evacuation operations by sharing boats where possible, assist the most vulnerable groups in the village (mainly elders and single-headed households), gather and move livestock animals, and allowing the most disadvantaged households to borrow rice in order to cope with post-flooding food shortages.

In Ka Chout Krom, Andoung Meas District, villagers built a communal rice storage in 2007, with assistance from GAA and collective money contributed by villagers. The project was facilitated by a village elder.

The division of community labor with equal sharing of the crop production between families was reported in some villages. In Pa Kalan Village, for instance, villagers decided to join their efforts after the 1997 floods and formed groups of three families to work together on one hectare of land, where a new rice variety, called *Ilya,* was planted for the first time. The *Ilya* rice seeds and water pump machines were provided by the province.

Adaptive behavior through the recourse of social networks amongst surveyed villages was manifested in basic but effective community-based disaster risk management initiatives. Dei Lou and Lumphat villagers identified four different evacuation routes based on the distribution of village houses across the rivers, and the proximity to areas such as hills or forest identified as their safe havens in case of floods. Lumphat residents went even beyond these steps by preparing a proposed social concession plan to relocate people in flooded areas. This was submitted to the commune for approval and support.

Social networks can be activated through ethnic affiliation. J'arai groups in Viet Nam provided crucial information about the storm and collapse of the Yali Dam in 1996 to the J'arai groups in Andoung Meas. Therefore, in the event of disasters, ethnic affiliation proves to be a powerful resource for community mobilization within indigenous society.

Photo 4.11: A high-posted rice storage in Pateng.

Pockets of adaptive behavior at the household level were seen with more houses and rice storage structures being built using stronger wood and on higher posts. In 2000, people in Pa Kalan Village (Veun Sai District) began building higher rice storage units. The need for filling gaps in food shortages during periods following floods has led other villages to also build rice storage structures at higher posts.

More houses were observed or reported to have been built in chamkars in hills to allow villagers to have a place stay for longer periods when they evacuate their primary residences in times of flooding. In some cases, villagers have designated existing structures, like pagodas or schools, as evacuation centers. This is the case in Dei Lou where the pagoda, as the highest building in the village, is used as an evacuation center.

Photo 4.12: A villager in Tanong holds a trokut.

4.2.3c Indigenous Knowledge and Practices

Confidence about local knowledge of warning signals for floods, combined with the observation of flood indicators, can be the basis for building further knowledge of other early warning devices to better prepare communities for floods. Some of the local warning signals perceived by communities to be reliable were noted as:

- Trokut, a type of lizard, changes the color of its tail to black;
- Trong, a type of water monitor, lays its eggs ar far from the river;
- Jangrat, a local species of spider, reduces the size of the ground hole where it lives;
- Trech, a type of red-color ant, nests higher on the tree tops.

Along with traditional warning signals, people demonstrated the capacity to observe changes in water characteristics, which indicate the imminent occurrence of floods, as follows:

- River water becomes red and itchy, causing skin infection;
- Floating trees, rubbish, and white foam surface on river waters;

Box 4.5: Indigenous Practices for Post-Flood Diseases

Post-flood diseases such as vomiting, diarrhea, skin disease and fever are traditionally treated with kongrit root and kandol or sdoav leaves. The latter, for example, are found in the forest and are utilized by crushing the leaves to form a powder, which is then mixed into a pot of oil before being applied onto the infected skin. For fever, the leaves can be mixed with water and taken orally.

Photo 4.13: Women show sdoav leaves in Tiem leu.

- Water level is changed, as measured by looking at small bridges built across streams.

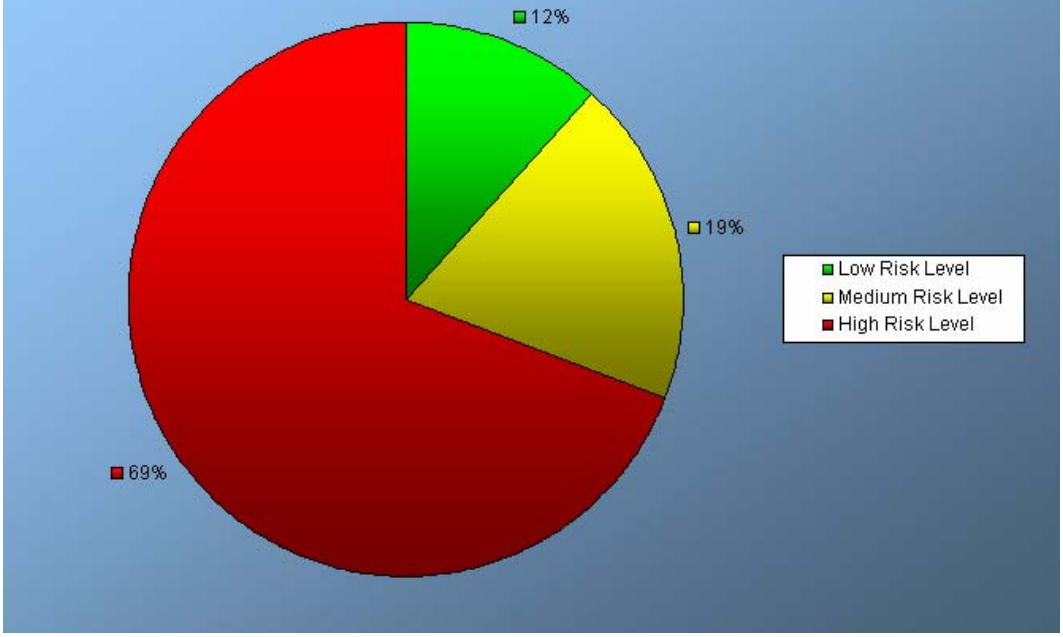
After warning signals and local indicators demonstrate a threat, people are alerted of the risk, and react by taking their buffaloes and cows away from the river. However, an increase in daily water fluctuations, and the more recent unpredictability of water levels, has been a cause of concern and security for villagers, whose knowledge and understanding of the river's tides and flows for generations has now been demonstrated to be less useful in current conditions.

The establishment of community forests and protected areas is key to preserving the traditional knowledge of, and access to, indigenous warning signals and remedies for floods. The value of this knowledge, therefore, presupposes that the access to forest and wildlife resources is ensured in a manner that builds ownership, trust and participation, and is sustainable for the indigenous communities.

4.2.4 Conclusion

This assessment on floods in Ratanakiri strongly indicates that flooding in the province is a matter of concern requiring action, and that its occurrence and impacts are considerable. *Figure 4.1* illustrates the percentage of villages in Ratanakiri vulnerable to flooding, with a total of 69% of villages surveyed being found to be at a high risk of flooding. Villages facing a medium risk of flooding comprised a total of 19% of at-risk areas, therefore, over 80% of surveyed villages in Ratanakiri were found to be at medium or high risk to floods.

Figure 4.1: Total Percentage of Surveyed Villages in Ratanakiri Prone to Flooding.



At present, there are 72 villages along the Se San and Sre Pok rivers with an estimated population of 30,739 covering six districts – Ou Ya Dav, Andoung Meas, Veun Sai, Ta Veaeng, Lumphat and Koun Mom. Floods in Ratanakiri are characterized by seasonal flooding from heavy and continuous rains and rapid, intense floods in the Se San and

Sre Pok rivers. Each village found vulnerable to flooding in Ratanakiri is ranked and illustrated in *Table 4.3*.

Table 4.3: Ranking of Surveyed Ratanakiri Villages at Risk to Flooding.

Villages Prone to Flooding	Hazard	Vulnerability	Capacity	Ranking
Dei Lou	3	3	1	**9**
Kanat Touch	3	3	1	**9**
Lumpat	3	3	1	**9**
Pateng	3	3	1	**9**
Phav	3	3	1	**9**
Phnom Kok Prov	3	3	1	**9**
Sayas Krom	3	3	1	**9**
Tanong	3	3	1	**9**
Tieum Leu	3	3	1	**9**
Veun Hai	3	3	1	**9**
Veun Sai	3	3	1	**9**
Dal Leng	2	3	1	**6**
Ka Chut Krom	2	3	1	**6**
Ke Koung Krom	2	3	1	**6**
Pang Kit	2	3	1	**6**
Plueu Touch	2	3	1	**6**
Samot Leu	3	2	1	**6**
Tumpoun Reung Thum	2	3	1	**6**
Lumphat	3	3	2	**4.5**
Pakalan	3	3	2	**4.5**
Phak Nam	3	3	2	**4.5**
Lorm	2	2	1	**4**
Rok	2	3	2	**3**
Ka Tieng	1	2	1	**2**
Kamplegn	1	2	1	**2**
Prouk	1	2	1	**2**

Growing awareness is given to flash flooding incidents as a result of dams in the Mekong tributaries, which also contribute to changes in the hydrological system. When these incidents coincide with seasonal heavy rainfall, tropical storms and changes in climate trends, they can lead to destructive and enduring negative effects on peoples' livelihoods, security and social cohesion, exacerbated already by environmental degradation. While human deaths are very minimal, with only two deaths reported as being directly caused by flood since 1996, serious health problems and human deaths from flood-related diseases have been overlooked. Damage to primary agricultural assets has been substantial, greatly undermining food security, livelihood and agricultural resources. With a majority of the villages still dependent on primary agricultural activities, such as upland and chamkar farming, a lack of emergency preparedness and mitigation measures to protect people's assets and livelihoods in times of floods can push already-vulnerable populations into deeper levels of poverty.

