CAMBODIA NATIONAL MEKONG COMMITTEE

Basin Development Plan Programme

Sub-Area Analysis and Development

The Northern Cambodia-Southern Laos and Kratie Sub-Areas

SA – 6C & 8C

January 2005
Phnom Penh, Cambodia

Table of Contents

List of Tables

List of Figures

Acronyms and Abbreviations

ADB	:	Asian Development Bank
AIT	:	Asian Institute of Technology
ASEAN	:	Association of South East Asian Nations
BDP	:	Basin Development Plan (MRC)
CARDI	:	Cambodian Agricultural Research and Development Institute
CARE	:	CARE International in Cambodia
CARERE	:	Cambodia Area Rehabilitation and Regeneration Project
CDC	:	Council for the Development of Cambodia
CIAP	:	The Cambodia- IRRI-Australia Project
CNMC	:	Cambodia National Mekong Committee
DANIDA	:	Danish International Development Agency
DFW	:	Department of Forestry and Wildlife
DIT	:	Department of Industrial Technology
DOF	:	Department of Fisheries
DWSS	:	Department of Water Supply and Sanitation
EIA	:	Environmental Impact Assessment
EU	:	European Union
FAO	:	Food and Agriculture Organization
FWUCs	:	Farmer Water User Communities
GDP	:	Gross Domestic Product
GEF	:	Global Environmental Facility
GMS	:	The Greater Mekong Sub-region
HRD	:	Human Resource Development
HRM	:	Human Resource Management
I & D	:	Irrigation and Drainage
IDE	:	International Development Enterprises
IDRC	:	International Development Research Canada
IFReDI	:	Inland Fisheries Research and Development Institute
ILO	:	International Labor Organization
IOs	:	International Organizations
IRRI	:	International Rice Research Institute
IUCN	:	International Union for the Conservation of Nature
JICA	:	Japan International Cooperation Agency
Lao PDR	:	Lao People’s Democratic Republic
LMB	:	Lower Mekong Basin
MAFF	:	Ministry of Agriculture, Forestry and Fisheries
MIME	:	Ministry of Industry, Mines and Energy
MLMUPC	:	Ministry of Land Management, Urban Planning and Construction
MOE	:	Ministry of Environment
MOH	:	Ministry of Health
MOP	:	Ministry of Planning
MOT	:	Ministry of Tourism
MOWRAM	:	Ministry of Water Resources and Meteorology

MPWT	:	Ministry of Public Works and Transport
MRC	:	Mekong River Commission
MRCS	:	Mekong River Commission Secretariat
MRD	:	Ministry of Rural Development
MW	:	Mega Watt
NCAC	:	National Committee for Assisting the Community
NCDP	:	National Capacity Development Project
NCHP	:	National Center for Health Promotion
NGOs	:	Non-Governmental Organizations
NRM	:	Natural Resources Management
NTFP	:	Non Timber Forest Products
PADEK	:	Partnership for Development in Kampuchea
PCD	:	Pollution Control Department
PDAFF	:	Provincial Department of Agriculture, Forestry and Fisheries
PDE	:	Provincial Department of Environment
PDIME	:	Provincial Department of Industry, Mines and Energy
PDT	:	Provincial Department of Tourism
PDWRAM	:	Provincial Department of Water Resources and Meteorology
PIPs	:	Public Investment Programs
PRASAC	:	Programme de Rehabilitation et d'Appui au Secteur Agricole du Cambodge
PRDC	:	Provincial Rural Development Committee
RGC	:	Royal Government of Cambodia
RWS	:	Rural Water Supply
SAWG	:	Sub-Area Working Group
SEDP I	:	First Five-Year Socio-Economic Development Plan
SEDP II	:	Second Five-Year Socio-Economic Development Plan
SEDRP	:	Socio-Economic Development Requirements and Proposals
SIDA	:	Swedish International Development Agency
SMEs	:	Small and Medium Enterprises
UN	:	United Nations
UNDP	:	United Nations Development Programme
UNICEF	:	United Nations Children's Fund
UNTAC	:	United Nations Transitional Authority in Cambodia
USAID	:	The United States Agency for International Development
WB	:	World Bank
WHO	:	World Health Organization
WRAM	:	Water Resources and Meteorology
WRM	:	Water Resources Management
WSM	:	Watershed Management
WUG	:	Water User Groups
WUP	:	Water Utilization Programme
WWF	:	World Wide Fund for Nature

Foreword

In partnership with the Mekong River Commission Secretariat (MRCS) Basin-wide initiative, the Cambodia National Mekong Committee (CNMC) is leading the effort in Cambodia on the Basin Development Plan (BDP) Programme. This programme seeks to develop both an *initial plan* as a guiding framework for basin-wide water and water-related resources development in a sustainable manner and a *sustainable planning process*.

It gives me great pleasure to introduce the Northern Cambodia-Southern Laos and Kratie Sub-area Analysis and Development. This has been undertaken by the Sub-Area Working Groups of the Northern Cambodia-Southern Laos and Kratie Sub-areas, with a focus on eight sectors: *irrigated agriculture*; *watershed management*; *fisheries*; *hydropower*; *navigation, transport, river works*; *tourism and recreation*; *water supplies*; and *flood control and management* sub-sectors and four cross cutting themes: *socio-economies, human resource development, environment and participation.*.

The Sub-area Analysis and Development set the context for Basin-wide development strategies and formulation of cross-border sector development, the two first-stages of the five stages of the BDP planning process by defining the macro-issues at the country level. Amongst ten Sub-areas in the Lower Mekong Basin, five Sub-areas have been delineated in the Cambodian part of the Mekong River Basin. The report serves as a vital resource of reference for CNMC-BDP and MRCS-BDP Teams and Local Consultants in developing Basin wide management strategies and cross-border sector development.

This report is the third Cambodia Sub-area Report after the Tonle Sap and the Delta Sub-area Reports produced within the framework of the BDP planning process. Members of Sub-area Working Groups sourced from the concerned Provincial Departments in the Northern Cambodia-Southern Laos and Kratie Sub-areas, with overall guidance and coordination by the CNMC Secretariat. This approach ensured full ownership of each stage of production.

On behalf of the Chairman of the Cambodia National Mekong Committee (CNMC), I would like to extend my sincere thanks and profound gratitude to all leadership of the CNMC and Line Ministries for their persistent guidance and constructive recommendations and especially for full participation and support from Ministries concerned that gave rise to the success of this report.

Again, on behalf of the Chairman of the CNMC, I wish to thank and acknowledge the assistance of several local authorities within the Northern Cambodia-Southern Laos and Kratie Sub-areas and Northern Cambodia-Southern Laos and Kratie Sub-Area Working Groups for their full collaboration and support, dedicated endeavors and enthusiasm that contributed greatly to the successful completion of this report.

I would also like to acknowledge and appreciate the efforts of the CNMC BDP Team, particularly *Mr. Watt Botkosal*, National BDP Coordinator and *Dr. An Pich Hatda*, National Specialist for their outstanding coordination, technical assistance and facilitation to the Northern Cambodia-Southern Laos and Kratie Sub-area Working Group members in bringing out this valuable report.

Particular thanks are due to *Mr. Jeffrey Himel*, Short-term International Consultant to the CNMC for his technical assistance, valuable advice and guidance, to *Dr. Pichara Leang*, Support Local Consultant, and to *Mr. Yem Dararath*, Local Consolidating Editorial Consultant for his inputs to the successful finalization of the Northern Cambodia-Southern Laos and Kratie Sub-area report.

I am of the belief that this report will become an important resource of document for development of Sub-area and Basin-wide management strategies, which will contribute ultimately to the development for the LMB. Additionally, I hope that this report will serve as Sub-area cross-sectoral references, which can be further used by any interested groups such as government agency, private sector and civil society.

Sin Niny
Vice Chairman of CNMC
Chairman of BDP Sub-Committee

Phnom Penh
January 2005

PART I

Executive Summary

CHAPTER 1: INTRODUCTION

1.1. Background

The Basin Development Plan (BDP) formulation started on 1st October 2001, as one of the three core programmes of the Mekong River Commission (MRC). The formulation involves the National Mekong Committees (NMCs) in each country, national planning and line agencies, and a wide range of other government, private sector and civil society actors. The work is supervised by the MRC Joint Committee and by National Sub-Committees.

The BDP seeks to develop both an *initial plan* as a framework for the basin-wide water and water-related resources development and a sustainable *planning process* in the four member states of the MRC, including Cambodia, Lao PDR, Thailand and Vietnam.

The BDP team in each country has been initiating studies and analysis in a number of Sub-areas making up the Lower Mekong Basin (LMB). This is the first stage of the BDP development process. Five Sub-areas have been delineated in the Cambodian part of the Mekong Basin (MB).

In Cambodia, the Cambodia National Mekong Committee (CNMC) is leading the efforts on the BDP. The overall process involves reviewing, collecting, analyzing relevant data and information and conducting forums at regional, national and provincial levels. Background study is being finalized at national level through sub/sectoral reviews by Technical Officials from line agencies involved.

The work in the Sub-areas is being divided into two components as following:

- **Component A: Review and Analysis**
  - Review of provincial and sector plans/data and insight collection; and
  - Analysis.
- **Component B: Scenario and Strategy Development**
  - Scenario development; and
  - Strategy development.

The Sub-area review and analysis will provide the basis for formulating the scenarios and strategies for water use in the sub-areas and subsequently in the region. It will therefore be essential that *the level of detail be tailored and targeted to facilitate macro thinking and analysis and the promotion of suitable oversight and vision in the subsequent stages*. The outcomes for each sub-area analysis will therefore be:

- Summary of present conditions and context for development;
- Summary of water availability, ecological demands and present water uses;

- Identification of opportunities, concerns and risks; and
- Formulation of development objectives.

1.2. Process of Sub-Area Study and Analysis

Sub-area studies involve:

- ***Preliminary review:*** Review of available information at regional, national and sub-area levels to provide overviews of keys issues, review of development plans/programmes (either already prepared or under preparation) and preparation of GIS and related information from MRC data sets;
- ***Identification of key issues and sectors;***
- ***Information collection****:* Identify information gaps, collate or collect required information (particularly from national and provincial agencies);
- ***Analysis:*** Identify sub-area development objectives, formulate scenarios and strategies and identify potential projects/programmes; and
- ***Public consultation:*** Include local knowledge and opinions.

It is proposed that the process of sub-area study and analysis should be orientated around two forums. The process can then be broken down into a number of steps as follows:

- ***Review:*** Mainly through activities coordinated at MRC Secretariat;
- ***Forum 1:*** A multi-stakeholder forum within the sub-area to consider sub-area information, identify key issues and information gaps, and prepare a work plan for further study and analysis;
- ***Implementation of work plan:*** Mainly collection of further information as defined at Forum 1; and
- ***Forum 2:*** A second multi-stakeholder forum to agree on sub-area development objectives, scenarios and strategies and to identify potential projects/programmes.

1.3. Development of Scenarios and Strategies

According to the BDP, scenarios are not about predicting the future; rather they about perceive the future in the present. A scenario is a hypothetical combination of events and physical conditions, describing a possible future situation. Development scenarios will be formulated in order to illustrate anticipated limits to the long-term basin development, as well as the significance of external driving forces and uncertainties about applied key assumptions.

Development strategies will be drafted as a tool for identification and assessment of development projects and programmes. Development and management strategies will be

formulated for each sub-area and each relevant water related sector. This will be done in a close dialogue with the stakeholders, and drawing on related MRC programmes.

The strategies need to be justified in terms of: (i) socio-economic implications; (ii) environmental implications; (iii) human resources development implications; and (iv) national priorities, strategies and plans.

1.4. Importance of the Report

The report might also be useful for governmental institutions, external support agencies, project evaluation teams, investors and technical specialists in helping them understand:

- The current condition of various development sectors at provincial levels around the Northern Cambodia-Southern Laos and Kratie Sub-areas;
- The trends within and future plans of the sectors within the Northern Cambodia-Southern Laos and Kratie Sub-areas;
- The linkages between one sector and another;
- The cross-cutting themes: socio-economic, environment, public participation and human resources aspects; and
- The Trans-boundary issues within the Northern Cambodia-Southern Laos and Kratie Sub-areas.

CHAPTER 2: OVERVIEW OF THE 6C & 8C SUB-AREAS

2.1. Baseline Description

2.1.1. Northern Cambodia-Southern Laos Sub-area (6C Sub-area)

The Northern Cambodia-Southern Laos Sub-areas (6C), which covers an area of approximately 6,000 Km^2 is located in the northern part of Cambodia. According to the CNMC-BDP study and analysis (April, 2004), the 6C Sub-area encompasses partly two provinces, namely Preah Vihear (58% of the district of Chhaeb), and Stung Treng (38% of the district of Stung Treng and 50% of the district of Thaala Barivaat).

The total area of the 6C Sub-area represents approximately 3.3% of the total area of Cambodia. The total population estimated in 2002 within the 6C Sub-area is 24,260 inhabitants, equivalent to 0.2% approximately of the total population of Cambodia. The 6C Sub-area is characterized by a very low population density, the lowest in Cambodia, ranging between zero and 20 persons per Km^2. The presence of forests in this Sub-area leads to intensive exploitation for logging provoking conflicts between the ethnic minority population and stakeholders of the private and the public sector, as well as harmful effects on the environment. Few data is available on the agriculture activities in the Sub-area.

The 6C Sub-area is considered as the least developed area in terms of economy and social conditions, compared to other areas in the country, despite high potential for agriculture development.

An estimate has indicated that the water availability per capita is approximately 6,220m^3/year. The water demand for the 6C Sub-area has not been known due to lack of data and information. Anyway, the water demand per capita for Cambodians is estimated about 12 m^3 per year (MRC, 2002i). Fully irrigated crops utilize approximately 10,000 m^3/ha. Some irrigation engineers in Cambodia estimate that recession rice receives approximately 4,000 m^3/ha of irrigated water. The water consumption for rice is high compared to other crops. The total water consumption is dependent on crop type, stage of crop growth, soil type, irrigation method, and so on.

2.1.2. Kratie Sub-area (8C Sub-area)

The Kratie Sub-area (8C Sub-area), which covers an area of approximately 22,170 km2, is located in the eastern part of Cambodia. This covered area represents about 12.25% of the total area of Cambodia. The 8C Sub-area encompasses partly five provinces, namely Kratie (85%), Stung Treng (24%), Mondulkiri (50%), Preah Vihear (10% of the District of Chey Saen), and Kompong Cham (10% of Dambae District and 50% of Memot District).

The Kratie Sub-area is the continuation of the complex of Korat Plateau mixed with a vast area of lowlands which compose the floodplain. It is crossed from north to south by

the Mekong River. The Sub-area is characterized by the deposition of recent sediments over older bedrock. Owing the flatness of the terrain, large areas are submerged during the high flow period of the Mekong River and its tributaries.

About two third of the Sub-area is occupied by the floodplain which elevation is between o and 100 meters. The remaining is mostly made of plateau of 100-200 meters high. Only in the southeastern part of the Sub-area, in the southern part of the province of Mondulkiri it is a found mountainous formation of 200-500 meters. Thus, the Sub-area 8C is a relatively flat area that elevates from northwest to south east thanks to a mountainous continuation of the Korat plateau.

The 8C Sub-area is mainly covered by forest (at least 90% in 2002) with sparse areas of woodland and agriculture (about 5% in 2002). Alongside the Mekong River, a mosaic of river bank crops e.g. sesame, tobacco, maize. Land use distribution in the top three provinces of the Sub-area is displayed in the below table. It is seen than areas devoted to rice represent 67% of the total Sub-area while irrigated areas occupy about 27% only of the cultivated land. The average rice yield ranges from 1.4 to 1.9 tons per ha.

The Sub-area encompasses partly three important wildlife reserves in the eastern part of Cambodia that are Lomphat (Mondulkiri part), Phnom Prich (Mondulkiri) and Snuol (Kratie). As an example, the Mekong River hosts a colony of the mammal Irrawaddy Dolphin (Orcaella brevirotris) that constitutes a tourist attraction in Kratie. Orcaella brevirotris is registered in CITES appendices in 2001. CITES is the Convention on International Trade in Endangered Species of Wild Fauna and Flora in which Cambodia is also a signatory member.

Except in the districts of Dambae (10% within the sub-area) and Memot (57%) located in the province of Kompong Cham, the population density of the 8C Sub-area ranges between 0 to 70 persons per km^2. The whole province of Kratie is the most heavily populated area with 20-70 km^2 while Stung Treng and Mondulkiri account 0-20 persons per km2, the lowest density in Cambodia. As a comparison, the density of Kandal, Prey and Takeo, easily reaches 150-350 persons per km^2.

Rice is the major crop cultivated in the Sub-area in term of superficies, since only 33% of the area is devoted to other crops than paddy. Irrigation is under developed with only 27% of irrigated land in the three main provinces. The average yield does not exceed 1.9 tons per hectare, but a lot of disparity is observed in different locations (Table 10). Low quality soils combined with inadequate water supply and weak cultural methods are key factors leading to low productivity. Data on varieties, crops and fertilization is too fragmented and incomplete to allow deeper analysis of the agricultural situation in the Sub-area.

2.2. The Agenda for Development

After the July 1998 election, the Government of Cambodia adopted the Triangle Strategy in which the promotion of economic and social development composes the third side of the triangle. One of the numerous and urgent priorities identified was an extensive reform

of the administrative system. Administration reform includes decentralization, military demobilization, legal and judiciary, gender equity, public financial management, anti-corruption, and natural resource management.

The long term Vision of the Government is *"to have a socially cohesive, educationally advanced, and cultural vibrant Cambodia without poverty, illiteracy, and disease, which will allow each person to be the best that it is in them to be".*

The strategic message of the plan is that Economic growth is a prerequisite for poverty reduction and the key to growth is private sector development, which will be achieved largely through sustained improvement in the government environment. Specific strategies for civil service reform including decentralization, military demobilization, legal and judiciary, gender equity, public financial management, anti-corruption, and natural resource management. In pursuing a higher economic growth path Cambodia will be established as a popular ecological and culture tourism destination.

The Government recognizes that achieving national development objectives relies crucially on creation of a more positive and predictable business environment to facilitate the development of the private sector with a special consideration to the development of small and medium-sized enterprises, as the engine of increased investment, higher incomes and more employment.

Physical infrastructure development is another major area in which the RGC plays an important role. The limited coverage and poor condition of existing infrastructure constrain private sector-led development and access to health and education services, especially by the poor.

A numbers of key development issues have been identified, including irrigated agriculture, irrigation, fisheries, navigation, flood control and management, hydropower, watersheds management, tourism, and water supply.

PART II

Sub-area Study and Analysis (Forum #1)

CHAPTER 3: INTRODUCTION

3.1. General

Literature and studies about the Northern Cambodia-Southern Laos Sub-areas (6C) are very scarce and mainly focus on the ethnological and political aspects related to e.g. threat on indigenous traditions and culture, challenges of decentralization, etc. Few adopted a trans-sectoral approach, emphasizing global trends, potentials-opportunities, constraints and treats. For the Kratie Sub-area (8C Sub-area), the literature and studies are rare. When they are produced, few adopted a trans-sectoral approach, emphasizing global trends, potentials-opportunities, constraints and threats.

Another deficiency is the lack of effort to provide a comprehensive reflection on the cross-cutting issues as well as on the trans-boundary issues by putting into evidence the relationships between the different components. The identification and analysis of the trans-boundary issues is of importance for planning and decision-making of the riparian Governments.

The purpose of this work is to attempt to provide an in-depth analysis of the development plan of the Northeastern Cambodia and Kratie that have been delimited as the 6C & 8C Sub-areas in the Basin Development Plan (BDP) of the Lower Mekong Basin.

This analysis emphasizes the challenges and implications of the development of the 6C & 8C Sub-areas. It mainly calls upon a critical review of existing documents produced by various relevant stakeholders, e.g. the Mekong River Commission (MRC), the Cambodia National Mekong Committee (CNMC) and the Provincial Sectoral Departments.

3.2. Objective

The objective of the Sub-area analysis is to provide the basis for formulating scenarios and strategies for water use in the sub-areas and region.

3.3. Tools and Methodology

3.3.1. Tools

A number of documents have been utilized in this in-depth analysis so that a wide and comprehensive view is made possible:

- The first category of documents reviewed is composed of Provincial Sectoral Department Planning and Reviews of four provinces, namely Stung Treng, Kratie, Mondulkiri and Preah Vihear as well as the Commune Database of the Ministry of Planning.
- The second category of materials includes the National Sector Reviews on Irrigation, Agriculture, Fisheries, Hydropower and Tourism Development. It also

includes the Se San/Sre Pok/Se Kong and Kratie Sub-area studies and analysis conducted by a national consultant for CNMC that was released in April 2004.

- The third category encompasses MRC and CNMC materials including the Regional Sector Overviews prepared by the MRC-BDP team, the Draft Guidelines on Sub-area analysis (MRC, 2002c). It also includes additional materials compiled in the BDP Archive CD-ROM.
- The fourth category of materials comprises the 2003 State of the Basin Report (MRC, 2003d) and the Social Atlas of the Lower Mekong Basin (MRC, 2003c). Additional maps and LandSAT imagery have been extracted from the People and the Environmental Atlas of the Lower Mekong Basin, MRC in order to enrich the analysis of spatial relationships and to assist with visualization of resources, environmental and land use, and connections between sub-areas.
- The fifth category includes external support agency overviews and reports; for instance, the 1999 Mekong Papers and the SEI/Resources Policy Support Initiative.
- The sixth category includes various independent research publications such as the Cambodia National Report on Protected Areas and Development by the PAD Partnership 2003.

As the Sub-area analysis will rely heavily on secondary data (derived and summarized from other sources), an important role of the first forum was to assess whether the data adequately reflected the real situation, identify information gaps and agree on a work plan to collect missing and needed information.

3.3.2. Methodology

The in-depth analysis is conducted through three complementary tasks:

- Document review and analysis
- Stakeholders consultation; and
- Analysis of the outcomes of the Informal Working Group Session in 2003 prior to the Forum 1 and the outcomes of the 2004 Forum 1 in Kratie Province.

3.3.2.1. Documents Review and Analysis

Materials are provided by MRC, CNMC and additional ones from CDRI, IFReDI, ADB, UNDP, and WB. The in-depth analysis relies heavily on secondary data – derived and summarized from other sources.

3.3.2.2. Stakeholders Consultation

The stakeholder consultation was conducted following a guide-question checklist, emphasizing critical issues to be addressed, trends, constraints, potential development plans and relevant projects in the 6C & 8C Sub-areas. For this, several key stakeholders - whom we acknowledge for their availability - have been met including:

- MRC: Dr Mak Solieng, Natural Resources Development Planning, Dr Tue Kell Nielson, Consultant and Mr Thim Ly, Junior Riparian Professional (JRP)
- CNMC: Dr An Pich Hatda, Dep. Director-BDP National Specialist and Mr Watt Botkosal, Dep. Director-Planning Dept. and National BDP Coordinator.
- IFReDI: Mr Lieng Sopha, Dep. Director-AMCF
- MAFF-DoF: Mr Sam Nuov, Deputy Director, Department of Fisheries
- MAFF: Mr Kith Seng, Director of Planning, Statistics and Intern. Coop. Dept.
- Seila Prog- UNOPS: Mr Scott Leiper, Senior Prog. Advisor
- Min. of Public Works & Transport: Mr Va Sim Soriya, Director of Planning Dept.
- Min. of Water Resources and Meteorology: Mr Pech Veasna

3.3.2.3. Analysis of Outputs of the Informal Working Session prior to Forum 2

This work is based on the proceedings of the informal working session prior to the Second Stakeholders' Forum that is further planned in 2004.

Basically, this analysis aims at assessing the level of understanding on the sub-area development planning and the ability of the working group in identifying development objectives and proposing a scenario formulation at the Forum 2.

Despite difficulties to collect some data, more work has to be done for obtaining reliable and consistent information. Trans-boundary issues analysis is of importance. Many questions and issues were raised by the external stakeholders and suggestion was made to incorporate the negative impacts such as water quality, flooding, socio-economic and environmental impacts in the analysis. Clarification on trans-boundary issues has been made on how they have been addressed by CNMC and MRC as a whole.

SECTION 1

The Northern Cambodia-Southern Laos Sub-area (SA – 6C)

CHAPTER 4: BASELINE DESCRIPTION

4.1. Geographical Features

4.1.1. Coverage

The Northern Cambodia-Southern Laos Sub-areas (6C), which covers an area of approximately 6,000 Km2 is located in the northern part of Cambodia. According to the CNMC-BDP study and analysis (April, 2004), the 6C Sub-area encompasses partly two provinces, namely Preah Vihear (58% of the district of Chhaeb), and Stung Treng (38% of the district of Stung Treng and 50% of the district of Thaala Barivaat).

Table 1: Numbers of Districts and Areas within the 6C Sub-area

Province	No. of Districts(*) within the 6C Sub-area	Area (Km^2) within the 6C Sub-area(**)
Stung Treng	2	4,521
Preah Vihear	1	1,480
Total	**3**	**6,001**

Note: (*) Partly or entirely
(**) Source: MRC "*Districts in Cambodian Sub-areas-Using new boundaries (2003) and BDP Sub-areas as of January 2004* ".

In terms of district coverage, the Cambodian part of the 6C Sub-area encompasses partly or entirely 3 districts as shown in Figure 1.

The total area of the 6C Sub-area represents approximately 3.3% of the total area of Cambodia. The total population estimated in 2002 within the 6C Sub-area is 24,260 inhabitants, equivalent to 0.2% approximately of the total population of Cambodia. The population estimation within the 6C Sub-area is based on the Commune Database Version 5.3 of the Ministry of Planning-General Directorate of Planning.

4.1.2. Elevation

In average, the 6C Sub-area is located of maximum 140 meters above sea level, thus forming a plateau.

4.1.3. Soil

In this Sub-area, Soils are mainly composed of acid lithosols and lateritic clay. Along the rivers, are found brown or non-differentiated alluvial soils.

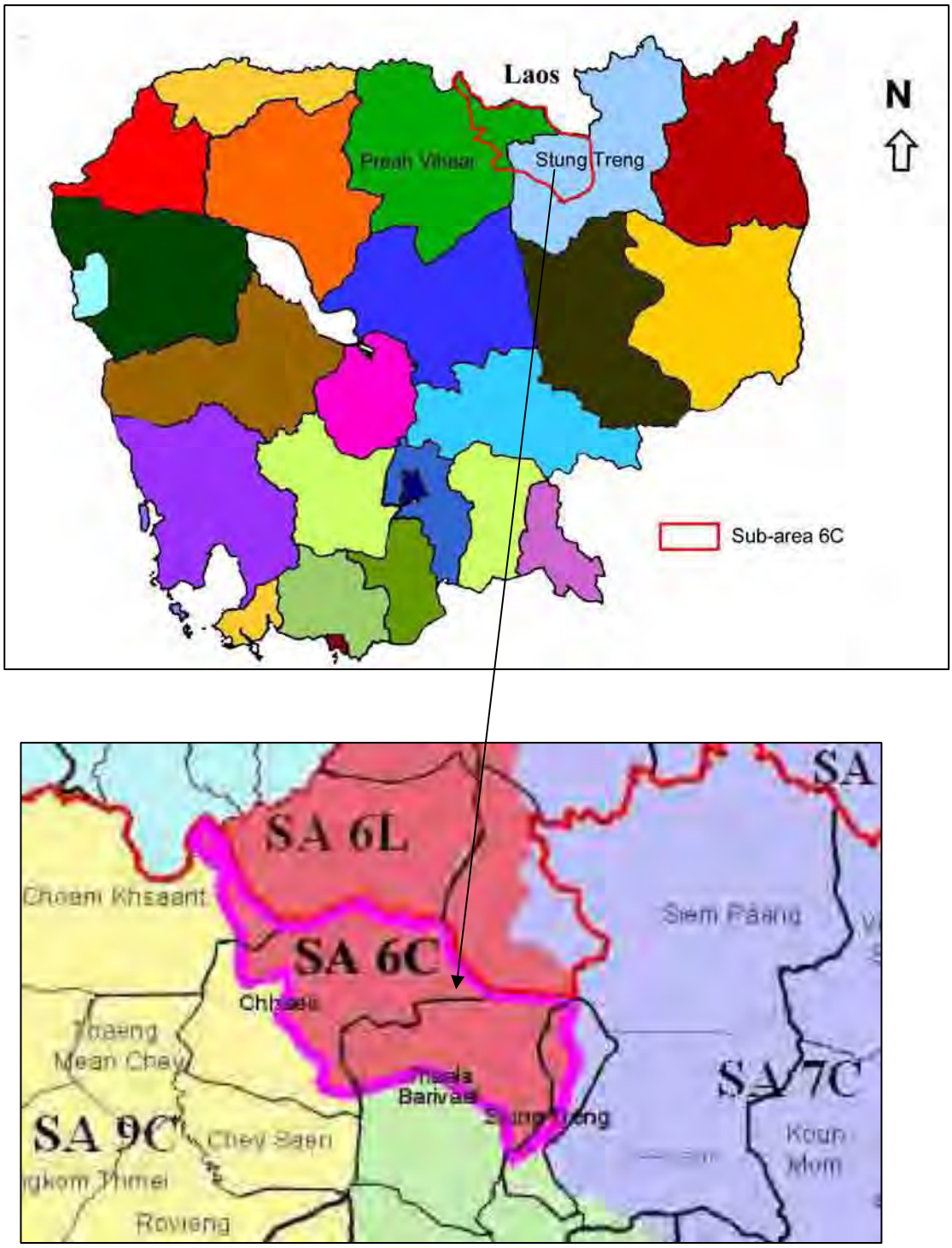


Figure 1: Provinces covered by the 6C Sub-area

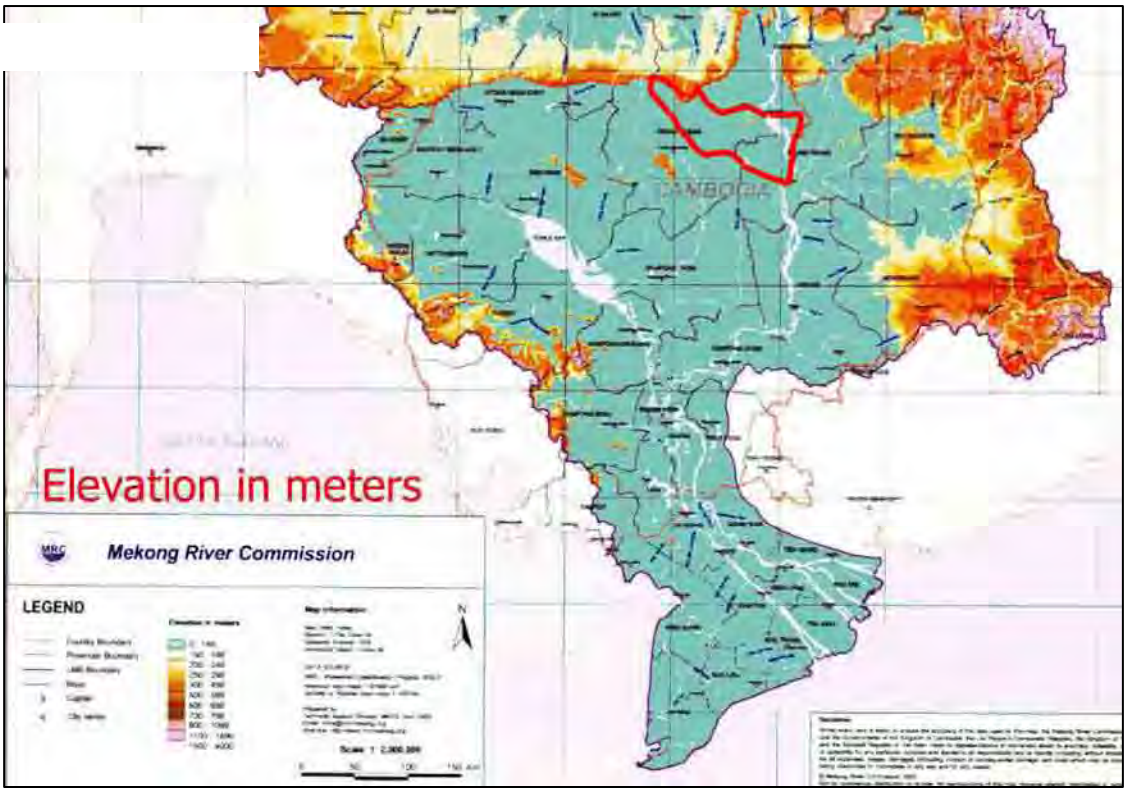


Figure 2: Elevation above Sea Level

4.1.4. Land Cover

The huge majority of the Se 6C Sub-area is occupied by forests. There should be contact with the Geography Department of the Ministry of Land Management, Urban Planning and Construction, so that updated information on land use as well as various administrative and other data sets can be gathered. Statistics from MRC on land use give some additional indications.

The presence of forests in this Sub-area leads to intensive exploitation for logging provoking conflicts between the ethnic minority population and stakeholders of the private and the public sector, as well as harmful effects on the environment. Few data is available on the agriculture activities in the Sub-area.

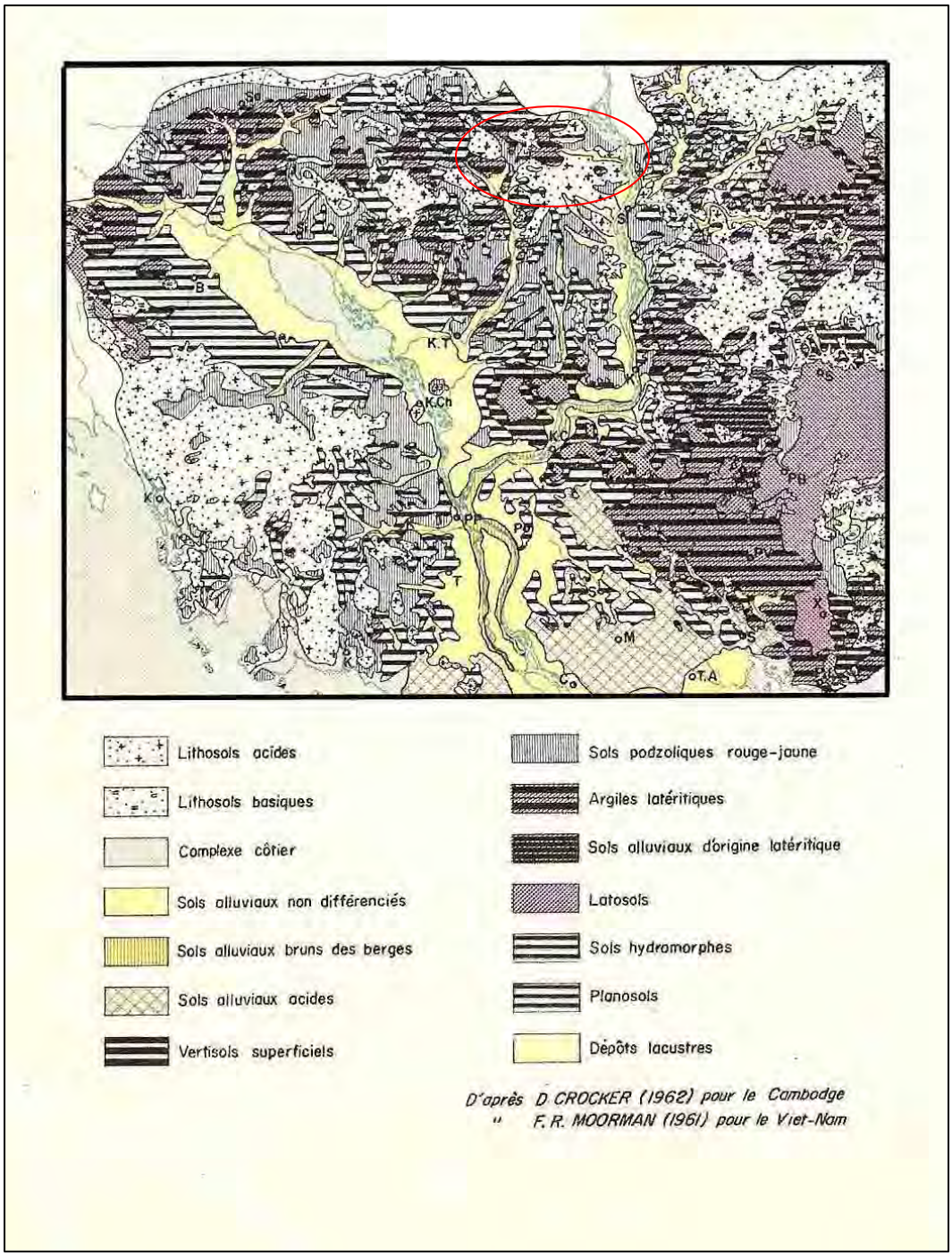


Figure 3: Soil Map of the 6C Sub-area

Figure 4: Land Cover of the 6C Sub-area

4.2. Population and Livelihoods

4.2.1. A Very Sparse Human Settlement

The 6C Sub-area is characterized by a very low population density, the lowest in Cambodia, ranging between zero and 20 persons per Km².