The presence of critical facilities like health centers/posts and communication signals, as well as growing access to roads connecting isolated villages into district and commune centers, have improved in the last few years. However, the majorities of villages still have no electricity or access to communication signals, and do not own mobile phones or electronic devices that can be used to communicate risk levels in the event of floods.

Furthermore, the quality and availability of public health services at the commune and district levels is low, with very few competent health staff.

The communication of water levels, particularly the notification on the release of water from dams in Viet Nam, has slightly improved, but dissemination to districts, communes and villages is late (usually a day before or several days after water has already been released) and not systematic. The network of village focal persons established by local organizations has been instrumental in raising community-based cooperation and awareness on floods, although this has to be supported by the reading and use of scientific flood data collected from relevant tributaries. This awareness is being gradually elevated to the level of advocacy, with people demanding just compensation for floods and noting these hazards as trans-boundary natural resource concerns.

Pockets of adaptive behavior at the household and community level, and community solidarity in times of crisis are emerging, suggesting that natural disasters and common threats have a way of binding villagers towards common goals. Traditional knowledge and indigenous warning signals do exist and are considered as reliable mechanisms by local population for predicting floods.

4.3 Drought

4.3.1 Introduction

Although drought is experienced within the whole province, less attention has been given to this hazard type, not necessarily because it poses a lower risk than other hazards, but mainly due to the lack of relevant data and knowledge available. Drought in Ratanakiri is normally experienced during the rainy season, and is characterized by an uneven distribution of rainfall during this season (April-November), as well as little or no rainfall during the dry season (November – April). Whereas the rainy season generally has an early onset of heavy rain at the beginning of the season, the rest of the season may see little or no rain. At the end of the wet season, rain can sometimes be lacking to such an extent to have rice failing to develop or harden. Drought can cause not only lower production of rice and other crops, but also complete crop failure.

The type of drought in Ratanakiri is predominantly agricultural, with the primary characteristics being identified as:

- Erratic distribution of rain during the wet season with no rain from April to June, followed by little rain in July and then no rain from August to October, and concluding with little rain from October through November. Variations of the erratic distribution of rainfall occurs when rain is delayed from June to July, and sometimes August, followed by no rain in September, and then little rain from September/October until harvest time. The delay of expected rainfall from mid-May to June can lead to a delay of planting, which then makes rice plants vulnerable to an early ending of the rain season. The lack of rainfall in September prevents rice grains from developing;
- High temperatures during periods of no rain;
- Early onset of dry season, with the end of rains as early as September.

Hazard factors for drought include the depletion of soil moisture, very high temperatures, insufficient and erratic rainfall, soil cracks, surface/ground water drying up, and the loss of soil cover in chamkar because of deforestation, wind erosion and arid conditions affecting trees. Deforestation, in particular, has been indicated as possibly affecting rainfall patterns and the availability of ground water during periods of drought. Villagers

noted that in recent years, they have experienced more frequent droughts with longer periods of either little or no rain occurring between the rice growing seasons. Past droughts had shorter durations, with smaller periods of irregular rainfall during the rice growing season, and crops experiencing less damage. *Table 4.4* shows recent drought years in the surveyed districts, as identified and reported by villagers.

Table 4.4: Recent Drought Years in Four Districts.

District	Frequency	Recent Drought Years
Ta Veaeng	Before 1995, every 2- 4 years	1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008
Lumphat	Annual	1987, 1995, 1997, 1998,2002, 2003, 2004, 2005, 2006, 2007, 2008
Veun Sai	Annual	1987, 1998, 2005, 2006, 2007, 2008
Andoung Meas	Annual	1996, 1997, 1998, 1999, 2001, 2002, 2003, 2004. 2005, 2008

Note: Years underlined were the most serious drought years.

Rainfall data collected by the Provincial Department of Water Resources and Meteorology in 2008 show a ten-year rainfall pattern, with the lowest rainfall recorded in 1998 at approximately 1500 mm. Data records show more rainfall in 2008 than in 2007, with enough for planting at the beginning of the wet season as well as towards the end of the season. However, key information relating to the proportion of rainfall distribution among the nine districts is not available.

4.3.2 Vulnerability

Primary agricultural activities – such as upland and chamkar farming – are highly vulnerable to changes in weather, including changes in rainfall patterns within an agricultural context where cropping is limited to the wet season and almost entirely rain-fed.

4.3.2a Food Insecurity

Agricultural drought is closely linked with food insecurity where agricultural production, primarily rice as well as secondary crops, is vulnerable to crop failure and smaller harvest. Drought occurring before the transplanting phase of crops can damage seeds, and those farmers who plant late are likely to be impacted by rain ending too soon. Drought exposes chamkars to an even higher risk of crop failure and insect infestation, as farmers have no access to supporting agricultural services, such as water pump machine, ploughing machine, or quality rice seeds.

The worst droughts in Ta Veaeng were experienced in 1995, 1998, 2005, 2006, and 2008. The worse drought experienced in Tumpuon Reung Thum Village occurred in 2008 when there was no rainfall from July to August, high temperatures, and only a small amount of rainfall from September until harvest time. Increased insect infestations, animal deaths and gastro-intestinal illnesses, such as diarrhea were also observed and said to have occurred a result of the drought. In the same year, the drought experienced in Phav Village was characterized by an absence of rainfall from July to August, followed by little rainfall from September to November. It was also considered to be the worst drought year by the village, causing damage to crops including mangos, cashew nuts, corns, potatoes and cucumbers, and leading to both sickness and deaths in animal populations. The rice crops of the village also failed to produce grain. All villages in Ta Veaeng considered drought and the resulting food shortages as the primary hazards affecting them.

Photo 4.14: River sandbar in Dal Leng.

All villages in Lumphat District suffer from drought. In 1995, there was no rainfall in Pruok Village when the rice started producing grain, and as a result, grain failed to develop. All of the village's chamkars and rice fields were destroyed. Some families replanted crops wherever possible, using seeds left over from the previous year. The harvest of 1995 was around 80 kilograms per hectare, compared to the previous annual average of 1 ton per hectare. In 2003, Sayas Krom Village experienced drought from July to August, which prevented seeds from growing and resulted in a lack of harvest for the entire year. With the 2004 drought in Samot Leu, there was no rain from September to October, which resulted in no harvest of late-term rice and only a small harvest of early-term rice. Katieng and Dei Lou villages suffered the worse droughts during that same year, which also resulted in animal deaths, including the loss of cows and buffalos. In 2007, Lumphat Village experienced its most severe drought from September to October, drastically reducing their harvest to only 200 kg of rice per hectare, compared to their usual harvest of 1.5 ton per hectare.

In Tanong Village (Andoung Meas District), a drought in 2002 occurred from August to September when villagers received insufficient rain for the rice to produce grain. As a result, most rice plants were not able to produce grain in chamkars and rice fields, and there were barely enough seeds available for the next planting season. Other crops also failed, such as chili, eggplant, yam and cassava. During the 2005 drought in Kanat Touch, rice in chamkars and rice fields could not produce grains due to insufficient rainfall. Harvest declined by 3 tons per hectare in 2004 and by 1 ton per hectare in 2005. In Kachout Krom, the village faced serious drought from August to September 2004, characterized by no rainfall and worsened by increased insect infestation. Harvest that year was only 15% of that from the previous year, amounting to 3 tanks of rice per hectare in 2004 compared to 20 tanks in 2003, and, consequently, resulting in a serious food shortage the following year.

Villagers reported that crop failure leads to the multiple adverse effects of:
a) increased agricultural spending for some families who need to replant destroyed seedlings;
b) increases in food spending to fill in food production gaps;
c) borrowing rice and money to be returned by the following year, putting a strain on the next year's harvest; and
d) seasonal off-farm work, forcing villagers to move to other parts of the province in order to work in construction or plantation companies.

Drought is reported to not only affect rice production, but also other types of crops which further limits alternative options for filling gaps in food production. Cashew nuts and fruit

trees were reported to be highly vulnerable to prolonged shortfalls of rain and high temperatures in the dry season, when they tended to produce little or no fruits.

4.3.1b Lack of Access to Agricultural Resources

Surveyed villages all indicated the lack of irrigation and drainage schemes for rice fields, as well as the lack of diversified sources of water and stream diversions for their chamkar as factors that exacerbate the vulnerability and limit their coping strategies to drought.

The lack of pumping machines and buffaloes greatly limits community agricultural options. Families, like those in Phnom Kok Prov Village, often have rice fields available to use, but claim that they cannot plant them without a buffalo. Animal deaths happen mainly during the dry season with cows and buffaloes affected by *satak* (Septicemi Hemorrhagie) and *otkadam* (foot and mouth disease). *Satak* can kill cows and buffaloes within days if it is untreated.

Although the government has made some efforts to support the use of modern farming techniques, these initiatives have not often proven to be sustainable due to financial and technical constraints. In 2000, for instance, the Provincial Department of Agriculture trained farmers in Dal Leng Village on how to grow dry season rice, with a water pump machine provided by Andoung Meas District. However, the pump was taken back by the Provincial Department in 2001, leaving the village without the capacity to grow dry season rice. In Veun Sai District, some of the surveyed villages had received a pumping machine from the province for growing dry season rice, but they did not have money to buy the gas required to run it.

Land pressures driven by a rapidly changing economy, combined with restrictions on cutting trees for purposes other than housing (as part of the establishment of community forest and protected areas), are limiting options for practicing traditional rotational cultivation techniques. Villagers used to move to new chamkars every two to three years once the soil became less fertile in order to allow old chamkars time to fallow, but now that there is less land available for chamkar, villagers have no alternative but to shorten fallow periods. This directly increases the risk of soil infertility, as experienced by both Tumpuon Reung Thum and Pangkit villages in Ta Veaeng District, and Phnom Kok Prov and Phak Nam villages in Veun Sai District, where chamkar soil is becoming increasingly infertile as farmers are forced to only leave the land to fallow for two to three years, sometimes less, before the same area is again farmed. In these villages, the fallow period depends on the type of soil, with 1 fallow year being given for white soil, and 2 years used for red soil.

4.3.1c Water Sources for Drinking and Household Consumption

Although the nature of drought in Ratanakiri is predominantly agricultural, and experienced during the wet season, most of the assessed villages also experience hydrological drought during the dry season, which leads to water-borne and animal diseases. Many of the wells, built in Lumphat and Veun Sai districts during the 1990s, dry up during the season, while others are broken and unusable. During dry seasons, rivers generally become shallow and streams run out of water. In Katieng, for instance, wells dry up every year from January to February. Villagers are unable to dig deeper into the wells in order to extract more surface water because of the rocky nature of the soil where the wells were built, and no support has been received for these activities from provincial authorities. Small-scale mining activities were reported by the same villagers to contribute to the pollution of water in the streams. The same facts were described by

villagers in Sayas Krom Village where the stream has been sedimented and polluted because of the mining activities in the area called *Beysrok* (which means in local language three districts), namely, Lumphat, Bokeo, and Ban Lung, since 2003.

When wells dry up completely, most villages end up using them for water storage during the rainy season. In 2003, the people of Pateng Village (Veun Sai District) contributed 2500 riel per family to build a communal well, which is now reported to carry no water in the dry season. Technical support is not available to fix the wells, as no external assistance has been provided to the village since 2003. Most villages do not have large water storage jars, which could lessen the burden for women and children fetching water several times a day from either a hand pump, well, river, or other more insecure sources of drinking water during the dry season. For many villagers, dug wells in the sandbar are the only source of water, which is normally stored in small containers called *khlooks* (made of dry vegetable). No rain harvesting practices were recorded among the surveyed villages mainly due to the costs related to the purchase of water jars for rain collection.

Photo 4.15: A woman fills her khlook with water from a well dug in the riverbank, Lumphat Village

4.3.1d Increase in Animal Disease

An increase in animal disease was reported by villagers during the dry season when *Satak* (Septicemi hemorragie) and *Otkadam* (foot and mouth disease) are known to cause considerable damage and deaths to livestock, particularly cows, buffaloes, and pigs. Changes in temperature beginning from the end of the dry season to the early rainy season increase the exposure of livestock to these diseases. The lack of clean water and sufficient grass cover during the dry season, combined with the alleged use of chemical insecticide and fertilizers by plantation companies, are also considered by villagers as contributing factors to livestock disease.

The effects of *Satak* on cattle and buffalo include nails peeling off, enlarged throats and swollen bellies. Without immediate intervention, livestock can die quickly, within four to five days of the first appearance of symptoms. *Otkadam* symptoms include cows, buffaloes and pigs salivating excessively and wounds begin to appear on their feet. They can die within 15 days if not treated, with small calves dying faster than older cattle. These two diseases have impacts not only on asset ownership but also on farming, as buffaloes and cattle are vital for cultivation activities.

Among the districts surveyed, Veun Sai is the most heavily affected by the sheer number of infected draft animals, particularly cows and bufaloes, and livestock deaths. In 2009, an astounding number of cows and buffaloes died toward the end of the dry season. The first incidence of *Satak* in Veun Sai District was in 1997, where 100 buffaloes were reported to have died. Symptoms included enlargement of the tongue, excessive salivation and indigestion. During the time of the assessment, from March to April 2009, there were 30 livestock deaths of cows and buffaloes in Veun Hay Village. A few years earlier, the rice farming practices of Veun Sai Village were negatively affected when 85 cows and buffaloes died.

The understanding of the nature of animal disease and knowledge of effective coping remedies is low. There is very limited information disseminated from commune and district authorities regarding disease control practices. Many animals do not receive timely treatment, as villagers must pay for every additional treatment injection, after receiving the first vaccination free of charge from the Provincial Department of Agriculture. The lack of cold storage for vaccine injections limits these medicines to a short shelf life when not administered immediately. There is also not enough medicine stock, requiring long travels on foot or by boat for either the animal health worker or villagers in order to provide or receive medical help. Provincial authorities explained that the indigenous practice of letting the animals roam freely also prevented timely vaccinations during the scheduled visits of veterinarian officers to the village.

4.3.3 Capacities

4.3.3a Access to Institutional and External Assistance

Assistance for drought comes in the form of agricultural inputs, food relief, and support for either small-scale infrastructure buildings or building restoration. Assistance differs from village to village and is provided mainly through joint initiatives between provincial line departments, the Red Cross, and non-governmental organizations.

Food relief was distributed by the Red Cross in 2007 in the form of 20 kg of rice per affected family during a drought experienced in July and August in several surveyed villages. For the 2007 drought, the Provincial Department of Agriculture provided the most affected villages with water pump machines in order to extract water from the stream for the planting season, and, in 2008, with support of DPA, it distributed seeds to six villages in Chey Utdom Commune. Also in 2008, some communities had the capacity to manage the impacts of drought, as noted by Lumphat villagers who were able to grow rice in their uphill farms and retain enough seeds for the next harvest from seeds distributed to them in 2007.

Tanong Village received farming tools, rice seeds, and draft animals from local organizations like CEDAC and GAA in 2008. The same organizations also provided training in farming techniques, with sessions on planting vegetables and food crops, animal husbandry, as well as how to take proper care of plants during drought. Villagers

welcomed these initiatives and showed a willingness to learn more about drought-resistant crop techniques.

Similar initiatives were also well received by other villages like Pateng, where CEDAC distributed seeds for the *Rumduol* rice variety in 2008 and trained farmers on how to grow fruit crops. During the course of this study, some villagers were found to be experimenting for the first time with fishpond farming as an alternative source of livelihood to cope with droughts. Other villages are planting fruit trees and vegetable gardens from seeds given by non-government organizations.

CEDAC and GAA recently introduced a rice farming technique, new to most indigenous people called SRI (system of rice intensification) among several villages in Ta Veaeng and Andoung Meas. Villagers reported that using the SRI technique would allow them a 30 percent savings in seeds for paddy fields and a 50 percent increase in yields. Trial farms have been set up to demonstrate the benefits of SRI. Current practice among indigenous upland farming dictates that 70 to 80 seeds should be put in each hole in a chamkar, compared to 15 seedlings being placed in one hole using SRI. People expressed the need for more follow-up and support for agricultural inputs to help them successfully adopt these new agricultural techniques.

In Kamplegn, one of the surveyed villages, the Department of Agriculture, with support from IFAD, is currently piloting a rice bank with 20 household beneficiaries. A rice bank commission, with members from each family, oversees the project.

Different initiatives have been taken by various villages in relation to water management. The O'Tang stream diversion in Veun Sai District was recently rehabilitated to increase its usage by villagers, and now has the capacity to serve about 200 rice fields in Phnom Kok Prov and Phnom Kok Lao villages. In Kanat Touch Village (Andoung Meas District), GAA supported the construction of a small irrigation dam for most of the lowland rice fields, with labor contribution from the villagers.

The Provincial Department of Agriculture, with the support of local organizations, started training animal health workers in 2000. By 2008, all villages in the province were reported to have animal health workers. All villages under study had at least one 'village veterinarian.' The department provides free vaccination twice a year to the villages. Costs for subsequent injections after these vaccinations given by the department must be borne by the villagers. These animal health workers have the potential to draw attention to, and manage the impacts of drought on the health of livestock in each village. However, more support is needed for each community to have the financial backing and training to vaccinate and properly care for their animals.

4.3.3b Coping Strategies

Household-level coping strategies include the reallocation of labor between farm work, and work outside the village. Common livelihood activities include going to the forest to collect NTFP, mainly *kadouch*, wild potatoes, wild mushrooms, vegetables and firewood by women, and hunting wild game by men, although hunting practices have been severely restricted over the years due to depletion and poaching of wildlife, and new regulations on wildlife protection in protected areas.

As fishing for household consumption is limited during the dry season due to the river drying, women from some families plant drought-resistant vegetable gardens along the riverbank for household use.

Photo 4.16: A villager in Lumphat District shows a wild mushroom she has just collected for supplementary food during the dry season.

In Kamplegn and Sayas Krom, women have a special way of taking the poison out of *kadouch*, which is a root crop consumed in times of food shortage. From March to April, men, women and children in Kamplegn forage in the forest in groups to find food, sometimes staying overnight. Villagers then share whatever is collected.