4.2.2. Some Elements of the Socio-economic Conditions

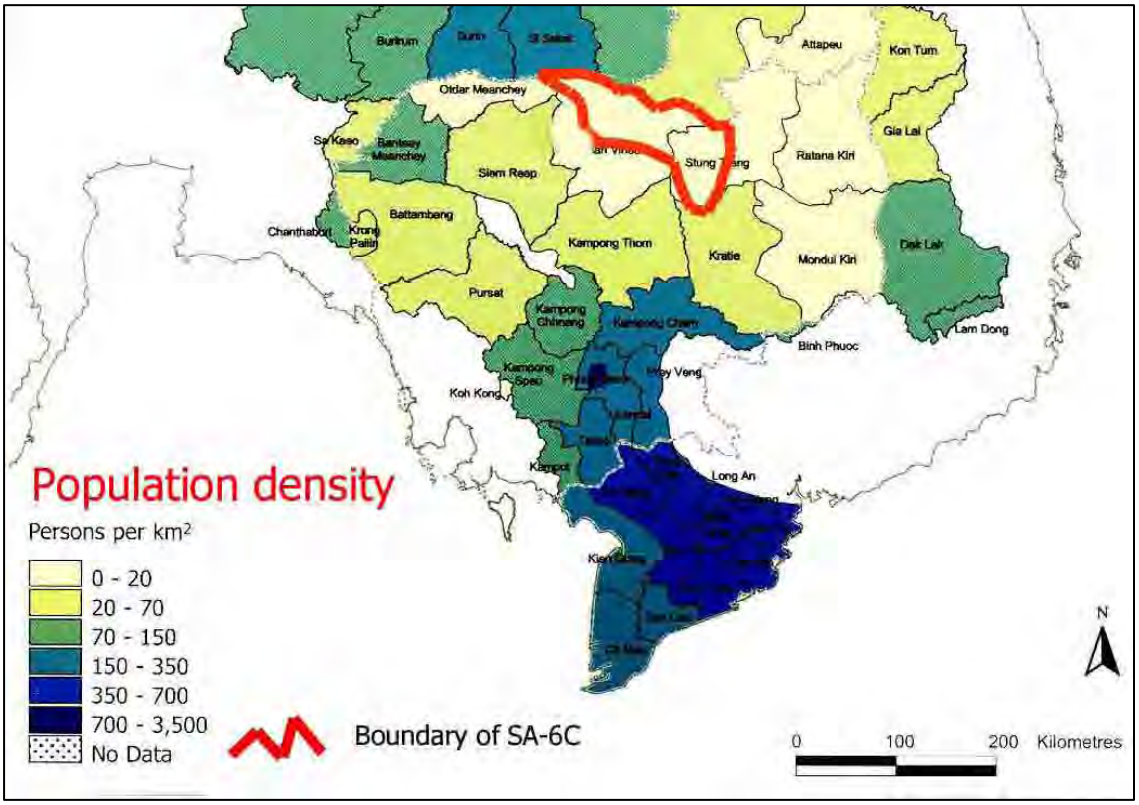
The 6C Sub-area is considered as the least developed area in terms of economy and social conditions, compared to other areas in the country, despite high potential for agriculture development.

Table 2: Socio-economic Indicators in Stung Treng in the 6C Sub-area (2002)

Indicators	Stung Treng
Population by sex	***91,795***
Female	47,236
Male	44,559
Population by age	
0-17 years	39,834
18-64 years	42,504
Over 65 years	9,457
Illiteracy (%)	30-40
Ethnic group (%)	23
People live under poverty line (%)	30
Access to clean water %	7-30
Access to public electricity service %	7
Occupation (%)	

Indicators	Stung Treng
Agriculture	80
Industry	2
Trade	13
Tourism	2.5
Other	2.5

Source: Provincial Reports, 2002.



Source: Social Atlas of the LMB (MRC), 2003.

Figure 5: Population Density of Cambodian in 1998

4.2.3. People's Health

4.2.3.1.Access to Safe Water

The population living within the 6C Sub-area has the poorest access to safe water in Cambodia, and is among the lowest in the entire Lower Mekong Basin. Less than 20% of the population has access to safe water. The implication of this is the high incidence of intestinal diseases, including intestinal diseases.

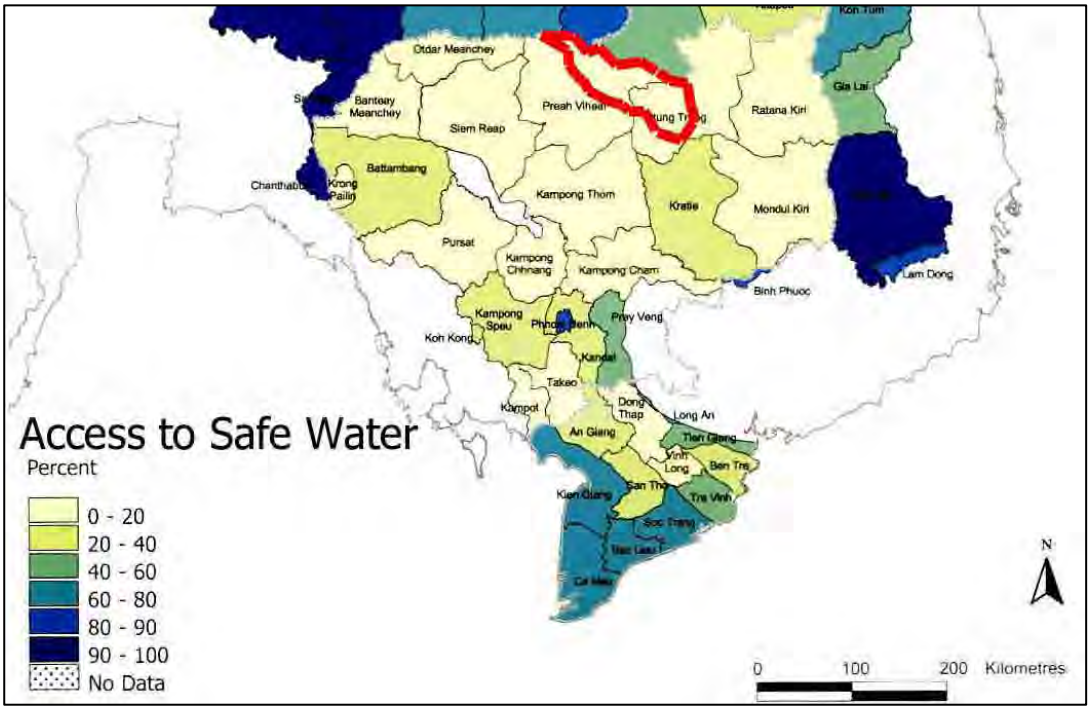


Figure 6: Proportion of Population with Access to Safe Water

4.2.3.2.High incidence of Malaria (Malaria cases per 1,000 people per year)

Malaria is most common in rural areas where mosquito habitats are found. The population of the 6C Sub-area faces the highest incidence of malaria in Cambodia and in the entire Lower Mekong Basin. 10 up to 100 malaria cases per 1,000 people per year are being counted there. Again, this is more common in the remote upland areas of the country, where it is difficult to reach people with prevention or treatment services.

There is a strong correlation between the prevalence of malaria and poverty, as poorer people are less able to prevent the spread of the disease or to seek cures. The disease has significant impacts on socio-economic development, as it can quickly develop to the stage of an epidemic within a given area and do great damage to economic productivity and social well-being

4.2.3.3.Child malnutrition (Proportion of children underweight for age)

Similar to the incidence for malaria, the population of the 6C Sub-area faces the one of highest proportion of children underweight for age in Cambodia and throughout the Lower Mekong Basin, with a rate of 40 up to 50 percent. Child malnutrition is closely related to high levels of poverty. Declines in child malnutrition often follow reductions of poverty.

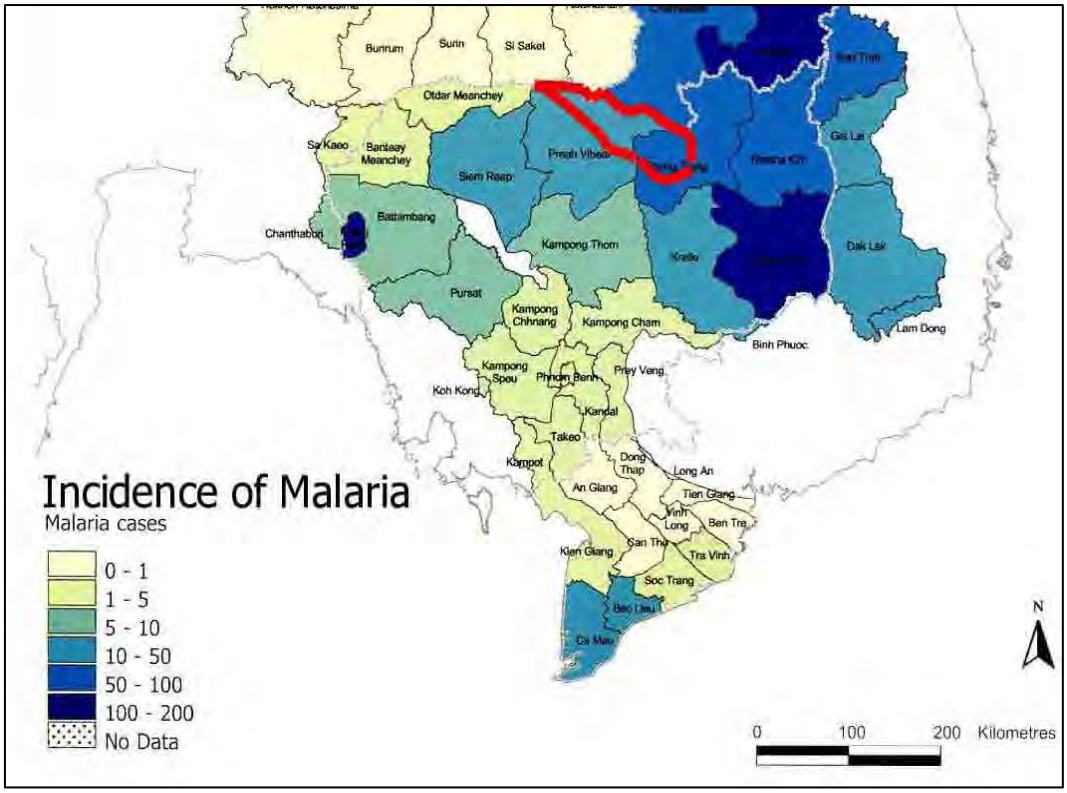
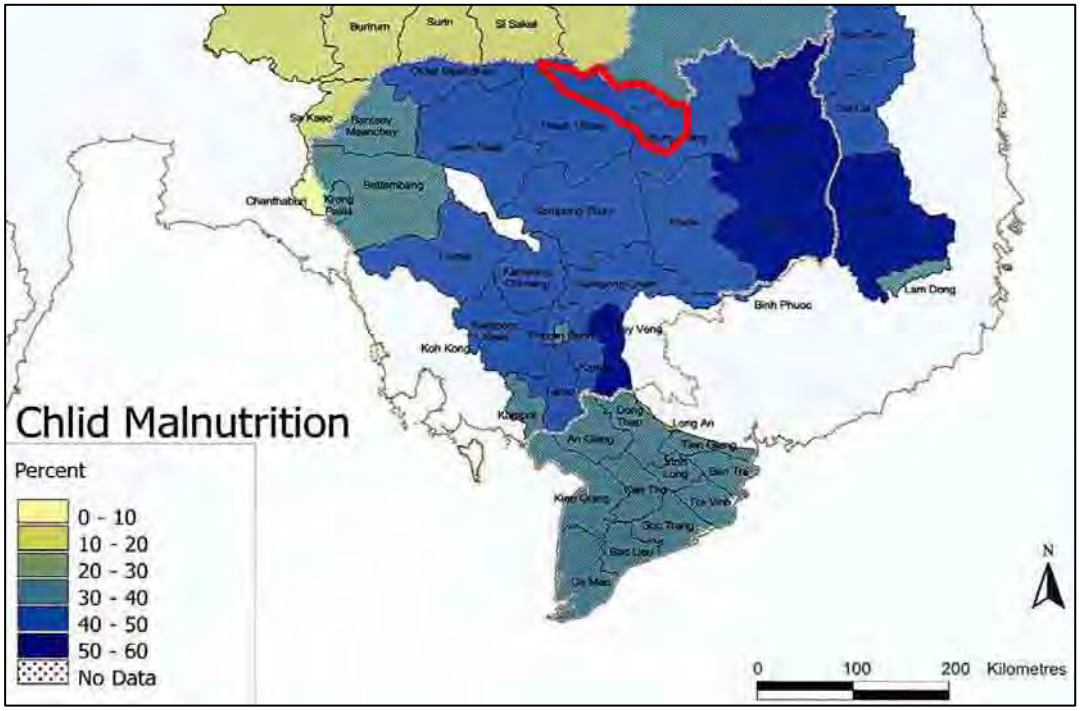


Figure 7: Malaria Case per 1,000 per year



Source: Health Survey, 2000.

Figure 8: Child Malnutrition

4.3. Water and Related Resources

Water resources analysis is a complex work which requires availability of comprehensive, accurate and updated scientific data. In contrast to the neighboring countries of the Lower Mekong Basin, Thailand and Vietnam, Cambodia is a country that crucially lack necessary data. For instance, according to N. Bonheur-2003, hydrological data related to the rivers of the Tonle Sap basin and river are available for only one hydrological year as collected by Carbonnel and Guiscafre (1962-63). With the support of the MRC, there have been some gauging stations installed in some rivers of the basin. In the below paragraph, attempt is made to provide a state of existing data that has been collected from various sources. Only fragmentary information has been gathered, thus possibility for serious and comprehensive analysis is limited.

According the BDP Inception Report (MRC, 2002j), water resources analysis should comprise three main components:

- Availability of water
- Demand of water
- Use of water

4.3.1. Availability of Water

This can be defined as the flow of water into a sub-area from upstream, plus the (surface and groundwater) resources generated by net rainfall in the sub-area, minus the ecological demand within the area at its downstream boundary. The availability changes slowly, from one decade to the next, due to medium-term climate variations, or due to constructions of reservoirs or diversions. The availability can be measured, and/or determined by numerical modeling, with an accuracy that is conditioned by the coverage and quality of the basic hydrological data.

4.3.1.1.Rainfall and Surface Water

Cambodia has access to substantial surface water resources. On average, the annual inflow from upstream countries is estimated at 410 km^3 and the internally generated flow 90 km^3 per year (MOWRAM, 2003). In Cambodia, the Mekong River flows from the North to the South, over a distance of about 480 km. Its drainage basin covers about 86% of the land area of the country. The Mekong River brings yearly floods of about 475km^3, and before flowing downstream, inundates the lowlands and where the floodwaters enter partially the Great Lake and eventually flow down the Mekong and Bassac Rivers.

4.3.1.2.River Discharge

The discharge during the dry season period (April – May) in 2003 is shown in the table below. A study by JICA has indicated that the dry season flows in Cambodian floodplains are strongly affected by tidal fluctuation.

Table 3: Effects of Tidal Fluctuation to the Dry Season Flow

Station	Average Flow (m^3/sec)	Range of Fluctuation (m^3/sec)	Fluctuation Rate (percent)
Kampong Cham	1,600	100	6
Chrui Changvar	2,000	1,500	75
Neak Luong	3,000	3,000	100
Monivong Bridge	100	150	150

Source: WUP-JICA, 2004.

4.3.1.3.Groundwater

Groundwater is presently used for two main purposes: domestic and drinking water supply and irrigated agriculture. The groundwater resource within the country has been subject to a few investigations but has not been comprehensively studied to date such that serious analysis or conclusions can be drawn. Most provinces include significant areas where groundwater is used as the main source of domestic water supply. As of 2001, withdrawal of groundwater for domestic and drinking water supply was approximately 2,147 cubic meters per day (CNMC, 2003).

4.3.2. Water Demand and Use

According to Nielsen (2004), the water demand is the amount required for a given purpose. The demand can be based on the *present* or *future,* and it can be *actual* (i.e. related to an available infrastructure) or *potential* (assuming full infrastructural development and no raw water shortage). The *serviceable* (part of the) demand is limited both by infrastructure and raw water availability.

A distinction can be made between *consumptive demand* (for households, industries and agriculture), and *non-consumptive demand* (for fisheries, navigation, and environmental preservation).

4.3.2.1.Domestic Water Use

Domestic water use includes water for normal household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and watering lawns and gardens. Domestic water use also includes drinking water and bathing water for livestock – this is an important issue for rural livelihoods

Increase of domestic demand is mainly based on the population growth. Assuming that the annual domestic demand is between 20 m^3 and 100 m^3, a total demand for domestic water is in the range of 286,000m^3 per day and 1.4 million m^3 per day. It is estimated that the domestic demand increased from 3.1m^3/s to 3.3m^3/s in 2002. The domestic water demand is shown in the below table.

Table 4: Domestic Water Demand

Population		Water Demand, m^3/day	
1998	**2002**	**1998**	**2002**
4,930,320	5,198,981	271,168	285,944

4.3.2.2.Agriculture Use

Cambodia has inventoried 946 operating irrigation systems[1] which can service 256,120 ha of the 2 million ha wet season cultivated area. In the dry season, rice is grown on 225,000 ha and 143,490 ha of this are fully irrigated by receiving irrigation water from irrigation schemes. Hence, only 12% of the wet season rice is irrigable, the remainder being rainfed and just over half of the dry season crop is irrigated, the remainder being recession rice receiving supplementary irrigation from manually operated and diesel driven pumps. Very few of the irrigation schemes are capable of irrigating all year round.

Fully irrigated crops utilize approximately 10,000 m³/ha. Some irrigation engineers in Cambodia estimate that recession rice receives approximately 4,000 m³/ha of irrigated water.

The water consumption for rice is high compared to other crops. The total water consumption is dependent on crop type, stage of crop growth, soil type, irrigation method, and so on. The water consumption for different kinds of crops and for rice is presented in the table below.

Table 5: Water Consumption within a Critical Period

Activity	Water Flow (l/sec/ha)	Water Requirement (m^3/ha/month)	Crop Irrigation Life (month)	Critical Period Consumption (m^3/ha)
Irrigated rice	0.8	2,074	3.5	7,258
Upland crops	0.6	1,555	4	6,221
Fruit trees	0.4	1,037	4	4,147

Source: MRC, 2003e.

Assuming that the water requirement during the critical period (February – May) for dry season irrigated rice and that for non-rice crops is approximately 0.8 l/sec/ha and 0.6 l/sec/ha respectively, hence the total water use for rice and non-rice crops is estimated at about 1,571 million m^3/month and 509 million m^3/month respectively.

On a nationwide basis, the LMB countries do not fully utilize their renewable water resources. Renewable water resources are equal to the total precipitation in the country minus evapo-transpiration. Cambodia and Laos use only 1% of their total renewable water resources for agriculture while Vietnam and Thailand use 5 and 20% respectively. Based on these figures, an average Mekong River flow of 460 km³ each year can service

[1] The inventory of irrigation systems in Cambodia is not comprehensive and it is likely that there are significantly more systems and larger potentially irrigated areas than this.

the irrigation requirements of all LMB countries 11 fold. An annual Mekong river flow can also service approximately 64 million ha of fully irrigated rice based on a consumption of 10,000 m³/ha (1 meter of water) per crop. This compares with the 1999/2000 area of 2 million ha of dry season cropping in the LMB watersheds.

Therefore, there is no shortage of water in the Mekong River to service agriculture in its watersheds if all water is captured and redistributed when required. This is, of course, not the case, with a majority of water flowing through to the ocean during the wet season when crops receive most of their water requirements directly from rainfall. Water shortages may occur (especially in the Mekong Delta) during the months of February to May when water flows in the Mekong River are at their lowest. Crop irrigation is the major consumer.

4.3.2.3.Ecological Demand

Ecological demand (of water) is a minimum stream flow or water level required for prevention of irreversible ecological degradation. The ecological demand varies from year to year and from place to place. The flow must be high in the wet season in order to maintain a healthy environment; for instance, fish species mainly rely on annual floods for their reproduction.

Some figures on water demand and use
Total water demand/capita = 150 m³ per capita per year Share agriculture = 94% Share Municipal and Industrial = 6% Municipal and Industrial withdrawal 1990 = 78 million m³ Municipal and Industrial withdrawal 2020 = 187 million m³ (Source: Ringler, 2001 in MRC-BDP Planning Regional Sector Overview 2002) Total water demand = 0.5 Bm³ per year Internal water supply = 1,004 m³ per person Water for domestic use = 5% Water for industrial use = 1% Water for agricultural use = 94% These figures will change due to future development in the LMB that bring about changes in the river hydrology. (source: CNMC, 2003)

4.3.3. Major Legal and Policy Documents pertaining to Watershed Management in Cambodia

- Land Law (endorsed in August 2001);
- Law on Commune Administration Management (endorsed in August 2000);

- Law in environmental protection and natural resource management (endorsed in November 1996);
- Forestry Law (already submitted to the Council of Ministers in July 2001, but has not yet passed);
- Sub-decree on forest concession management (signed by the Prime Minister in February 2002);
- Law on Water resources management (draft);
- National Water Resources Policy (endorsed by Council of Ministers in January 2004);
- Water Sector Roadmap (prepared by MOWRAM in July 2004);
- Decentralization and devolution Policy of the Ministry of Interior;
- 5 year socio-economic Development Plan (2001-2005); particularly relevant for poverty alleviation;
- Interim Poverty Reduction Strategy Paper;
- Agricultural Development Plan (2001-2005);
- Action Program for the Development of Agriculture in Cambodia (2001-2010;)
- Government Action Plan 2001, which includes a section specifically dealing with natural resources management;
- Draft Policy for Ethnic Minority People's Development, also called "Highland Policy" (Sept. 1997, not yet ratified by the Council of Ministers); and
- Forest Policy- currently being draft by a national working group.

4.3.4. Policy of Water Resources and Meteorology Development

To implement the programme of the Cambodia Royal Government and accelerate economic development, the Ministry of Water Resources and Meteorology has set four policies for social development and in particular poverty reduction, which are as follows:

- To increase the irrigated area of rice production from 16.6% to 20%, through water storage during the wet season for double crop production, with a view to increase job opportunities and income of the population in the rural areas.
- To take a leading role with regard to drainage, water conservation, water resources development to the benefit of the population by developing drainage systems and flood protection dikes.
- To study surface water and groundwater to ensure water quantity and quality management in an integrated manner and determine the balance between demand and water availability.
- To improve weather forecasts, hydrological forecasts and ensure the timely warning of natural disasters such as typhoons, floods and drought to the population in the whole country.

4.3.5. Government's Goals in the Water Resources Sector

1. To implement viable irrigation systems based on local cost recovery,
2. To develop hydropower, focusing on multipurpose projects

3. To increase the domestic technical capacity and databases needed for effective water resource management capacity.

Water resources management is addressed in section 11.9 in the current 5-year socio-economic development plan (2001-2005). Details are found in the separate policies and activity plans for each ministry, as presented in their respective 5-years plans and 3-years Public Investment Programs (PIPs).

The national targets for access to safe water are as follows:

- Rural population: from 29% in 2000 to 40% in 2005.
- Urban population: from 48% in 2000 to 87% in 2005.

4.3.6. Analysis

- Data gathered from diverse sources are fragmentary, inconsistent and vary widely from one source to another. This lack of capacity of the Cambodian institutions to produce accurate and reliable data on water resources (surface and groundwater) seriously impacts on any possibility to plan, manage and evaluate actions aiming at securing water availability for the population for better access to water and greater development opportunities, be they irrigated agriculture, fisheries, tourism, industry and/or navigation.
- Potential water availability is huge including groundwater, but the effective access of the population to water is limited because of weak management expertise of relevant institutions, lack of infrastructure and budget. Therefore, water is not available at when it is needed.
- Cambodia's challenge related to water is threefold; technological, institutional and social. Technologically, the main challenge is water control including flooding control and warning systems set up. The latest technologies based on satellite imagery and GIS are capable to assist man in forecasting and warning about some natural calamities and thus, to minimize their disastrous impacts on human activities. However, these technologies are expensive and require a corresponding level of technical capacity to be able to take advantage of them. Institutionally, there is a need to achieve the reforms so that competent human resources are employed and overlapping mandates between rival institutions reduced, for the sake of more efficient and effective water resource management and exploitation. Efforts in capacity building must continue and funds allocated to this task.
- Socially, the challenge is to enable equitable access to water resources to the population, especially the poorest and the rural inhabitants. Access to safe water should be nation-wide and a priority for further policy enforcement.
- The impressive panoply of existing laws, regulations and policies is conducive to rational and sustainable watersheds resources management on the condition that there is real and sufficient political willingness for enforcement.

4.4. Trends

4.4.1. Water Resources Threatened in Terms of Quality and Quantity

Many sectors rely on water resources, e.g. agriculture, fish production, biodiversity, water supply, sanitation, transport and hydropower. The current trend is a shortage of water supply in many areas, including domestic purposes. Serious competition for water is intensifying between fast growing population and irrigation development. In this basin, shortage may be provoked by over-use of water or more, because of lack of development of infrastructure. No serious pollution issue has been reported there.

Geo-hydraulic conflicts resulting from hydropower and dams construction by the riparian countries have already arisen in the near future, because both quality and quantity of water are affected. Hydropower involves dam building which requires water diversions. Conflict may arise between upstream countries and downstream countries because of water scarcity and/or unequal allocation. The most crucial is perhaps where a basically agricultural country risks losing the access to the water sources and thereby being deprived of the chance of achieving food security, poverty alleviation, and possible economic growth (Öjendal, 2000). Furthermore, aggressive and hostile capture could lead to tensions and conflicts through population movements, group identity conflicts, economic deprivation and/or civil strife (Ibid).

The trans-boundary implications of hydropower projects on water quality and quantity are numerous. Risks for riparian countries need to be objectively assessed.
The first risk of hydropower projects development in the upstream area of the Mekong River is the negative impact on the environment and society. Those risks have been duly identified as:

- Adverse impacts on the ecosystem (aquatic life, animals, birds, vegetation);
- Blocking of the flow of sediment;
- Negative impacts due to changing a river's flow pattern;
- Negative social impacts (resettlement, loss of livelihood);
- Loss of scenic landscapes (tourism potential);
- Negative impacts on water quality due to storage of water (eutrophication, lower temperatures for discharged water);
- Negative impacts to other users of water (navigation, fisheries);
- Problems during the construction period (noise, vibration, dust, traffic problems);
- When associated with irrigation, land Stalinization and water logging; and
- Danger from sudden and unexpected release of water from flood spilling or hydropower generation.

The second type of risk is geo-political, i.e. the inevitable dependence of countries who do not possess hydropower upon those who develop hydropower projects. Cambodia is particularly vulnerable because it will certainly depend more and more on Thailand, Laos and Vietnam for power supply. A cut-off of power supply by power producers would seriously impede any possibility for Cambodia to achieve its development goal and

strategies, e.g. to alleviate poverty, to improve the population livelihood, to welcome further foreign investments, to sustain tourism development, etc.

4.4.2. Degradation of Environment

No data and information are available.

4.4.3. Land Encroachment and Speculation

No data and information are available.

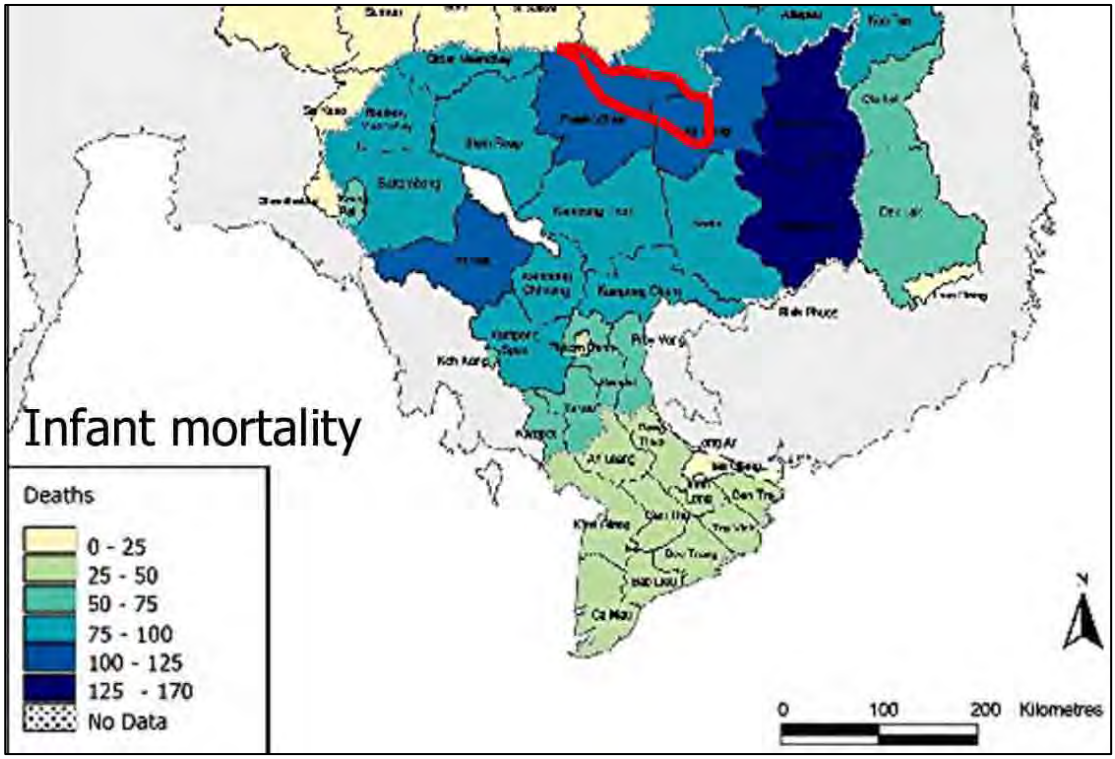
4.4.4. Intensification of Population Pressure through Migration

No data and information are available.

4.4.5. Aggravation of Vulnerability of the Poorest

In Cambodia, half of the villages have between 40-60% of the households below the poverty line with a peak of 80% in some areas (MRC, 2003c). Many households have no land holdings and are entirely dependant on fishing and foraging, with access to fishing areas often under dispute. If conflict and instability are major causes of poverty, impoverishment originates from poor access to health and education services, lack of land ownership, women's social deprivation and increasing vulnerability to natural

calamities. Demographic pressure on the environment resulting in degradation is also a mechanism of impoverishment of the vulnerable in terms of limited access to resources. This trend is aggravated by the inadequacies of the governance system.



Vulnerability of the deprived population can be seen through many socio-economic disparities, e.g. the infant mortality. The 6C Sub-area has one of the highest rates of infant mortality with 100-125 deaths in one year per 1,000 live births. The factors influencing these rates include low birth weights, diseases such as diarrhea, dysentery and malaria; and poor access to adequate health services.

4.5. Tran-Boundary Issues

Identification and analysis of trans-boundary issues are crucial for planning and decision-making of the riparian Governments. The following are five key trans-boundary issues identified for the BDP of the 6C Sub-area.

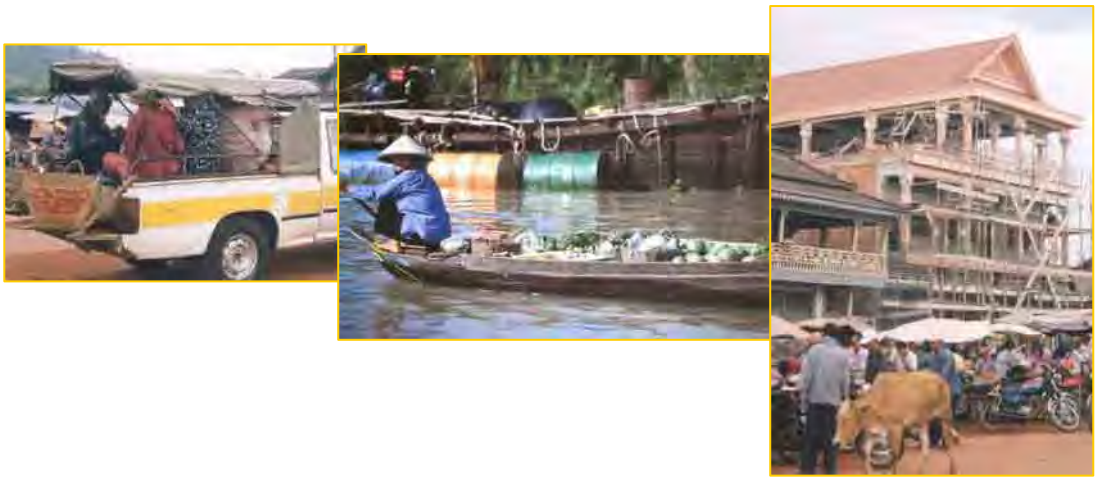
4.5.1. Environmental Degradation

Deforestation impacts on the environment beyond the boundaries of the concerned country. The most direct environment consequences of deforestation are the depredation of the forest biota in the deforested area. Because forests are almost always more biologically diverse than the system with which they are replaced, this usually results in a local loss biodiversity, and potentially a reduction in global species diversity (MRC, 2003d).

The agricultural encroachment that follows deforestation often causes the loss of traditional land use rights and traditional conservation mechanisms. The changes threaten the ecological balance at large as well as the livelihood, or even the existence, of the indigenous peoples and their cultures (Himel & Nhem, 1997). As should be obvious, no single actor has the power to control the situation in a real sense. Instead, a multitude of various interests – ranging from local businessmen, to local and so local military, national level politicians, multinational companies and international development agencies – have approached the area with plans on how to tap its riches (Sam Ath Sith et al, 2002a).

Development workers who live in the area expect accelerated land grabbing, illegal logging, legal but disastrous logging, cash-crop farm establishments, and dam building in the near future. Some have come to the conclusion that in perhaps five years from now there will be virtually no primary forest left, apart from a few areas that have been either labeled protested or turned over for community management (e.g. Virachey National Park which covers a large part of northern Ratanakiri). The previous primary users, the indigenous population, tend to be the one with the least chance of making their voices heard and having their rights protected. Already on a number of occasions, they have been pushed aside (Colm, 1997).

4.5.2. Population migration



Migration is another trans-boundary issue of concern in terms of social and geo-political implications. The search for employment is a major cause of migration. Seasonal and semi-permanent migration to urban areas provides important income for households in

rural areas. Several different types of migration appear to be taking place at the same time, as suggested by national level data from Cambodia and Thailand. The largest movements are between rural areas. People relocated from densely populated rural areas to remote ones to seek new economic opportunities. Economic development in the Lower Mekong Basin, especially in urban centers, creates strong attraction for rural people because jobs are more numerous, better paid and services are more developed.

Human migration also facilitates propagation of diseases which bypass economic, political, administrative or international boundaries. For instance, the rapid spread of HIV/AIDS, SARS and some other epidemics, for e.g. Avian Fever, is increased by the population movement all around the world, regionally and internally as one of the effects of migration supported by tourism industry development and waterway and inland transportation rehabilitation.

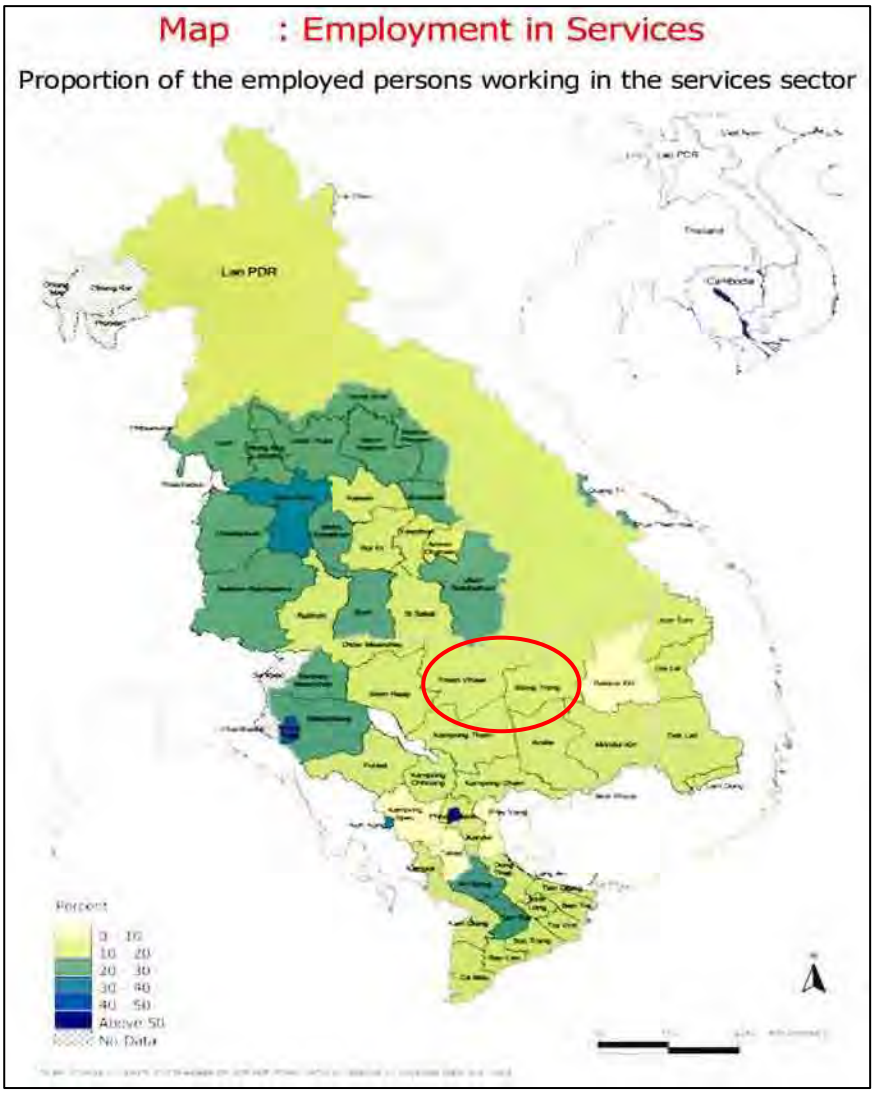


Figure 9: Proportion of the Employed Persons Working in the Services Sector

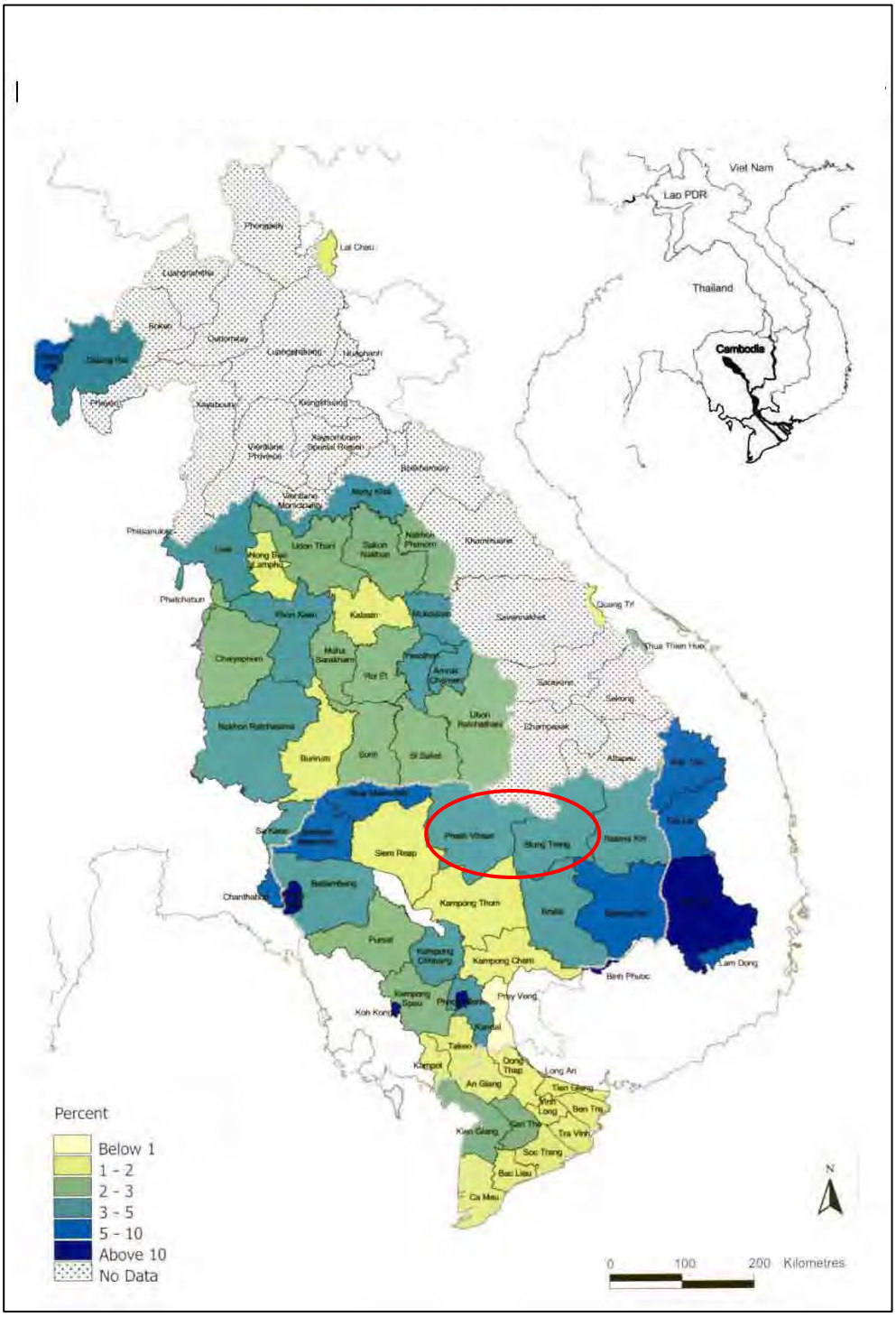


Figure 10: Proportion of the Employed Persons Working in the Services Sector

4.5.3. Fishery Resources Management

Trans-boundary Factors Impacting on Fisheries Resources:

- Development of water resources, particularly dam and weir construction for hydroelectric power, result in drastic changes in water levels, increased turbidity and reduction in nutrient levels. Dams also impact upon water quality, affecting downstream total suspended solids and nutrient levels, especially total phosphorus and dissolved oxygen levels. Oxygen-consuming decomposition of organic material mainly occurs at the bottom, and the bottom water can become hypoxic or even anoxic if the reservoir is stratified. If oxygen-depleted bottom water is released from a dam, fish kills can occur downstream.
- The introduction of exotic fish species – if uncontrolled – represent a serious threat for biodiversity through hybridization, destruction of local species and competition for food and habitat. A good illustration of this is the introduction and the banning of freshwater species "Trey Chap" (Pirania sp.) from foreign countries for aquaculture purposes. Carnivorous and voracious, "Trey Chap" has caused significant damage to local species of fish.
- The increased and irrational use of chemical pesticides, herbicides and fertilizers in the agriculture sector is also causing harm to the fisheries habitat and aquatic eco-system, through eutrophication and water pollution by aggressive chemical molecules, some of which (e.g. DDT and Dieldrin) have been banned from use by WHO and other relevant international institutions, but not yet from production and commercialization.

4.5.4. Hydropower

4.5.4.1. Cambodia's Demand of Electrical Power

The country's demand of electrical power is projected to increase from 251 MW to 746 MW between 2000 and 2016. Previous feasibility study reveals potential hydropower in Pursat (3.5 MW) and Stung Sen (38 MW) (Bohneur, 2003).

4.5.4.2.Potential for Hydropower Development in the Mekong Basin

The total potential for feasible hydropower projects in the four Lower Mekong Basin countries is approximately 30,000 MW including 13,000 MW on the Mekong's Mainstream, and the remaining tributaries' potential (13,000 MW in Lao PDR's tributaries, 2,200 MW in Cambodia and 2,000 MW in Vietnam).

Table 6: List of Completed Hydropower Projects (10MW<)

Country	Name	Location	Capacity (MW)	Output (GWh/year)	Commissioning
China	Manwan	M	1,500	7,870	1993
	Dachaoshan	M	1,350	5,930	2001
Lao PDR	Nam Ngum	TR	150	900	1971-85
	Xeset	TR	45	150	1991
	Theun Hinboun	TR	210	1,645	1998
	Houay Ho	TR			
	Nam Leuk	TR	60	184	2000
Thailand	Sirindhorn	TR	36	115	1968
	Chulabhorn	TR	15	62	1971
	Ubolratana	TR	25	75	1966
	Pak Mun	TR	136	462	1997
Viet Nam	Dray Ling	TR	13	70	1995
	Yaly	TR	720	3,642	2000

Note: TR = Tributary, and M = Mainstream
Source: MRC, 2002g.

Only 5% (1,600 MW) of the Lower Mekong's hydropower potential have been developed, and all projects are on the tributaries, not on the mainstream. There is also huge hydro potential in the Upper Mekong Basin. In Yunnan Province of the People's Republic of China, total hydro potential is an estimated 23,000 MW, and two projects, totalizing 2,850 MW, have already begun operating.

4.5.4.3.Analysis of Trans-boundary Implications of Hydropower Projects

Obligation of consultation between countries:

In signing the 1995 Agreement that established the MRC, member countries all agreed that before any hydro project can be built on the mainstream of the Mekong, all four member countries must agree. Furthermore, the 1995 Agreement obligates member countries to ensure that no harmful effects will occur downstream in neighboring countries. One problem is that China and Myanmar are not signatory to the MRC

Agreement: thus, China is building dams with a high storage capacity without consultation and participatory evaluation of impacts downstream, which puts downstream member countries in a position where they have to compensate for water capture carried out upstream without full understanding of the operations of the upstream dams or their likely impacts.

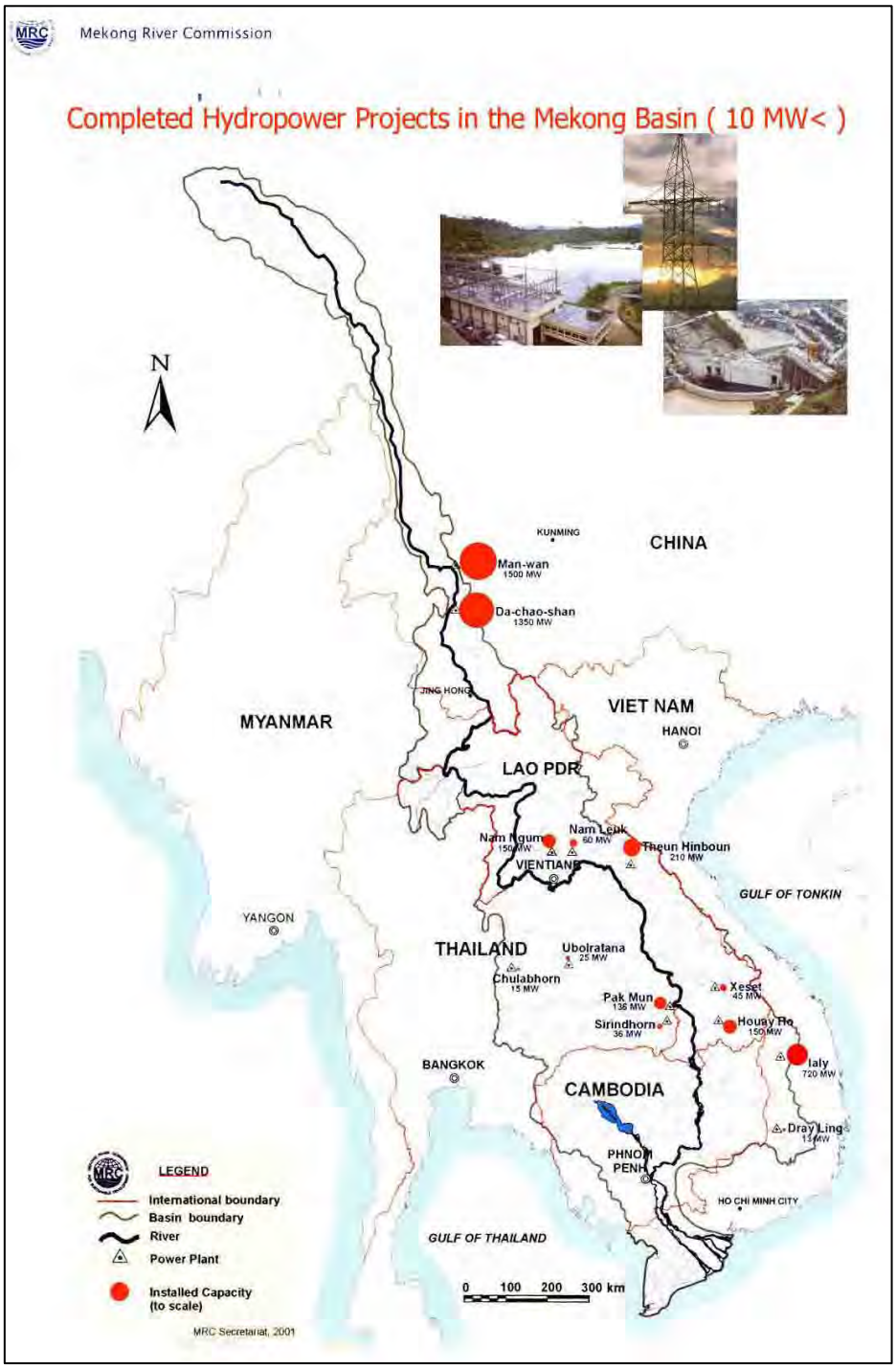


Figure 11: Completed Hydropower Projects in the Mekong Basin

Risks for riparian countries:

The first risk of hydropower projects development in the upstream area of the Mekong River is the negative impact on the environment and society. Those risks have been duly identified as:

- Adverse impacts on the ecosystem (aquatic life, animals, birds, vegetation);
- Blocking of the flow of sediment;
- Negative impacts due to changing a river's flow pattern;
- Negative social impacts (resettlement, loss of livelihood);
- Loss of scenic landscapes (tourism potential);
- Negative impacts on water quality due to storage of water (eutrophication, lower temperatures for discharged water);
- Negative impacts to other users of water (navigation, fisheries);
- Problems during the construction period (noise, vibration, dust, traffic problems); and
- When associated with irrigation, land Stalinization and water logging.

Geo-hydraulic conflicts:

Hydropower involves dam building which requires water diversions. Conflict may arise between upstream countries and downstream countries because of water scarcity and/or unequal allocation. The most crucial is perhaps where a basically agricultural country risks loosing the access to the water sources and thereby being robbed of the chance of achieving food security, poverty alleviation, and possible economic growth (Öjendal, 2000). Furthermore, aggressive and hostile capture could lead to tensions and conflicts through population movements, group identity conflicts, economic deprivation and/or civil strife (Ibid).

Progress generated by Hydropower projects:

Quite a number of positive impacts of hydro projects deserve to be highlighted:

- Harnessing of a renewable natural resource;
- Reducing of the negative impacts that power generation has on the global environment (e.g. use of fossil fuels reduced, thus will lessen air and water pollution);
- Increasing the river's flow in the dry season, and reducing peak flow during the flood season;
- Increasing the availability of electrical power will stimulate economic development and improve people's living standards; and
- Revenues will be earned from the sale of power.

4.5.5. Soil and Water Conservation

The tenuous situation of most rural people stems from their difficult situation as subsistence rice farmers dependent on making a living from poor quality soils and uncertain and inconsistent rainfall. This is clearly identified usually by requests to solve the water problem with "irrigation". Yet often the problem is not just water shortage but flooding due to poor drainage or pests associated with a drought period or low yields that prevent farmers from escaping the debt cycle caused by a failed crop.

A more holistic approach to these problems is to examine the situation within the framework of soil and water management and conservation. Cambodia was previously able to produce large surpluses of rice without major investments in irrigation reservoirs by utilizing local knowledge and resources and smaller investments to improve the rice cropping situation[2]. Many traditional techniques of soil and water control have been developed over the course of centuries of rice farming that involve flood spreading, water harvesting, storage, drainage, soil conservation through bundling and field leveling and improved crop management.

Numerous small-scale improvements in infrastructure are proven to work and contribute to the catchment's response to rainfall thereby contributing to the reduction of downstream flooding and sedimentation. In addition, the better soil and water conservation improves the viability and performance of larger investments in the watershed and reduces pressure for populations to migrate from tenuous economic situations to put more pressure on important areas like the Tonle Sap flooded forest or overcrowding urban areas.

The overall water balance within the sub-basins can be greatly improved through widespread application of these techniques that have the corollary effect of increasing the absorption of rainfall and runoff into the soils and thereby increasing the quantity of groundwater available. The groundwater provides the base flow in the rivers during the dry season, and thereby contributes the necessary volume to maintain the situation in the Mekong Delta area downstream from increasing encroachment of seawater.

Through careful management of the watersheds to maintain and conserve local resources, the environmental situation throughout the basin is improved and the local people's ability to respond to natural disasters is strengthened.

[2] For example, during the "Sangkum Reastr Niyum" period of 1953-1969, a rural engineering department mobilized local people and leadership to work together on small-scale water resource projects appropriate to the village that gained good success for a relatively small investment.

CHAPTER 5: THE AGENDA FOR DEVELOPMENT

5.1. Key Development Objective

5.1.1. Development Needs and Priorities

Development Needs and Priorities
Access to electricity
Agro-industry processing and handicrafts
Conserve fisheries critical habitats and spawning grounds
Construction of solid waste disposal sites and processing
Control riverbank erosion of mainstream Mekong and tributaries
Control siltation of the mainstream Mekong and its tributaries
Development of agricultural research system
Establishment of liquid waste treatment in urban towns
Expansion of clean water supply system
Food security
Improve concession management and land tenure for people
Improve national and provincial road network
Improve navigation channels along mainstream Mekong and tributaries for river transport
Improvement of hygiene and sanitation
Improved land use and management
Increase groundwater exploitation for rural water supply
Increase international, regional and national tourism
Increase participation of women in leadership roles
Irrigation system rehabilitation and development
Manage and mitigate negative impacts from upstream dams on downstream people and locations
Market for agricultural products
Flood preparedness, warning systems and disaster relief
Poor soils improvement/management
Promote human resources development
Protect flagship fisheries species for biodiversity and eco-tourism
Protect the wetlands
Protection and improvement of tourism areas
Protection of national parks and sloped forest lands, natural forest
Reduce illegal fishing methods and over-fishing
Repair and construct flood protection system
Strengthen institutional education
Strengthening and expanding agricultural sector

5.1.2. Short-term Development Objectives (5-10 years)

Short-term Development Objectives (5-10 years)
Address impacts from upstream tributary dams through cooperative management and sharing of information
Environmental awareness and education and link to eco-tourism to generate economic growth and jobs
Expand and increase irrigated agriculture development
Flood and drought management
Improve concession management and land use, rights to land
Improve navigation and ports to increase waterways transport
Increase diversification of farming and development of markets
Increase micro-hydropower infrastructure and prepare feasibility study for large-scale hydropower project
Prepare and implement management plan for protected areas and national parks and critical upper watersheds
Promote economic sector and attract industrial production to create more jobs
Promote science and economic research for development
Promote social and cultural development
Promote the establishment of agricultural development community and water user community
Protect and conserve deep pools and dolphin habitats/numbers
Protect indigenous culture and traditions and promote tourism
Reform trade along the borders
Rehabilitate national and provincial road network to increase traffic and reduce transport and travel costs and time
Sustainable natural resources use and management
Train human resources knowledge and skill to attract private investors

5.1.3. Long-term Development Objectives (20 years)

Long-term Development Objectives (5-10 years)
Develop agro-industry for exportation
Develop border regions and open market opportunities with the neighboring countries, particularly with the riparian countries of the GMS
Ensure urban and rural water supply and control of bank erosion
Ensured water supply for the entire urban and rural population
Expand and increase irrigated agriculture development
Flood and drought management
Improve navigation and ports to increase waterways transport
Improved upland farming systems: land-water-forest and crops
Increase micro-hydropower infrastructure and prepare feasibility study for large-scale

Long-term Development Objectives (5-10 years)
hydropower/irrigation project
Integrated forest management
Prepare and implement management plan for protected areas and national parks and critical upper watersheds
Promote environmental, cultural and agro-tourism between Cambodia, Laos and Vietnam along the Mekong River
Promote infrastructure development, science and economic research for development
Promote social and cultural development
Promote the establishment of agricultural development community and water user community
Protect and maintain the traditions and culture of minorities
Protect the mainstream Mekong from bank erosion especially between Stung Treng and Laos
Rehabilitate national and provincial road network to increase traffic and reduce transport and travel costs and time
Sustainable natural resources use and management
Train human resources knowledge and skill to attract private investors
Water resources management

5.2. Identification of Assets

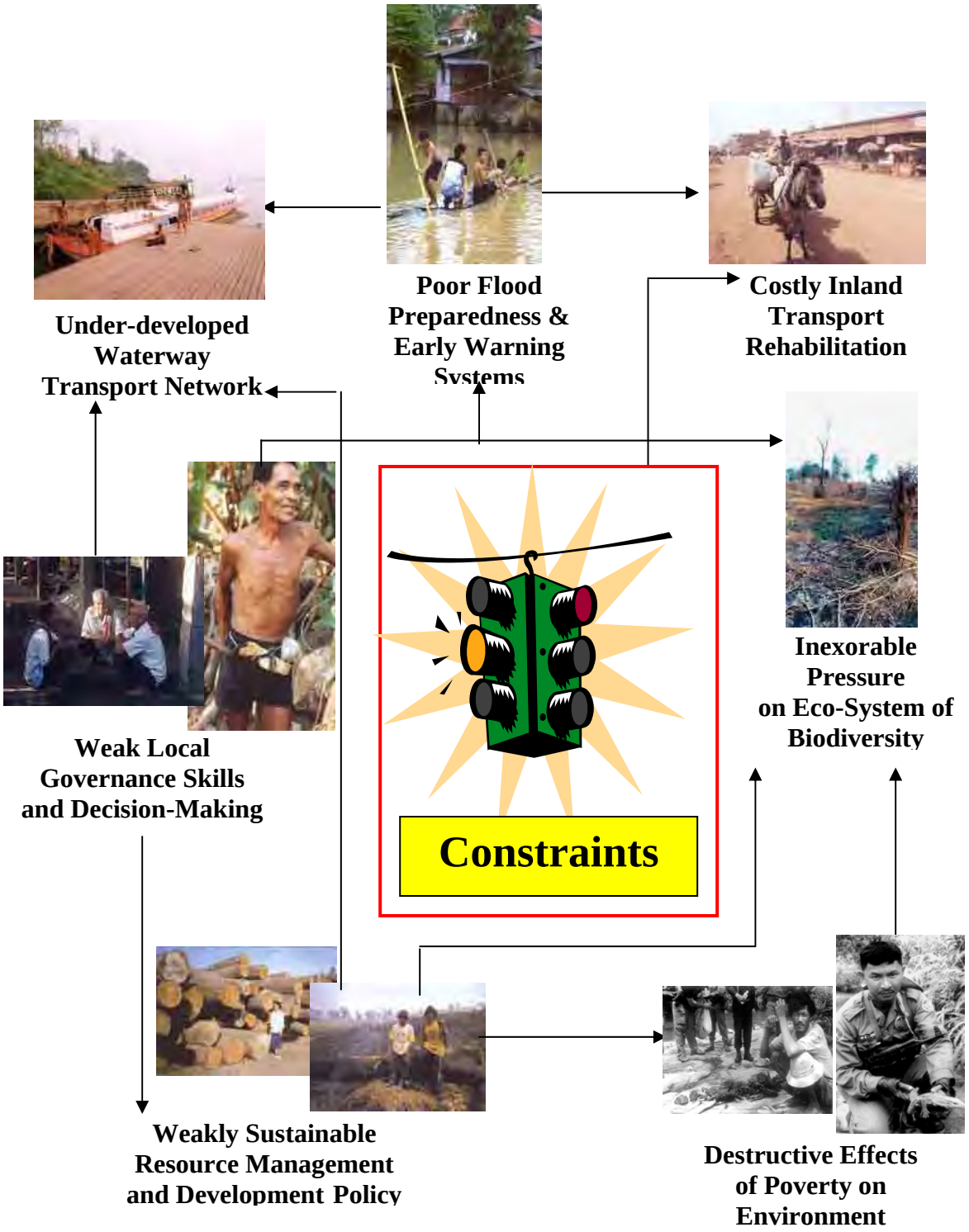
Assets can be defined as resources – both natural and manmade – as well as opportunities which rational exploitation is able to provide economic and social benefits to all layers of the society.

Assets of the sub-area identified by SAWG and agencies involved during data and information collection, meeting and Forums are as follows:

- ***The Mekong River****:*
  - Fishery resources
  - Deep pools for fish spawning
  - Flooded forest
  - Ramsar wetland
  - Bamboo bushes
  - Waterway transport
- ***Stream, lakes:***
  - Fishery resources (e.g. Pasahi fish in Stung Treng)
  - Small-scale navigation
  - Small-scale hydropower

- ***Water resources***
  - Hydropower
  - Irrigation schemes
  - Water supply for domestic use
- ***Mine:***
  - Gold, silver, stone, chalks, nitrate
- ***Forestry, national parks and waterfalls:***
  - Habitats for wildlife
  - Biodiversity eco-system
  - Forest products
  - Natural waterfalls
- ***Agricultural land:***
  - Red soil
  - Watershed
  - Grass land
- ***Cultural heritage:***
  - Temples, tourism sites, historical centers, sacred sites (Preah Vihear)

5.3. Constraints



5.4. Risks of Intervention

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
Deforestation impacts on economy and society. Unimpeded semi-illegal and illegal logging is perhaps the biggest problem in Kratie, Stung Treng and Mondulkiri. The negative consequences of logging are manifold and the minority ethnic population suffers the most severe and direct consequences. The collection of Non-Timber Forest Products (NTFPs) is vital for food security because it provides supplementary nutrition that can be sold. Where careless logging is practiced, discarded logs and litter rivers. Traveling through the area to collect products become difficult, aquatic resources are destroyed and fish migration is disturbed. Biodiversity would ultimately be threatened if logging were to continue at the same pace. Industrial and anarchic exploitation are main causes of this depredation.	***Opportunities:*** Presence of biodiversity eco-system is of interest for funding agencies. The unique ecosystem able to provide substantial and diverse resources to insure quality livelihoods. ***Constraints:*** Strong conflict of interests. Weak local governance. The forestry sector appears to be the most difficult one to regulate through decentralization. It is also the natural resource over which the national government is least willing to hand over power. Enforcement of regulatory framework is challenged by impunity and highly profitable practices.	To prepare feasibility studies and project proposals for funding and submit to interested donors. To map and delineate which areas are to be preserved and which are allowed to be developed and to demarcate and patrol those areas designated for preservation. Capacity building and awareness raising on the issue. To appeal to the highest powers to prevail upon them to reduce these activities and support the preservation of the remaining area. Another option is to publicize the problem so that public support is gained and pressure placed on these interests.	Dependence upon aid agencies and banking institutions Over-exploitation of natural resources at the expense of the environment. Long process

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
Decline of fishery resources and degradation of refuge for spawning and breeding such as deep pools in the provinces of Stung Treng and Kratie are of great concern. This threat is mainly provoked by the development of big hydropower projects in the upstream part of the Mekong River and its tributaries, e.g. in China, Vietnam, Laos and Thailand. The dam's damage to downstream fisheries is irreversible and devastating to inhabitants who depend heavily on fish for protein and their means of their living.	***Opportunities:*** In the provinces of Stung Treng and Kratie, 58 deep pools have been identified to be primary rearing and dry season refuge for large catfish and carp. Some fish habitats in the upper stream part of the Mekong River, called Khone Falls, are important feeding grounds and dry season refuge for the Irrawaddy dolphins as well as a spawning area for Giant Carps. ***Constraints:*** Weak legal framework in Fishery resources management and development Weak local governance. Lack of government resources to conduct research and recommend measures.	To strengthen legal framework in fisheries resource management. To build capacity through "learning by doing", thus this intervention could best be combined with the intervention requesting assistance from the outside aid agencies as a means of addressing the core issues in a capacity-building and participatory manner. Capacity building and awareness raising on the issue. Others who might be targeted include those who are damaging the resources as a whole, such as China (dam building on the upper Lancang /Mekong), those engaging in destructive fishing practices such as using illegal gears and explosive /electrical fishing. It is best to formulate the problem and idea to solve it prior to approaching aid agencies in order to maintain more input and control of the solution. Political appeals and campaigning: Appealing to the highest authorities appears to have an impact on returning control of some resources to the local people. This is often brought about through a campaign both through the media and other methods to raise public awareness and bring pressure on the authorities for change.	The long process does not fit with immediate individual interest. The long process does not fit with immediate individual interest or long-term planned international projects (transboundary issues). Dependence on aid agencies.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
There is an immediate need for poverty alleviation so that pressure on environment and fishery resources can be regulated and relieved. The province of Kratie has quite a high percentage of population living below the poverty line with a poverty rate of 30-40%.	Tourism industry development will create a number of job opportunities. However how many of those opportunities are provided to the poorest people is the real question, because the poorest don't live where tourists tend to go for the most part. They are in a subsistence economy so don't produce things that tourists are interested in buying. They are the least trained and adapted to enter the service industry so are least likely to gain jobs from the tourist sector. The most concerning matter is the harm provoked by sex tourism industry on the most vulnerable people, especially young rural women and children (pedophilia). Road infrastructure improvement facilitates investments. Impacts on the poor remain to be assessed, but the expected results are to bring opportunities for the poor to access education and health services markets for their produce and to get to places where they can find seasonal jobs,	To strategize tourism development plan to attract investment so that job opportunities are effectively enhanced. To maximize the potential of the - indeed - rare tourism sites, e.g. the Irrawaddy dolphin sites in Sombok Commune in Kratie, eco-tourism tours in Mondulkiri, creating new tourism destination in Stung Treng in connection with the visit of Khone Falls in Laos, etc…	Pressure on environment and social side-effects. Limited interest of tourists on this new concept of eco-tourism. The extinction of the Irrawaddy dolphin to limit the sustainability of tourism investment in Kratie.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	knowledge and information.		
	Abundant fishery resources insure food security.	To enforce fishery res. management and development policy.	
	A number of unqualified migrants.	To have clear and enforced immigration policy and regulations. To train and educate young people through non-formal education programme.	Conflict of interests.
	Weak provincial development policy and strategies.	To promote the private sector investment through transparency, incentives and access to cheap and sufficient credit.	Trained skills do not fit with labor market.
	Difficulty in land law enforcement. Low salary/income.	To protect women from sex industry through law enforcement.	
			Lack of interest upon the limited investment opportunities.
			Long process....
Water pollution and solid waste disposal	No data available to know the state of water quality.	To set up database on water quality and pollution.	Weak capacity pre-requires costly training of staff. Overlapping mandates leads to "laissez-faire".
	Lack of resources of relevant institutions to tackle this issue. But the most pressing issue than institutions (that exist) are the facilities for solid and liquid waste disposal. Disposal of waste is a difficult issue requiring a choice of technology all of which have some negative impacts and	To clarify relevant government policy and strategies so that financial resources are mobilized.	

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	overcoming local opposition to disposal sites (the "NIMBY" syndrome - "Not In My Back Yard" . This is particularly acute and difficult with respect to toxic waste. Both those used in industries like agriculture (toxic pesticides) and illegal disposal of toxic industrial and solid waste from other countries which require enforcement of importation rules to prevent their entering the country.		
	Increasing population pressure. Tourism development aggravates the problem. No waste recycling system to limit effects on environment.	To enforce immigration law. To find balance between conservation needs and development policies. To enforce relevant government policy and strategies relevant to environment protection.	Costs for waste are high especially in comparison to dumping improperly. Corruption develops where opportunity to reduce costs or gain profit exists.
	Lack of local understanding of pollution problem and impacts and widespread practice of littering.	To promote proper waste disposal and stopping littering through public information campaign.	
Wildlife sanctuary endangered by animal trafficking: Demand rising from neighboring and western countries increase pressure on local wildlife trade. Traditional medicine	Attractive biodiversity and endemicity of fauna for research on preservation of endangered species. High potential in funding opportunities	To design appropriate research programme in partnership with funding agencies. To develop research programme that fit with	Low absorption capacity and scientific skills of local researchers. Idem

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
market encourages traders to capture wild animals in the reserve zone.	for preservation of fauna and environmental /ecological research. Impunity and collusion of powerful actors.	international concern.	
		To enforce relevant government policy and strategies relevant to protected areas. To intensify ongoing campaigns against trafficking in wildlife and cultural property.	Conflict of interests.
Vulnerability to drought and flooding and crop failures.	Current production levels are low and could improve significantly without tremendous efforts.	Studies and research on traditional techniques and pilot projects to demonstrate their utility.	Small-scale efforts are less visible to donors and government so are lower priority.
	Irrigation infrastructure and land development have been handicapped by poor development of Khmer Rouge.	Proper engineering and rehabilitation of Khmer Rouge and other existing irrigation and drainage infrastructure.	Economic analysis of works is difficult.
	Flooding events are common both locally and basinwide and appear to be increasing.	Examination of successful techniques in other countries such as “controlled drainage” and improved water management.	Many Khmer Rouge works are not economically viable or require significant investment when available funds are low.
	Understanding of traditional soil and water management techniques is limited due to losses of people and culture.	Promotion of small-scale technique and improvement of agricultural extension services.	Low capacity and salaries of government staff limit commitment
		Collection of required hydrological, meteorological economic	Lack of understanding of the value of data.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
		and soils data required to improve designs. Working closely with local farmers to improve their situation and preparedness for disasters.	 Difficult and long process required to work with farmers on management entities Lack of experience in these techniques

5.5. Cross-Cutting Issues

5.5.1. Environment

– The commercial logging sector is characterized by active logging, often carried out on a cross-border basis. The demand for wood in Thailand and Vietnam is a major factor driving logging in Cambodia and Lao PDR.

– Commercial forestry activity is often carried out on an unsustainable scale, with government regulatory controls sometime unable to prevent overexploitation**.**

– Increasing run off in logged areas can result in erosion, turbidity and sedimentation.

Table 7: Deforestation Rate in Lower Mekong Countries

Area	Deforestation Rate, %
Cambodia	0.50
Lao PDR	0.58
Thailand	0.40
Viet Nam	0.73
LMB	0.53

Source: MRC, 2003d.

5.5.2. Population Pressure



Demographic pressure seriously impacts on resources exploitation which destructive practices impede equitable sharing of benefits. The population pressure on environment, by jeopardizing natural resources sustainability, is a major factor of aggravation of poverty for future generation.

The Sub-area is being experiencing intensive positive migration during the past decade. Comparison between the density map and the migration map clearly reveals that while the Sub-area has the lowest population density in the country (0-20 persons per Km^2), it is one the region that has been receiving the highest proportion of migrants (3 up to 10% of population was not living in the three provinces of the Sub-area as 5 years earlier).

5.5.3. Gender and Natural Resources Management


In Cambodia, women compose 65.9% of the economically active population and 54% of skilled agricultural actors and fishery workers (MRC, 2003d). No demographic data related to gender distribution is available in the 6C Sub-area.

Women are vulnerable to deficient health care, HIV/AIDS, human trafficking and domestic violence. Women literacy rate is 61.1% compared to 82.9% for men. Women have limited long-lasting employment opportunities.

5.5.4. Human Resources Development

Human resource development is one of the fundamental of the country's development. The creation of employment opportunities needs to be strongly supported by availability of well-trained people able to provide quality services.

Outside of Phnom-Penh, fewer than 20 percent of people of secondary school are enrolled in school. Most young people are working by this age, and the network of secondary school age is very sparse throughout much of the country. The average distance from a village to the nearest lower secondary school is estimated at 27 km, too far for daily travel (MOP, 1999).

Educated people often find that there are no jobs available for their skills due to the slow development of the private sector economy. This leads to frustration and loss of the resource as the people are not able to gain the experience needed to provide the benefit from their education.

The education system is not geared towards the needs of the employers. The rote learning method employed does not engender the analytical skills looked for by outside investors.

Post-secondary educational institutions of international standard and recognition do not exist within Cambodia. Students graduating from these institutions are too few to fill the large need for their quality of services.

Government staff with ability and training are often overworked; many leave for the private sector once trained resulting in a “brain drain”. There is often no clear delineation between the public and private sector jobs of these staff with resultant confusion of roles, conflict of interest and lack of continuity in both sectors.

5.5.5. Public Participation

Public participation at all the levels, central, provincial, district and commune is a key factor of success in the context of decentralization. The many different aspects of civil society including the private sector need to be encouraged to join within the processes that are currently dominated by development agencies and government.

Gender is a major factor in public participation – as previously outlined in Issue #3 - women's voices are seldom heard, particularly in comparison to their proportion of the population and workforce.

Participation is a key element in the success of all development – it allows design to incorporate local knowledge and concerns, people to gain ownership and makes long-term management and maintenance sustainable.

CHAPTER 6: STAKEHOLDERS AND DIALOGUE

Institutional capacity throughout the Royal Government of Cambodia (especially at the provincial, district and commune levels) is limited, because of the loss of almost an entire generation of people during the civil war, the poor public evaluation sector, low salaries in the public service, run-down infrastructure, and other factors. To address this problem, the Government is implementing a variety of measures in administrative and governance reform. Capacity building is another concern with physical facilities and equipment, ongoing funding for operational expenses and human resources development required in MOWRAM, other water-related institutions, and the civil service as a whole. The RGC seeks a greater level of private sector and/or beneficiary involvement in water services provision (water supply, sanitation, hydropower, irrigation).

Given the difficult situation with respect to human resources and the identified widespread weakness in the concerned government agencies, a number of different efforts are required to gradually address these deficiencies. A key factor in overcoming the constraints is identifying them clearly. Some of these issues are discussed below.

6.1. The Cambodian Water Policy and Strategies

6.1.1. The Draft Water Sector Roadmap for Cambodia

Interesting initiatives to address the various water sector issues exist. For instance, a Draft Water Sector Roadmap for Cambodia has been presented by the Government to ADB and discussed in a consultation meeting on April 7th 2003. The roadmap summarizes the RGC's goals for the water sector in Cambodia and provides a basis for setting priorities and planning investment and development assistance. It also reviews the context provided by national goals for poverty reduction and socio-economic development. It provides an overview of the sector, and considers the issues and constraints that are faced. Finally it summarizes recent, current and planned activities and investment by international funding agencies. The road map does not actually define a single direction to go, but indicates the possible routes to many destinations, and the obstacles that must be overcome.

6.1.1.1.Sector Issues and Constraints

The key issues and constraints in the water sector have been classified in various ways by recent analyses, such as the National Water Sector Profile (MOWRAM, 2001). In this roadmap, issues are grouped into the following topics:

- Legislation and policy
- Institutional arrangements
- Institutional capacity
- Providing data and information
- Managing irrigation and drainage systems and other water-related infrastructure
- Mitigating the impacts of water-related hazards
- Managing competition for water and deteriorating water quality

- Conserving aquatic ecosystems and fisheries
- Managing international water resources
- Managing the coastal zone
- Financing water resources development and management

6.1.1.2.Summary of Issues and Constraints[3]

Legislation and policy

There is not at present a coherent body of water-related law, regulatory instruments, or policy. A draft Law on Water resources Management (WRM) is before the National Assembly, and a National Water Resources Policy was passed by the Council of Ministers in January 2004. Several sub-sectoral policies are at various stages of development or approval. Implementation of laws is generally weak, although advances are being made, e.g. in administering water pollution-related provisions of the Law on Environmental Protection and Natural Resources Management. The MOWRAM needs to develop the institutional capacity to administer the Law on WRM if/when it is passed.

Institutional arrangements

Several RGC line ministries have responsibilities for different aspects of water resources exploitation, while the CNMC deals with Cambodia's responsibilities under the Mekong Agreement. The MOWRAM was established in 1999 with a mandate to manage the Nation's water resources, but has directed its attention primarily towards irrigation and drainage (I&D). Inter-agency relationships tend to be competitive and uncooperative, although MOWRAM has reached formal agreements with several other ministries to delineate responsibilities. The RGC is devolving responsibilities to provincial and more local levels, which will require allocation of increased financial and trained human resources, to lessen reliance on non-governmental support. Institutional arrangements for managing I&D works are reasonably well-defined, with some lack of clarity regarding relative responsibilities of MOWRAM, MRD and MAFF for water management for agriculture. However, water management cannot be sustained because of limited government resources.

Institutional-Community capacity

Institutional capacity throughout the RGC (especially at sub-national levels) is limited, because of previously discussed problems in human resources development and management. The successful development of PPWSA as a public corporation is a good example of what is possible, and the RGC seeks a greater level of private sector and/or recruitment programme will be required, at both central and provincial/district levels, in areas such as water resources management, law enforcement, support for community groups, etc. This will assist the Ministry to evolve from a primarily construction and

[3] Excerpt with some edits from: the Draft ADB "Roadmap" for the Cambodian Water Sector. Draft report on MRC participation in the ADB meeting on the Water Sector "Roadmap" for Cambodia, April 7th 2003.

operation agency, to one that is able fully to carry out its mandate in water resources planning, management and regulation.

Providing data and information

The capacity of MOWRAM and other RGC agencies to provide the data and information required for design of water-related infrastructure, development and management of water resources, and management of extreme events (droughts and floods) is limited, although participation in international programmes in the dissemination of data and information about water resources and use (quantity and quality; surface water and groundwater), river basin characteristics, weather and climate is needed, in terms of a coordinated water and climate information strategy. Exchange of existing information among RGC institutions is not always efficient, because of a lack of awareness of what is available, a lack of formal mechanisms for obtaining access, and possessiveness regarding information assets. As a result, the heavy investment by international funding agencies in natural resources information has not been fully effective. International agencies have also contributed to inefficiency through duplication of work, poor planning and failure to address structural problems that lead to un-sustained data collection.