To generate income in times of drought, some villagers do seasonal labor, such as construction work, picking cashew nuts in Ban Lung, clearing the forests for cash, and working in rubber and other plantations. From March to August, married women tend to remain in each of their villages while their husbands leave their villages to find work.

Some villages, like Pruok, have direct access to underground water from the mountain (*Toek Chrob*). The *Toek Chrob* provides water the whole year, and pipes have been constructed, which enable people to collect this water. Organizations like Health Unlimited helped villagers install a system of pipes in 2004, and a five-member committee was set up to maintain them. This system of underground water harvesting helps villagers cope with water shortages when streams dry up during the dry season, and increases the quality of drinking water as water sources from *Toek Chrob* were reported to be safer to drink than stream water.

Community-based mechanisms for rice banks, either through ad hoc contributions of households or with initial support of organizations, have been established in several surveyed villages. These banks have local monitoring and management mechanisms in place, and villagers noted that they brought some relief in times of drought. However, villagers are often unable to replenish the rice they borrow every year from subsequent harvests, therefore, the rice storage becomes empty once people have borrowed all the rice stock.

There is a communal system among some villages in Veun Sai district where villagers who do not have rice fields or draft animals to work their land can rent from other families. In Veun Sai, five families who do not have rice fields can rent from other villagers in exchange for 7 hab of rice the following harvest (1 hab is equivalent to 60 kg). In Tiem Leu, villagers can rent a buffalo by paying back 25 bags of rice from the next harvest.

As a local remedy for *Otkadam* disease, villagers, such as those in Tiem Leu Village, mix crushed crabs and tamarind fruits together until the mixture becomes like an ointment. The ointment is then applied 10 to 20 times a day onto the nails of the sick cattle.

4.3.3c Indigenous Knowledge and Practices

The most reliable traditional warning signal for drought is the *Trokut*'s tail. When the tail of this lizard becomes white, it is predicted that there will be drought; however, when the color of the tail changes to black, it is predicted that there will be flood. People begin observing the *Trokut* in the forest starting in February.

Other local warning signals include the observation of the following:

- Holes of crickets or spiders are open in the ground;
- *Sror Loa* trees in the forest produce many flowers;
- The leaves of the *Ampil* and tamarind trees are short. If they are long, however, there will be abundant rain;
- The water monitor lizard lays its eggs near the river;
- Continued crying of the *Kokrok* (small bird);
- Red ants appear on the leaves of trees;
- The clouds in the sky are shaped like a dragon;
- Earthworms come out of the ground;
- Layers of bamboo falling upside indicate dry/no rain. If they fall downside, however, it indicates rain.

Villagers usually hold a ceremony called 'SenNeakta' before the start of the planting season to ask for rain, which is celebrated with wine jars and chicken. Important village celebrations during the rice growing season are:

- **Sen Poum**: In this ceremony, the villagers celebrate their happiness and well-being. The ceremony is celebrated for two days between March and April, when a pig, chicken, wine jar, candle and incense are offered to the spirit.
- **Sen Srov:** Villages celebrate this ceremony in rice fields or chamkars during the planting season, where they walk around to call the spirit of rice to their fields.

Ceremonies may differ between indigenous groups, but all activities tend to focus on asking the rice spirit for strengthening the harvest, especially for their own homes and families.

4.3.4 Conclusion

Drought is a complex hazard as it is increasingly marked by changes in climate trends within a context of low adaptive capacity, high dependency on a natural resources-based livelihood, traditional farming systems, and rapid depletion and degradation of forest and land resources. Drought is perceived by villagers as manifesting into a shortfall of water sources for rice farming and household consumption during periods of erratic rainfall, combined with resulting low harvests and food shortages. Institutional interventions in response to drought mainly aim to mitigate its effects rather than preparing communities with preventative measures. While changes in drought patterns brought about by increased climate variability is still not yet fully understood by many villagers, there is a sense that the lost of forest has been contributing to rainfall patterns and availability and quality of water. Mining exploration activities were also identified as a contributing factor to the pollution of natural water sources such as streams and ponds.

Figure 4.2 illustrates the percentage of villages in Ratanakiri found vulnerable to drought during this research, with a total of 54% of villages surveyed being found to be at a high risk of drought. Villages facing a medium risk of drought comprised a total of 38% of at-

risk areas, therefore, over 90% of surveyed villages in Ratanakiri were found to be at a medium or high risk to drought.

Figure 4.2: Total Percentage of Surveyed Villages in Ratanakiri Prone to Drought

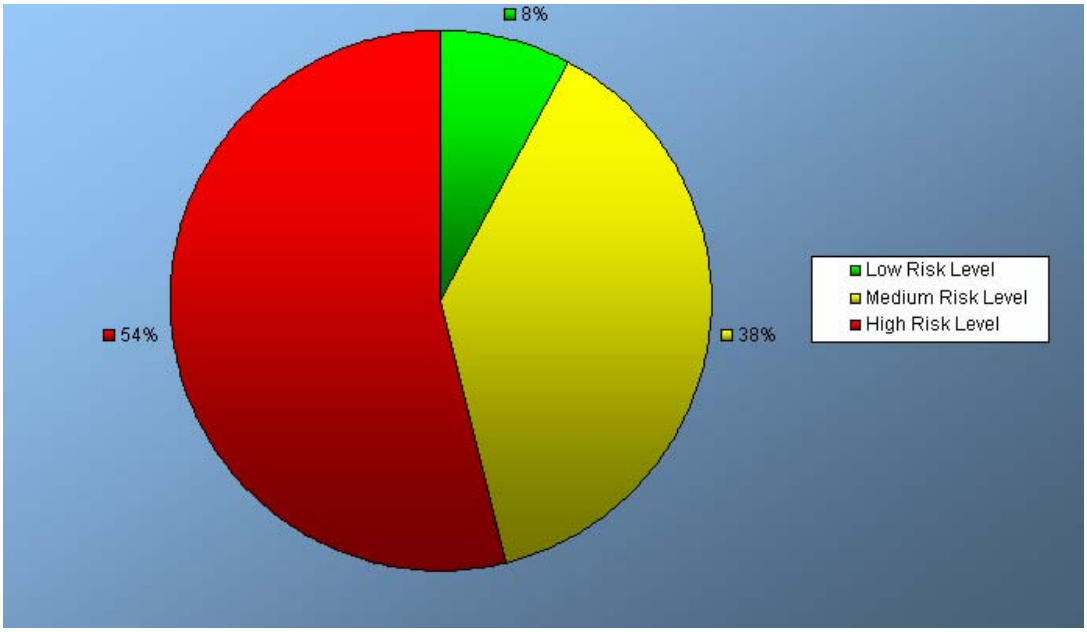


Table 4.5: Ranking of Surveyed Ratanakiri Villages at Risk to Drought

Villages Prone to Drought	Hazard	Vulnerability	Capacity	Ranking
Ke Koung Krom	3	3	1	**9**
Lumpat	3	3	1	**9**
Pang Kit	3	3	1	**9**
Pateng	3	3	1	**9**
Phak Nam	3	3	1	**9**
Phav	3	3	1	**9**
Plueu Touch	3	3	1	**9**
Samot Leu	3	3	1	**9**
Sayas Krom	3	3	1	**9**
Tanong	3	3	1	**9**
Veun Hai	3	3	1	**9**
Veun Sai	3	3	1	**9**
Dei Lou	3	2	1	**6**
Tumpoun Reung Thum	2	3	1	**6**
Ka Chut Krom	3	3	2	**4.5**
Kanat Touch	3	3	2	**4.5**
Phnom Kok Prov	3	3	2	**4.5**
Prouk	3	3	2	**4.5**
Rok	3	3	2	**4.5**
Tieum Leu	3	3	2	**4.5**
Pakalan	2	2	1	**4**
Dal Leng	2	3	2	**3**
Kamplegn	2	3	2	**3**
Lorm	2	3	2	**3**
Ka Tieng	2	2	2	**2**
Lumphat	2	2	2	**2**

A comprehensive approach to drought management is needed, which includes the building of necessary infrastructure and technology, skills and capacity development, and improved access to meteorological information (e.g., monthly rainfall trends) in order to prepare farmers to better manage and respond to drought impacts. Each village found vulnerable to drought in Ratanakiri is ranked and illustrated in *Table 4.5.*

4.4 Insect Infestation

4.4.1 Introduction

Although this type of hazard receives little attention in Cambodia, annual insect infestation is a regular cause of concern for farmers in the assessed districts, especially during the rice growing season. It has been observed that the incidence of insect infestation also increases during drought and, in recent years, new forms of insects never known before to villagers have appeared both in rice fields and chamkars, contributing significantly to crop failure and food shortages.

Partially due to the trend of not identifying insect infestation as a hazard requiring intervention, little information is available on the identification and naming of different invasive species. Communities have a strong knowledge of these insects, however, and where communities could not identify an insect by species, they tended to give each type a descriptive name, which is what is used here throughout the text.

Box 4.6: Dei Lou Villager Recalls Worm Infestation.

'Worms had three different colors: black worm the size of an index finger; green, which is smaller; and pink to pale red, which is very small. The three worms appear at the same time in mid-June when the rice seeds are in the seedbeds. People plant their rice at the beginning of the rainy season. The worms come out when there is no rain and eat the seeds for about 15 days, gradually disappearing when the rice seeds have been transplanted into the rice field. Worms also appear in other chamkar crops: beans (September – October) and corn (June-July), but they are easier to control.'

Villager from Dei Lou

In 2008, a significant 'multi-colored worm infestation' destroyed the rice seedlings before they were able to be transplanted to rice fields. When seedlings were 15 days old, the worms appeared in large numbers. The common white worm also appeared during this time. The most affected districts by these infestations were Lumphat and Veun Sai. In Samot Leu, consecutive worm infestation, described as red in color, in 2004, 2005 and 2008 damaged all rice fields and rice in chamkars. Red worms destroyed the stem of the rice, eating as many as 4-6 stems per rice plant.

Srang, a brown winged insect (sometimes described as green by villagers), is one of the most destructive in the rice field and chamkar, and was reported to appear when the rice flower blooms and then disappear when rice stalks start to mature. These insects usually swarm without warning, remain for about 15 days, and contribute to rates of higher crop failure and lower harvest production. Another seasonal insect, the *kratoek* lives on the surface of rice field water and appears after the growing of small rice crops from August to September. *Kratoek* eats the stem of the rice, and are often killed only when water is released from the rice field. Brown hoppers (*Mor Meach Tnout*) eat the flowers of rice and are very harmful to large crops, but do not significantly affect the rice plants when they are planted sparsely with only a few plants in each group. Incidences of hopper infestations increase when the weather is cooler and there is no sun.

CEDAC documented, under its Stung Chinit Irrigation System Project, at least 11 different insects that damage the rice plants. Findings confirm a 2008 Provincial Department of Agriculture's report noting the presence of extensive army worm infestation for the first time during the wet season due to a lack of rainfall. Since 2004, army worms, green in color, have been considered a major type of infestation in the country, particularly since they eat seedlings of crops. Districts which have a recent history of infestation by army worms include Lumphat (the most affected area), Veun Sai and Koun Mom. Army worms are said to be controlled by traditional means, such as flooding the infested areas to wash out the worms and then using wild fruits to kill them.

Table 4.6: Types of Insects in Rice Fields and Chamkar.

District	Chamkar	Rice field	Frequency	Worst
Ta Veaeng	• Locusts • Khnong (black fly) • Black ants • Worms • Crickets • Gnouy (Srang in Prao)	• Locusts • Khnong (black fly) • Blue/Yellow worms	Annual	1999
Lumphat	• Srang (green winged insect, also known as Yay)	• Red/Multi-colored worms • Meng (Lao word for small winged insect) • Kratoek (small insect) • White worms • Mor Meach Tnout (brown hopper)	Annual	2004 2005 2008
Andoung Meas	• Locust • Termite	• Red worm • Locust • Chalev (white worm)	Annual	2003 2008
Veun Sai	• Gnouy (same as *srang* in Kavet and Prao languages) • Worms	• Multi-colour worms • Kratoek • Kra Pleung • Meng Chi Hai (small winged insects) • Locust • Lalev (white worms)	Annual	2007 2008

4.4.2 Vulnerability

4.4.2a Higher Crop Failure and Lower Harvest

Villages in Lumphat are among the most heavily affected by red and army worm infestations. In Samot Leu, farmers faced both red worm infestation and drought. The compounded effects of both hazards resulted in very low rice harvests in 2004. The year 2005 is considered to have had the most serious red worm infestation, resulting in villages producing only half of their harvest compared to the previous year. In 2008, their harvest was 40% lower than their 2007 harvest, again due to the effects of infestations.

In Sayas Krom Village, red worm infestations were reported in the rice fields. These worms developed inside the seedlings, destroying at least half of the seedlings in the seedbed. In the same village, *srang* destroys 20% of the rice stems in most paddy fields every year, while white worms mainly affect chamkars and return annually.

Box 4.7: Samoet Leu Villager's Personal Story

A woman villager, 42, describes her plight:

She was born in Samot Leu but moved to Lumphat to run a small business store. She decided to return to the village when she was unable to earn enough income to sustain her business in the district center. After moving to the village, she managed her mother's 1.5 hectare rice field. In 2004, her rice field was damaged by red worms and drought. That year, she harvested only 20 kg of rice, which was 80% lower than the previous year's harvest of 100 kg. As a result of food shortage experienced in her family, her six children suffered from fever and stomach aches. Her alternative livelihood strategy now includes collecting potatoes and kadouch in the forest, and running a small store in the village on a concession basis.

In Dal Leng Village, the 2003 insect infestation was identified as the worst infestation event, as insects such as *srang* and locusts damaged half of the village rice crops. In July 2008, the villagers in Veun Hay reported that, in one night, worms infested as much as a 30m x 30m area of a rice field. During that time, they had also experienced drought and, as a result, could harvest only 40% of the rice field. This case of the widespread worm infestation of 2008, as well as cases of earlier infestation, demonstrated how villages were unprepared for such fast and aggressive occurrences.

During 2003, Tanong Village experienced difficulties with many types of insects. An outbreak of black furry worms in rice fields and chamkars was particularly harmful as the worms ate the leaves of the rice and other crops. The harvest of 2003 was only 30% of the previous year's harvest. During this time, there was also no rain for 3 to 7 days. After 2003, infestations started becoming even more extreme.

In Phav Village, the worst insect infestation experienced was in 1999 when locusts and *khnong* (black flies) infested the rice fields and chamkars. Locusts ate the stems and fruits of the rice in both chamkar and rice fields from June to August, while infestations of *khnong* on the rice fruit lasted from August to September. Since 1999, a small insect, called *gnouy,* and a small black fly called *khnong*, which eat the flower of the rice from September to October, have caused more and more damage every year. In the last few years, the number of insects in chamkars was observed to have increased. However, in this village, annual infestations in the past did not contribute to extensive crop damage as the numbers of insects were quite low.

Photo 4.17: A mixture of Mumkhabhea roots and leaves (pictured above) is sprayed in the rice fields as a traditional form of pesticide.

4.4.2b Loss of Confidence on Local Knowledge and Practices

While traditional knowledge on insect control is rich and strategies are diversified per type of insect, indigenous control and prevention measures have proved ineffective during the recent infestations experienced by many villages, particularly the events experienced in 2008. Loss of forest habitat was indicated as a possible cause of this

increase in insect infestation. Villagers in Lumphat reported the occurrence of infestations to the commune and unsuccessfully requested for insecticide. In the past, the same villagers had used local remedies to contain the pests, such as using the roots of *mumkabhea* tree to ward off insects. It was reported that while this method was good to ward off a small number of insects, it was ineffective in the face of massive infestations. Other villages like Phak Nam in Veun Sai had not been able to develop any local means to control new forms of insects.

Villages traditionally had not used pesticides on insect infestations, as illustrated by the Pa Kalan Village, which had not used pesticides on crops until the Department of Agriculture in 2008 distributed insecticide to all families for army worm infestations that year.

In spite of a history of attempting to manage infestations, there are no reliable warning signals or local practices used to effectively anticipate insect infestation. Traditional estimates are vague, relying upon the number of days that rice has grown or the observation of the drying of plants to predict when insects might attack crops.

4.4.2c Barriers to Integrating New Insect Control Techniques

Villagers who shifted to the use of insecticides believe that this technique is a faster and better solution for dealing with large numbers of insects. However, for certain types of worms, like *srang,* even the use of insecticide has proven to be ineffective.

Although some organizations like CEDAC and ATSA are delivering training and practical demonstrations on the production and use of natural insecticides and natural fertilizers, villagers seem to be reluctant to explore them further as the process requires a number of natural ingredients that are not always largely available.

The restrictions to villagers' entry to the forest can affect their access to traditional plants and herbs used for insect control. In Sayas Krom, villagers used to apply traditional remedies for insects from the *vaselei triang* tree, *meumprong* root, and *sleng* skin (bark). They have had to stop using these remedies, however, as these resources are rare and available only in *Prey Chas* (old forest), a 500-hectare protected forest under the Department of Environment, where their access is restricted.

Past attempts to teach new agricultural techniques were not very successful and experienced low levels of adoption by indigenous groups. Those who purchased insecticides on their own were often not properly informed on the correct insecticide to use. This was due to low levels of literacy and to the different languages spoken, where the name given to a particular type of insect by an indigenous group does not necessarily correspond to the name given by other indigenous dialects. The wrong choice of insecticide, aside from the resulting loss of money and health risks, can also lead to resistance being developed by insects and a resulting lack of trust in the effectiveness of insecticides being developed by farmers.

The lack of appropriate spraying materials was identified as another problem by various villages. Stories on the usage of different forms of insecticides were varied. In Phnom Kok Prov, some villagers bought insecticides and used them on rice that had been infested by worms. They did not have any local remedies or any form of control to deal with other types of insects. In Ke Koung Krom, some families used mosquito spray to kill ants. They learned this technique from Tumpuon Reung Thum, their neighboring village.

In Pangkit Village, they used an insecticide called *antrine* to protect the rice stalks from being eaten by ants in chamkars.