6.1.2. The National Water Policy

The National Water policy was passed by the Council of Ministers in January 2004. The National Water Resources Policy includes policies on exchange of data and information. Mechanisms and willingness to implement these policies will be required.

6.2. Analysis

If lack of human resources in terms of quantity and quality is recognized as the major factors of the institutional capacity weakness, a number of socio-political factors also impede national institutions from properly enforce existing laws and regulations. In this context, there are many limitations in the improvement of data accuracy, sustained collection of the needed long-term records and data reliability, since statistics and figures generated by various institutions lack of consistency and comprehensiveness. Time, steady efforts, political willingness and success of public reform are prerequisites for change of mindset and behavior.

SECTION 2

The Kratie Sub-area

(SA – 8C)

CHAPTER 7: BASELINE DESCRIPTION

7.1. Geographical Features

7.1.1. Coverage

The Kratie Sub-area (8C Sub-area), which covers an area of approximately 22,170 km2, is located in the eastern part of Cambodia. This covered area represents about 12.25% of the total area of Cambodia.

The 8C Sub-area encompasses partly five provinces, namely Kratie (85%), Stung Treng (24%), Mondulkiri (50%), Preah Vihear (10% of the District of Chey Saen), and Kompong Cham (10% of Dambae District and 50% of Memot District).

The map below accompanied by a detailed table shows the district covered by the 8C Sub-area (Figure 12). Data displayed in the table relevant to proportion of areas covered by the 8C Sub-area are provided by MRC. Data relevant to population 2002 originates from the Commune Database generated by the Ministry of Planning. The estimation of population within the districts of the 8C Sub-area is based on the above proportion, but the major limitation is that this calculation is merely arithmetic, meaning that it does not take into account the population density.

Table 8: Geographical and Demographic Coverage of 8C Sub-area

GIS Code	District	Province	Proportion District Area in SA - 8C	Area within SA – 8C (km^2)	Whole District (Population 2002)	Population* in SA – 8C (2002)
10304	Dambae	Kampong Cham	10%	72	64,195	6,420
10310	Memot	Kompong Cham	57%	879	119,156	67,919
	Total	**Kompong Cham**		**951**	**183,351**	**74,339**
11001	Chhloung	Kratie	100%	866	49,781	49,743
11002	Kratie	Kratie	100%	1,547	82,958	82,958
11003	Prek Prasop	Kratie	98%	1,350	60,108	59,146
11004	Sambour	Kratie	91%	4,912	45,009	41,178
11005	Snuol	Kratie	100%	2,818	38,461	38,461
	Total	**Kratie**		**11,493**	**276,317**	**271,486**
11101	Kaev Seimaa	Mondulkiri	100%	3,084	10,855	10,852
11102	Koh Neak	Mondulkiri	33%	1,753	11,814	3,922
11103	Ou Reang Peechr	Mondulkiri	27%	273	3,146	853
11104	Chendaa Saen	Mondulkiri	38%	1,381	6,730	2,587
11105	Monourom	Mondulkiri	61%	299	4,643	2,836
	Total	**Mondulkiri**		**6,790**	**37,188**	**21,050**

GIS Code	District	Province	Proportion District Area in SA - 8C	Area within SA – 8C (km^2)	Whole District (Population 2002)	Population* in SA – 8C (2002)
11301	Chey Saen	Preah Vihear	10%	105	17,137	1,640
	Total	**Preah Vihear**		**105**	**17,137**	**1,640**
11902	Siem Bouk	Stung Treng	93%	1,358	11,621	10,814
11904	Stung Treng Thaalaa	Stung Treng	25%	172	11,255	2,810
11905	Barivaat	Stung Treng	50%	1,298	24,235	12,078
	Total	**Stung Treng**		**2,828**	**47,111**	**25,702**
Total	**16 districts**	**5 provinces**		**22,170**	**561,104**	**394,217**

Note: (*) Calculation based on proportion of district area within SA – 8C. This estimation is rough because does not into account the population density.

Source: MRC "*Districts in Cambodian Sub-areas-Using new boundaries (2003) and BDP Sub-areas as of January 2004* ". Ministry of Planning, General Directorate of Planning, Commune Database Version 5.3

Analysis:

- The above table shows that 16 districts belonging to five provinces are actually covered partly or entirely (Chhlong, Kratie, Snuol and Kaev Seimaa) by the 8C Sub-area. Furthermore, one can note that the province of Kratie occupies the first position in term of area covered with about 11,490 km^2. The provinces of Preah Vihear and Kompong Cham are the less covered by the Sub-area with only 105 km^2 and 951 km^2 respectively.
- In 2002, the total population within the 8C Sub-area is estimated at 394,220 persons, equivalent to 3.6% of the Cambodia's population (approximately 11,000,000 persons).
- The total area of the 8C Sub-area is estimated at 22,170 km^2, equivalent to 12.25% of the Cambodia's area.
- Data obtained from the provincial reports are limited in terms of reliability and consistency. For instance, there is neither indication on the estimation of area covered by the relevant provinces, nor the calculation of the population within the sub-area. Only data related to the whole province is available in the provincial report.
- There is a contradiction between the current data and the one generated by CNMC-BDP in the Sub-area study and analysis published in April 2004. In this report, it is read in page 15 that the total population estimated in 2002 in the Kratie sub-area is 303,719 persons. It is also mentioned that the 8C Sub-area covers about 22,597 km^2 comprising the provinces of Kratie, Stung Treng and Mondulkiri.
- Very likely, the major cause of this inaccuracy is due to a wrong delimitation of the 8C Sub-area by the previous author who groups 6C Sub-area and 8C Sub-area under a so-called Kratie Sub-area. Another explanation is that the previous author

did not integrate parts of the provinces of Preah Vihear and Kompong Cham in the boundary of the 8C Sub-area.

Figure 12: Districts covered by the 8C Sub-area

7.1.2. Topography and Elevation

The Kratie Sub-area is the continuation of the complex of Korat Plateau mixed with a vast area of lowlands which compose the floodplain. It is crossed from north to south by the Mekong River. The Sub-area is characterized by the deposition of recent sediments over older bedrock. Owing the flatness of the terrain, large areas are submerged during the high flow period of the Mekong River and its tributaries.

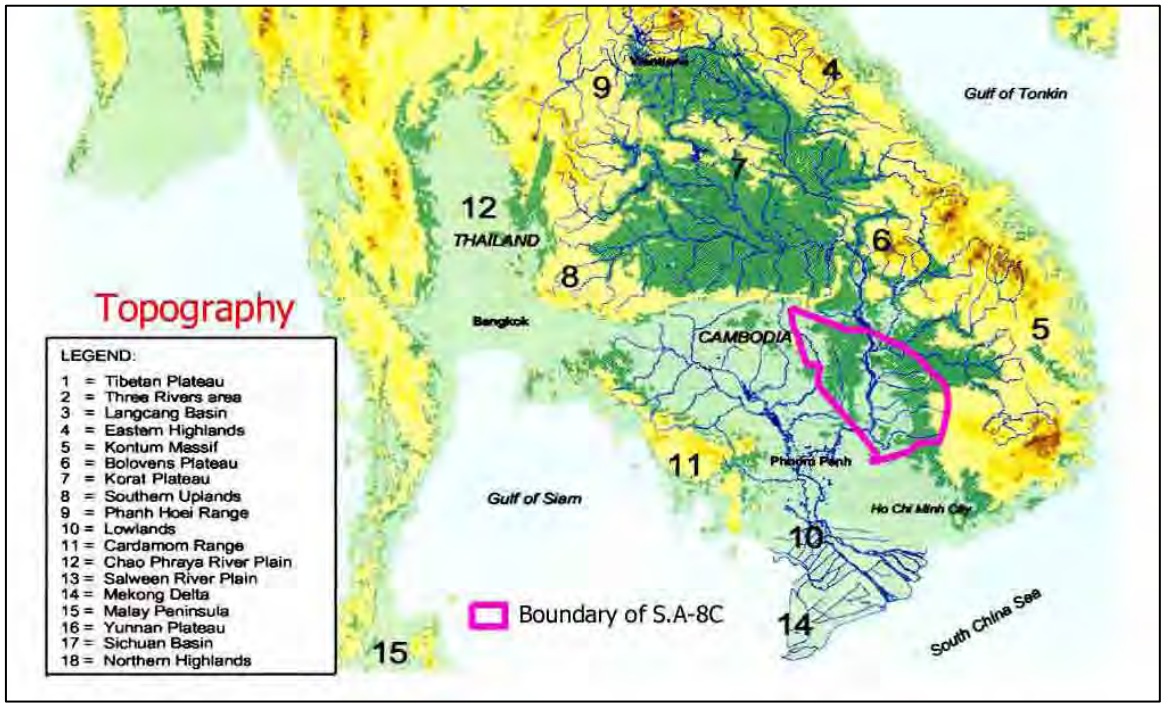


Figure 13: Topography of the 8C Sub-area

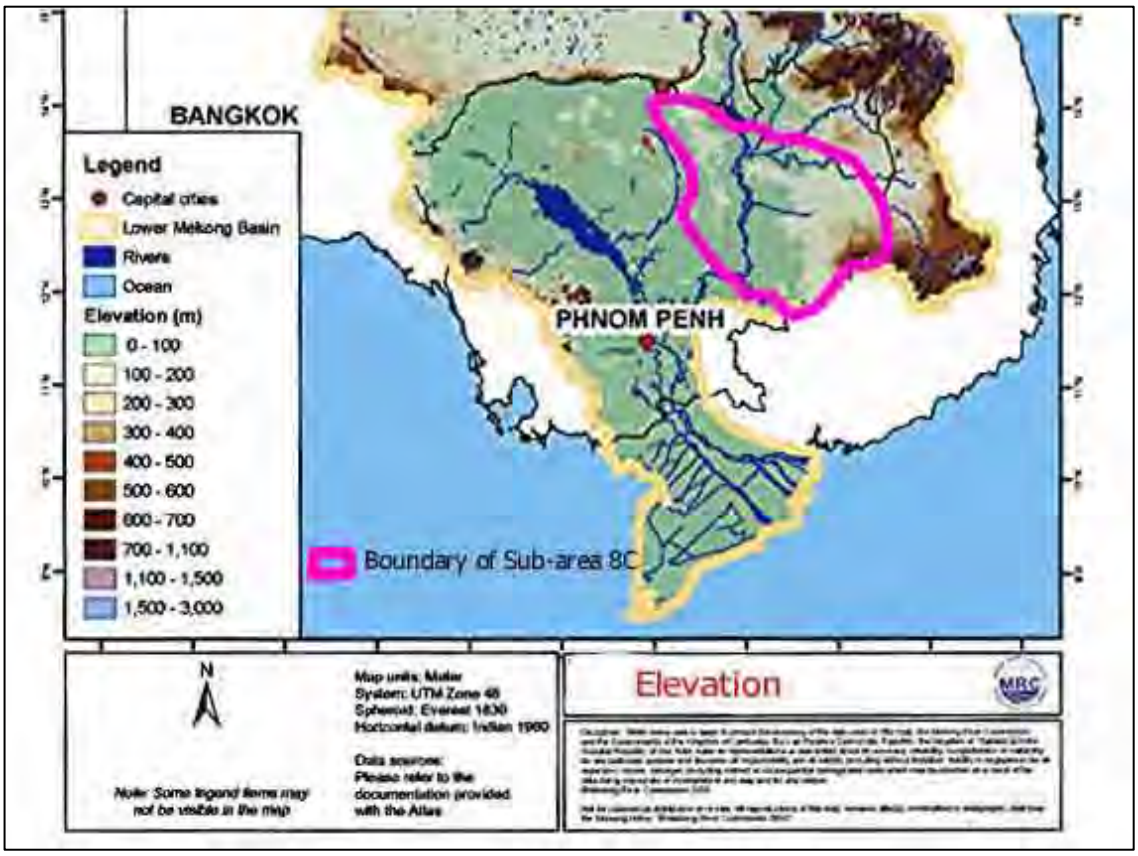


Figure 14: Elevation above Sea Level

About two third of the Sub-area is occupied by the floodplain which elevation is between 0 and 100 meters. The remaining is mostly made of plateau of 100-200 meters high. Only in the southeastern part of the Sub-area, in the southern part of the province of Mondulkiri it is a found mountainous formation of 200-500 meters. Thus, the Sub-area 8C is a relatively flat area that elevates from northwest to south east thanks to a mountainous continuation of the Korat plateau.

7.1.3. Hydrology and Watershed

Owing to the presence of the Mekong River in its boundary, the 8C Sub-area is abundant of water resources and this abundance is a solid guarantee of food security since fishery and agriculture constitute the major source of protein and other nutrients for the population of the Sub-area in particular and of Cambodia in general. Comprehensive and accurate data on hydrology of the Sub-area is scarce, and when it exists, is not updated. The Sub-area is mainly composed of watershed of class 5 that is devoted to lowland farming, with several spots of watershed of class 3, suitable for agro-forestry.

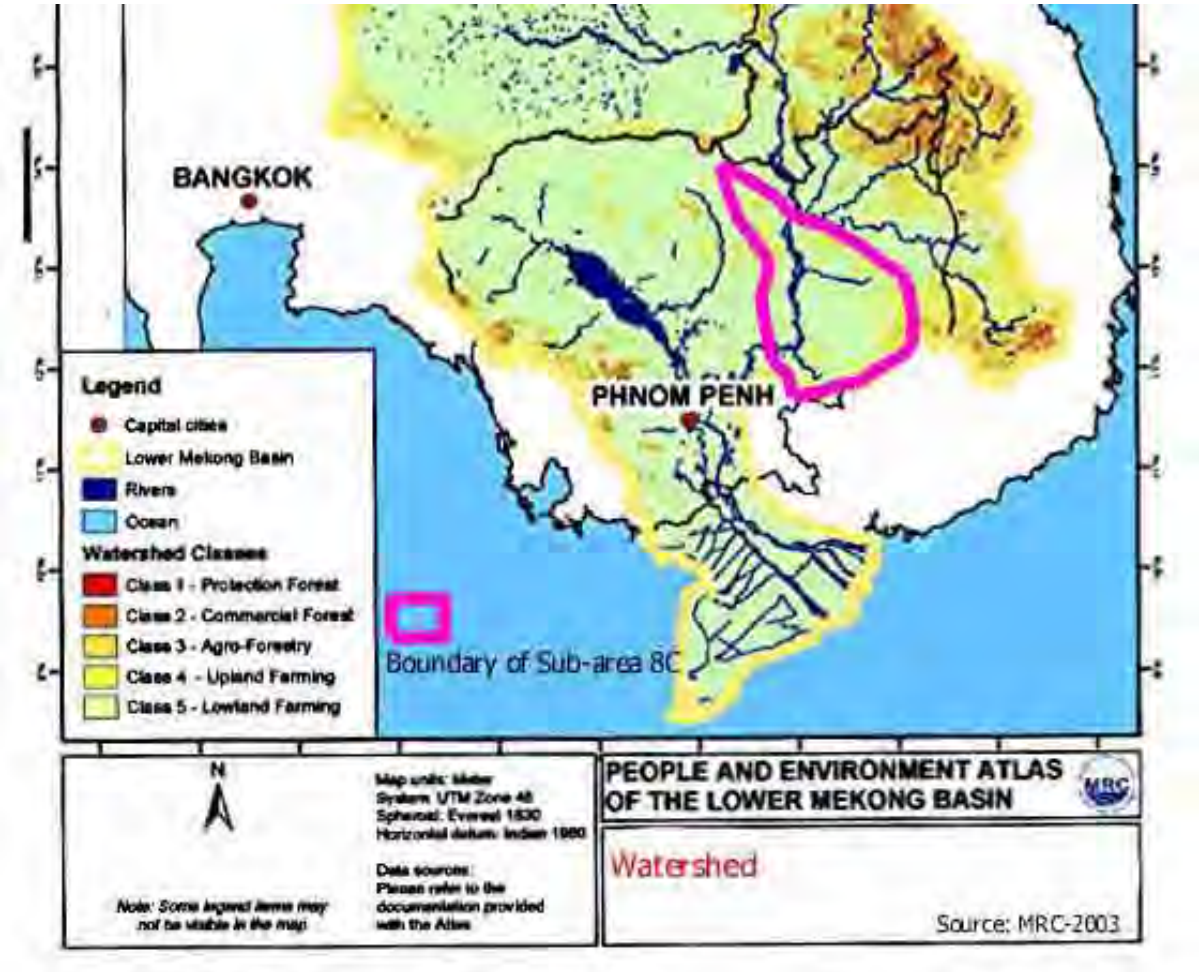


Figure 15: Classification of Watershed

7.1.4. Land Cover

The 8C Sub-area is mainly covered by forest (at least 90% in 2002) with sparse areas of woodland and agriculture (about 5% in 2002). Alongside the Mekong River, a mosaic of river bank crops e.g. sesame, tobacco, maize. Land use distribution in the top three provinces of the Sub-area is displayed in the below table. It is seen than areas devoted to rice represent 67% of the total Sub-area while irrigated areas occupy about 27% only of the cultivated land. The average rice yield ranges from 1.4 to 1.9 tons per ha.

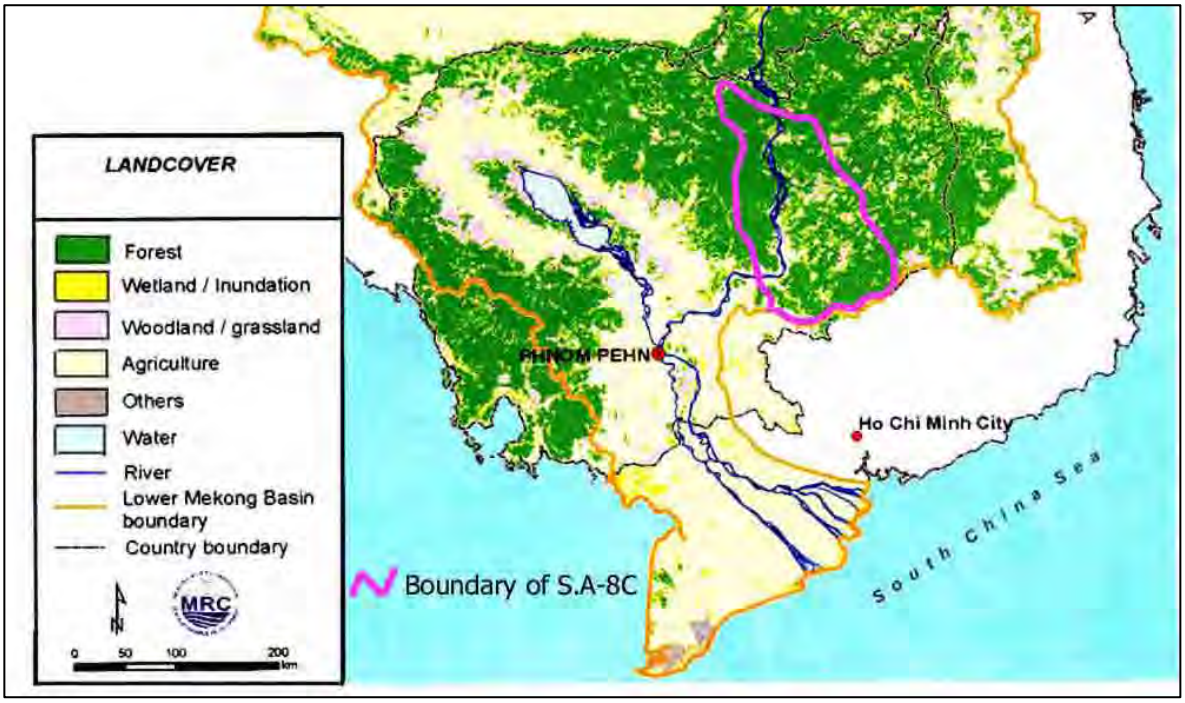


Figure 16: Land Cover of the 8C Sub-area

Table 9: Land Use of the 3 Provinces in the Sub-area, 2002 (ha)

Land Use	Stung Treng	Ratanakiri	Mondulkiri	Total	%
Agriculture land	21,193	58,647	14,990	94,830	4.7%
Forest land	928,800	891,802	11,222	1,831,824	90%
Flooded Forest		2,651	215	2,866	0.2%
Others	103,217	--	1,756	104,973	5.1%
Total	**1,053,210**	**953,100**	**28,183**	**2,034,493**	**100%**

Source: Provincial reports, 2002.

Table 10: Rice Land and other Crop Land, 2002 (ha) in the 8C Sub-area

	Stung Treng	Ratanakiri	Mondulkiri	Total	%
Rice land (ha)	20,801	22,550	13,820	57,171	67%
Other crop land (ha)	5,900	20,355	2,427	28,682	33%
Total	**26,701**	**42,905**	**16,247**	**85,853**	**100%**
Irrigated land (ha)	14,387	8,300	295	22,982	27%
Number of irrigated systems	26	60	19	105	
Average Rice yield (t/ha)	1.4	1.4	1.9		

Source: Provincial reports, 2002.

7.1.5. Soils and Limited Suitability for Paddy

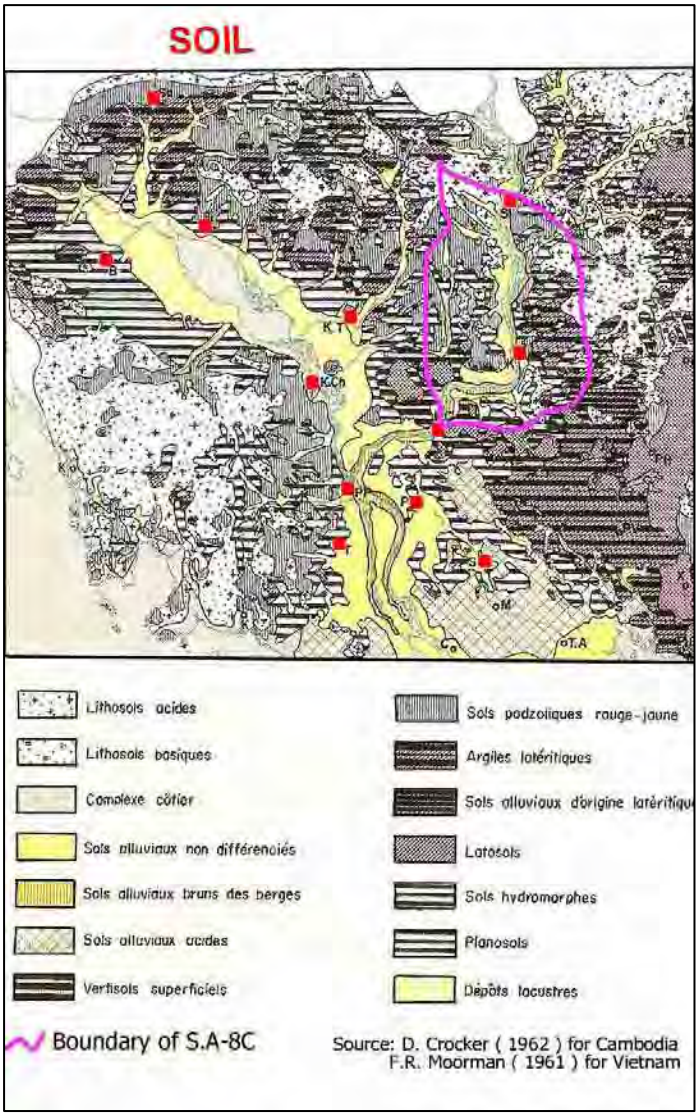


Figure 17: Soil Map of the 8C Sub-area

According to D. Crocker Classification in 1962, the Sub-area is a mosaic of six major types of soils including Latosols, Acid Litosol, Lateritic Clay, Red-Yellow Podzolic soil and hydromorphic soil. Alongside the Mekong River, alluvium soil is predominant.

No data is available on the proportion of each type of soil within the Sub-area. Regarding the land classification according to the suitability for Paddy, the Sub-area's soils are moderately suitable on the Mekong River banks and in the south (Snuol), most suitable in the southern part and not suitable in the south-eastern part (Ou Reang). But the vast majority of the Sub-area is marginally suitable for paddy.

7.1.6. Biodiversity

7.1.6.1. Wildlife Sanctuary

The Sub-area encompasses partly three important wildlife reserves in the eastern part of Cambodia that are Lomphat (Mondulkiri part), Phnom Prich (Mondulkiri) and Snuol (Kratie). As an example, the Mekong River hosts a colony of the mammal Irrawaddy Dolphin (Orcaella brevirotris) that constitutes a tourist attraction in Kratie. Orcaella brevirotris is registered in CITES appendices in 2001. CITES is the Convention on International Trade in Endangered Species of Wild Fauna and Flora in which Cambodia is also a signatory member.

In addition, three main endangered species of fish – according to IUCN Class - are found in the Mekong River and its tributaries within the 8C Sub-area, namely Jullien's Golden Carp (EN A 1ac), Dwarf Botia (CR A 1c) and Laotian shad (EN A 1a). Furthermore, the region of Kratie is abundant of deep pools where fishes are breeding so that the fingerlings travel towards Laos, Thailand, and Vietnam and inside Cambodia via the Mekong River and the Tonle Sap Lake for growing during the wet season. In the dry season, fishes join the deep pools from the north and the south and spread into the Mekong tributaries in the provinces of Kratie, Mondulkiri and Ratanakiri, providing people with quality and abundant protein.

The 8C Sub-area is occupied by several wetland areas along the Mekong River, constituting perhaps one of the last sanctuaries for some endemic and endangered species of mammals, invertebrates, reptiles and birds. Below are the wetland areas inventoried in the province of Kratie in 1999.

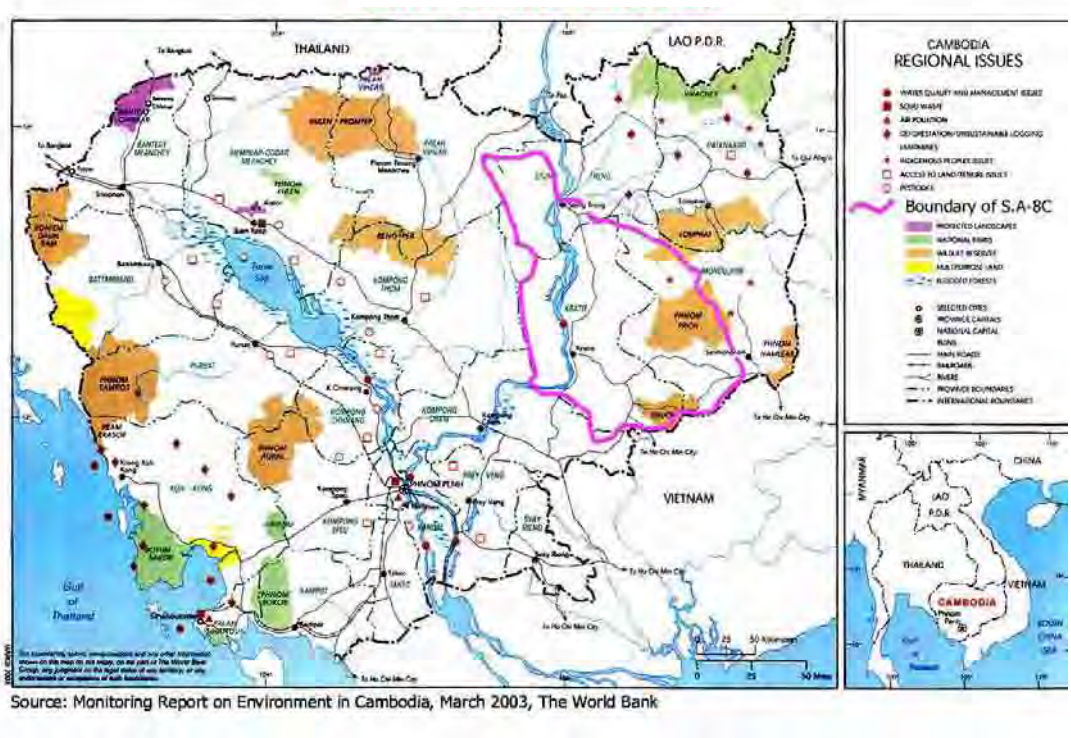


Figure 18: Environmental Protection

Table 11: Wetlands located in the Province of Kratie in 1999

Name of Areas	Name of Communes
Kratie District	
1. Boeung Tronoul Chhnang	Krokor
2. Prek Kampi	Sam Bok
3. Boeung Trosom	Prek Tachhoeung
4. Boeung Rom lech	Bos Leav
5. Boeung Cham Naum	Bos Leav
Sambo District	
1. Tounle Mekong	Sandan
2. Boeung Tropeang Sandan	Sandan
3. O' Sandan	Sandan
4. Boeung Tropeang Machar	Sandan
Prek Prosab District	
1. Boeung Khmol	Chhroy Banteay
2. Boeung Romeas	Chhroy Banteay
3. Boeung Krosom	Cham Boak
4. Boeung Trobek	Chhroy Thmor
5. Boeung Veng/Thom	Russey Keo

Name of Areas	Name of Communes
6. Boeung Kahat	Russey Keo
7. Boeung Phka	Russey Keo
8. Boeung Rey	Prek Prosop
Chhlong District	
1. Boeung Yeay Sor	Chhlong
2. Boeung Phum Pros	Chhlong
3. Boeung Kaun Sat	Prek Saman

Source: Provincial Reports of the Kratie, 1999.

7.1.6.2. Fishery Eco-system (Unique, but fragile despite protection efforts)

The Mekong River and its tributaries are remarkable food baskets for the Sub-area's population in particular, and the whole Cambodia in general. Numerous deep hole areas in the Mekong River are natural breeding-spawning shelters for a number of fish species, ranging from 6 to 25 different species reported at the survey stations. The region of Kratie is the most fish populous owing to the presence of deep pools.

Therefore, the Sub-area plays an important role of ecological plate-form for fish breeding and spawning, and actually is a vital corridor for fish migration not only in Cambodia but in the entire Lower Mekong Basin.

However, the fishery sector is under stress. Concerns that fisheries resources have been over exploited are widespread. The overall tonnage of fish caught in the Mekong system has increased reflecting the increasing fishing effort, rapid improvements in fishing equipment technology, position fixing and catch preserving techniques (PAD, 2003). But there has been a consistent decline in the catch per unit effort and in the value of catch. Also, there has been a reduction in the catch of some long-lived species and a shift to those that are smaller and short-lived (Sverdrup-Jensen, 2002). Yet, changes to land use in the floodplain are the main impact on freshwater aquatic system. A major threat to sustaining capture fisheries in the Mekong system is environmental degradation arising from the activities of other sectors (Ibid), including:

- Destruction of spawning grounds or dry season refuges by habitat alterations;
- Local changes in the quality and quantity of water;
- Construction of dams, weirs or diversions which act as physical barriers to fish migration; and
- Increased sediment load due to deforestation.

The expansion of agriculture, forest loss and urbanization, particularly in the coastal zone, and increasing population has all added to the pressures on aquatic environments. Overexploitation, combined with water pollution, introduction of exotic species and degradation of fish breeding areas and habitat threaten to undermine the critical role fisheries play in the everyday life of most Cambodians.

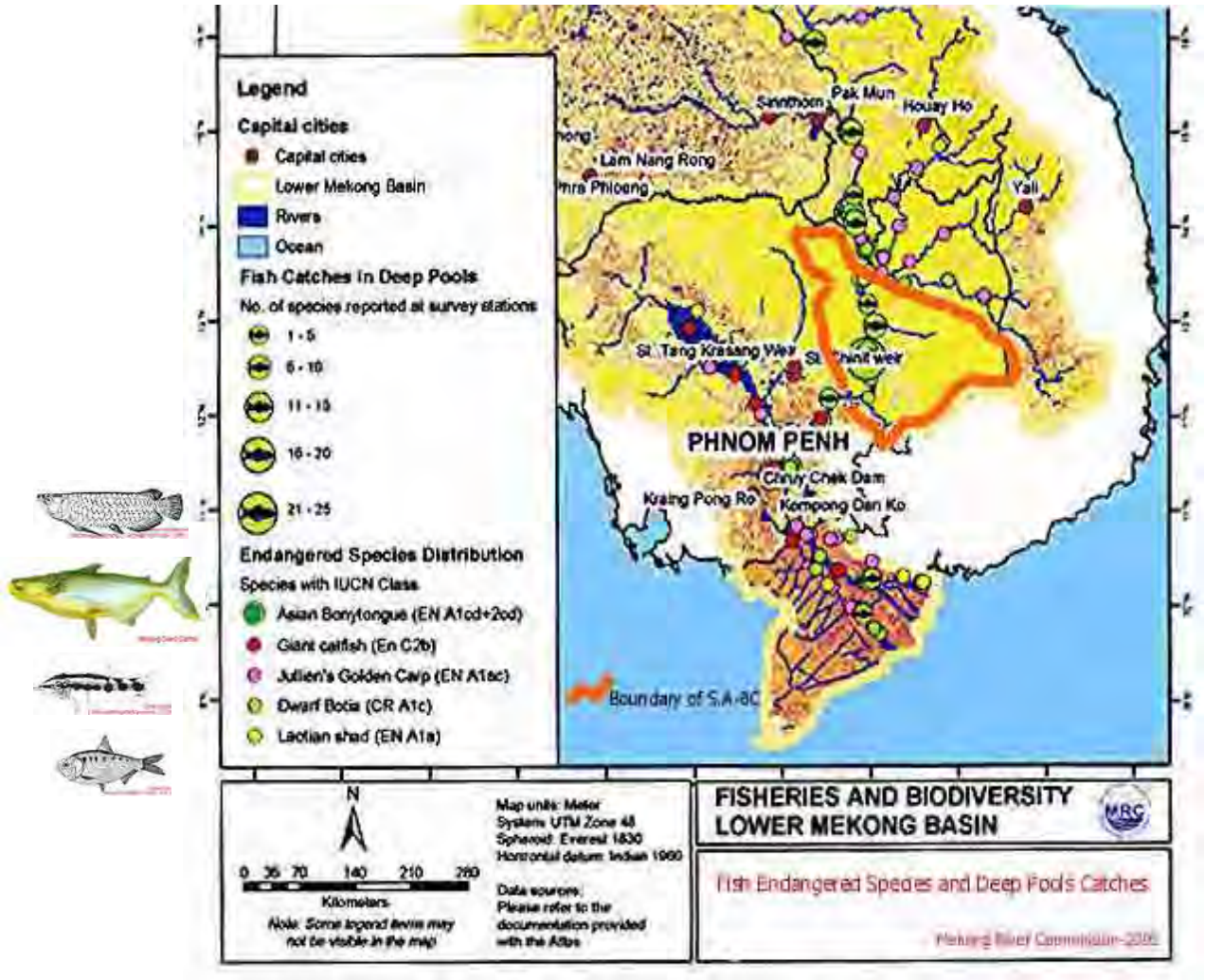


Figure 19: Fisheries and Biodiversity

Fish sanctuaries are protected areas established by DOF. Since the end of the civil war in 1979, 13 fish sanctuaries have been established in the Tonle Sap-Mekong system including the deep hole reserves on the mainstream between Kratie and Khone Falls to preserve inland fish brood stock for spawning and nursing from one flooding season to the next. These sanctuaries are protected under the KRET-CHHBAB/33 Kra. Char/9 March 1987 on Fishery Management in Cambodia which states that "all kinds of fishing activities in fish sanctuaries are absolutely forbidden, except scientific fishery research conducted by the Dept of Fisheries with special permission". But there have been difficulties in enforcing protection in these sanctuaries, which has led to a shift to community established protection areas (PAD, 2003).

Sites supplied with fish from protected areas will be more resilient to over-fishing. For instance, many species of freshwater fish such as Pangasius migrate upstream in Stung Treng and Kratie provinces, spawn and hatch, then the larvae drift down the Mekong

River to the Tonle Sap Great Lake and the Bassac Marshes and other delta areas downstream from Phnom Penh. Aquatic protected areas established by the DOF in Stung Treng and Kratie have provided a basis for protection of some endangered species such as giant catfish and the freshwater Irrawaddy Dolphin.

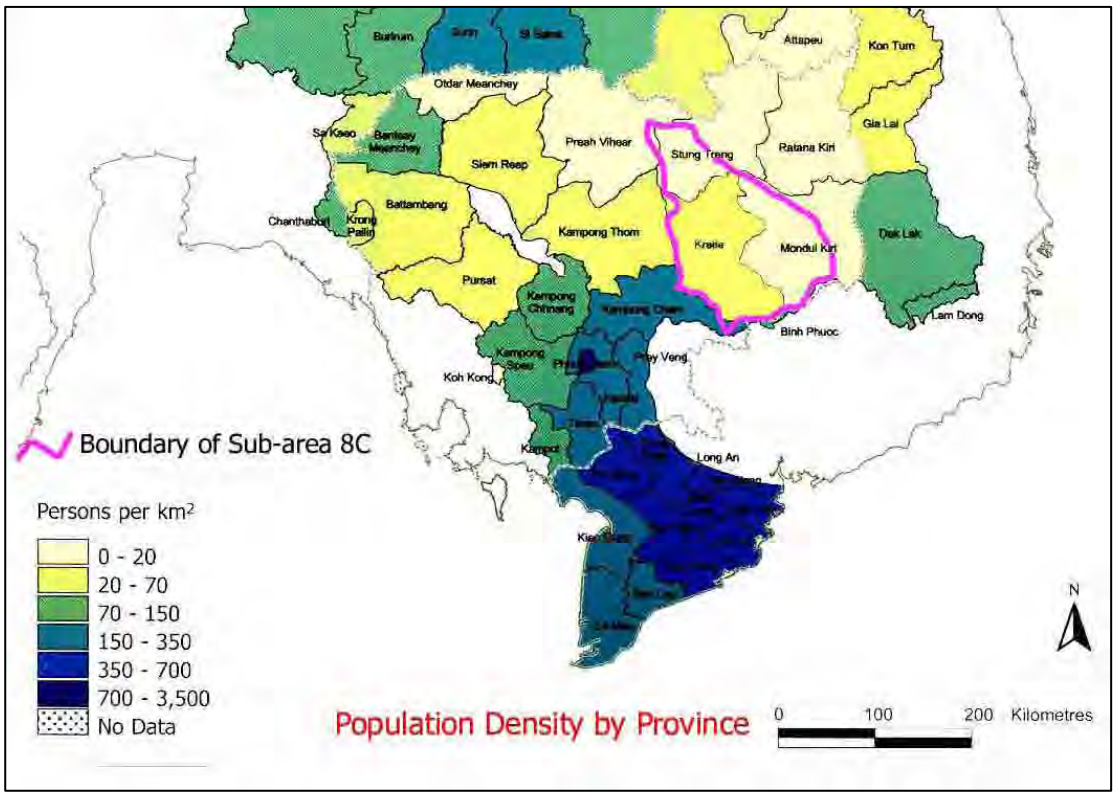
The below map shows the distribution of endangered fish species and the location of deep pools where fishes are caught in the Mekong River part of the Sub-area and in the upstream area. Excepted for the Mekong Giant Catfish and the Asian bony tongue, the three other endangered species are living in the Mekong River part within the 8C Sub-area. Furthermore, all the deep pools existing in Cambodia are located within the Sub-area.
Thus the challenge of the protection of the endangered species and the deep pools of the Mekong River is clear and must be definitely addressed in the future development of the Sub-area, as well as in the upstream and downstream parts of the sub-area.