A lack of cash also prevents villagers from exploring appropriate new insect control methods, as insecticides are considered to be very costly. In Pruok, some families noted that they could afford to buy insecticides from the market, but others had to borrow money to buy them. In the rest of the surveyed villages, people generally did not have enough money to buy insecticides even if they wished to do so.

4.4.2d Lack of Institutional Assistance

Assistance for insect infestation is limited and arrives late, with some villages having a history of receiving no support for preventing or managing infestations.

Assistance from the Department of Agriculture to two of the most affected villages in Lumphat District was noted to be late in arriving. Villagers expressed doubt that the pesticide would arrive at all, thus, some families bought their own pesticides until they finally received assistance. In 2008, the Veun Sai Village reported the incidence of an army worm infestation and received five bottles of insecticide and 2 spray cans to manage the event. Still, however, the supplies given were insufficient leaving some families forced to buy their own insecticide and others to replant. In Phnom Kok Prov, villagers reported infestations to the district, but they were told to buy insecticides themselves due to a lack of financial resources. The district did provide one spraying container to be used with the privately purchased insecticides, but this was also insufficient, leaving villagers to manually apply the product.

Insect infestations are widely underreported, which further prevents villagers from receiving assistance. Villages in Ta Veaeng and Andoung Meas, for example, as well as the villages of Veun Hay and Lumphat, did not report incidences of infestation to their districts at all, in spite of damage caused to their rice plants.

4.4.3 Capacities

4.4.3a Preference for Natural Means of Insect Control

Many villages are still reluctant to try chemical insecticides, although they recognize that traditional means may not be effective for widespread infestation. In Kok Lak Commune, no one has used insecticide as villagers consider it a poison. In Lorm Village, no one has used, or has knowledge on, chemical insecticides. Many villagers fear these products may be detrimental to the health of the people and animals. This is a well-founded concern, since most villages are currently not equipped with chemical products waste management techniques or facilities, nor do they possess knowledge on how to store and use these products safely. Recognizing a preference for using natural methods of insect control, the Provincial Department of Agriculture has delivered briefings and training to villages on the use and preparation of natural insecticides and fertilizers in farming. For instance, in March 2009 the Provincial Agricultural Department and relevant district officers trained some villages in Dal Leng on the use of natural insecticides, composting and application of natural fertilizers on crops. Aside from government support, some non-governmental organizations have also been providing training on insect control on crops and vegetables

4.4.3.b Indigenous Knowledge and Practices

Indigenous means of insect control have varying levels of effectiveness, depending on the number and type of insects, though local knowledge of insect infestation behavior

and nature is rich. Indigenous methods are often used in combination with other means of insect control.

Table 4.7: Traditional Insect Control Means.

District	Insects	Insect Control
Veun Sai	Ants	• Spreading a mixture of rice bran and small pieces of rice in the chamkar • Burning the path and colony of the ants
	Srang/Gnouy/Pien	• Dead crabs are placed on a stick and placed in the rice field. • *Prang* root crop is cut into small pieces and placed in small bamboo sticks in rice fields. *Srang* eat these root crops instead, as they are sweet.
	Worms	• Manually take out the worms from the field • Pray to *Arach* for the spirit of rice when rice starts to grow
	Locusts	• Put over a fire
Andoung Meas	Srang	• Bark of *Thnung* tree is attached to a bamboo or wooden stick and placed around the rice field to prevent attacks on rice or crops
	Small red worms and other insects	• Ashes of burned wood are sprayed into the rice fields or chamkars to kill insects, especially small red worms. The salty component of the ashes makes this remedy effective.
	Kandop (locust)	• A big trap is made and baited with rice (20-30 locusts can be trapped at a time).
	Chalev (worms)	• Dead plants are dug up and removed
Lumphat	Srang	• *Kadingkat* leaves and braches are cut and placed near the rice. It is also used as a compost fertilizer. • *Mumkabhea* tree
Ta Veaeng	Worms	• Bark of *Thnung* tree is mixed it with rice from wine jar and thrown in the rice field • Manually dig around the plants and remove
	Locust	• Put over a fire • They pray to *Arach* by killing a chicken and preparing wine jar in the forest
	Ants	• Burning the path and colony of the ants

4.5 Climate variability as an emerging hazard

Most of the assessed villages noted that in recent years they have experienced more frequent and unexpected changes in climate variability. This has resulted in the disruption of traditional farming practices, which have been conventionally dependent upon predictable rainfall levels and distribution patterns.

Drought is reported to be characterized more recently by longer periods of either little or no rain in between rice growing seasons. Past droughts had shorter durations, with

shorter periods of irregular rainfall during the rice growing season which caused less crop damage. Drought is reported to not only affect rice production but also impact other types of crops which further limits alternative options for filling gaps in food production.

Cashew nuts and fruit trees were reported to be highly vulnerable to these prolonged shortfalls of rain, and to higher temperatures in the dry season, during which the trees tend to produce little or no fruit.

The delay of expected rainfall, for example from mid-May to June for instance, can lead to a delay of planting, which then makes rice plants vulnerable to an early ending of the rainy season. A lack of rainfall in September, which would suggest an early end to the rainy season, can prevent rice grains from developing. Early onset of dry seasons often found farmers unprepared and unable to adjust their farming schedule to changes in rainfall and climate.

An increase in animal disease was reported by villagers during the dry season when *Satak* (Septicemi hemorragie) and *Otkadam* (foot and mouth disease) are known to cause considerable damage and deaths to livestock, particularly cows, buffaloes, and pigs. Changes in temperature beginning from the end of the dry season to the early rainy season increased the exposure of livestock to these diseases, which were not previously as severe as they have been in previous years of climate fluctuations.

Incidences of insect infestation have also been observed to increase as a result of higher temperatures and more frequent shortfalls of rain in wet as well as in dry seasons. In recent years, new forms of insects never known before to villagers have appeared both in rice fields and chamkars, contributing significantly to crop failure and food shortages.

More intense and frequent flooding resulting in higher agricultural losses was also documented by villagers, which may represent the direct effect of the emerging changes in climate trends.

Ratanakiri Province was ranked as the 6th most prone province to climate change in Southeast Asia, out of 530 provinces assessed by a recently released report[8]. The ranking process is based on the levels of exposure, sensitivity, and adaptive capacity to climate change and climatic variations, with the latter scoring very low in the case of Ratanakiri.

Climate variability, as identified in the course of the study, suggests the need for channeling weather forecasting information to communities, and the promoting of awareness on adaptive agricultural measures which can be taken to mitigate resulting negative effects. A challenge to raising awareness on mitigation and adaption activities to changes in climate is the lack of information available, at the provincial or lower levels, on the Cambodian Government's National Adaptation Programme of Action to Climate Change (NAPA). Also, no baseline data has also been available to date to allow communities to clearly map trends in climate shifts.

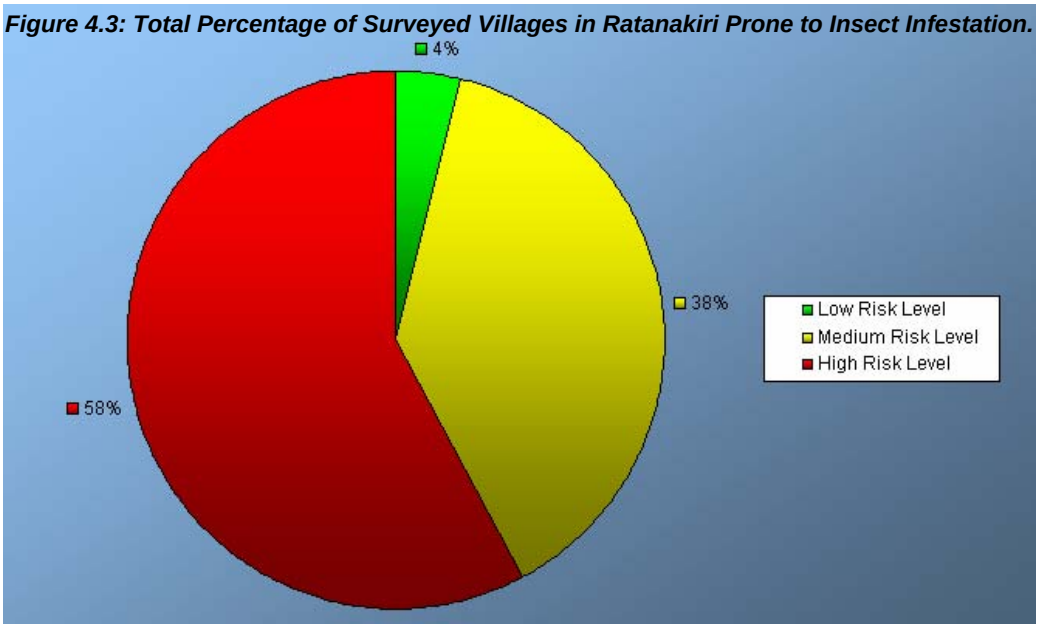
[8] For full report, see Yusuf, A. and Francisco, H. (2009). *Climate change vulnerability mapping for Southeast Asia*. Singapore: Economy and Environment Program for Southeast Asia (EEPSEA).

4.6 Chapter Conclusion

Hazard information on insect infestations is not widely available. Unless the infestation is massive in size, villagers tend to overlook the impacts of insect infestation as this hazard is de-prioritized at the community level to other threats, including that of drought. Institutional interventions on insect infestations are one-off, and mainly limited to the distribution of insecticides and spray cans.

Figure 4.3 illustrates the percentage of villages in Ratanakiri found vulnerable to insect infestation during this research, with a total of 58% of villages surveyed found to be at a high risk of infestations. Villages facing a medium risk of insect infestation comprised 38% of at-risk areas, therefore, over 90% of surveyed villages in Ratanakiri were found to be at either medium or high risk to insect infestations.

Figure 4.3: Total Percentage of Surveyed Villages in Ratanakiri Prone to Insect Infestation.



In general, people are uninformed about their decisions to use insecticides and the possible effects of these products on the soil and on their health. Advice from other farmers and recommendations from the market seem to be the primary sources of information on the insecticide to be used for different types of insect infestation, but this advice has in the past proven to be ineffective or improper.

Farmers acknowledge the importance of adopting natural pesticides as taught by the Department of Agriculture or by local organizations, but cite the tedious process of making these pesticides, as well as the lack of availability of necessary raw materials due to their restricted access to forests. Low levels of confidence on timely delivery of assistance explain, to a certain extent, the underreporting of insect infestation events.

Villages tend to take the initiative to buy their own insecticides, even when reports have been sent to the commune requesting for external support, though this purchase can be made only if the community has financial resources available. Overall, insect infestation as a hazard has been treated in isolation from other hazards, when observations point to a strong link between drought and increased insect infestations. Each village found vulnerable to insect infestation in Ratanakiri is ranked and illustrated in *Table 4.8.*

Table 4.8: Ranking of Surveyed Ratanakiri Villages at Risk to Insect Infestation

Villages Prone to Insect Infestation	Hazard	Vulnerability	Capacity	Ranking
Phav	3	3	1	**9**
Rok	3	3	1	**9**
Samot Leu	3	3	1	**9**
Sayas Krom	3	3	1	**9**
Tanong	3	3	1	**9**
Veun Hai	3	3	1	**9**
Ka Tieng	2	3	1	**6**
Kanat Touch	3	2	1	**6**
Lorm	3	2	1	**6**
Lumpat	2	3	1	**6**
Phnom Kok Prov	2	3	1	**6**
Plueu Touch	2	3	1	**6**
Tieum Leu	3	2	1	**6**
Tumpoun Rheung Tom	3	2	1	**6**
Veun Sai	2	3	1	**6**
Dei Lou	3	3	2	**4.5**
Kamplegn	3	3	2	**4.5**
Lumphat	3	3	2	**4.5**
Prouk	3	3	2	**4.5**
Ke Koung Krom	2	2	1	**4**
Ka Chut Krom	2	2	1	**4**
Pang Kit	2	2	1	**4**
Pateng	2	2	1	**4**
Phak Nam	2	2	1	**4**
Dal Leng	2	3	2	**3**
Pakalan	2	2	2	**2**

Chapter 5: Conclusions and Recommendations

Findings from this research clearly highlighted the vulnerability of Ratanakiri to natural hazards, specifically flood, drought and insect infestation. This report presents an analysis of the risk levels of the province's communities, but also highlights their resiliency and capacity levels, specifically noting the significance of indigenous practices relating to disaster mitigation, prevention and response. Surveyed villages were ranked by risk to each type of hazard, as presented in the previous chapters.

When considering how to move forward in using the findings presented here, attention should not only be paid to those villages experiencing medium or high levels of disaster risk, as communities were often found to have varying levels of risk depending on the hazard. Furthermore, findings from this research clearly highlighted compounded levels of vulnerability in Ratanakiri, meaning that hazard events as well as changes in livelihoods, social, political and economic shifts, and an increasingly changing climate can all quickly move risk levels from low to either medium or high category. Also, when left unattended, low levels of risk over periods of time can develop into medium or high levels, as corresponding vulnerabilities also continue to increase.

The core suggestions of this research are outlined in the following recommendations, which are sorted into actions to be undertaken at both the institutional and operational levels over the short, mid, and long-term. The recommendations focus on activities that can be undertaken by a variety of actors, from community groups to government authorities, but, in order to be effective, should be cooperatively approached by multiple actors involved in DRR in Cambodia.

As this entire report is comprised of findings from research, these recommendations serve to start the 'next step' of engagement with vulnerability in Ratanakiri, providing an entry point for new organizations working in DRR, as well as guiding existing mandates by offering suggestions for activities which will reduce the risk levels of some of Cambodia's most marginalized communities. These recommendations are not considered specifically suited for individual organizations, except where noted (such as recommendations for PCDMs and other governmental line committees), and, therefore, can be chosen and amended to suit the unique skill sets and experience of various organizations.

5.1 Recommendations at the Institutional Level

5.1.1 Short-Term

1. Conduct training needs analysis in preparation of the delivery of future training to PCDM;

2. Enhance the capacity of PCDM through training activities which are based on the outcomes of the training needs analysis;

3. Foster coordination between CCDM-DCDM-PCDM through periodical meetings;

4. Promote dialogue between PCDM, NGOs and civil society through annual DRR Forums;

5. Promote awareness of the DRR framework at the PCDM, DCDM, and CCDM level;

6. Ensure that standardized training curricula at the national level are replicated and adapted to the context of Ratanakiri;

7. Evaluate the progress of DRR status in the province through systematic NCDM visits;

8. Create the conditions for a community-owned Early Warning System (EWS) by increasing coordination between RC volunteers, formal and informal village authorities, communes, districts and the province;

9. Establish a provincial Disaster Risk Profile Database in order to keep records of disaster history and prompt coordination, as well as response in the event of a disaster;

10. Conduct needs assessment for communes and districts to determine a budget for emergency supplies at the district and commune levels;

11. Include Ratanakiri in the Strategic Action Plan of Action for DRR (SNAP);

12. Build CBDRM strategies on past and present experiences of community-based natural resource management (CBNRM) in Ratanakiri before integrating them into local development planning;

13. Fit CBDRM into existing mechanisms at the community level to avoid duplications and increase interest and engagement;

14. Identify and address needs for CBDRM within the context of environment preservation and ecosystem management;

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

16. Support National Adaptation Programme of Action to Climate Change at the provincial level;

17. Conduct needs assessment for public health for communes and districts to determine the type of assistance required, as well as barriers to access and attitude toward quality of health service delivery and institutions;

5.1.2 Mid-Term

18. Monitor and evaluate the outcomes of all training initiatives;

19. 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;

20. Formulate a provincial contingency plan which adopts a multi-hazard approach;

21. Expand cross-border dialogues and cooperation on disaster-related issues, especially in the context of trans-boundary water management;

22. Harmonize risk assessment methodology and risk ranking models among relevant provincial departments and non-governmental actors;

23. Disaster response planning built upon hazard mapping exercises;

24. Conduct Training-Of-Trainers (TOT) programs on DRR for provincial, district, commune levels, and record where further training is undertaken;

25. Facilitate periodic meetings between neighboring provinces to share challenges and lessons learned in DRR;

26. Ensure that safe areas for evacuation operations are identified, taking into account the different eco-zones and the existing infrastructure levels;

27. Provide equipment for and training on EWS at the district and commune level;

28. Develop an early warning dissemination plan that take into account the remoteness of areas amongst the different districts;

29. Establish clear and formalized evacuation plans at the commune and district level based on risk assessments;

30. Enhance the PCDM capacities and resources to deliver training to communes and Districts on disaster preparedness and response;

31. Define clear responsibilities from village to commune to provincial levels, in emergency supplies distribution and management;

32. Diversify EWS strategies for dam opening and failure;

33. Utilize media networks for the purpose of conducting DRR awareness campaigns and to disseminate early warning and forecasting information;

34. Promote the creation of Village Disaster Management teams (VDMTs) following consultations and based on the outcomes of community-risk assessment, and with due respect to traditional local governance system among the different indigenous groups;

35. Conduct consultations regarding proposed hydropower development plans with affected communities;

36. Promote a shift from emergency response to preparedness in order to avoid one-off interventions and encourage a holistic approach to DRR;

37. Take into account the consequences of human activities that have a potential to lead or contribute to increased risks of natural disasters (i.e., deforestation, mining, hydropower development, etc.);

38. Increase the number of human resources within PCDM to relieve the burden of extra workload on concerned government actors, and redistribute roles and responsibilities effectively;

39. Allocate a sustainable budget to improve means of communications and transportation to be used for the technical design and implementation of an effective EWS;

40. Strengthen synergy and partnership between governmental and non-governmental actors during and in preparation of emergency response operations, by enabling information sharing and formulating coordination mechanisms (i.e., SOPs);

41. 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;

42. Understand roles of CBDRM within the traditional social structure and governance system of the indigenous people and educate 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;

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

44. Develop Provincial Disaster Risk Reduction Plan to ensure interventions do not become one-off, and include in it trans-boundary issues of hydro-power development and downstream impacts;

45. Develop a Public Health plan, with consideration to practical and strategic gender needs of women and children, as part of the Provincial Disaster Risk Reduction Plan to be implemented at the district, commune and village levels.