7.2. Population and Livelihoods

With 22,170 km^2 area and hosting about 394,220 inhabitants, the Kratie Sub-area is characterized by the following socio-economic features.

7.2.1. Key Socio-Economic Features

7.2.1.1. Low Density Settlement



Source: MRC, 2003c.

Figure 20: Population Density by Province in the 8C Sub-area

Excepted in the districts of Dambae (10% within the sub-area) and Memot (57%) located in the province of Kompong Cham, the population density of the 8C Sub-area ranges between 0 to 70 persons per km^2. The whole province of Kratie is the most heavily populated area with 20-70 km^2 while Stung Treng and Mondulkiri account 0-20 persons per km2, the lowest density in Cambodia. As a comparison, the density of Kandal, Prey and Takeo, easily reaches 150-350 persons per km^2.

Therefore, the Kratie Sub-area is not pressured by rural migration towards the urban areas. The Sub-area is characterized by a positive migration, meaning that it is an area of immigration from other provinces (Figure 21).

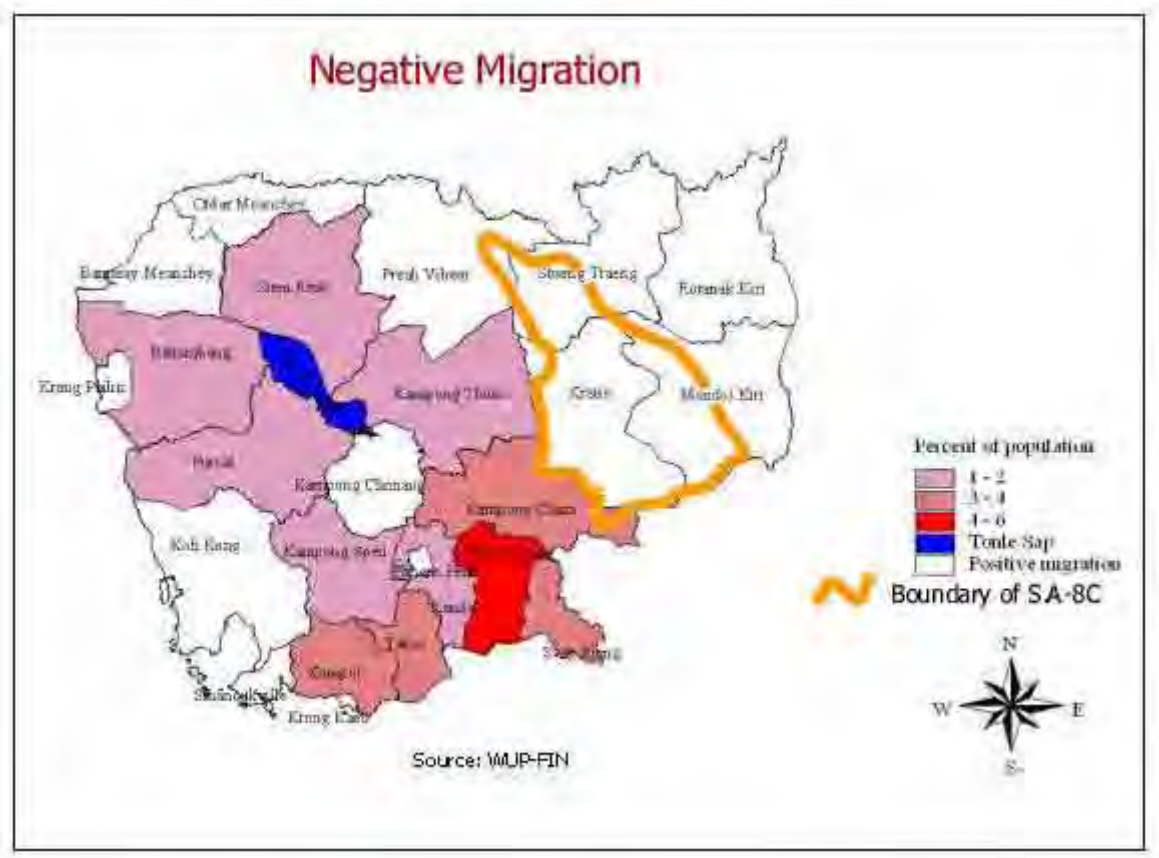


Figure 21: Negative Migration in the 8C Sub-area

7.2.1.2. Poverty and Endemic Issues

Poverty is endemic across the Lower Mekong Basin and acutely in Cambodia, despite a lot of disparity from one province to another. The situation regarding poverty is contrasting in the 8C Sub-area. The province of Kratie which 85% of area composes the 8C Sub-area, witnesses a relative high proportion of people living below the consumption-based poverty line (30-40%), while the provinces of Stung Treng and Mondulkiri hold a lower rate of below 20%.

The most concerning implication of poverty is the pressure it provokes on the exploitation of natural resources, thus on the environment, including fishery resources

and forests. Kratie, Stung Treng and Mondulkiri are the main provinces involved in heavy deforestation in Cambodia. The presence of deep pools in the Mekong River at the level of Kratie that guarantees shelter for fish breeding and spawning is seriously threatened by human activities under the pressure of both economic development and deterioration of social situation.

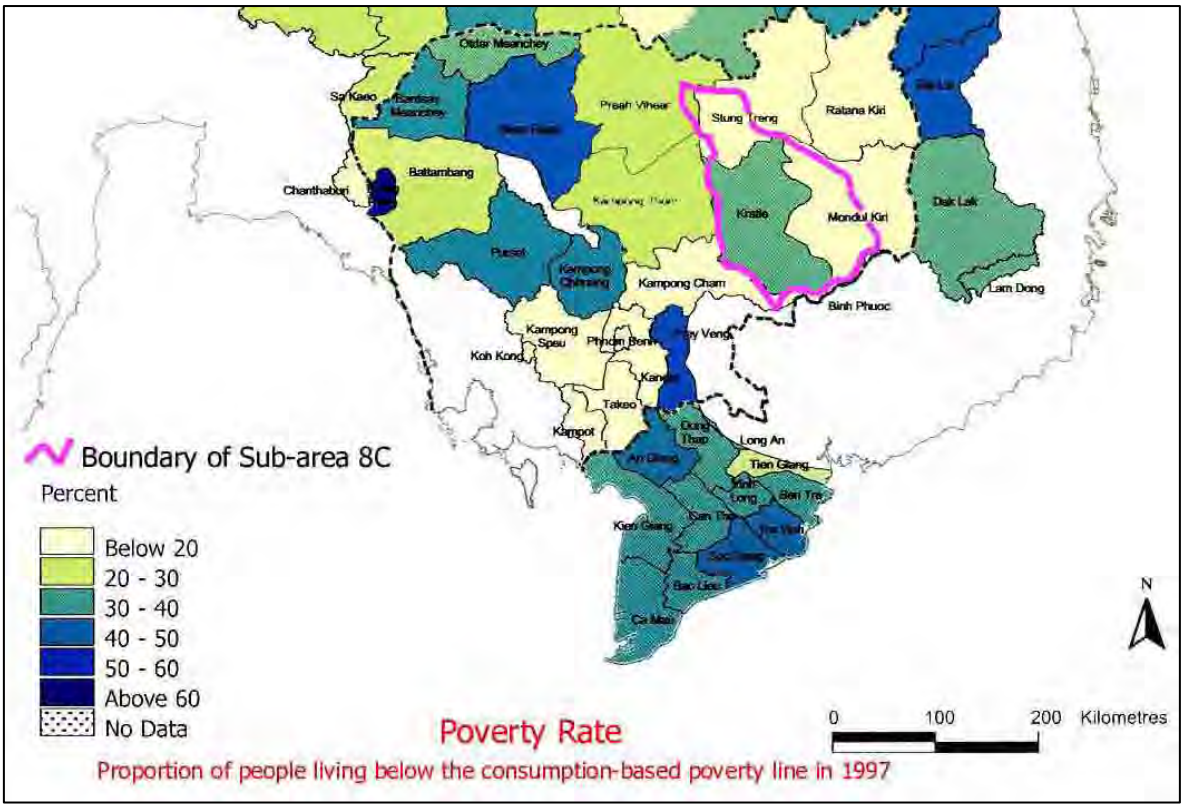


Figure 22: Poverty Rate In the 8C Sub-area

7.2.1.3. Access to Safe Water

According to the 1998 Population Census in Cambodia, Access to safe water includes access to either piped, tube well, pipe well, or bought drinking water. This access to safe water remains low with 0-40% in the Sub-area. The population living in the provinces of Stung Treng and Mondulkiri have little access to safe water with a maximum rate of 20%. The majority of remote areas have no access at all and this situation induces high incidence of intestinal diseases and other diseases, thus affecting people's health and life expectancy. For instance, the province of Mondulkiri has been reported as holding the highest infant mortality rate in Cambodia with 125-170 deaths in one year per 1,000 live births, according to the population Census in 1998. Stung Treng's situation is slightly better, but still rates 100-125 deaths in one year per 1,000 live births, while Kratie rates 75-100.

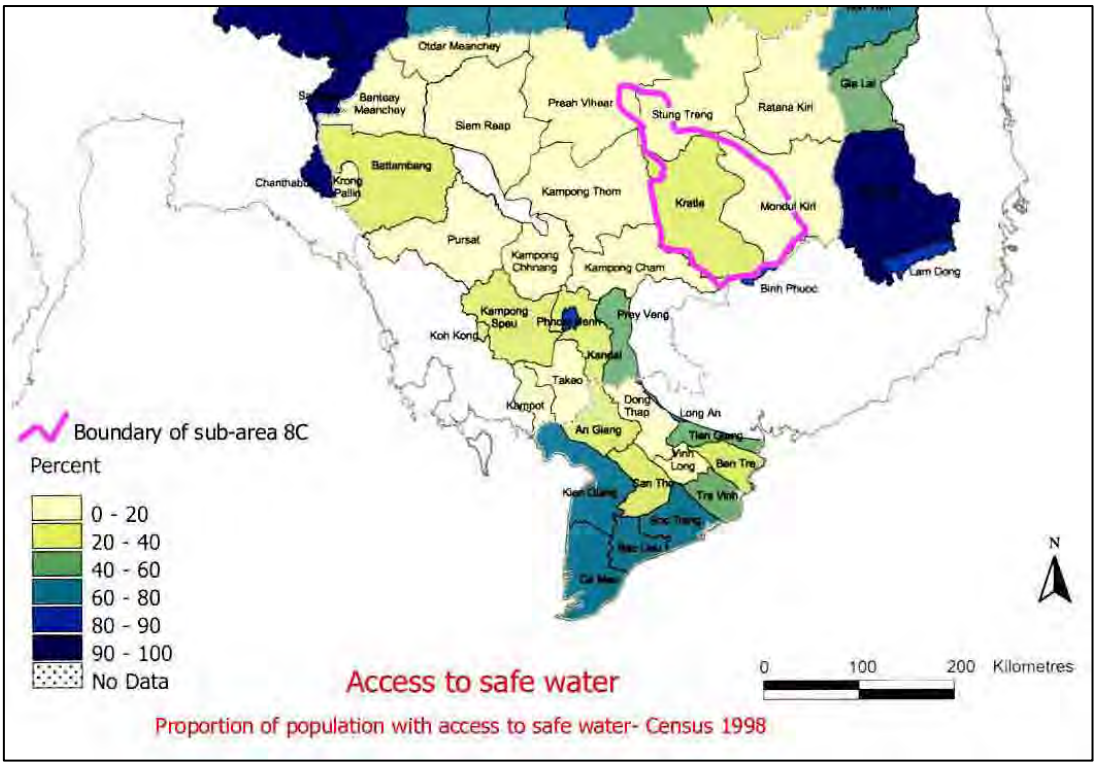


Figure 23: Proportion of Population with Access to Safe Water

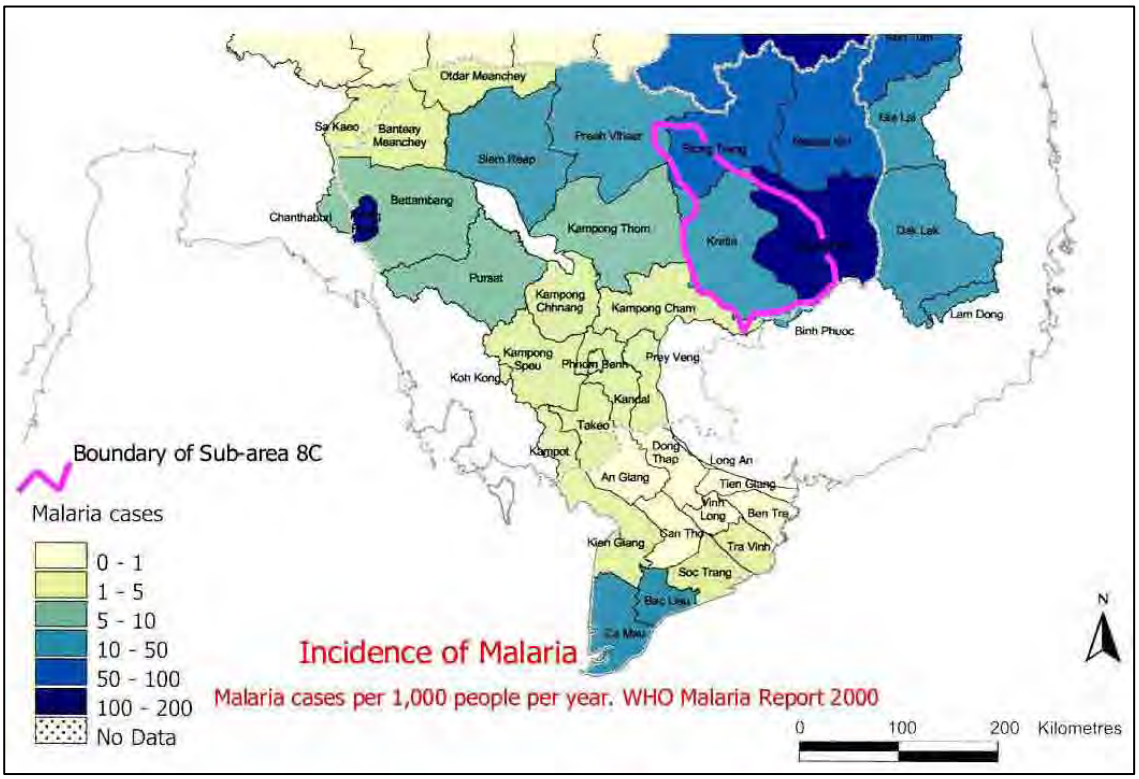


Figure 24: Incidence of Malaria in the 8C Sub-area

7.2.1.4. Incidence of Malaria

Since the Sub-area is mainly covered by forests, malaria is an endemic disease.

7.2.1.5. Child Malnutrition

Child malnutrition is a critical indicator of poverty, especially in rural areas where people are the most vulnerable to lack of food security and natural disasters, e.g. flooding and drought. Child malnutrition is closely related to high levels of poverty. Declines in child malnutrition often follow reductions of poverty.

The Kratie sub-area is characterized by a relative high rate of child malnutrition with 50-60 percent in the Mondulkiri part, the highest in Cambodia, and with 40-50 percent in Kratie and Stung Treng parts. As a comparison, Phnom-Penh, Banteay Meanchey and Battambang rate 20-30 percent only. Therefore, the majority of people living within the 8C Sub-area faces great burden of poverty and poor social conditions. They are very vulnerable to the floods and droughts that frequently plague the country, as they are heavily dependent upon agriculture, often conducted on a subsistence basis.

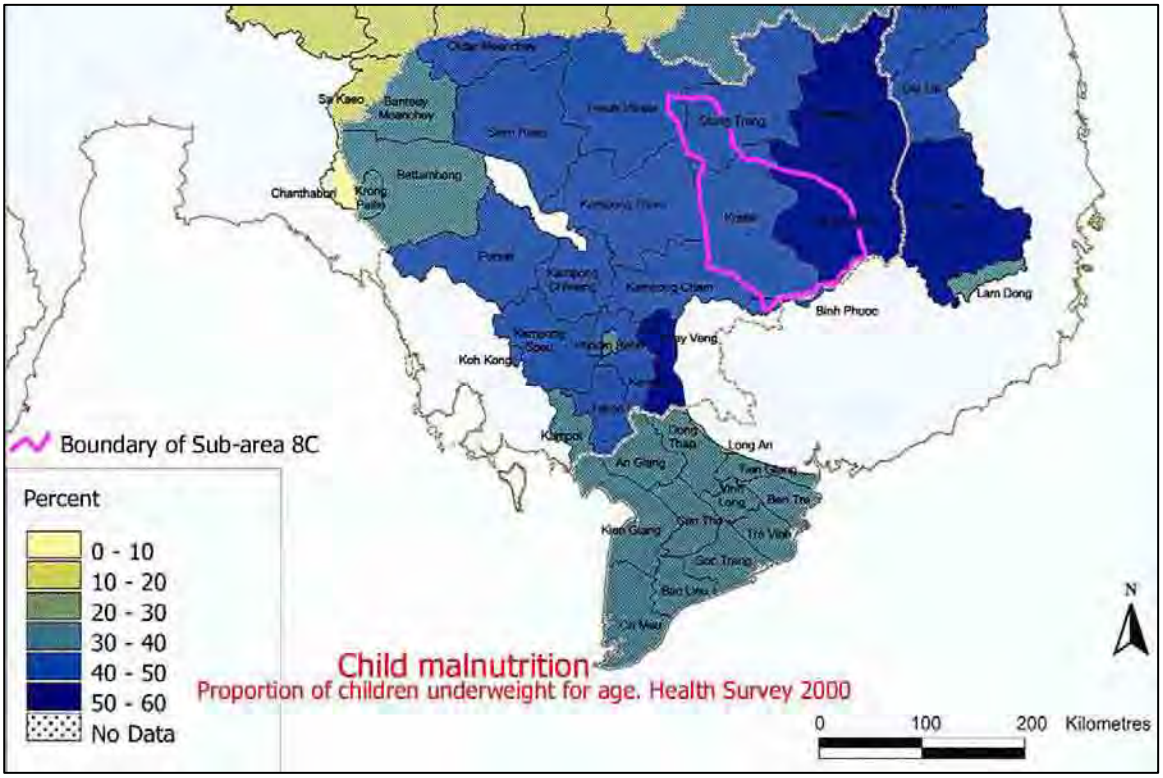


Figure 25: Child Malnutrition

7.2.2. Key Human Activities

7.2.2.1. Agriculture

Rice is the major crop cultivated in the Sub-area in term of superficies, since only 33% of the area is devoted to other crops than paddy. Irrigation is under developed with only 27% of irrigated land in the three main provinces. The average yield does not exceed 1.9 tons per hectare, but a lot of disparity is observed in different locations (Table 10). Low quality soils combined with inadequate water supply and weak cultural methods are key factors leading to low productivity. Data on varieties, crops and fertilization is too fragmented and incomplete to allow deeper analysis of the agricultural situation in the Sub-area.

7.2.2.2. Fisheries

90% of the population in the Sub-area is reliant on fishing for the household nutrition (CNMC, 2004). The table below summarizes the key fishery features of the provinces composing the 8C Sub-area.

Table 12: Number of People, Community and Company Engaged in Fishery, and Fish Production in the Provinces of Stung Treng and Mondulkiri (2002)

	Stung Treng	Mondulkiri
Number of Family Engaged in Fishing Activities	90 % of the family in the sub-area engaged in fishing for family consumption	
Number of fishery community	51	--
Number of Private Company engaged in Fisheries	--	
Fish production (t/y)	1, 500	20
Aquaculture Fish production (t/y)	100	--

Source: Provincial Reports, 2002.

There are 56 fishery communities in the sub-area, of which 51 are in Stung Treng province. There is one private company engaged fisheries activities in Ratanakiri. It is estimated that more than 1, 654 tones originates from catches in natural water-bodies and basin, while about more than 100 tones are produced from aquaculture every year in the sub-area (Ibid). A total value of the catches is not available as well as detailed data related to fishing activities.

Deep pools provide safe refuge for fish during the dry season. Deep pools and channels in the main stream of the Mekong near Kratie, in Nam Thuen and Nam Hin Boun in Lao PDR and in Sesan in Cambodia are widely acknowledged as the most important dry season refuges for dish. Deep pools that lie in the stretch between Khone Falls to Kratie are important habitats for fish in Cambodia and the Delta in Vietnam. In Kratie and Stung Treng provinces, 58 deep pools are identified to be primary rearing and dry season refuges for large catfish and carp. In the upper stream part of the Mekong River, called Khone Falls, 8 deep pools are listed as important fish habitats. Some are important

feeding grounds and dry season refuge for the Irrawaddy dolphin as well as a spawning area for Giant carps.

Table 13: Fish Sanctuaries Established by the Department of Fishery

Fish Sanctuary	Area, ha	Location
Kompong Pluk	6,377	Tonle Sap Lake (Siemreap)
Piek Kantel	1,230	Tonle Sap Lake (Battambang)
Dey Roniet	5,826	Tonle Sap Lake (Pursat)
Riangtil	1,859	Tonle Sap Lake (Pursat)
Kompong Prak	3,954	Tonle Sap Lake (Pursat)
Vhroy Sdey	1,490	Tonle Sap Lake (Pursat)
Pi Stuon	1,031	Tonle Sap Lake (Kg Chhnang)
Bar Lord	1,777	Tonle Sap Lake (Kg Thom)
Lot No. 14	691	Takeo
Lot No. 10	30	Kompong Cham
Lot No. 10	115	Kompong Cham
Lot No.3	9	Banteay Meanchey
Lot No.4	3	Banteay Meanchey
Total	**24,392**	

Source: PAD, 2003.

Table 14: Protected Areas which Include or Influence Significant Aquatic Ecosystems

Name of Protected Area	Area, ha	Location	Type of Aquatic Areas Influenced
Stung Treng Ramsar Site	14,600	On the Mekong River between Stung Treng and the border with Lao PDR	Inland wetland
Sarus Crane Reserve		Ang tra Peang Thmor	Inland wetland
Proposed marine protected area		Koh Kong province, Kiri Sakor District	Marine
Peam Krasop Wildlife Sanctuary	23,750	Koh Kong (Koh Kapik wetland and associated islets)	Inland wetland
Beng Per Wildlife Sanctuary	242,500	Kompong Thom	Inland wetland
Kep National Park	5,000	Kampot	Marine
Ream National Park	21,000	Sihanoukville	Marine
Botum Sakor National Park	171,250	Kampot and Sihanoukville	Marine
Tonle Sap Multiple Use Area	316,250	Kampong Chhnang, Kg. Thom, Siem Reap, Battambang and Pursat	Inland wetland

Source: PAD, 2003.

Protected areas established by DOF are called "Fish Sanctuaries". Unfortunately, it is to be noted that there is no fish sanctuary established within the 8C Sub-area as shown in the above table. But, while not designated as fish sanctuaries, most MOE protected areas contribute to localized fisheries productivity by maintaining river, lake and coastal habitats. The table above displays those protected areas, among which the Stung Treng Ramsar Site occupies 14,600 ha on the Mekong between Stung Treng and the border with Lao PDR, that represents less than 2% of the total protected areas in Cambodia.

Fishing Communities:

In 2001, the government embarked on a significant reform of the fisheries sector by improving community access to commercial fishing lots covering most of the traditional fishing areas. 56 percent (495,000ha) of officially auctioned fishing lots in 12 provinces were repealed for use by the poor as communal fishing grounds (PAD, 2003). In Stung Treng province, local communities have set up a Fisheries Community Commission as well as Fisheries Community Regulations to help manage these common fisheries areas (Chea & Sean, 2001). Some pools are given the status of "protected zones" by these regulations. All regulations prohibit catching fish by using dynamite, electro fishing and specify permitted sizes of gillnets in the pools. The creation of Village Fisheries Communities and local protected areas of various kinds is an important pilot in sustainable fisheries through local management (Ibid).

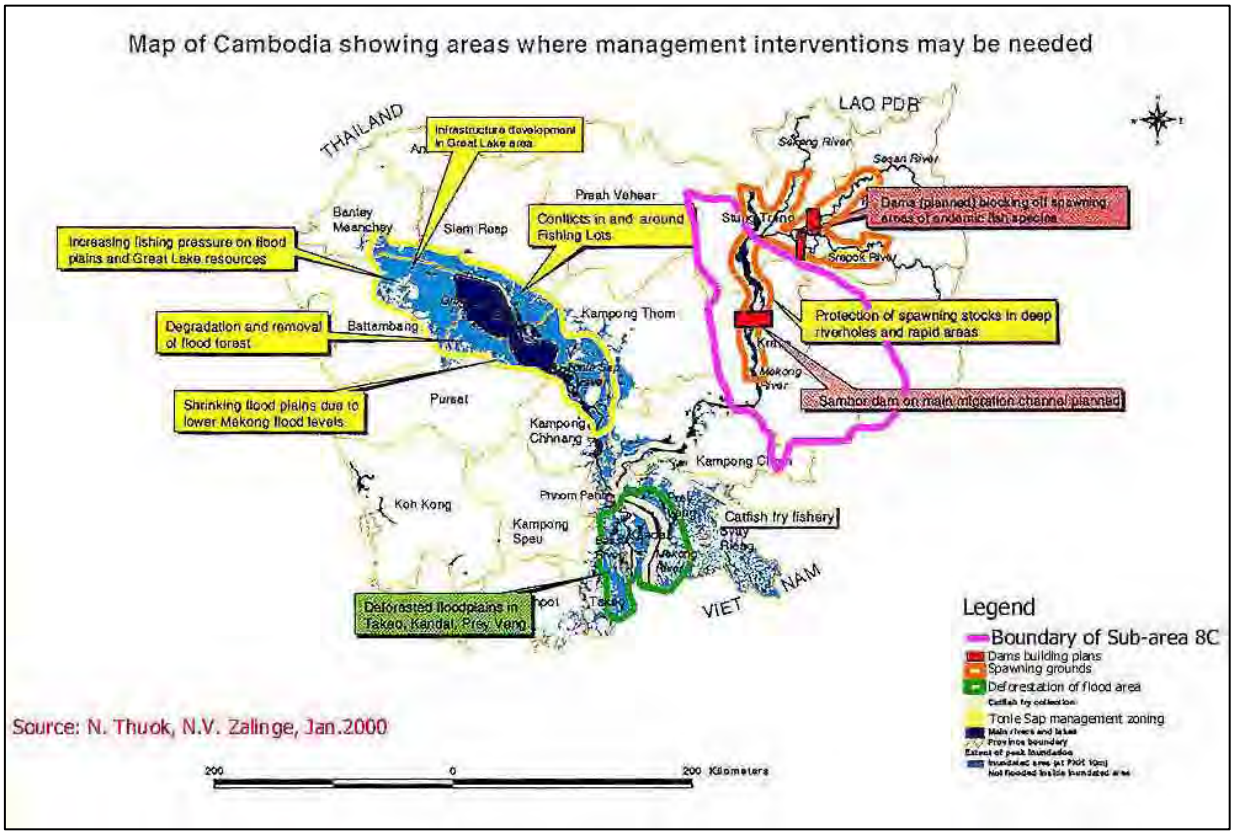


Figure 26: Area needed to be Managed

Numerous conflicts arise due to non-existence of fishing law and regulations. The draft fisheries law, decrees and sub-decrees have not yet entered into force. Dam construction is serious threats for fish migration, breeding and spawning in the 8C Sub-area. The map below gives an idea of the challenge of the fisheries sector in terms of threats, interventions, and conflicts.

7.3. Water and Related Resources

Water resources analysis is a complex work which requires availability of comprehensive, accurate and updated scientific data. As a contrast to neighboring countries of the Lower Mekong Basin, i.e. Thailand and Vietnam, Cambodia is a country that crucially lacks of data. Currently, with the support of MRC, there have been starting to install some gauging stations in some rivers of the basin. On the below paragraph, attempt is made to provide a state of existing data that have been collected from various sources. Only fragmentary information has been gathered, thus possibility for serious and comprehensive analysis is limited.

According the BDP Inception Report (MRC, 2002j), water resources analysis should comprise three main components:

- Availability of water
- Demand of water
- Use of water

7.3.1. Availability of Water

It can be defined as the flow of water into a sub-area from upstream, plus the resources (surface and groundwater) generated by net rainfall in the sub-area, minus the ecological demand within the area at its downstream boundary. The availability changes slowly, from one decade to the next, due to medium-term climate variations, or due to constructions of reservoirs or diversions. The availability can be measured, and/or determined by numerical modeling, with an accuracy that is conditioned by the coverage and quality of the basic hydrological data.

Data Gathered

Data gathered from the provincial reports of Stung Treng and Kratie are fragmented and lack of consistency and comprehensiveness.

Table 15: Water Resource in Stung Treng (whole province)

Water resource	Length (Km)
Mekong river	N/A
Sesan river	N/A
Sekong river	N/A
Sre Pok river	N/A

Number of well	360 wells
Rainfall data	1,836 mm
Other: lake, pond, canals	N/A

Source: Provincial Reports, 2003.

Table 16: Water Resource in Kratie by District (whole province)

District	HPW	HDW	FJ
Prek Prosop	98	181	384
Sambo	125	69	885
Chnoul	119	905	185
Kratie	294	340	1,516
Chhlong	295	293	764
Total	**931**	**1,788**	**3,734**

Source: Provincial Reports, 2003-2004.

Table 17: Water Supplies in Kratie (whole province)

Water sources	Unit	Total
Number of well Ø 1.50m X 96m	m3/h	40
Number of well Ø 1.50m X 209m	m3/h	40
Number of water pumps Ø 85mm	m3/h	45
Length of supply structure:		
Tube Ø 300mm (Font)	m	90
Tube Ø 250mm (Font)	m	1,806
Tube Ø 200mm (Font)	m	616
Tube Ø 150mm (Font)	m	843
Tube Ø 100mm (Font)	m	417
Tube Ø 250mm (PVC)	m	1,835
Tube Ø 200mm (PVC)	m	2,260
Tube Ø 150mm (PVC)	m	1,750
Tube Ø 100mm (PVC)	m	1,400
Tube Ø 200mm (Fer)	m	68
Tube Ø 150mm (Fer)	m	36
Volume of water distribution	m3/day	1,100

Source: Provincial Reports, 2003-2004.

7.3.2. Water Demand

Demand of water is the amount of water required for a given purpose, for example liters per person per day, or mm per crop. The demand can be consumptive (e.g. domestic use and irrigation), or it can be non-consumptive (e.g. ecological demand, navigation). It can be present or future. And it can be actual (i.e. related to an available infrastructure) or potential (assuming full infrastructural development and no water shortage). The serviceable (part of the) demand is limited both by infrastructure and water availability. The demand is related to aspects such as consumer lifestyles, topography and land use, crops and cultivation routines, and industrial development and technology. It can be estimated by various techniques, often with a large uncertainty.

Data gathered:

There is no data available for the Kratie Sub-area yet. According to the MRC-BDP Planning-Regional Sector Review 2002 (Domestic Water and Sanitation), per capita use of water for domestic purposes varies widely – estimates quoted by Seager (2002) are from 2 m^3 per year in Cambodia to 47 m^3 in Vietnam. Estimates of demand from MRC-WUP (2002) are displayed in the below table.

Table 18: Estimate of Water Demand

	Population LMB (Estimate)	Demand per capita (m^3 per year) MRC-WUP
Cambodia (1998)	9,800,000	12
Lao PDR (2000)	4,905,000	20
Thailand (2000)	23,130,000	24
Vietnam (2000)	16,920,000	42
Average	-	24.5

Source: MRC, 2002f.

An alternative measure of likely demand is given by the supply targets set by each country. Lao PDR aims to provide 7 m^3 per year per capita (ADB, 1998) and Vietnam 22 m^3 per year per capita (NSWSS, 2000). Given a total population in the Lower Mekong Basin of approximately 55 million and assuming a demand of between 20 and 100 m^3 per year, current total demand for domestic water is in the order of 1,100 to 5,500 million m^3 per year, or about 0.2% to 1.2% of Mekong annual flow (estimated as 450,000 million m^3 per year from data in MRC 1998).

Table 19: Access to Improved Water Supply and Sanitation, 1999-2000 (Percentage of population)

	Improved Water Supply			Sanitation		
	Total	Urban	Rural	Total	Urban	Rural
Cambodia	30%	54%	26%	17%	56%	10%
Lao PDR	37	61	29	30	67	19
Thailand	84	95	81	96	96	96
Vietnam	77	95	72	47	82	38

Source: MRC, 2002f.

Excepted in Thailand, the proportion of population who can access to improved water supply and sanitation is higher in the urban areas than in the rural areas. This gap is wide in Cambodia and Lao PDR than in Vietnam. For improved water supply, the gap between urban and rural areas in Cambodia is about 52% at the advantage of the urban. Regarding sanitation, only 10% of population in the rural areas in Cambodia do actually access to, while it is available for 56% of urban population. This high disparity between rural and urban areas can be explained by imbalanced development policy at the detriment of the countryside where 80% of population is living and producing food.

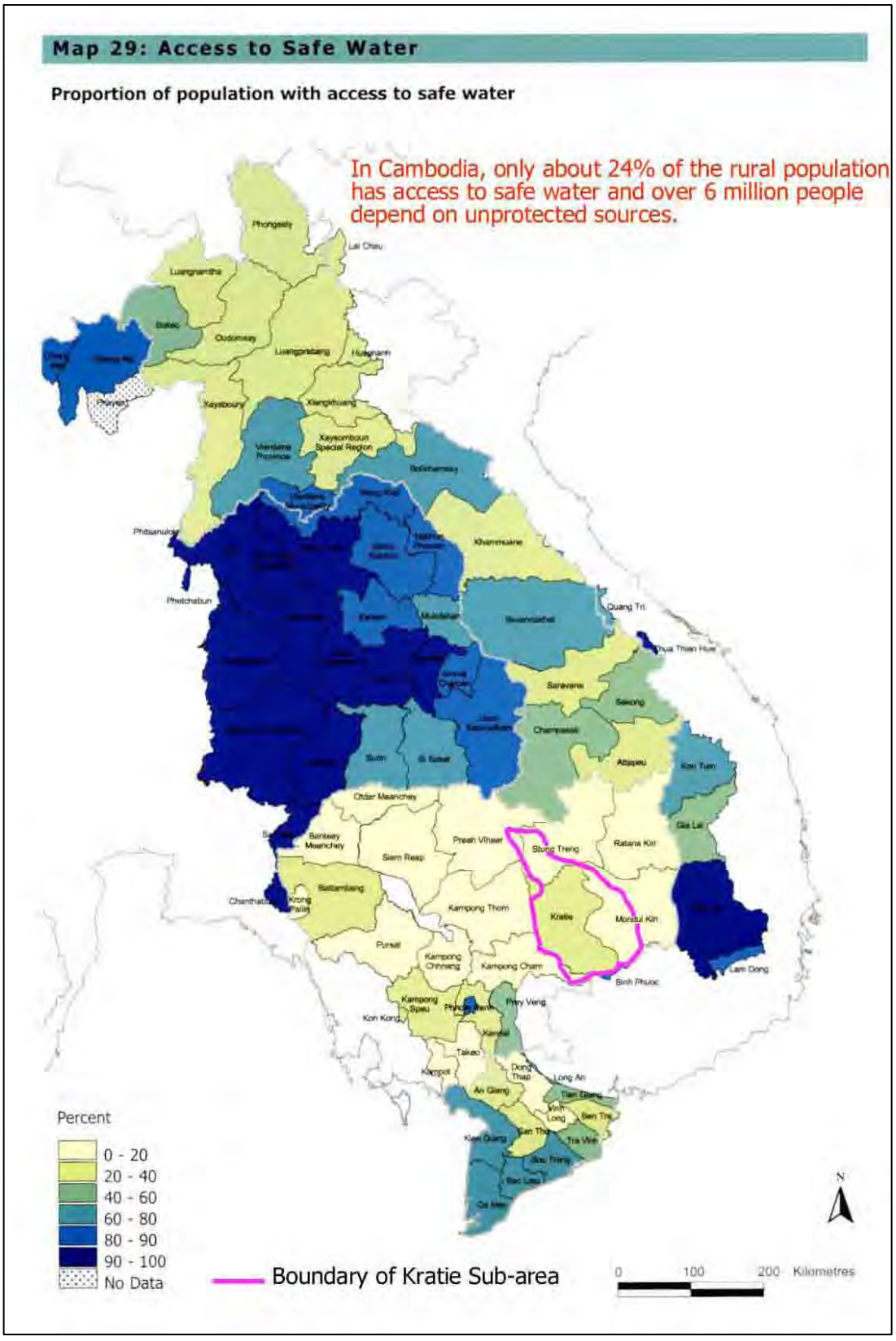


Figure 27: Access to Safe Water in the 8C Sub-area

7.3.3. Access to Safe Water

The quality of water supply varies widely across the LMB. In the majority of Cambodian provinces, the proportion of population having access to safe water is less than 25%. In the Kratie Sub-area provinces, maximum 40% of population has access to safe water in the province of Kratie, compared to 25% only in the provinces of Stung Treng, and Mondulkiri.

Also, during the dry season in Cambodia, the number of households with access to safe water declines in both urban and rural areas. In urban areas, piped water systems increase the availability of safe water. Access to safe water is much more common in Phnom-Penh and Vientiane Municipality than in other areas of Cambodia and Lao PDR. Water supplies are also improving in secondary urban centers as a result of government and donor investments

7.3.4. Use of Water

Use of water is the part of the consumptive demand that is actually served at a given time. Many such uses generate a return flow, for example as sewage, or as irrigation tail water. The return flow can occur at a different time or place than the withdrawal, for example in case of a storage reservoir retaining water in a part of the year and releasing it in a different part of the year. The use of water can be increased by infrastructural development and reduced by demand management.

An important part of the water resources analysis is to examine the scope for balancing the availability and demand of water under different assumptions about availability. During this analysis, a clear distinction should be made between water availability (or water resources generated), water demand, and actual water uses. This is in order to prevent ends and means being mixed up.

Data Gathered:

No data on use of water in the Kratie Sub-area is available. Only general data at the national level is available as described below. Cambodia has 946 operating irrigation systems which can service 256,120 ha of the 2 million ha wet season cultivated area. In the dry season, rice is grown on 225,000 ha and 143,490 ha of this can receive irrigation water from irrigation schemes. Hence, only 12% of the wet season rice is irrigable, the remainder being rainfed and just over half of the dry season crop is irrigated, the remainder being recession rice receiving supplementary irrigation from manually operated and diesel driven pumps. Very few of the irrigation schemes are capable of irrigating all year round.

Fully irrigated crops receive approximately 10,000 m^3/ha. Some irrigation engineers in Cambodia consider recession rice receives approximately 4,000 m^3/ha of irrigated water.

7.3.5. Water Consumption by Agriculture in the LMB

No specific data is available for the Kratie Sub-area. Only general data related to the Lower Mekong Basin is presented below. Mekong river water is utilized for irrigation,

hydropower generation, domestic and industrial purposes. Much of water emerging from hydropower stations is also consumed downstream for irrigation, domestic and industrial purposes. Irrigated agriculture is responsible for 80-90% of water abstractions from the Basin (FAP from MRC, 2002) and is utilized in the form of receding flood water storage, diversion of water from streams and from ground water sources.

On a nationwide basis, the LMB countries do not fully utilize their renewable water resources. Renewable water resources are equal to the total precipitation in the country minus evapo-transpiration. Cambodia and Laos use only 1% of their total renewable water resources for agriculture while Vietnam and Thailand use 5 and 20% respectively. Based on these figures, an average Mekong river flow of 460 km³ each year can service the irrigation requirements of all LMB countries 11 fold. An annual Mekong river flow can also service approximately 64 million ha of fully irrigated rice based on a consumption of 10,000 m³/ha (1 meter of water) per crop. This compares with the 1999/2000 area of 2 million ha of dry season cropping in the LMB watersheds.

Therefore, there is no shortage of water in the Mekong River to service agriculture in it watersheds if all water is captured and redistributed when required. This is of course, not the case, with a majority of water flowing through to the ocean during the wet season when crops receive most of their water requirements directly from rainfall. Water shortages may occur (especially in the Mekong Delta) during the months of February to May when water flows in the Mekong River are at their lowest. Crop irrigation is the major consumer.

7.3.6. Water Consumption by Industry

No specific data is available for the Kratie Sub-area. The below data is general data at the national level. Water is necessary for all industrial activities, including cooling processing or manufacturing operations, power generation, cleanup and other sanitary purposes, and fire protection. The quality and quantity of industrial water demand varies significantly by country, industry and particularly uses, ranging from high water quality for the beverage industry to brackish water or treated municipal effluent for cooling purposes. Urban water usage is estimated at about 100 liters per person per day, for a total average annual supply of 36 million m³ for other urban centers in Cambodia. The total water usage represents about 0.01% of the flow in the Mekong River (WUP, 2001).

Some figures on water demand and use
Total water demand/capita = 150 m³ per capita per year Share agriculture = 94% Share Municipal and Industrial = 6% Municipal and Industrial withdrawal 1990 = 78 million m³ Municipal and Industrial withdrawal 2020 = 187 million m³ (Source: Ringler, 2001 in MRC-BDP Planning Regional Sector Overview 2002) Total water demand = 0.5 Bm³ per year Internal water supply = 1,004 m³ per person Water for domestic use = 5%

Some figures on water demand and use
Water for industrial use = 1% Water for agricultural use = 94% These figures will change due to future development in the LMB that bring about changes in the river hydrology. (Source: CNMC, 2003)

7.3.7. Major Legal and Policy Documents pertaining to Watershed Management in Cambodia

- Land Law (endorsed in August 2001);
- Law on Commune Administration Management (endorsed in August 2000);
- Law in environmental protection and natural resource management (endorsed in November 1996);
- Forestry Law (already submitted to the Council of Ministers in July 2001, but has not yet passed);
- Sub-decree on forest concession management (signed by the Prime Minister in February 2002);
- Law on Water resources management (draft);
- Decentralization and devolution Policy of the Ministry of Interior;
- 5 year socio-economic Development Plan (2001-2005); particularly relevant on poverty alleviation;
- Interim Poverty Reduction Strategy Paper;
- Agricultural Development Plan (2001-2005);
- Action Program for the Development of Agriculture in Cambodia (2001-2010;)
- Government Action Plan 2001, which includes a section specifically dealing with natural resources management;
- Draft Policy for Ethnic Minority People's Development, also called "Highland Policy" (Sept. 1997, not yet ratified by the Council of Ministers); and
- Forest Policy- currently being draft by a national working group.

7.3.8. Analysis

- Data gathered from diverse sources are fragmentary, inconsistent and vary widely from one source to another. This lack of capacity of the Cambodian institutions to produce accurate and reliable data on water resources (surface and groundwater) seriously impacts on any possibility to plan, manage and evaluate actions aiming at securing water availability for the population for better access to water and greater development opportunities, be they irrigated agriculture, fisheries, tourism, industry and/or navigation.

- Potential water availability is huge including groundwater, but the effective access of the population to water is limited because of weak management expertise of relevant institutions, lack of infrastructure and budget. Therefore, water is not available at when it is needed.

- Cambodia's challenge related to water is threefold; technological, institutional and social. Technologically, the main challenge is water control including flooding control and warning systems set up. The latest technologies based on satellite imagery and GIS are capable to assist man in forecasting and warning about some natural calamities and thus, to minimize their disastrous impacts on human activities. However, these technologies are expensive and require a corresponding level of technical capacity to be able to take advantage of them. Institutionally, there is a need to achieve the reforms so that competent human resources are employed and overlapping mandates between rival institutions reduced, for the sake of more efficient and effective water resource management and exploitation. Efforts in capacity building must continue and funds allocated to this task.
- Socially, the challenge is to enable equitable access to water resources to the population, especially the poorest and the rural inhabitants. Access to safe water should be nation-wide and a priority for further policy enforcement.
- The impressive panoply of existing laws, regulations and policies is conducive to rational and sustainable watersheds resources management on the condition that there is real and sufficient political willingness for enforcement.

7.4. Trends

7.4.1. Threats on wildlife and fishery eco-system

The presence of deep pools serving as refuge for fish spawning during the dry season (Kratie and Se San) are seriously threatened by the construction of huge hydroelectric projects in the tributaries of the Mekong. Water diversion and the alteration of the river's hydrologic cycle resulted from the hydroelectric projects impact on water quality and quantity in the tributaries of the Mekong River where a fragile eco-system of fish biodiversity provides substantial food and resources to the population so far. Furthermore, the disturbance created by the hydroelectric projects is jeopardizing the future of fishery resource due to the change induced in fish migration itineraries.

It is of importance to remind that in Kratie and Stung Treng provinces, 58 deep pools are identified to be primary rearing and dry season refuges for large catfish and carp. In the upper stream part of the Mekong River, called Khone Falls, 8 deep pools are listed as important fish habitats. Some are important feeding grounds and dry season refuge for the Irrawaddy dolphin as well as a spawning area for Giant carps.

The wildlife trade of endangered species of fauna at the domestic and international levels provides the smugglers with substantial financial resources. Very often, those smugglers benefit from the collusion and the protection of influential and powerful persons, which makes difficult repressive action against them, despite the existence of laws and regulations relevant to the protection areas.

Future directions aiming at managing the protected areas efficiently include review and revision of the national classification and categories of protected areas, and resolving institutional uncertainties between MAFF and MOE concerning protected areas.

The map below shows the wildlife trade itinerary within the protected areas, the national parks and the wildlife reserve. Within the Kratie Sub-area, part of the wildlife reserve of Lomphat (Mondulkiri) and the whole area of the Phnom Prich (Mondulkiri) and Snuol (Kratie) wildlife reserves are not direct sources of the wildlife trade , but the domestic itinerary passes through the Sub-area in many locations, e.g. Stung Treng town and Kratie town. This suggests that there is high possibility that the Sub-area become a new source of wildlife trade in the near future.

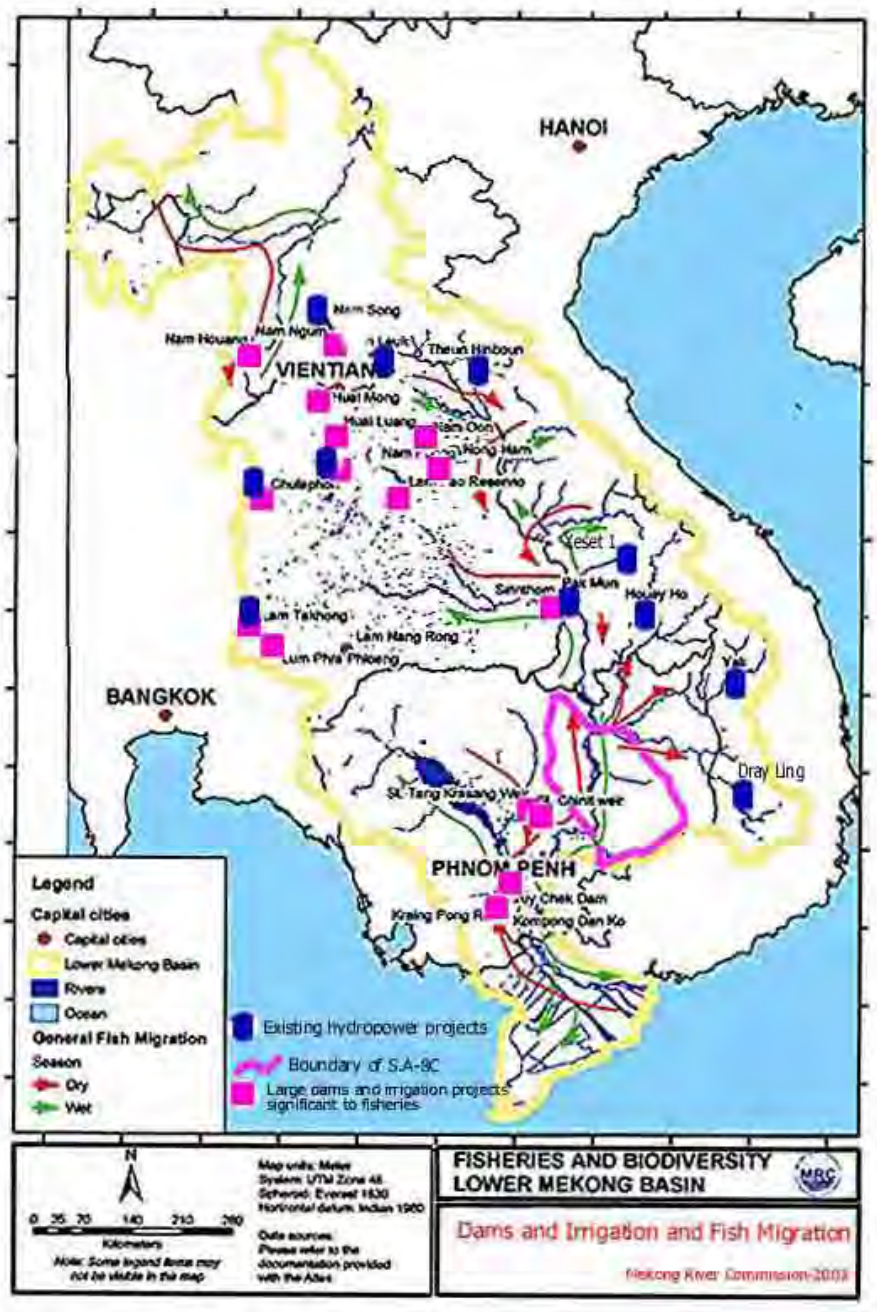


Figure 28: Fisheries and Biodiversity

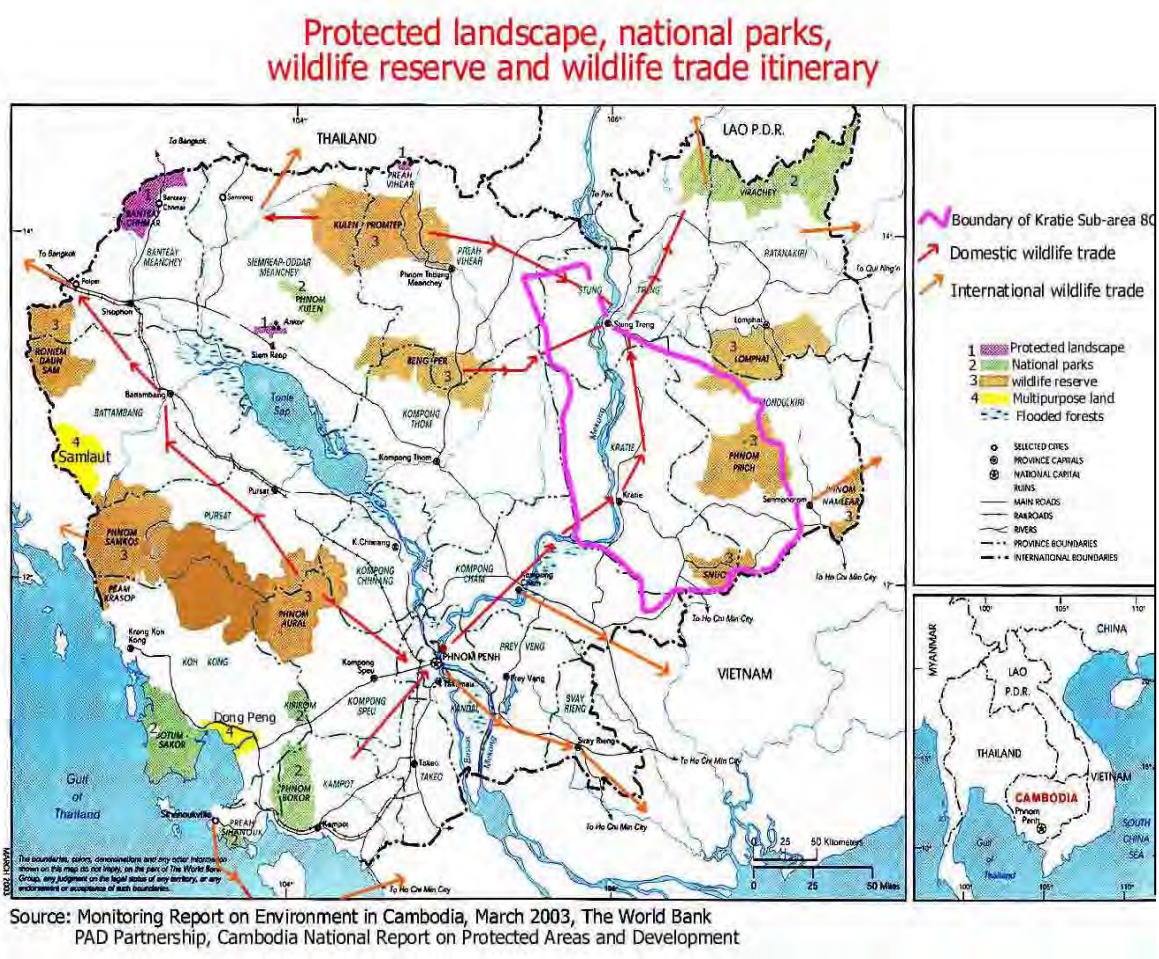


Figure 29: Protected Landscapes, National Parks and Wildlife Reserve

The inundation of spawning areas would economically impact important species which are sensitive to water depth. The inundation of wetland adjacent to the river would affect the nursery habitat. The blockage of migratory species may cause their extinction and the disruption of fishery dynamics. Pollutants from hydropower reservoirs could harm the reservoir fish and, therefore, the food chains (Long & Pham, 1999). The dam's damage to downstream fisheries is irreversible and devastating to inhabitants who depend heavily on fish for protein and their means of their living

7.4.2. Degradation of Environment (The examples of forestry and water issues in Mondulkiri)

The forestry issue:

Unimpeded semi-illegal and illegal logging is perhaps the biggest problem in Mondulkiri in short term to medium term. In its March 1998 report (for the dry season 1997/1998), Global Witness explains that permits to collect and export 12,865 illegal logs (27,000

cubic meters) from several provinces were officially issued at the Prime Minister level to Commanders in Military Region number 1 (Öjendal J. et al, 2001). Further documents state that only 12,500 cubic meters were to be taken from Ratanakiri. It is common knowledge in Ratanakiri, however, that the actual amounts may be as much as 200,000 cubic meters (Ibid, 2001).

The negative consequences of logging are manifold and the indigenous population suffers the most severe and direct consequences. The collection of Non-Timber Forest Products (NTFPs) is vital for food security because it provides both supplementary nutrition and products that can be sold. Where careless logging is practiced, discarded logs and litter are left behind which makes the understudy of the forest too thick and clogs streams and rivers. Traveling through the area to collect products become difficult, aquatic resources are destroyed and fish migration is blocked. Biodiversity would ultimately be threatened if logging were to continue at the same pace.

The forestry sector appears to be the most difficult one to regulate through decentralization. It is also the natural resource over which the national government is least willing to hand over power.

The water issue:

The water issue could be viewed at two different levels. The first is the micro level where water resources are used for individual villages and minor communities, including local streams and ponds and the infrastructure around them. The second is the provincial level, concerning overall water supplies and the major tributary rivers to the Mekong, which is in a geographical sense define the living, agricultural and fishing conditions of the province.

7.4.3. Intensification of Illegal Immigration from Vietnam

Despite the fact that this is a very sensitive and controversial issue, no consistent statistics is available to support the insistent allegations of this illegal immigration. However, it is to be noted that this issue is exacerbate by the political parties especially during the elections period, and becomes less passionate when a political agreement is reached between the major rivals.

No data is available to verify whether it is a stigmatization of the Vietnamese migrants who – one must recognize - have always been settling in Cambodia during the past two centuries. So far, the issue of illegal immigration has been addressed with a remarkable sense of complaisance and laxity.

7.4.4. Tourism Development

The provinces of Mondulkiri and Kratie are parts of the new destinations for tourism, despite the fact that the development of the concept of ecotourism remains embryonic in Cambodia. Poor infrastructure and limited number of attractive tourism sites are major constraints for the development of investment in those areas.

For instance, the Irrawady Dolphins in Kratie constitute the unique attraction in this province. Furthermore, recent pessimistic reports by conservationist Isabel Beasley from the Mekong Dophin Conservation Project warn the authority that the Irrawaddy dolphins which inhabit the Mekong River are on the edge of extinction (Phnom Penh Post 10-23, 2004). Thus they will soon be listed as critically endangered and may even be classified as a unique sub-species. It is estimated that as few as 80 of the creatures survive in the Mekong after years of over-fishing and hunting, including being used for target practice by Khmer Rouge soldiers during the 1970s (Ibid, 2004). As said Beasley, " Tourism is a good thing for conservation because people can see benefit from conserving the dolphins. But development has to involve the community" (Ibid, 2004). She estimates that only 80 dolphins remain in the Mekong, and once that number drops below 50, conservation efforts will become effectively useless. Tourism development in Mondulkiri also effects on land speculation.

Table 20: Number of Tourist influx and Mean of Travel by Province

	Stung Treng	Ratanakiri	Mondulkiri
Number of tourist arrival	***9,111***	***9,041***	***3,027***
local	2,625	5,014	2,108
Foreigner	6,486	4,027	919
Mean of travel			
By road	30%	70%	100%
By boat	60%	0%	--
By air	10%	30%	--

Source: Provincial Reports, 2002.

7.4.5. Land Encroachment and Speculation (Consequences on Environment and Livelihood of Indigenous People)

A growing population, due among other things to the improved health situation, is indeed one cause of increasing pressure on the land. Land encroachment is one problem, but there are others still. Abuse of power is not restricted to the local or individual level. Agricultural concessions have been grated and land has been sold by ministry and government officials in Phnom-Penh – sometimes providing local leaders with a share of profit, sometimes plainly undermining benevolent local leaders who lack the power or courage to go against deals made at the central level (Global Witness, 1996). Moreover, the cyclical nature of highland farming, in which large areas are left fallow for many years, has several cases led to land lain fallow being taken be outsiders. The reasons for this have probably been a combination of not being aware of the traditional system and of simply not respecting it (Öjendal J. et al, 2001). Currently, Cambodian law states that any land not being used belong to the Government.

Another aspect is that land is becoming such an issue in the country as a whole that people with money realize that they can make a large profit if they buy and resell it or use it for large-scale plantations. This problem is therefore connected to the forestry issue. People obtain land covered with forest, cut down the trees – without worrying about sustainability or long-term consequences – because they know that they will them be able to use the land for agriculture. In addition, small and large-scale plantations are being

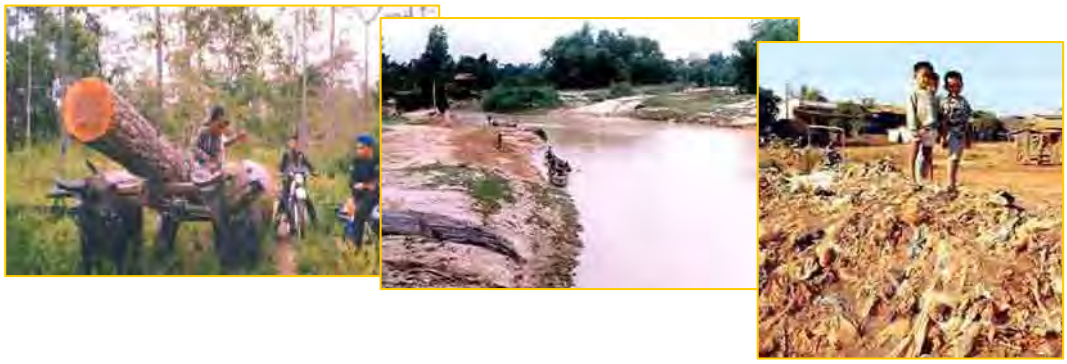
established in the province at a fairly high pace (Colm, 1997). Another, perhaps even more difficult, land problem is posed by the overall governance situation in the country. It is fairly common to find informal leaders whose power is based on a reputation for being knowledgeable and willing to work in people's best interest, but it can also be based on force (Hasselskog, 2000).

The environmental and survival consequences of land grabbling are inevitable: because people are moving away from the low-intensive use of land, the soil is becoming less fertile, which means that yields will be lower, as will the level of food security. As a result, the weakening of the local culture may become a serious concern, despite the official discourse of promotion of minorities' culture.

7.5. Tran-Boundary Issues

Identification and analysis of trans-boundary issues are crucial for planning and decision-making of the riparian Governments. Below are the key trans-boundary issues identified for the BDP of the Kratie Sub-area.

7.5.1. Environmental Degradation and Contamination



Deforestation impacts on the environment beyond the boundaries of the concerned country. The most direct environment consequences of deforestation are the depredation of the forest biota in the deforested area. Because forests are almost always more biologically diverse than the system with which they are replaced, this usually results in a local loss biodiversity, and potentially a reduction in global species diversity (MRC, 2003d).

An issue of great concern is the Lower Mekong Basin, and thus in the Kratie Sub-area, has been the consequences of forest clearance on hydrology and related processes, i.e. flooding, soil erosion and mass soil movement. When mature forest is cleared, the hydrological consequences depend on the subsequent use of the land.

Deforestation also impacts on society and economy. Progressive disappearance of the flooded forest in the downstream Tonle Sap Sub-area is a serious threat for fish reproduction and refuge where large numbers of people draw upon fishery resources for a high proportion of their subsistence and income needs. The agricultural encroachment

that follows deforestation often causes the loss of traditional land use rights and traditional conservation mechanisms.

Water pollution by pesticides and chemical fertilizers under the development of intensive agriculture is another great concern. Even through persistent pesticides are banned in the riparian countries, it is clear that residual and illegally imported stocks continue to be used because residues of DDT, Dieldrin, and similar chemicals have been found in fish across the Mekong basin.

Pesticides can also cause environmental problems through build-up in the soil, toxicity to human and the development of resistance on the part of pests. Rapid development of hydropower projects in the upstream part of the Mekong River and its tributaries is being negatively affecting the spawning and rearing ecological system of fishes with the progressive destruction of deep pools in Kratie and Stung Treng. When fish reproduction and migration are affected, so is the livelihood of people who rely on local resources their living.

7.5.2. Population Migration

Migration is another concerning trans-boundary issue in terms of social and geo-political implications. The search for employment is a major cause of migration. Seasonal and semi-permanent migration to urban areas provides important income for households in rural areas. Several different types of migration appear to be taking place at the same time, as suggested by national level data from Cambodia and Thailand. The largest movements are between rural areas. People relocated from densely populated rural areas to remote ones to seek new economic opportunities. Economic development in the Lower Mekong Basin, especially in urban centers, creates strong attraction for rural people because jobs are more numerous, better paid and services are more developed.

Migration towards the Sub-area comprises internal rural migrants and trans-boundary migrants which statistics and legality remain a hot and controversial issue. Foreigners' migrants are motivated by abundant fishery resources and very open business opportunities after the liberalization of the political system since 1989. There are few comprehensive and consistent data related to this migratory phenomenon.

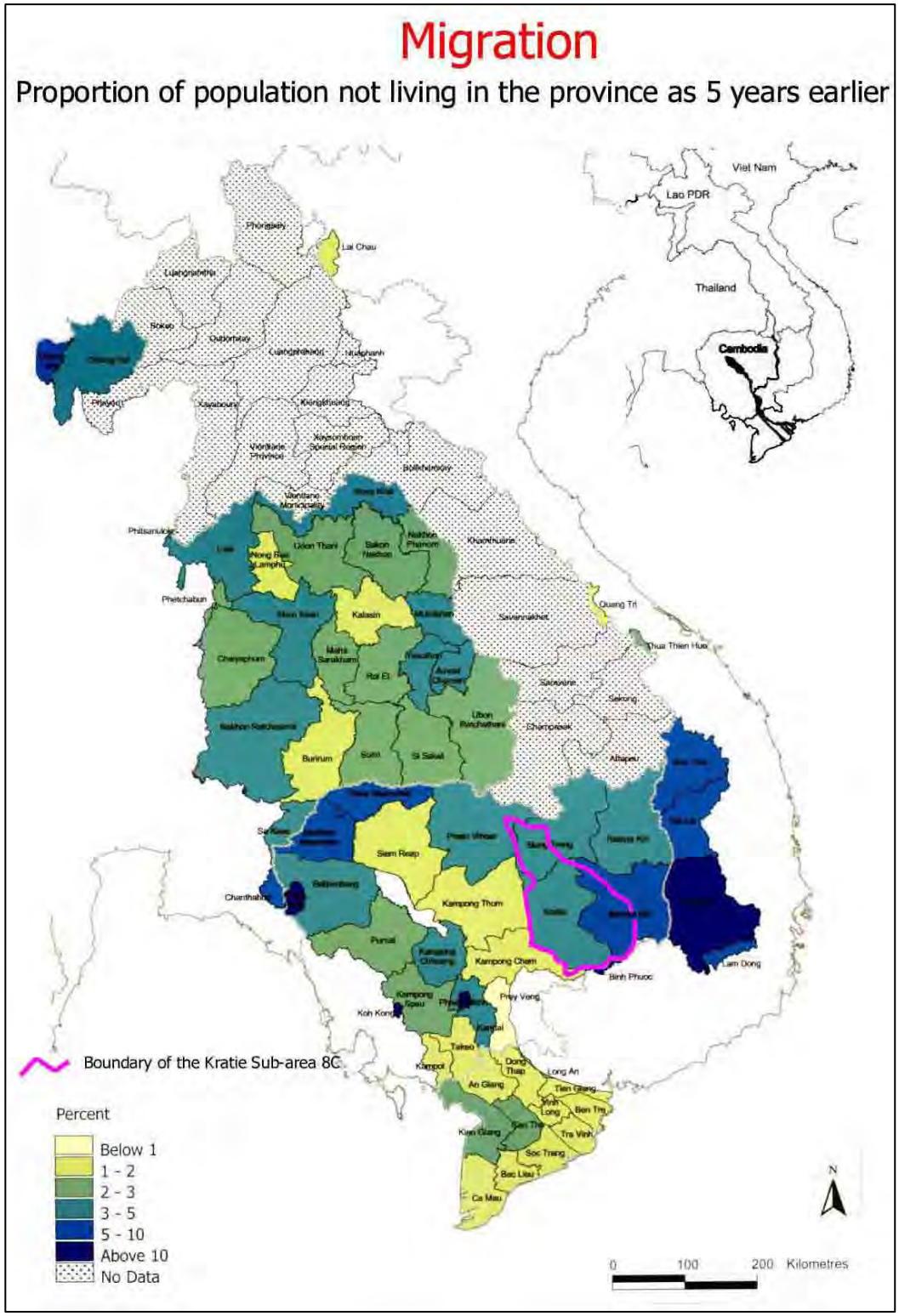


Figure 30: Proportion of Population not living in the Provinces as 5 years earlier

The province of Mondulkiri accounts one of the highest rate of quite recent immigration in Cambodia, since 5-10% of his population is not living in the province as 5 years earlier. This phenomenon is comparable to the provinces of Banteay Meanchey and Oddar Meanchey. The provinces of Kratie and Stung Treng are also affected by recent immigration flux with a lower rate of 3-5%, but still significant given their geographical location in the Sub-area.

7.5.3. Fishery Resources Management

Fishery resources management is the perfect example of trans-boundary issue that challenges every riparian country. Because fish reproduction and associated migration factors go beyond political, administrative and economic frontiers delimiting the States, the fishery issue is exacerbated by growing conflict of interest between the Governments. Rising waters, turbidity and/or the first rains trigger adults of many Mekong fish species to spawn (Poulsen, 2000). Long distance migratory fish species or "White" fish have adapted to spawn at the onset of the monsoon season (May-July), so that their fry and juveniles are ready to enter and feed when the plains become flooded from July to September. Short distance migratory or "black" fish species also migrate to spawn and feed in the inundated floodplains. Deep pools and channels in the mainstream of the Mekong near Kratie in Cambodia, in the Nam Theum, Nam Hinboun in Lao PDR, and in the Se San River in Cambodia are widely acknowledged as dry season refuges for fish, which re-colonize flooded areas during the following monsoon (Poulsen & Valbo, 2001). The long distance fish migrations within main river channels and their main tributaries are referred to as "longitudinal migrations". Such long distance migrations can cover distances of hundreds of km from the Mekong Delta in Vietnam, through Cambodia, to Thailand or Lao PDR through the Mekong River mainstream, Lao PDR through the Se Kong River, or the Central Highlands in Vietnam through the Se San and Sre Pok Rivers (Coates et al., 2001).

It is obvious that any change of the eco-system occurring in the upstream region will affect and impact on the livelihood of hundred millions of people whose food supply and economic activities heavily rely on fishery resources in the downstream areas. Water quality, water availability, and preservation of the flooded forest are key conditions for the survival and sustainability of fishery resources in Cambodia.

The 1995 Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin, means that attempt is being made to " Cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin, ...in a manner to optimize the multiple –use and mutual benefits of all riparian and to minimize the harmful effects that might result from natural occurrences and man-made activities" (Article 1).

However, among the weak-points, the Agreement does not set any strict upper limits to water use, except for trans-basin diversions in the dry season, but this is not where the large potentials are anyway. Cambodia obtained an assurance that the reversed flow of the Tonle Sap River, following the annual flooding would be allowed. Cambodia, as a relatively small country, also benefits from the relative security of such an Agreement. More importantly, Cambodia received an assurance for protection of the water supply to the Tonle Sap Lake. It is perhaps the single most important factor for Cambodia. It will also benefit from improved information flow and a higher concern of overall environmental protection in the Basin. On the other hand, Cambodia is vulnerable vis a vis Thailand and Laos when it comes to trans-basin diversions and other large-scale upstream water use, e.g. Hydropower development. But Cambodia can however expect strong support from Vietnam that has similar problems, and both have, consequently, a high interest in regional cooperation around this question. Flood control is an issue that deserves more attention in the Agreement.

To what extent the Agreement represents a move toward a higher degree of regional cooperation or does it mean a move away from it? For instance, large-scale trans-basin diversions, the most unwanted and conflicting scenario for the downstream countries, are allowed as long as the right amount of information is given and/or prior consultation is practiced, and that is done outside the critical dry season period. Even though the Agreement keeps a high profile on environmental sustainability in the Basin, it must be noted that there is yet no credible monitor mechanism in place.

7.5.3.1.Fishery Resources Decline in Figures

Table 21: Depredation of the Eco-System Supporting Fishery Resources

Type of Land and Water Resources in Cambodia	Area (ha) 1985/87	Area (ha) 1992/93
Permanent water (river, lake, pond, etc.)	567,100	411,1000
Flooded forest	795,400	370,700
Flooded secondary forest	28,200	259,800
Flooded grassland	80,800	84,900
Receding and floating rice fields	17,500	29,300
Seasonally flooded crop fields	366,800	529,900
Swamp	12,200	1,400
Total	**1,868,000**	**5,387,000**

Source: Ahmed et al, 1996.

Note: Beside and overall decline, there were significant changes in the area under different types of land and water resources which support fisheries between 1985/87 and 1992/93. The changes in the area under each type of resource can be attributed to loss of primary flooded forests and timing of the survey between the two periods.

As an indication, in 1940 the Tonle Sap Great Lake Region catch of 125,000 tons consisted mainly of large and medium size fish, while the 1995-96 catch of 235,000 tons contained hardly any large fish and was strongly dominated by small fish.

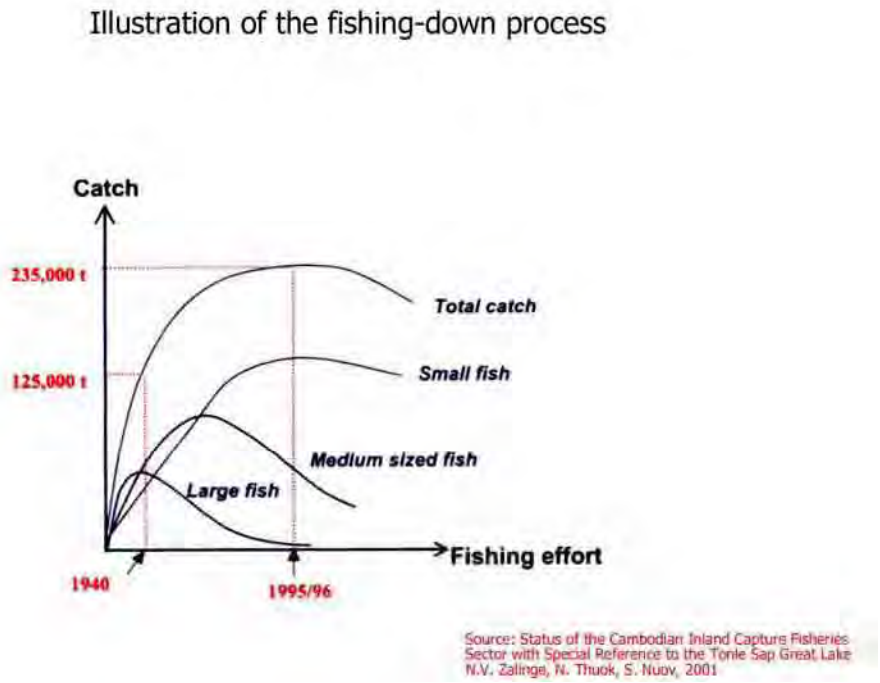


Figure 31: Illustration of the Fishing-Down Process

These above figures could be analyzed in term of variation between 1987 and 1993. Results are displayed in the Table 22:

Table 22: Variation of Various Types of Land and Water between 1987 and 1993

Type of land, water resources in Cambodia	Area Variation 1987-1993 (%)	Estimate Average Variation per year (ha)
Permanent water (river, lake, pond etc.)	-27.5	- 26,000
Flooded forest	-53.4	-70,783
Flooded secondary forest	x 9 times	+38,600
Flooded grassland	+5.0	+683
Receding and floating rice fields	+67.5	+1,967
Seasonally flooded crop fields	+44.5	+27,183
Swamp	-88.5	-1,800
Total	**-9.7**	**-30,150**

Every year, between 1987 and 1993, the average area of eco-system which supports freshwater capture fish has declined 9.7% equivalent to 30,150 ha. Flooded forest pays the highest tribute to this depredation: 53.4% of its area disappears between 1985 and 1993, equivalent to 70,783 ha per year. As a result to this destruction, flooded secondary

forest occupies the space. Its area has been multiplied by 9 in six years, meaning 38,600 ha increase per year. Receding and floating rice fields gain of areas with 67.5% increase in the same period (1,967 ha annually)

Table 23: Fresh Fish Production, 1992-2000

Year	Fish Yield, tons
1992	68,900
1993	67,900
1994	65,000
1995	72,500
1996	63,510
1997	73,000
1998	75,700
1999	231,000*
2000	245,600*

Source: Touch & Bruce, 2000.
Note: (*): Include small-scale fishing.