5.1.3 Long-Term

46. Include disaster reduction plans in provincial development and investment planning;

47. Conduct an engineering assessment of the 3 Rivers area for flood management options;

48. Factor DRR in school curriculum that takes into account the variety of spoken local languages;

49. Integrate DRR into land use management and planning including communal land registration procedures;

50. Integrate DRR into natural resource management and environmental policies;

51. Incorporate public health and livestock health issues in the DRR priorities and programming of government line departments, province, districts and communes.
52. 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);
53. Ensure that environment and natural resource management policies are promoted in a manner that protects indigenous people access to traditional coping mechanisms for times of floods and drought;
54. Strengthen the role of the communes in DRR as the most basic level of sub-national government and the closest to the communities;
55. Ensure that decentralization and deconcentration are reflected in DRR policies and programming at all sub-national levels;
56. In the context of decentralization of DRR, enforce the development of disaster management plans, as listed amongst the newly mandated roles and functions of the councils;
57. Meet the need of ensuring that the 2009 indigenous policy document is included in any DRR actions, such that the participation of indigenous people in policy formulating, planning, implementing and monitoring in the area of disaster management is real and effective;
58. 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;
59. Formulate climate change adaptation measures and guidelines for farmers, as well as community members who also rely on vulnerable livelihood strategies, including families who rely on fishing;
60. Promote the diversification of livelihood options for communities whose mobility is limited by restrictions in access to land and forest;

5.2 Recommendations at the Operational Level

5.2.1 Short-Term

61. 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;

62. Plant appropriate crop mixes and varieties suitable for drought and flood conditions;

63. Promote and disseminate information on climate change adaptation to farmers;

64. Identify drought and flood resistant crops and store seeds at the community level for future use;

65. Support the diversification of crops, and appropriate spacing (i.e., widened spacing) 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;

66. Create organic manures and fertilizers using traditional forest products, manure, and leaves to limit the use of chemical pesticides by building upon indigenous knowledge;

67. Strengthen community seed banks where members can contribute seeds and retrieve new varieties to diversify crops;

68. Encourage the planting of appropriate trees (with established root balls where possible) along riverbanks and fields to mitigate flooding, and to decrease erosion;

69. Keep and update an inventory of the equipment and supplies to be deployed and distributed in the event of disaster

70. Conduct evacuation drills for flash flood locations, ensuring that topographic and infrastructure conditions are considered for times of flood;

71. Provide water filtration devices where necessary, and build wells on higher landscapes (e.g., on hills used for evacuation) to provide sources of drinking water during floods;

72. Encourage the development of micro-finance projects to increase savings for times of drought;

73. For times of prolonged drought, ensure resources are allocated to provide food aid, emergency supplies and seeds for replanting where necessary;

74. Disseminate to communities radios or other communication tools for public awareness, hazard preparedness, and EWS alerts, and train their members on their appropriate uses;

75. 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;

76. Where new livelihoods are being explored (i.e., aquaculture, fish farming), ensure that ponds are resistant to both drought and floods;

77. Train men and women on drinking water sanitation (including for stored water, particularly for children);

78. Involve women, children and elderly in community-based disaster risk management activities;

79. Improve the flow of information on weather forecasting to communities in a way that takes into account the variety of locally spoken languages, as well as people's level of literacy;

80. Conduct public awareness campaigns for DRR in a manner that takes into account the variety of locally spoken languages, and people's level of literacy, and ensure that campaigns are respectful of traditions and beliefs;

81. 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;

82. Emphasize soil moisture management programs (i.e., changing crop patterns and appropriate irrigation techniques);

83. Improve methods to store foods (i.e. smoking, salting drying techniques for meats as well as vegetables);

84. Ensure that safe areas for evacuation operations are equipped with water and sanitation facilities;

85. Encourage the sharing and documenting of information on indigenous knowledge of disaster risk and coping strategies, including early warning signs and indigenous resources;

86. Encourage the stockpiling of medicines and essential medical supplies to be made available at the village level, where possible;

87. Establish a calendar of diseases for livestock with the community, to know when to expect certain diseases and take proper preventative measures.

5.2.2 Mid-Term

88. 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;

89. Advocate for meteorological services to have a hub for information dissemination on drought and floods in each commune;

90. Train communities to access and interpret information on weather trends, and flood and drought forecasting;

91. Invest in higher and stronger roads and infrastructure, such as bridges for streams and road foundations;

92. Encourage the diversification of both agricultural and livestock resources, and train communities in effective and relevant modern farming practices;

93. Collect baseline data for future climate change adaptation programming;

94. Develop community dam failure or opening plans, including response and alert strategies with trans-border partners, and set up alert system for sharing of information on flash and slow-onset floods, as well as the opening of dams;

95. Advocate for information dissemination on insect infestation at its earliest possible detection point before infestations begin;

96. Train communities on making and usage of natural insecticides, based on their existing indigenous knowledge and provide practical demonstrations, exercises, and periodical overseeing;

97. 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;

98. Reorientation of village and commune development and investment planning to include disaster risk management;

99. Promote environmental and natural resources protection to improve people's resilience by building on existing structures (such as village monitoring committees), and through advocacy and dialogue;

100. Promote awareness amongst relevant government officers at the provincial, district, and commune level on DRR, Climate Change Adaptation, and CBDRM;

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

102. Identify different drought management responses for mixed agro-ecological zones, namely, areas which are lowland, upland and riverside;

103. Use Province-to-Province dialogues with counterparts in Viet Nam on the implementation of an institutional EWS (support with relevant MOUs and information dissemination activities);

104. Introduce new farming techniques, building upon traditional agriculture practices;

105. Build the capacity of PCDM to play supervisory and support roles to the DCDM, including its provision of technical training;

106. Enhance the capacity of DCDM to report to PCDM on event damage and needs assessment for search and rescue operations, and to inform of emerging hazards, as well as to facilitate operations through its communes.

5.2.3 Long-Term

107. Identify measures to stabilize water resources and assess possible impacts of other dams to be built within Cambodia;

108. Support infrastructure investment for the enlargement and/or building of irrigation canals and dams where deemed necessary, and repair wells where possible;

109. Empower communities through improved access to institutions (markets, health service, government and external assistance, justice);

110. Ensure that the required resources, both human and financial, are allocated to conduct training programs, and monitor the transparency and uses of these resources;

111. Hydro-power development projects should include social concession plans for resettlement and compensation of affected populations;

112. Monitor the status of water and sanitation facilities built in identified areas for evacuation operations;

113. Enforce natural resource management and environment protection-related laws as a means for stabilizing communities;

114. Strengthen forecasting infrastructure (both hard and soft) at the MOWRAM;

115. Monitor the state of EWS equipment to ensure all tools are functioning properly and being used effectively;

116. Improve infrastructure in designated evacuation routes, and ensure that the infrastructural support takes into account livestock and animals in evacuation strategies;

117. Promote DRR school curriculum through formal and informal education (for youth who do not attend school);

118. Ensure that DRR considerations are factored into any environmental impact assessments;

119. 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;

120. Ensure that the decentralization process adapts to traditional governance systems and builds upon it;

121. Assess the impact of human displacement driven by disasters from an environmental and human security perspective;

122. Assess the social and security impact of seasonal off-farm labor pursued by the recurrence of natural hazards;

123. 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.

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Annex I

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 II

Key Questions for Semi-structured Interviews

- What are the hazards facing the district or commune?
  - ⇒ Do you experience drought, flood and/or insect infestations?
  - ⇒ Which areas are most affected?
  - ⇒ Who are affected?
- What is the role and mandate of the District and the commune in disaster risk management?
- What is your working relation with the NCDM and PCDM in this regard?
- Are you aware of national policies on disaster risk management or international agreements such as the Hyogo Framework of Action?
- How does the National Government bring down this mandate to you?
- How does commune work with the district and the village on DRM?
- What activities are being undertaken by the District/Commune to reduce the risks and vulnerabilities brought about by flood and drought?
- Do you have a DRM plan or a Development Plan that includes disaster risk management for the district, commune and the village?
- Are you aware of the PCDM or CCDM in your community?
- Are you aware of Village Development Teams that have been established in the District/Communes?
- If they have been established, are they functional?
- What are your past interventions in Disaster Risk Reduction?
- Do you have local early warning signals?
- What facilities are available in the province and commune that can assist communities during hazard events (e.g., stockpiles, pesticide, dry food rations, drinking water tents, evacuation centers, medical first aid, and trained personnel of emergency rescue)?
- Do medical officers periodically visit villages where there are no health centers/facilities?
- How do you prioritize programs and projects for flood and drought?
  - ⇒ Do you conduct village-level consultations where people identify their needs?
  - ⇒ How much budget is allocated for projects on flood and drought, if any?
  - ⇒ What types of assistance do you receive from external organizations, such as donors and NGOs?
  - ⇒ What has been done to better communities to mitigate hazards?
  - ⇒ What problems did they encounter in implementing DRR projects?
  - ⇒ For villages affected by flash floods, do you inform the National Committee for the Mekong River Cambodia?
  - ⇒ Are you aware of the MRC agreement signed between Cambodia and Viet Nam with regards to flash floods caused by dams built in Viet Nam?

Annex III

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 Ratanikiri 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 Ratanikiri, 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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