7.5.3.2. Trans-Boundary Factors Impacting on Fisheries Resources

- Development of water resources, particularly dam and weir construction for hydroelectric power, resulting in e.g. increased water levels, increased turbidity and reduction in nutrient levels. Dams also impact in water quality, affecting downstream total suspended solids and nutrient levels, especially total phosphorus and dissolved oxygen levels. Oxygen-consuming decomposition of organic material mainly occurs at the bottom, and the bottom water can become hypoxic or even anoxic if the reservoir is stratified. If oxygen-depleted bottom water is released from a dam, fish kills can occur downstream.
- The introduction of exotic fish species – if uncontrolled – represent a serious threat for the biodiversity through hybridization, destruction of local species and competition for food and habitat. The good illustration of this is the mysterious introduction and the banning of freshwater species "Trey Chap" (Pirania sp.) from foreign countries for aquaculture purpose. Carnivorous and voracious, "Trey Chap" is feared for damages provoked on local species of fish.
- The increased and irrational use of chemical pesticides, herbicides and fertilizers in the agriculture sector is being provoking harm on the fish habitat and eco-system, through eutrophication and water pollution by aggressive chemical molecules which some (e.g. DDT and Dieldrin) have been banned from utilization by WHO and other relevant international institutions, but not from production and commercialization.

7.5.4. Hydropower

7.5.4.1. Cambodia's Demand of Electrical Power

The country's demand of electrical power is projected to increase from 251 MW to 746 MW between 2000 and 2016. Previous feasibility study reveals potential hydropower in Pursat (3.5 MW) and Stung Sen (38 MW) (Bohneur, 2003).

7.5.4.2. Potential for Hydropower Development in the Mekong Basin

The total potential for feasible hydropower projects in the four Lower Mekong Basin countries is approximately 30,000 MW including 13,000 MW on the Mekong's Mainstream, and the remaining tributaries' potential (13,000 MW in Lao PDR's tributaries, 2,200 MW in Cambodia and 2,000 MW in Vietnam). Only 5% (1,600 MW) of the Lower Mekong's hydropower potential have been developed, and all projects are on the tributaries, not on the mainstream. There is also huge hydro potential in the Upper Mekong Basin. In Yunnan Province of the People's Republic of China, total hydro potential is an estimated 23,000 MW, and two projects, totalizing 2,850 MW, have already begun operating.

Table 24: List of Completed Hydropower Projects (10MW<)

Country	Name	Location	Capacity (MW)	Output (GWh/year)	Commissioning
China	Manwan	M	1,500	7,870	1993
	Dachaoshan	M	1,350	5,930	2001
Lao PDR	Nam Ngum	TR	150	900	1971-85
	Xeset	TR	45	150	1991
	Theun Hinboun	TR	210	1,645	1998
	Houay Ho	TR			
	Nam Leuk	TR	60	184	2000
Thailand	Sirindhorn	TR	36	115	1968
	Chulabhorn	TR	15	62	1971
	Ubolratana	TR	25	75	1966
	Pak Mun	TR	136	462	1997
Viet Nam	Dray Ling	TR	13	70	1995
	Yaly	TR	720	3,642	2000

Note: TR = Tributary, and M = Mainstream
Source: MRC, 2002g.

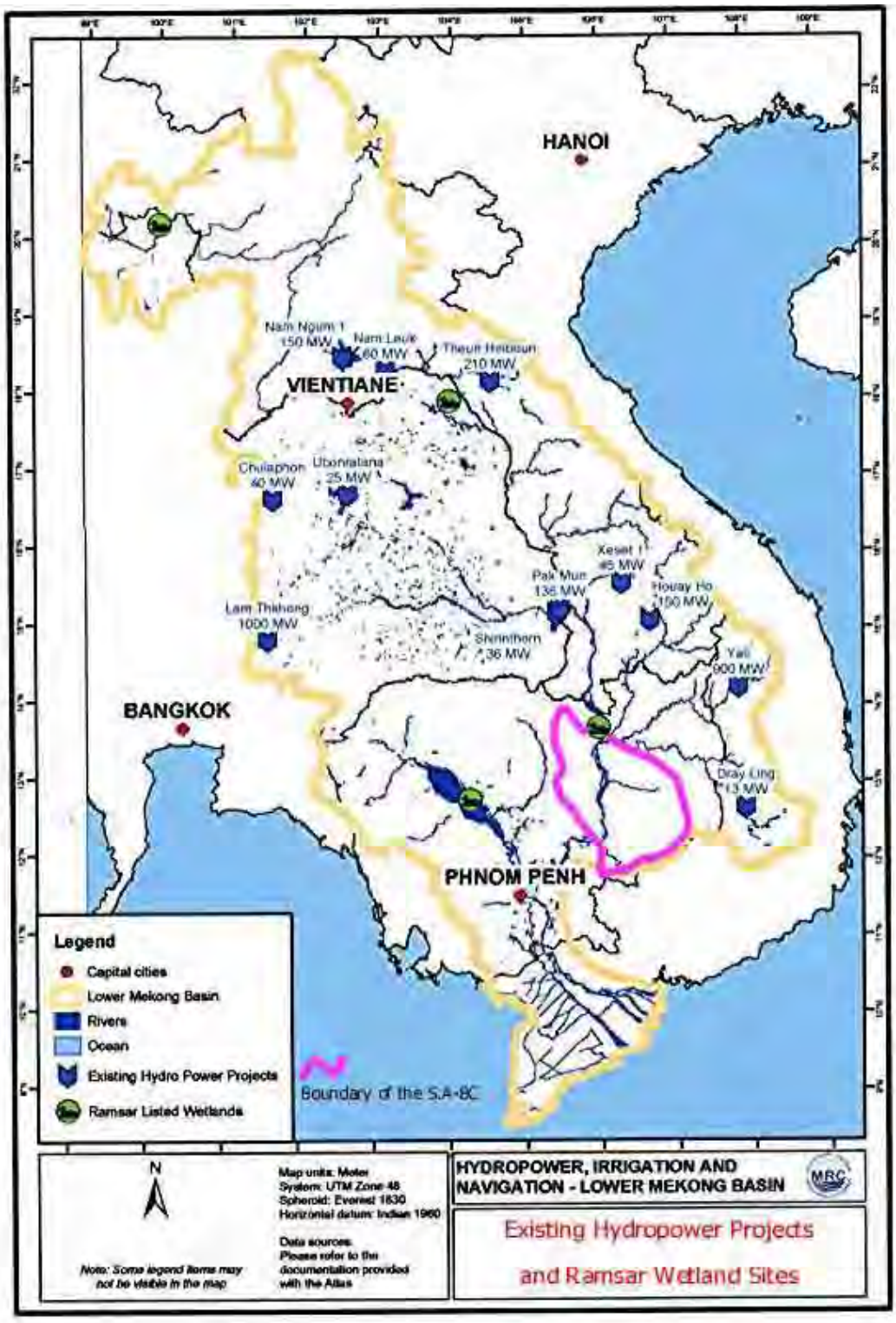


Figure 32: Existing Hydropower Projects in the Mekong Basin

7.5.4.3.Analysis of Trans-boundary Implications of Hydropower Projects

Obligation of consultation between countries:

In signing the 1995 Agreement that established the MRC, member countries all agreed that before any hydro project can be built on the mainstream of the Mekong, all four members must agree. Furthermore, the 1995 Agreement obligates members to ensure that no harmful effects will occur downstream in neighboring countries. The problem is that China and Myanmar are not signatory to the MRC-Agreement. China is probably building dams with high storing capacity, which puts Thailand and Laos in a position where they have to compensate for water capture carried out upstream.

Risks for riparian countries:

The first risk of hydropower projects development in the upstream area of the Mekong River is the negative impact on the environment and society. Those risks have been duly identified as:

- Adverse impacts on the ecosystem (aquatic life, animals, birds, vegetation);
- Blocking of the flow of sediment;
- Negative impacts due to changing a river's flow pattern;
- Negative social impacts (resettlement, loss of livelihood);
- Loss of scenic landscapes (tourism potential);
- Negative impacts on water quality due to storage of water (eutrophication, lower temperatures for discharged water);
- Negative impacts to other users of water (navigation, fisheries);
- Problems during the construction period (noise, vibration, dust, traffic problems); and
- When associated with irrigation, land salinization and water logging.

The second type of risk is geo-political, i.e. the inevitable dependence of countries who do not possess hydropower upon those who develop hydropower projects. Cambodia is particularly vulnerable because it will depend on Thailand, Laos and Vietnam for power supply. A cut-off of power supply by power producers would seriously impede any possibility for Cambodia to achieve its development goal and strategies, to alleviate poverty, to improve the population livelihood, etc.

Geo-hydraulic conflicts:

Hydropower involves dam building which requires water diversions. Conflict may arise between upstream countries and downstream countries because of water scarcity and/or unequal allocation. The most crucial is perhaps where a basically agricultural country risks loosing the access to the water sources and thereby being robbed of the chance of achieving food security, poverty alleviation, and possible economic growth (Öjendal, 2000). Furthermore, aggressive and hostile capture could lead to tensions and conflicts

through population movements, group identity conflicts, economic deprivation and/or civil strife (Ibid).

Progress generated by Hydropower projects:

Quite a number of positive impacts of hydro projects deserve to be highlighted:

- Harnessing of a renewable natural resource;
- Reducing of the negative impacts that power generation has on the global environment (e.g. use of fossil fuels reduced, thus will lessen air and water pollution);
- Increasing the river's flow in the dry season, and reducing peak flow during the flood season;
- Increasing the availability of electrical power will stimulate economic development and improve people's living standards; and
- Revenues will be earned from the sale of power.

7.5.5. Soil and Water Conservation

The tenuous situation of most rural people stems from their difficult situation as subsistence rice farmers dependent on making a living from poor quality soils and uncertain and inconsistent rainfall. This is clearly identified usually by requests to solve the water problem with “irrigation”. Yet often the problem is not just water shortage but flooding due to poor drainage or pests associated with a drought period or low yields that prevent farmers from escaping the debt cycle caused by a failed crop.

A more holistic approach to these problems is to examine the situation within the framework of soil and water management and conservation. Cambodia was previously able to produce large surpluses of rice without major investments in irrigation reservoirs by utilizing local knowledge and resources and smaller investments to improve the rice cropping situation. Many traditional techniques of soil and water control have been developed over the course of centuries of rice farming that involve flood spreading, water harvesting, storage, drainage, soil conservation through bundling and field leveling and improved crop management.

Numerous small-scale improvements in infrastructure are proven to work and contribute to the catchment’s response to rainfall thereby contributing to the reduction of downstream flooding and sedimentation. In addition, the better soil and water conservation improves the viability and performance of larger investments in the watershed and reduces pressure for populations to migrate from tenuous economic situations to put more pressure on important areas like the Tonle Sap flooded forest. Through careful management of the watersheds to maintain and conserve local resources, the environmental situation throughout the Mekong basin is improved and the local people’s ability to respond to natural disasters is strengthened.

CHAPTER 8: THE AGENDA FOR DEVELOPMENT

8.1. Key Development Objective

8.1.1. Development Needs and Priorities

Development Needs and Priorities
Access to electricity
Agro-industry processing and handicrafts
Conserve fisheries critical habitats and spawning grounds
Construction of solid waste disposal sites and processing
Control riverbank erosion of mainstream Mekong and tributaries
Control siltation of the mainstream Mekong and its tributaries
Development of agricultural research system
Establishment of liquid waste treatment in urban towns
Expansion of clean water supply system
Food security
Improve concession management and land tenure for people
Improve national and provincial road network
Improve navigation channels along mainstream Mekong and tributaries for river transport
Improvement of hygiene and sanitation
Improved land use and management
Increase groundwater exploitation for rural water supply
Increase international, regional and national tourism
Increase participation of women in leadership roles
Irrigation system rehabilitation and development
Manage and mitigate negative impacts from upstream dams on downstream people and locations
Market for agricultural products
Flood preparedness, warning systems and disaster relief
Poor soils improvement/management
Promote human resources development
Protect flagship fisheries species for biodiversity and eco-tourism
Protect the wetlands
Protection and improvement of tourism areas
Protection of national parks and sloped forest lands, natural forest
Reduce illegal fishing methods and over-fishing
Repair and construct flood protection system
Strengthen institutional education
Strengthening and expanding agricultural sector

8.1.2. Short-term Development Objectives (5-10 years)

Short-term Development Objectives (5-10 years)
Address impacts from upstream tributary dams through cooperative management and sharing of information
Environmental awareness and education and link to eco-tourism to generate economic growth and jobs
Expand and increase irrigated agriculture development
Flood and drought management
Improve concession management and land use, rights to land
Improve navigation and ports to increase waterways transport
Increase diversification of farming and development of markets
Increase micro-hydropower infrastructure and prepare feasibility study for large-scale hydropower project
Prepare and implement management plan for protected areas and national parks and critical upper watersheds
Promote economic sector and attract industrial production to create more jobs
Promote science and economic research for development
Promote social and cultural development
Promote the establishment of agricultural development community and water user community
Protect and conserve deep pools and dolphin habitats/numbers
Protect indigenous culture and traditions and promote tourism
Reform trade along the borders
Rehabilitate national and provincial road network to increase traffic and reduce transport and travel costs and time
Sustainable natural resources use and management
Train human resources knowledge and skill to attract private investors

8.1.3. Long-term Development Objectives (20 years)

Long-term Development Objectives (5-10 years)
Develop agro-industry for exportation
Develop border regions and open market opportunities with the neighboring countries, particularly with the riparian countries of the GMS
Ensure urban and rural water supply and control of bank erosion
Ensured water supply for the entire urban and rural population
Expand and increase irrigated agriculture development
Flood and drought management
Improve navigation and ports to increase waterways transport
Improved upland farming systems: land-water-forest and crops
Increase micro-hydropower infrastructure and prepare feasibility study for large-scale

Long-term Development Objectives (5-10 years)
hydropower/irrigation project
Integrated forest management
Prepare and implement management plan for protected areas and national parks and critical upper watersheds
Promote environmental, cultural and agro-tourism between Cambodia, Laos and Vietnam along the Mekong River
Promote infrastructure development, science and economic research for development
Promote social and cultural development
Promote the establishment of agricultural development community and water user community
Protect and maintain the traditions and culture of minorities
Protect the mainstream Mekong from bank erosion especially between Stung Treng and Laos
Rehabilitate national and provincial road network to increase traffic and reduce transport and travel costs and time
Sustainable natural resources use and management
Train human resources knowledge and skill to attract private investors
Water resources management

8.2. Identification of Assets

Assets and resources that have been identified by the members of the working group are as follows:

- ***The Mekong River****:*
  - Fishery resources
  - Irrawaddy Dolphin pools
  - Flooded forest
  - Ramsar wetlands
  - Bamboo bushes
  - Waterway Transport
- ***Stream, lakes:***
  - Fishery resources
  - Small-scale navigation
  - Small-scale hydropower
- ***Water resources***
  - Hydropower
  - Irrigation schemes

  - Water supply for domestic use
- ***Mine:***
  - Gold, silver, stone, chalks, nitrate
- ***Forestry, national parks and waterfalls:***
  - Habitats for wildlife
  - Biodiversity eco-system
  - Forest products
  - Natural waterfalls
- ***Agricultural land:***
  - Red soil
  - Watershed
  - Grass land
- ***Cultural heritage:***
  - Temples, tourism sites, (e.g. Irrawaddy Dolphin in Kratie), historical centers, and sacred sites

8.3. Constraints

Six major constraints have been identified for the Kratie Sub-area:

- Limited disaster mitigation and management capacity
- Poor access to public health services
- Destructive effects of poverty on environment
- Lack of participation of the grass-root
- Weak local governance skills and decision making power
- Weakly Sustainable Resource Management and Development Policy

The analytical linkages between the six limiting factors in the Kratie Sub-area are shown in the below chart.

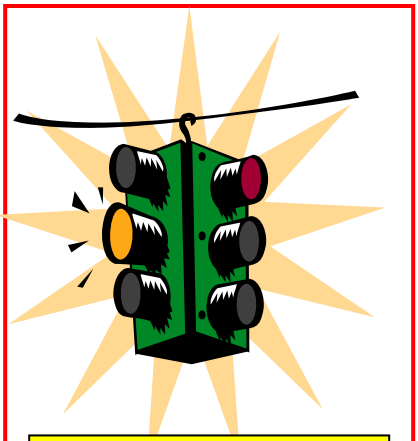


Limited Capacity in Disaster Mitigation and Management

Poor Access to Public Health Services

Destructive Effects of Poverty on Environment

Lack of Participation of the Grass-root



Constraints

Under-developed Waterway Transport Network


Weakly Sustainable Resource Management and Development Policy

Weak Local Governance Skills and Decision-Making Power

Indirect Effect **Direct Effect**

8.4. Risks of Intervention

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
Deforestation impacts on economy and society. Unimpeded semi-illegal and illegal logging is perhaps the biggest problem in Kratie, Stung Treng and Mondulkiri. The negative consequences of logging are manifold and the minority ethnic population suffers the most severe and direct consequences. The collection of Non-Timber Forest Products (NTFPs) is vital for food security because it provides supplementary nutrition that can be sold. Where careless logging is practiced, discarded logs and litter rivers. Traveling through the area to collect products become difficult, aquatic resources are destroyed and fish migration is disturbed. Biodiversity would ultimately be threatened if logging were to continue at the same pace. Industrial and anarchic exploitation are main causes of this depredation.	***Opportunities:*** Presence of biodiversity eco-system is of interest for funding agencies. The unique ecosystem able to provide substantial and diverse resources to insure quality livelihoods. ***Constraints:*** Strong conflict of interests. Weak local governance. The forestry sector appears to be the most difficult one to regulate through decentralization. It is also the natural resource over which the national government is least willing to hand over power. Enforcement of regulatory framework is challenged by impunity and highly profitable practices.	To prepare feasibility studies and project proposals for funding and submit to interested donors. To map and delineate which areas are to be preserved and which are allowed to be developed and to demarcate and patrol those areas designated for preservation. Capacity building and awareness raising on the issue. To appeal to the highest powers to prevail upon them to reduce these activities and support the preservation of the remaining area. Another option is to publicize the problem so that public support is gained and pressure placed on these interests.	Dependence upon aid agencies and banking institutions Over-exploitation of natural resources at the expense of the environment. Long process

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
Decline of fishery resources and degradation of refuge for spawning and breeding such as deep pools in the provinces of Stung Treng and Kratie are of great concern. This threat is mainly provoked by the development of big hydropower projects in the upstream part of the Mekong River and its tributaries, e.g. in China, Vietnam, Laos and Thailand. The dam's damage to downstream fisheries is irreversible and devastating to inhabitants who depend heavily on fish for protein and their means of their living.	***Opportunities:*** In the provinces of Stung Treng and Kratie, 58 deep pools have been identified to be primary rearing and dry season refuge for large catfish and carp. Some fish habitats in the upper stream part of the Mekong River, called Khone Falls, are important feeding grounds and dry season refuge for the Irrawaddy dolphins as well as a spawning area for Giant Carps. ***Constraints:*** Weak legal framework in Fishery resources management and development Weak local governance. Lack of government resources to conduct research and recommend measures.	To strengthen legal framework in fisheries resource management. To build capacity through "learning by doing", thus this intervention could best be combined with the intervention requesting assistance from the outside aid agencies as a means of addressing the core issues in a capacity-building and participatory manner. Capacity building and awareness raising on the issue. Others who might be targeted include those who are damaging the resources as a whole, such as China (dam building on the upper Lancang /Mekong), those engaging in destructive fishing practices such as using illegal gears and explosive /electrical fishing. It is best to formulate the problem and idea to solve it prior to approaching aid agencies in order to maintain more input and control of the solution. Political appeals and campaigning: Appealing to the highest authorities appears to have an impact on returning control of some resources to the local people. This is often brought about through a campaign both through the media and other methods to raise public awareness and bring pressure on the authorities for change.	The long process does not fit with immediate individual interest. The long process does not fit with immediate individual interest or long-term planned international projects (transboundary issues). Dependence on aid agencies.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
There is an immediate need for poverty alleviation so that pressure on environment and fishery resources can be regulated and relieved. The province of Kratie has quite a high percentage of population living below the poverty line with a poverty rate of 30-40%.	Tourism industry development will create a number of job opportunities. However how many of those opportunities are provided to the poorest people is the real question, because the poorest don't live where tourists tend to go for the most part. They are in a subsistence economy so don't produce things that tourists are interested in buying. They are the least trained and adapted to enter the service industry so are least likely to gain jobs from the tourist sector. The most concerning matter is the harm provoked by sex tourism industry on the most vulnerable people, especially young rural women and children (pedophilia). Road infrastructure improvement facilitates investments. Impacts on the poor remain to be assessed, but the expected results are to bring opportunities for the poor to access education and health services markets for their produce and to get to places where they can find seasonal jobs,	To strategize tourism development plan to attract investment so that job opportunities are effectively enhanced. To maximize the potential of the - indeed - rare tourism sites, e.g. the Irrawaddy dolphin sites in Sombok Commune in Kratie, eco-tourism tours in Mondulkiri, creating new tourism destination in Stung Treng in connection with the visit of Khone Falls in Laos, etc…	Pressure on environment and social side-effects. Limited interest of tourists on this new concept of eco-tourism. The extinction of the Irrawaddy dolphin to limit the sustainability of tourism investment in Kratie.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	knowledge and information.		
	Abundant fishery resources insure food security.	To enforce fishery res. management and development policy.	
	A number of unqualified migrants.	To have clear and enforced immigration policy and regulations. To train and educate young people through non-formal education programme.	Conflict of interests.
	Weak provincial development policy and strategies.	To promote the private sector investment through transparency, incentives and access to cheap and sufficient credit.	Trained skills do not fit with labor market.
	Difficulty in land law enforcement. Low salary/income.	To protect women from sex industry through law enforcement.	
			Lack of interest upon the limited investment opportunities.
			Long process....
Water pollution and solid waste disposal	No data available to know the state of water quality.	To set up database on water quality and pollution.	Weak capacity pre-requires costly training of staff. Overlapping mandates leads to "laissez-faire".
	Lack of resources of relevant institutions to tackle this issue. But the most pressing issue than institutions (that exist) are the facilities for solid and liquid waste disposal. Disposal of waste is a difficult issue requiring a choice of technology all of which have some negative impacts and	To clarify relevant government policy and strategies so that financial resources are mobilized.	

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
	overcoming local opposition to disposal sites (the "NIMBY" syndrome - "Not In My Back Yard". This is particularly acute and difficult with respect to toxic waste. Both those used in industries like agriculture (toxic pesticides) and illegal disposal of toxic industrial and solid waste from other countries which require enforcement of importation rules to prevent their entering the country.		
	Increasing population pressure. Tourism development aggravates the problem. No waste recycling system to limit effects on environment.	To enforce immigration law. To find balance between conservation needs and development policies. To enforce relevant government policy and strategies relevant to environment protection.	Costs for waste are high especially in comparison to dumping improperly. Corruption develops where opportunity to reduce costs or gain profit exists.
	Lack of local understanding of pollution problem and impacts and widespread practice of littering.	To promote proper waste disposal and stopping littering through public information campaign.	
Wildlife sanctuary endangered by animal trafficking: Demand rising from neighboring and western countries increase pressure on local wildlife trade. Traditional medicine	Attractive biodiversity and endemicity of fauna for research on preservation of endangered species. High potential in funding opportunities	To design appropriate research programme in partnership with funding agencies. To develop research programme that fit with	Low absorption capacity and scientific skills of local researchers. Idem

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
market encourages traders to capture wild animals in the reserve zone.	for preservation of fauna and environmental /ecological research. Impunity and collusion of powerful actors.	international concern.	
		To enforce relevant government policy and strategies relevant to protected areas. To intensify ongoing campaigns against trafficking in wildlife and cultural property.	Conflict of interests.
Vulnerability to drought and flooding and crop failures.	Current production levels are low and could improve significantly without tremendous efforts.	Studies and research on traditional techniques and pilot projects to demonstrate their utility.	Small-scale efforts are less visible to donors and government so are lower priority.
	Irrigation infrastructure and land development have been handicapped by poor development of Khmer Rouge.	Proper engineering and rehabilitation of Khmer Rouge and other existing irrigation and drainage infrastructure.	Economic analysis of works is difficult.
	Flooding events are common both locally and basinwide and appear to be increasing.	Examination of successful techniques in other countries such as “controlled drainage” and improved water management.	Many Khmer Rouge works are not economically viable or require significant investment when available funds are low.
	Understanding of traditional soil and water management techniques is limited due to losses of people and culture.	Promotion of small-scale technique and improvement of agricultural extension services.	Low capacity and salaries of government staff limit commitment
		Collection of required hydrological, meteorological economic	Lack of understanding of the value of data.

Concerns and Priorities	Opportunities and Constraints	Interventions	Risks of intervention
		and soils data required to improve designs. Working closely with local farmers to improve their situation and preparedness for disasters.	 Difficult and long process required to work with farmers on management entities Lack of experience in these techniques

8.5. Cross-Cutting Issues

8.5.1. Environment Degradation

The commercial logging sector is characterized by active logging, often carried out on a cross-border basis. The demand for wood in Thailand and Vietnam is a major factor driving logging in Cambodia and Lao PDR. Commercial forestry activity is often carried out on a sustainable scale, with government regulatory controls sometimes unable to prevent overexploitation. Increasing run off in logged areas can result in erosion, turbidity, sedimentation, flooding and drought at a larger scale.

The recent establishment of a Forestry Administration is conducive to some awareness improvement, but difficulty to enforce regulations and corrupt practice of local and central governance remain major constraints. Biodiversity is under threat with the increasing competition between man and wildlife due to the development of agriculture and fishery. More and more forests will be cleared for agricultural and commercial exploitation. For instance, in Kratie, the competition for fishing areas between local fishermen and the Irrawaddy dolphins will inexorably result in the extinction of this mammal species owing the fact that some fishing gears used are devastating for the dolphins.

8.5.2. Population Pressure

Population pressure seriously impacts on resources exploitation which destructive practices impede equitable sharing of benefits. The population pressure on environment, by jeopardizing natural resources sustainability, is a major factor of aggravation of poverty for future generation.

8.5.3. Poverty

Despite efforts developed by the government and the civil society, there is not yet tangible result in poverty alleviation. The most concerning is that poverty is wide spreading into new areas as a result of weak capacity to mitigate natural disasters by the government institutions. Women and children are certainly the most vulnerable vis a vis the effects of poverty on the population, as they are confronted with HIV/AIDS, human trafficking and domestic violence.

8.5.4. Need for Human Resources Development

Human resource development is one of the fundamental of the country's development. The creation of employment opportunities needs to be strongly supported by availability of well-trained people able to provide quality services.

Outside of Phnom-Penh, fewer than 20 percent of people of secondary school are enrolled in school. Most young people are working by this age, and the network of secondary school age is very sparse throughout much of the country. The average distance from a village to the nearest lower secondary school is estimated at 27 km, too far for daily travel (MOP, 1999).

Educated people often find that there are no jobs available for their skills due to the slow development of the private sector economy. This leads to frustration and loss of the resource as the people are not able to gain the experience needed to provide the benefit from their education.

The education system is not geared towards the needs of the employers. The rote learning method employed does not engender the analytical skills looked for by outside investors.

Post-secondary educational institutions of international standard and recognition do not exist within Cambodia. Students graduating from these institutions are too few to fill the large need for their quality of services.

Government staff with ability and training are often overworked; many leave for the private sector once trained resulting in a “brain drain”. There is often no clear delineation between the public and private sector jobs of these staff with resultant confusion of roles, conflict of interest and lack of continuity in both sectors.

8.5.5. Public Participation

Public participation at all the levels, central, provincial, district and commune is a key factor of success in the context of decentralization. The many different aspects of civil society including the private sector need to be encouraged to join within the processes that are currently dominated by development agencies and government.

Gender is a major factor in public participation – as previously outlined in Issue #3, women's voices are seldom heard, particularly in comparison to their proportion of the population and workforce.

Participation is a key element in the success of all development – it allows design to incorporate local knowledge and concerns, people to gain ownership and makes long-term management and maintenance sustainable.

CHAPTER 9: STAKEHOLDERS AND DIALOGUE

The institutional capacity throughout the Royal Government of Cambodia is limited, because of the loss of almost an entire generation of people during the civil war, low salaries in the public service, run-down infrastructure, and other factors. To address this problem, the Government is implementing a variety of measures in administrative and governance reform. Capacity building is another concern with physical facilities and equipment, ongoing funding for operational expenses and human resources development required in MOWRAM, other water-related institutions, and the civil service as a whole. The RGC seeks a greater level of private sector and/or beneficiary involvement in water services provision (water supply, sanitation, hydropower, irrigation).

Given the difficult situation with respect to human resources and the identified widespread weakness in the concerned government agencies, a number of different efforts are required to gradually address these deficiencies. A key factor in overcoming the constraints is identifying them clearly. Some of these issues are discussed below.

9.1. The Cambodian Water Policy and Strategies

9.1.1. The Draft Water Sector Roadmap for Cambodia

Interesting initiatives to address the various water sector issues exist. For instance, a Draft Water Sector Roadmap for Cambodia has been presented by the Government to ADB and discussed in a consultation meeting on April 7, 2003. The roadmap summarizes the RGC's goals for the water sector in Cambodia and provides a basis for setting priorities and planning investment and development assistance. It also reviews the context provided by national goals for poverty reduction and socio-economic development. It provides an overview of the sector, and considers the issues and constraints that are faced. Finally it summarizes recent, current and planned activities and investment by international funding agencies. The road map does not actually define a single direction to go, but indicates the possible routes to many destinations, and the obstacles that must be overcome.

9.1.2. Sector issues and constraints

The key issues and constraints in the water sector have been classified in various ways by recent analyses, such as the National Water Sector Profile (MOWRAM, 2001). In this roadmap, issues are grouped into the following topics:

- Legislation and policy;
- Institutional arrangements;
- Institutional capacity;
- Providing data and information;
- Managing irrigation and drainage systems and other water-related infrastructure;
- Mitigating the impacts of water-related hazards;

- Managing competition for water and deteriorating water quality;
- Conserving aquatic ecosystems and fisheries;
- Managing international water resources;
- Managing the coastal zone; and
- Financing water resources development and management.

9.1.3. Summary of Issues and Constraints[4]

There is not at present a coherent body of water-related law, regulatory instruments, or policy. A draft Law on Water resources Management (WRM) is before the National Assembly, and a draft National Water Resources Policy is before the Council of Ministers. Several sub-sectoral policies are at various stages of development or approval. Implementation of laws is generally weak, although advances are being made, e.g. in administering water pollution-related provisions of the Law on Environmental Protection and Natural Resources Management. The MOWRAM needs to develop the institutional capacity to administer the Law on WRM if/when it is passed.

Institutional arrangements

Several RGC line ministries have responsibilities for different aspects of water resources exploitation, while the CNMC deals with Cambodia's responsibilities under the Mekong Agreement. The MOWRAM was established in 1999 with a mandate to manage the Nation's water resources, but has directed its attention primarily towards irrigation and drainage (I&D). Inter-agency relationships tend to be competitive and uncooperative, although MOWRAM has reached formal agreements with several other ministries to delineate responsibilities. The RGC is devolving responsibilities to provincial and more local levels, which will require allocation of increased financial and trained human resources, to lessen reliance on non-governmental support. Institutional arrangements for managing I&D works are reasonably well-defined, with some lack of clarity regarding relative responsibilities of MOWRAM, MRD and MAFF for water management for agriculture. However, water management cannot be sustained because of limited government resources.

Institutional-Community capacity

Institutional capacity throughout the RGC (especially at sub-national levels) is limited, because of previously discussed problems in human resources development and management. The successful development of PPWSA as a public corporation is a good example of what is possible, and the RGC seeks a greater level of private sector and/or recruitment programme will be required, at both central and provincial/district levels, in areas such as water resources management, law enforcement, support for community groups, etc. This will assist the Ministry to evolve from a primarily construction and

[4] Excerpt with some edits from: the Draft ADB "Roadmap" for the Cambodian Water Sector. Draft report on MRC participation in the ADB meeting on the Water Sector "Roadmap" for Cambodia, April 7, 2003.

operation agency, to one that is able fully to carry out its mandate in water resources planning, management and regulation.

Providing data and information

The capacity of MOWRAM and other RGC agencies to provide the data and information required for design of water-related infrastructure, development and management of water resources, and management of extreme events (droughts and floods) is limited, although participation in international programmes in the dissemination of data and information about water resources and use (quantity and quality; surface water and groundwater), river basin characteristics, weather and climate is needed, in terms of a coordinated water and climate information strategy. Exchange of existing information among RGC institutions is not always efficient, because of a lack of awareness of what is available, a lack of formal mechanisms for obtaining access, and possessiveness regarding information assets. As a result, the heavy investment by international funding agencies in natural resources information has not been fully effective. The draft National Water Resources Policy includes policies on exchange of data and information. Mechanisms and willingness to implement these policies will be required.

9.2. The Example of the Management and Development of Protected Areas (limited resource to achieve huge ambition)

9.2.1. Mandate and Responsibilities

There are two key ministries with responsibilities for the establishment and management of protected areas: the Ministry of Environment (MOE) and the Ministry for Agriculture, forests and Fisheries (MAFF). The provinces also have the authority to establish and manage protected areas.

The mandate of MOE is to supervise and manage the environment throughout Cambodia, and this according to the Sub-Decree No.57 on the Organization and Functioning of the Ministry of Environment dated 25 September 1997. The planning and management of the protected area system, and supervision and coordination of conservation work country-wide falls under its department of Nature Conservation and Protection (DNCP). Protected areas units are operating in each of the 23 protected areas managed by MOE. Subsequent laws have brought conservation functions to a range of sectoral agencies, particularly MAFF. When first established in 1993, DNCP had 35 staff (PAD, 2003). By 2003, it has 97 staff working in the 59 protected areas units or one staff for more than 6,000 hectares. As a comparison, Vietnam has adopted a standard of one staff member for every 1,000 hectares of protected area. The number of staff assigned to each protected area ranges from 7 to 35 staff depending on the need and remoteness of the protected area. In addition, some protected areas such as Kirirom National Park, Bokor National Park, Ream National Park, Virachey National Park and Boeung Per Wildlife Sanctuary have sub-offices in strategic locations. Some protected area units have set up an efficient organizational structure, including sections for administration, patrolling and enforcement, environmental education and tourism.

The provincial and municipal departments of environment are under the direct control of MOE and are responsible for implementing environmental policy, preventing violations in protected areas and preparing proposals for the creation of new protected areas and extension of existing areas in cooperation with relevant departments.

MAFF has a mandate for planning and managing the agricultural, forestry and fisheries sectors, according to the Sub-Decree No. 17 on Management and Process of the Ministry of Agriculture, Forestry and Fisheries, dated 7 April, 2000. In 1999, its staff totalized 10,995 (Ibid). There are two main departments having a very significant stake in the protected area system: the Department of Forestry and Wildlife and the Department of Fisheries. The responsibilities of the Department of Forestry and Wildlife (DFW) include:

- Preparing policies and regulations for the environmental protection and management of forest resources, and wildlife conservation;
- Participating in setting up measures for environmental protection and developing plans for the management of forests, forest reserves for wildlife, protected areas and reforestation areas; and
- Supporting initiatives for protection and rehabilitation of fishery resources.

Provincial and municipal Departments of Agriculture, Forestry and Fisheries are required to protect natural resources such as forests, water and fisheries in cooperation with other relevant agencies.

9.2.2. Staffing Issues

Overall staff expertise has increased. Some staff have received formal and informal training from several sources, particularly conservation NGOs working in Cambodia. Often government staff are formally seconded to NGOs and received on-the-job as well as other, more formal training opportunities. Some have participated in international conferences, where they exchange information with colleagues from other countries. The knowledge level, abilities and effectiveness of staff, particularly at central level, has increased significantly. Some staff also report improvements in the energy, motivation, teamwork and overall professionalism in both MOE and MAFF (Ibid).

Despite these improvements, staff also mention the following concerns as disincentives to consistent performance:

- Inadequate training- particularly in the field;
- Poor government salaries. On average, US$ 20 per month reduces commitment. Field staff lack financial motivation and spend a good deal of time working for alternative sources of income;
- Brain drain. Many staff are more interesting in working for NGOs or NGO-supported projects to increase income;

- Few operational resources. The DNCP has limited funds constraining staff initiative, for example, for infrastructure rehabilitation and development, interpretation, patrolling and restoration; and
- Too much to do and too few staff to do it.

Another issue is the "two speed" staff structure. One group involved in foreign funded projects is well paid, motivated and works full time. The remaining government staff are poorly paid, have broad responsibilities and demands but need to find additional work to supplement their income. Placing so many staff as counterparts to NGOs has resulted in many advantages to individuals and the NGOs involved (and to the country as a whole in the long term), but there are managerial challenges and disadvantages tat have to be faced, and these are likely to increase in the future.

9.2.3. Analysis

It is of importance to strengthen working partnership and coordination between MOE and MAFF for the welfare of the national protected areas system, because of the limited resources. For example, the Forest Crime Monitoring and Reporting Project brings MAFF and MOE together to work on an issue of great mutual concern, which is controlling illegal exploitation of forest and wildlife resources. It establishes links between the two agencies at both the central and local levels and thus, promotes co-operation and collaboration between two important natural resource management institutions in dealing with forest crime. It also bridged the gap between the central and provincial/district levels. This positive contribution of the project needs to be built on in other aspects of planning and management of forest and protected areas.

A new Royal Decree intends to clarify responsibilities concerning the Tonle Sap Biosphere Reserve. MOE is given the mandate for managing 3 core areas, while MAFF is responsible for managing the buffer zone in collaboration with other agencies. This collaborative framework has yet to work effectively in practice. For example, difficulties remain in sorting out management consistency and arrangements for the fish sanctuaries overlying parts of the multiple use area.

Equally, it will become increasingly important for MOE and DFW to build partnerships with other stakeholders because:

- ***Central government doses not have the resources to do it all:*** MOE and DFW alone will not have the funds and staffing to maintain the growing national system of protected areas.
- ***The growing importance of the local stakeholders:*** local people and local governments are becoming more important due to decentralization and growing interest in and support for the rights of traditional communities. Local governments and communities are becoming actively involved in protected area and buffer zone issues and are being given the authority to determine their use.

> The challenge will be to recognize the right to participate while reinforcing the obligations and accountability that comes with it.

The entire government public service is undergoing difficult but courageous reforms and MOE and MAFF will both need to work through the implications of decentralization or protected area management and determine the balance between the number of staff and budgets at the central offices in Phnom Penh and at provincial and protected area levels. All evidence indicates that both MOE and MAFF protected areas need more staff for improved management.

Regarding the staffing issue, the level of income is not sufficient to live on so all protected area field officers need additional income generating activities. Even so the demands on staff are increasing. Protected areas managers are now expected to be community development and poverty alleviation officers, as well as conservation managers- yet they do not have the mandate, skills and capacity to fulfill this community development role. Also new responsibilities in conflict resolution and working with key economic sectors go well beyond the experience and training of many staff.

PART III

Sub-area Scenarios and Development Strategies (Forum #2)

CHAPTER 10: KEY ISSUES

This chapter introduces economic and environmental development needs, opportunities and concerns for the Northern Cambodia-Southern Laos and Kratie Sub-areas. All main issues raised below resulted from the sub-area report, group discussions during the working sessions, Forum 1 and Forum 2.

10.1. Needs (20 year timeframe)

1. Access to electricity
2. Agro-industry processing and handicrafts
3. Conserve fisheries critical habitats and spawning grounds
4. Construction of solid waste disposal sites and processing
5. Control riverbank erosion of mainstream Mekong and tributaries
6. Control siltation of the mainstream Mekong and its tributaries
7. Development of agricultural research system
8. Establishment of liquid waste treatment in urban towns
9. Expansion of clean water supply system
10. Food security
11. Improve concession management and land tenure for people
12. Improve national and provincial road network
13. Improve navigation channels along mainstream Mekong and tributaries for river transport
14. Improvement of hygiene and sanitation
15. Improved land use and management
16. Increase groundwater exploitation for rural water supply
17. Increase international, regional and national tourism
18. Increase participation of women in leadership roles
19. Irrigation system rehabilitation and development
20. Manage and mitigate negative impacts from upstream dams on downstream people and locations
21. Market for agricultural products
22. Flood preparedness, warning systems and disaster relief
23. Poor soils improvement/management
24. Promote human resources development
25. Protect flagship fisheries species for biodiversity and eco-tourism
26. Protect the wetlands
27. Protection and improvement of tourism areas
28. Protection of national parks and sloped forest lands, natural forest
29. Reduce illegal fishing methods and over-fishing
30. Repair and construct flood protection system
31. Strengthen institutional education
32. Strengthening and expanding agricultural sector

10.2. Opportunities (20 year timeframe)

1. Agricultural development communities (forestry, fisheries and water use)
2. Create development regions, heritage promotion and other development programs
3. Develop fee charging system for irrigation
4. Develop pumped irrigation systems from rivers
5. Establish hydropower dams
6. Expand and improve irrigation systems
7. Expansion of road networks and establish market for agricultural produce
8. Implement infrastructure and information systems for agricultural markets
9. Improve and enforce laws and procedures
10. Improve Government policies and strategies
11. Improve human resources in techniques and technical areas
12. Increase diversification of crops
13. Increase local and international investments
14. Increase off-farm income and job opportunities
15. Increase people's participation
16. Increase processing agro-industry and agro-business
17. Increase rice and agricultural production yields as well as quality
18. Increase tourism potential (qualities and services) to provide income and jobs
19. Maintain and increase support of donors (national and international), NGOs and private sector
20. Natural resources conservation and management
21. Promote micro-credit services
22. Smallholder livestock development
23. Strengthen human resources
24. Value-added processing of agricultural products by SMEs and cottage industry

10.3. Concerns and Risks (20 year timeframe)

1. Changes of nature and river
2. Coordination and cooperation between institutions are limited
3. Cross boundary trade increases
4. Decline of biodiversity and protected areas
5. Efficiency of law execution is low
6. Human resources management system is not yet well managed
7. Hydrological impacts of upstream tributary dams
8. Illegal fishing methods
9. Illegal migration into the area
10. Information system for natural resource and market management is weak
11. Issues of waste management (gas, liquid and solid wastes)
12. Lack of budget
13. Lack of data and study on hydraulic systems
14. Lack of human resources
15. Lack of investment

16. Lack of means and equipment
17. Lack of rural infrastructure
18. Land titling is costly and takes a long time
19. Limited public participation
20. Limited technology
21. Low level of knowledge and skills of farmers
22. Mechanism for balancing between development and environment conservation is limited
23. Natural disasters such as climate change, drought, bank erosion and decreasing water quality
24. Navigation system is not yet restored
25. Overlap of responsibilities of institutions
26. Political restlessness, security issues and poverty
27. Poor concession management for forestry
28. Protection of deep pool for dolphin and fish habitats
29. Protection of indigenous cultures
30. Public health problems, drugs, women and child trafficking
31. Rapid and large changes in land use
32. Releasing of liquid waste to river
33. Rights of people to use land and gain title
34. River banks continue to erode and river course changes
35. Still practicing traditional agricultural production
36. Upstream Mekong dam development affects ecology
37. Lost of wetland
38. People migration
39. Illegal settlement
40. Lack of measure to address trans-boundary impacts
41. Upstream tributary dam development affects downstream people and areas

10.4. Trends (20 year timeframe)

1. ASEAN open borders policy leads to increased interaction with neighboring countries
2. Changes in flood regime
3. Changes of water flow regimes due to hydropower dams construction
4. Decrease of areas of natural forest due to the expansion of farming
5. Decrease of damage to people, housing, infrastructure, crops from floods due to clear planning and strategies
6. Delays in development implementation
7. Demographic pressure
8. Enhanced rural development
9. Expansion of clean water supply service for urban and rural population
10. Extinction of some fish varieties
11. Increase of sedimentation in rivers, streams, and canals
12. Increased interest in protection of borders

13. Increasing concessions and conflicts with local people
14. Increasing diversification of cropping
15. Increasing erosion of earth cover
16. Increasing hydropower dam construction upstream on Mekong River and tributaries
17. Increasing number of tourists (national, regional and international)
18. Increasing of transport through waterway, road and airway
19. Increasing water use for irrigation due to the expansion of irrigated land
20. Land ownership conflict
21. Poor public morality and loss of culture and traditions
22. Poverty reduction due to economic growth and job availability
23. Pressure on natural resources use
24. Producing based on market demands
25. Production of surplus instead of for consumption
26. Reduction of Mekong River dolphin numbers
27. Strengthening fisheries community
28. Strengthening water user community and agricultural development community

CHAPTER 11: SCENARIOS AND ELEMENTS BY SECTOR

This chapter presents the results of the process to develop and refine the scenario elements (trends, risks, interventions) as undertaken by the Northern Cambodia-Southern Laos and Kratie Sub-area Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter was prepared for the participants of the 2nd Stakeholder Forum for the Northern Cambodia-Southern Laos and Kratie Sub-areas in order that the work could be reviewed by a wide range of stakeholders and to provide background on the basis for the development options, scenarios, strategies, and interventions that would be finalized during the forum.

11.1. Scenarios and Elements by Sector

11.1.1. Irrigated Agriculture

Trends

- Increased upland farming research and development
- Strengthening water user community and agricultural development community
- Increasing diversification of cropping
- Increasing water use for irrigation due to the expansion of irrigated land
- Producing based on market demands and for market
- Increase animal production

Risks

- Draughts and floods
- Climate change
- Economic policy regionally and internationally
- Change in flow regime
- Pest incidence

Interventions

- Policy, research and development projects/programmes and national and international extension
- Economic cooperation strategy between Cambodia, Lao PDR, Thailand and Myanmar
- First and second East-west economic corridor (RGC-ASEAN)
- GMS Programmes for tourism, navigation, agriculture, and watershed management (RGC-ADB)

11.1.2. Watershed Management

Trends

- Increasing concessions and conflicts with local people
- Decrease of areas of natural forest due to the expansion of farming
- Pressure on natural resources use
- Increasing erosion of earth cover
- Changes of water flow regimes due to hydropower dams construction
- Increase of sedimentation in rivers, streams, and canals

Risks

- Changes of Mekong river ecology
- Water resources threatened
- Change in flow regimes - flood
- Lost of biodiversities
- Illegal land claims

Intervention

- Policy, national and international development projects/programmes

11.1.3. Fisheries

Trends

- Reduction of Mekong River dolphin numbers
- Strengthening fisheries community
- Fisheries resources threatened
- Preserve deep pools and fish habitats
- Increase local fish demand

Risks

- Lost of wetland
- Protection of deep pool for dolphin and fish habitats
- Illegal fishing methods

Intervention

- National and international policy and regulations

11.1.4. Water Supply for Domestic and Industry

Trends

- Expansion of clean water supply service for increasing population, tourism, and industry
- Increasing demand in sewage, solid, and gaze wastes

Risks

- Water resources threatened in terms of quantity and quality
- Reduction of water quality due lack of adequate waste management
- Environment pollution

Intervention

- Project development at the national, international and private sector

11.1.5. Flood Management and Mitigation

Trends

- Changes in flood regime
- Increase absorption of benefits from floods for development
- Increase of vulnerability from floods (infrastructure, settlement)

Risks

- Changes in flood regime
- Construction
- Crop damages from floods
- Lack of information

Interventions

- National regulation and management and international relief programmes
- Increase of regional cooperation

11.1.6. Navigation and Transportation

Trends

- Increasing of transport through road, railway and airway
- Increase of cross-border transportation
- Establishment of tourist cooperation with countries in the region

Risks

- Siltation and sedimentation of the water way system
- Impacts of navigation on environment and biodiversities
- Decrease of water way transport

Interventions

- Increase of regional cooperation
- Navigation programme of MRC

11.1.7. Tourism

Trends

- Increasing number of tourists (national, regional and international)
- Development of agro-tourism and eco-tourism
- Increase of electricity and infrastructure
- Increase of regional tourist cooperation

Risks

- Emergence of contaminated disease
- Environment pollution
- Increase of foreign culture
- Increase of sex tourism and children and women trafficking
- Drugs trafficking and consuming

Intervention

- GMS Programmes for tourism, Cambodia, Lao, Thailand, Myanmar Economic Cooperation Policy on tourism

11.1.8. Hydropower

Trends

- Increase of electricity demands
- Expansion of hydropower generation capacity

Risk

- Impacts locally and trans-boundary impacts

Interventions

- Water utilization programme
- 1995 Mekong Agreement
- GMS cooperation framework

11.2. Scenarios and Elements by Cross-Cutting Issues

11.2.1. Trans-boundary Issues

Trends

- River bank erosion
- Issues in natural resources use and management cooperation
- Dams development in the neighboring countries leads to change of natural flow and biodiversities system (fish and forests)
- Small scale cross-border trading
- Sharing and exchanging good practices and agricultural techniques

Risks

- Change of river flow and river ecology
- Draughts and floods
- Environment and natural resources degradation
- Increase of solid and liquid waste

Intervention

- Regional cooperation in the Mekong region

11.2.2. Environmental Issues

Trends

- Pressure on water resources
- Forests degradation
- Change in river morphology
- Loss of biodiversities
- Increase of solid and liquid wastes

Risks

- Water resources threatened
- Draughts and floods incidence
- Environment and natural resources degradation
- Change in river ecology
- Increased erosion of top soil layer

Interventions

- Regulation of national and international environment management and protection
- National and regional environment protection and preservation

11.2.3. Private Sector and Investment

Trends

- Increase of private investment locally and externally
- Strengthening and building capacity in market competition
- Strengthening and building capacity in small and medium scale enterprise

Risks

- Change in national and regional markets
- Dependency on foreign aids
- Increase of foreign ownership and overseas control
- Limited management efficiency
- Increase of large private ownership
- Foreign influence in national economy

Interventions

- Increase of regional economic cooperation
- Increase of competition and regional cooperation
- Regulation of private investment

11.2.4. Capacity Building

Trends

- Increased human resources
- Increase technical capacity and expertise
- Demand for institutional education (local and national)
- Increase demand of modern technology, capacity and awareness building in environment and natural resources management

Risks

- Lack of data and information system and data updating
- Limited data/information collection system

Interventions

- Increase of regional cooperation
- Exchange of information technology between sub-areas
- Technical training center and adequate human resources development for the sub-area

11.2.5. Public Participation

Trends

- Increase people participation
- Establish agricultural development community (forestry, fisheries, water and land use)
- Increase women participation in leadership roles
- Increased participation of private sectors
- Participation of NGOs and IOs

Risks

- Unclear process
- Lack of participation from private sector in natural resources management and preservation

Interventions

- National policy and strategy
- Regional and international strategy and cooperation
- Increase of participation and regional cooperation

CHAPTER 12: SUB-AREA DEVELOPMENT OBJECTIVES

12.1. Introduction

This chapter presents the results of the process to develop and refine the development objectives as undertaken by the Northern Cambodia-Southern Laos and Kratie Sub-area Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter was prepared for the participants of the *2nd Stakeholder Forum* for the Northern Cambodia-Southern Laos and Kratie Sub-areas in order that the work could be reviewed by a wide range of stakeholders, augmented and refined, and finalized for submission within the overall program of the Basin Development Plan.

The chapter takes as its starting point the preliminary development objectives as developed and presented in chapter 10 and chapter 11: ***Key Issues and Scenario Elements, Northern Cambodia-Southern Laos and Kratie Sub-areas***. A two-step process is then presented whereby the preliminary development objectives are categorized and then reorganized in related groups. These groups provide an overall development objective with some sub-objectives and specific targets to be achieved within the 5- to 10-year and 20-year timeframes.

The results are then used as the basis for preparing strategies to achieve the development objectives as presented in chapter 13: ***Strategies, Northern Cambodia-Southern Laos and Kratie Sub-areas***.

Finally, the objectives were consolidated, refined and subsequently improved by incorporating all comments and suggestions made by the participants during the *2nd Stakeholder Forum* for the Northern Cambodia-Southern Laos and Kratie Sub-areas as presented in this chapter.

12.2. Organization and Grouping of Development Objectives

Development Objective 1: To address basic food security in lowland and upland areas so poor farmers can move into the market economy.

Sub-Objective 1.1:	Increased rice production and reliability in riverine and lowland areas.
Sub-Objective 1.2:	Increased food production in upland areas with sustainable farming systems and improved land use.
Sub-Objective 1.3:	Improved and increased smallholder livestock, natural capture fisheries, handicrafts and other income generating and smallholder savings activities.

Sub-Objective 1.4: Farmer organizations for irrigation, community forestry, agriculture, credit and marketing are expanded and strengthened.

Specific Targets:

5-10 Years	20 Years
80% food security	100% food security
2.5-3.0 tons/ha average	3.5 tons/ha average
10,000 ha irrigation areas increased	30,000 ha irrigation area increased
25% increase in irrigation efficiency	75% increase in irrigation efficiency
2 cattle, 10 poultry/family	5 cattle, 10 poultry/family
Sustain average natural catch of last 5 years	Sustain average natural catch of last 5 years
25% increase in upland food production	50% increase in upland food production and diversity
Market number and size doubles	Bank branch facilities at Commune level
One cooperative farmer organization per commune established and autonomous	One cooperative farmer organization per village established and autonomous

Development Objective 2: Increase agricultural production, quality, diversity and value-added products for markets.

Sub-Objective 2.1: IImproved agricultural production quantity, quality, diversity and value-added products for domestic markets including tourism.

Sub-Objective 2.2: Improved agricultural production quantity and quality and range of products for regional and international export markets.

Sub-Objective 2.3: Sustainable upland farming systems including permanent culture well established for domestic and export markets.

Specific Targets:

5-10 Years	20 Years
25% increase in grain production	50% increase in agricultural production
Domestic markets contain all locally produced vegetables	Local regional markets contain 25% Cambodian produce
$2 million exports to Thailand/Vietnam	$5 million exports to Thailand/Vietnam
25% increase in industrial crop production	50% increase in industrial crop production
$2 million investment in agro-industry	$5 million investment in agro-industry

Development Objective 3: Protect and conserve deep pools and Dolphin habitats/numbers.

Sub-Objective 3.1: A better understanding of interacting factors that affect management of deep pools and deaths of dolphins is achieved.

Sub-Objective 3.2: Conservation measures are successfully tested and implemented.

Sub-Objective 3.3: Increase in dolphin numbers and size and number of fish caught in rivers.

Specific Targets:

5-10 Years	20 Years
Participatory studies identifying root causes for deep pool damage and dolphin deaths	Conservation measures institutionalized within government system
Policy agreement with provinces and ministries to take specific measures to conserve habitat and dolphin numbers	30% increase in dolphin numbers
Conservation staff identified and funded	30% increase in average fish size in catch
10% increase in dolphin numbers and average fish catch by weight	

Development Objective 4: Sound natural resource and environmental management practices established at all levels.

Sub-Objective 4.1: Natural forest cover increased and unique eco-systems in Sub-area preserved.

Sub-Objective 4.2: Integrated watershed management programme established and running successfully.

Sub-Objective 4.3: Protected Areas and National Parks and critical upper watersheds under sound management.

Specific Targets:

5-10 Years	20 Years
Current forest cover maintained	10% increase in forest cover
2 community forestry projects established	10 community forestry projects established
50% of sub-catchments have management committees established and conservation pilot projects implemented	70% of sub-catchments have management committees established and 50% are functioning effectively
50% of Protected Areas/National Parks and critical upper catchments have management plan and organization in place	100% of Protected Areas/National Parks and critical upper catchments have management plan and organization in place

Development Objective 5: Promote tourism development as an engine for growth.

Sub-Objective 5.1: Increased cultural tourism provides income and security for indigenous minorities and contributes to their livelihoods and preservation of traditions and heritage.

Sub-Objective 5.2: Increased eco-tourism, particularly focusing on the dolphins, national parks and forests, as a means of promoting conservation and livelihoods for local communities.

Sub-Objective 5.3: Environmental and cultural awareness and education expanded to sustain tourism market and attractions.

Specific Targets:

5-10 Years	20 Years
2 major cultural tourism sites developed	Overall regional cultural tourism network developed
0.2 million tourists/year	1 million tourists/year
Average stay 3-7 days	Average stay 7-10 days
2 major eco-tourism sites developed	5 major eco-tourism sites developed
1 agro-tourism pilot areas developed	3 major agro-tourism sites developed

Development Objective 6: Improve the use and management of water resources.

Sub-Objective 6.1: Secured domestic and drinking water supply for rural and urban areas.

Sub-Objective 6.2: Water resources management improved through farmer water user communities (FWUC) establishment and strengthening.

Sub-Objective 6.3: Micro-hydropower infrastructure projects piloted and feasibility study for large-scale hydropower project completed.

Sub-Objective 6.4: Mainstream Mekong River bank erosion reduced.

Sub-Objective 6.5: Structural and non-structural flood management and mitigation measures implemented.

Specific Targets:

5-10 Years	20 Years
62% access to safe water in rural areas	90% access to safe water in rural areas
80% access to safe water in urban areas	100% access to safe water in urban areas
54% improved sanitation in rural areas	80% improved sanitation in rural areas
74% improved sanitation in urban areas	95% improved sanitation in urban areas
70% urban wastewater treatment	100% urban wastewater treatment
50% of irrigation systems establish registered FWUC	100% of irrigation systems establish registered FWUC
Hydro-meteorological data collection, mapping and studies completed in 50% of catchments	Hydro-meteorological database established and regularly operated, catchments studies and mapping completed for all catchments
Cooperation established between water management organizations and 50% of staff trained in integrated water resource management (IWRM)	Overall entity in place and staffed for IWRM in Sub-area and technically trained staff in place to manage water resources
5 micro-hydropower projects completed successfully	25 micro-hydropower projects completed successfully
1 large-scale hydropower project feasibility study completed	Funding obtained for large-scale hydropower project
Bank erosion protection constructed on critical locations between Stung Treng and Laos	Bank erosion protection constructed on all critical sections of Sub-area
Flood preparedness and warning systems established in pilot areas	Flood preparedness and warning systems established in all affected areas

Development Objective 7: Strengthen human resources development and management and governance.

Sub-Objective 7.1: Increased awareness of natural resource use and management and participation by local communities.

Sub-Objective 7.2: Improved practical technical staff ability available at national and provincial levels for natural resources and environmental management, conservation and planning.

Sub-Objective 7.3:	Strengthened local research capacity and skills for natural resource management available including established regional linkages.
Sub-Objective 7.4:	Increased participation of women in leadership roles within all natural resource development and management activities.
Sub-Objective 7.5:	Improved government policies, strategies, transparency and law enforcement.
Sub-Objective 7.6:	Land tenure secured for people and concession management improved to protect indigenous rights.

Specific Targets:

These are cross-cutting issues that are difficult to measure and monitor. They will be addressed by integrating human resources development and management into all project activities.

CHAPTER 13: SUB-AREA DEVELOPMENT STRATEGIES

13.1. Introduction

This chapter presents the results of the process to develop and refine the strategies for achieving the development objectives as undertaken by the Northern Cambodia-Southern Laos and Kratie Sub-area Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter was prepared for the participants of the *2nd Stakeholder Forum* for the Northern Cambodia-Southern Laos and Kratie Sub-areas in order that the work could be reviewed by a wide range of stakeholders, augmented and refined, and finalized for submission within the overall program of the Basin Development Plan.

This chapter takes as its starting point the development objectives as presented in the chapter 12: ***Development Objectives, Northern Cambodia-Southern Laos and Kratie Sub-areas***. A three-step process was undertaken. First, the individual sub-objectives were examined as the basis for preparing "brainstormed" strategies that would address the goals. Next, these strategies were grouped together on the basis of sectors and cross-cutting issues. The results of these first two processes are contained in the tables in the chapter 10 and chapter 11: ***Key Issues and Scenario Elements, Northern Cambodia-Southern Laos and Kratie Sub-areas***. Finally, the strategies were consolidated, refined and subsequently improved by incorporating all comments and suggestions made by the participants during the *2nd Stakeholder Forum* for the Northern Cambodia-Southern Laos and Kratie Sub-areas, as presented in this chapter.

The sectors and cross-cutting issues are as follows:

A. Irrigated Agriculture
B. Fisheries/Aquaculture
C. Watershed Management
D. Tourism and Recreation
E. Water Supply, Waste Management and Sanitation
F. Hydropower
G. Navigation and Transport
H. Flood Control and Management
I. Trans-Boundary Issues
J. Private Sector and Markets
K. Capacity Building and Human Resources Development
L. Stakeholder Participation
M. Institutional and Legal Issues

The results are then used as the basis for preparing interventions and project ideas as presented in the chapter 14***: Project Interventions and Ideas, Northern Cambodia-Southern Laos and Kratie Sub-areas***.

13.2. Development of Strategies by Sector/Sub-Sector

A. Irrigated Agriculture

Intensify and diversify agriculture to achieve food security and to supply domestic, regional and international markets:

- Rehabilitate irrigation systems and construct pump irrigation systems in lowlands, floodplain and near rivers to enable reliable wet season rice cropping and more diverse dry season cropping.
- Improve soil and water conservation and management for wet season rice cropping through infrastructure development, land leveling and bunding, small-scale surface water diversion and storage, and improved on-farm soil, crop and water management supported through government budget, loan and grant funds, Food-For-Work (FFW) and community association efforts.
- Improve situation of poor farmers through agricultural extension, rural credit/banking, production and distribution of better quality seed and inputs, water control and irrigation management, improved technique and technology, post-harvest processing, market research, marketing and training.
- Focus support efforts in the areas of cropping (grain, vegetable, industrial, organic), smallholder animal health and production, integrated farming, irrigated agriculture, post-harvest processing and handicrafts.
- Control and prevent from illegal cross-border smuggling of agricultural produces while strengthening and expanding local markets.

B. Fisheries/Aquaculture

Conserve deep pools and dolphins through habitat protection, improved fishing practice, law enforcement, and awareness raising and consensus building among stakeholders:

- Undertake participatory research with fishers and relevant government agencies to understand the issues and threats, design management, mitigation and monitoring measures and implement them to conserve deep pools and to prevent and reduce dolphin deaths.
- Ensure policy and legal framework in place to combat illegal fishing methods and enforce them effectively through awareness raising and education and participatory work with the fishing communities.
- Promote aquaculture development in the sub-area.

C. Watershed Management

Implement integrated watershed management to improve soil and water conservation, preserve biological resources, allocate water resources between competing uses, coordinate involved organizations and assist in conflict resolution and planning:

- Establish a pilot project in a watershed to develop and demonstrate a framework for cooperation among concerned agencies that incorporates bottom-up, participatory processes through the decentralization policy of the government in order to address critical resource problems of water demand and protection of important natural resources.
- Implement protected areas management projects in National Parks and Protected Areas with participatory land use planning and management, integrated rural development, generation of revenues through eco-tourism and recognition of local and indigenous land rights.
- Gain strong senior policy support and a legal framework for protected areas, national parks, critical watershed management, community forestry and improved concession management.

Promote improved and sustainable agriculture in upland areas for cropping, livestock/animal feed/fodder management, animal health and production, rural credit, permaculture, intercropping, integrated farming, and harvesting and post-processing techniques via government agencies and the private sector:

- Provide agricultural extension and support services for farmers through government agencies and the private sector in order to reduce shifting cultivation and land clearing for faming and ownership.
- Promote private sector interventions through incentives to agro-industry and SMEs, linking tourism and local farmers, contract farming, "buy local" campaigns, and regional market research.

D. Tourism and Recreation

Expand cultural and eco-tourism and increase the benefits to and role of local communities in the business:

- Increase the market and quality of tourism through international and regional.
- Promotion including particularly through ASEAN and GMS networks, restoration and development of sites, revitalized local social and cultural events and festivals and improved infrastructure and services.
- Community-based management tourism for on preservation and conservation of traditions and sites, development of agro-tourism and production of handicrafts, food and services for both domestic and foreign tourist markets.
- Awareness raising for communities to understand the importance of tourism and environment and to encourage them to maintain their traditional culture and practices.

- Cooperate with other countries in the region in order to ensure the safety, security and efficiency of tourist sector.

E. Water Supply, Waste Management and Sanitation

Improve rural and urban water supply and sanitation and solid and liquid waste management through increased investment in rural areas and privatization and cost recovery in urban areas:

- Increase investment in rural water supply including water use education and sanitation to efficiently use rainwater, surface water and groundwater to improve public health.
- Develop urban water supply through private sector financing and cost recovery by users.

F. Hydropower

Promote small-scale energy development while studying the potential for large-scale hydropower projects:

- Promote and develop provincial and rural electrification schemes through private involvement for fossil fuel generation, micro-hydropower and renewal energy such as solar energy in remote areas with ensured participation of the local communities and cost recovery.
- Select hydropower project with best potential for feasibility study and identify interested donors and private sector investors.

G. Navigation and Transportation

Promote and encourage private sector investment in navigation and transportation in both urban and rural areas:

- Expansion and maintenance of highway, waterway and airport facilities.
- Improve riverbank protection and soil erosion reduction for rivers and streams.
- Increase and develop ports through construction and dredging.

H. Flood and Drought Control and Management

Implement structural and non-structural measures for flood management and bank erosion control to provide protection from and preparedness for flooding events:

- Implement structural flood management measures including reducing bank erosion through protection works and re-vegetation, improving downstream drainage and channeling floodwaters to address drought problems where possible and implementation of early warning systems and flood information dissemination networks.

– Work with affected communities on non-structural flood management to provide protection against flood disasters and planning and preparedness to deal with floods.

13.3. Development of Strategies by Cross-Cutting Issues

I. Trans-boundary Issues

Enhance cooperation within and between the countries in the region through bilateral or multilateral cooperation among the MRC members:

– Undertake joint studies, identification and analysis of trans-boundary issues (source, causes and impact) between sub-areas and at basin-wide.

– Jointly address the trans-boundary issues base upon cooperation spirit, national sovereignty, and mutual benefits and principally on the 1995 Mekong Agreement.

– Identify a cooperation framework to address trans-boundary issues through joint implementation of common projects/programmes in order to enhance and determine cooperation agenda.

J. Private Sector and Markets

Promote and encourage increased private sector involvement in the rural economy and support farmers to gain best advantage from the investment:

– Provide incentives and an enabling environment (rule of law, security, and safety) to agro-industry and small and medium enterprises (SMEs) to work with farmers in rural areas and develop markets for agricultural produce and value-added products.

– Support farmers through farmer associations, providing information and technology, identification and promotion of comparative advantages and niche markets and regulation/mediation of private sector.

K. Capacity Building and Human Resources Development

Increase capacity throughout public and private sector at all levels of society:

– Improve quality and long-term impact of all project implementation through adoption of standards and appropriate technologies, increasing capacity by integrating “learning-by-doing” and on-the-job training in all project activities, incorporating research into regular project work and selecting consultants with demonstrated ability to work closely with national staff.

– Improve human resources development and management including identifying training needs, roles and responsibilities of staff, providing incentives, improving job placement and decentralizing trained and capable staff to provinces.

– Encourage students to focus on natural science and technology.

- Develop agreements and methods for data sharing and analysis to support management.

L. Stakeholder Participation

Broaden and deepen participation in all project activities particularly among less represented people:

- Increase level of participation in all project work through adoption of community-based natural resource management, ensuring local ownership and rights for common resources, encouraging local leadership and responsibility, awareness raising, education and promotion of good practices.
- Actively promote participation of women and involvement of women in leadership roles throughout project activity.

M. Institutional and Legal Issues

Address foundation for development through improving institutions, legal framework, and awareness raising:

- Review current rules, standards and regulations, roles and responsibilities and eliminate overlap and conflicts.
- Promote good management and conservation practice through media, education and training at local and national level, publicizing laws, exchanging experience with other countries and encouraging students to focus on natural science and technology.
- Identify key research issues and prioritize, with an emphasis on building upon local knowledge and link with regional and international institutions for knowledge sharing, training and funding including academic exchanges.

CHAPTER 14: PROJECT IDEAS/INTERVENTION

14.1. Introduction

This chapter presents the results of the process to develop and refine the project interventions and ideas as undertaken by the Northern Cambodia-Southern Laos and Kratie Sub-area Working Group with the assistance of the Cambodian National Mekong Committee Basin Development Plan Team.

The chapter is prepared for the participants of the *2nd Stakeholder Forum* for the Northern Cambodia-Southern Laos and Kratie Sub-areas in order that the work could be reviewed by a wide range of stakeholders, augmented and refined, and finalized for submission within the overall program of the Basin Development Plan. This chapter takes as its starting point the strategies as presented in the chapter 11: ***Strategies, Northern Cambodia-Southern Laos and Kratie Sub-areas***. A two-step process follows where the first step examined the grouped strategies by sector and possible general project ideas were prepared as preliminary project ideas and interventions. In order to maximize the number of ideas, individual provinces are also going to submit additional ideas to form a Long-list from which to work.

The last step is to form a Short-list by taking out the project ideas that are not within the mandate of the BDP (i.e., trans-boundary, water-related and of regional significance) and better detail the remaining ideas to make them viable and unique in the context of the sub-areas. In the prepared project ideas and interventions, sometimes a project will include elements from other groups, such as agriculture and irrigation while cross-cutting issues should be generally addressed within all project ideas.

The Project Ideas and Interventions presented are suggestions from the CNMC Development Plan Team that could form a basis for discussion during the *2nd Stakeholder Forum*. Finally, the Project Ideas and Interventions have been improved by incorporating all comments and suggestions made by the participants during the *2nd Stakeholder Forum* for the Northern Cambodia-Southern Laos and Kratie Sub-areas, as presented in this chapter.

14.2. Project Ideas/Interventions by Sector/Sub-Sector

A. Irrigated Agriculture

A.1. Lowlands and Riverine Irrigated Agricultural Production Project including rehabilitation of existing irrigation schemes and construction of reservoirs, pump irrigation following the participatory process, improved quality seed and inputs, increased rice production, cash cropping of high value vegetable, fruit, grain and industrial crops, farmer cooperatives and farmer water user community formation, organic farming training, certification and marketing, post-harvest processing, linking to private sector and high-value livestock production.

A.2. Agriculture Land Classification and Mapping Project

B. Fisheries/Aquaculture

B.1. Deep Pools, Dolphins and Spawning Ground Conservation Project including community-based participatory natural resource management, awareness raising and promotion of good practice, preparation of policy and laws against illegal fishing and support for enforcement of rules and improved regulations.

B.2. Aquaculture Development and Extension Project

B.3. Fishery Law Dissemination and Promotion of Community Fishery Management Project to preserve the biodiversity of local rare species for tourism promotion.

C. Watershed Management

C.1. Pilot Integrated Watershed Management Project in Kratie-Stung Treng Sub-areas, including mapping of land use change, trends and resources, inventory of infrastructure and proposed/implemented projects, hydro-meteorological and soils data collection, analysis and database management, inventory of irrigation and surface water systems, prioritization of investment and water availability, study on hydropower dam project potential, implementation of some irrigation projects with participatory methods.

C.2. Upland Agriculture Project including agricultural extension, domestication of forest vegetables and other non-timber forest products, rural roads, livestock/animal feed/fodder management, animal health and production, rural credit, permaculture, intercropping, integrated farming, and harvesting and post-processing techniques via government agencies and the private sector.

D. Tourism and Recreation

D.1. Cultural, Agricultural and Eco-Tourism Project to link to the ASEAN and GMS tourist networks and promote the local attractions in order to improve the lives of the local communities and provide opportunities for community-based critical habitat protection and handicrafts, food and service income serving tourists.

D.2. Tourism Triangle between Cambodia, Vietnam and Thailand to enhance human resources and physical infrastructure development to serve this sector in the tree countries.

E. Water Supply, Waste Management and Sanitation

E.1. Rural Water Supply, Use and Sanitation Project to increase availability of safe water sources in rural areas using groundwater, surface water and rainwater, improve

facility maintenance, increase awareness of sanitation issues, install toilets with appropriate technology and improve waste disposal.

E.2. Urban Water Supply and Waste Disposal Privatization Project to rehabilitate the water treatment and distribution systems in the major urban areas and contract out sewage and solid waste treatment to private interests paid for by urban users.

F. Hydropower

F.1. Exploration and geographical examination, study and data collection of hydropower potential sites

F.2. Prioritization of potential hydropower projects including construction and connection of distribution network to the regional power grid for private sector or loan investment.

G. Navigation and Transportation

G.1. Studies and research on expansion of other river, stream and canal transports and port location in order to rehabilitate and construct transport networks, prioritize projects for implementation.

G.2. Rehabilitation, maintenance and expansion of sub-area and provincial secondary and tertiary road networks including (i) the preparation of technical studies to assess requirements and priorities for new linking roads with neighboring countries; and (ii) the establishment of road-bridge maintenance organizations.

G.3. Integrated management of the impacts of navigation on river ecology and stream

H. Flood and Drought Control and Management

H.1. Studies and research on traditional techniques and implement pilot projects to demonstrate their utility.

H.2. Proper Engineering and Rehabilitation of the Khmer Rouge and Other Existing Irrigation and Drainage Systems and other flood-proofing and drought reduction infrastructures.

H.3. Examination and Application of Successful Techniques and Engineering Structures in other countries such as flood and drought controlling and management and improved water management.

H.4. Feasibility study and construction of an agro-meteorological center for data and information sharing within the Lower Mekong Basin (LMB) and the Greater Mekong Region (GMS).

14.3. Project Ideas/Interventions by Cross-Cutting Issues

I. Trans-boundary Issues

I.1. River bank protection and maintenance project in the sub-areas with joint implementation the sub-area of Lao PDR.

I.2. Conservation of the river ecology project in order to maintain the hydrological flow, biodiversity especially the Mekong Dolphins and significant brood stocks and fish species.

J. Private Sector and Markets

J.1. Foundation for market support and development project including research and market study to identify comparative advantage, international and regional marketing promotional material development, and study on appropriate credit and tax incentives for domestic private sector targeted to Small and Medium Enterprises (SMEs).

K. Stakeholder Participation and Capacity Building

K.1. Mekong River Basin Key Issues awareness raising, training and educational project including media campaign to target specific practices or issues of importance, education campaign in schools, training and advocacy for senior officials on water management, ecology and gender, conferences and workshops on basin-wide issues and participatory research for community-based natural resource management.

K.2. Human Resource Development and Management (HRD/HRM) Project including training and active promotion of women in leadership roles, preparation of HRD/HRM strategy and plan, links to regional and international institutes, internship programme for students, and roundtable forum for interagency cooperation to work towards rationalization of roles and responsibilities.

CHAPTER 15: PROPOSED PROJECT IDEAS

These projects are distilled from the process of Scenario and Strategy Development within the Basin Development Plan of the Cambodian National Mekong Committee. While a great many different project ideas have been generated through this work, particularly by the Sub-area Working Groups and during the 2nd Stakeholder's Forums, it must be noted that most of these ideas are not appropriate for the criteria of the Basin Development Plan. These main criteria require that project interventions are: (i) water-related; and (ii) trans-boundary or of regional significance. However, the projects that have pure national implications would also be prepared in PIN Format, but they will not be presented to the MRC Secretariat so it is the sole responsibility of the National Mekong Committee and respective Line Ministries in seeking financial assistance for implementation.

There is a strong need to refine the list so that it includes only those projects that meet the main criteria and which are likely to be of the most interest to the Mekong River Commission. This will provide the best likelihoods that the project ideas from Cambodia will be prioritized and accepted on the long-list and then selected for the short-list and ultimately implemented.

This Chapter presents a number of project ideas for each of the sub-areas as well as some ideas that could be implemented across sub-areas that meet the criteria for inclusion in the long-list of projects for the BDP. This list is by no means comprehensive and there is a good chance that additional projects could be identified and added to this list. It is prepared in order to facilitate submission of a more refined and relevant final list of ideas for Cambodia to the BDP.

The following is the list of development projects proposed by the Northern Cambodia-Southern Laos and Kratie Sub-area Working Groups and other External Stakeholders as the results of the Second Stakeholder Forum, which need to be included in the long-list of the MRC-BDP Programme of the 4 countries (Cambodia, Laos, Thailand and Vietnam).

This list still opens and waits for other development projects, which will be proposed by sub-area working groups and other stakeholders after completion of Forum 2. To propose these development projects, requesters have to prepare their own projects using Pro-forma (PIN) prepared by MRC-BDP Team for preparing the long-list.

The Northern Cambodia-Southern Laos and Kratie Sub-areas (6C and 8C) are ones where environmental issues are paramount, particularly those focusing on the rapid changes in the use of land in the upland areas and the health of the key fisheries resources in the main river systems. Economic development is relatively slow as the area is more sparsely populated than other parts of Cambodia; however, it is important that advantage be taken of the opportunities provided by the different land, forest and soil resources available, as well as the proximity to the larger and more dynamic economy of Vietnam.

The challenges for the Northern Cambodia-Southern Laos and Kratie Sub-areas are to conserve the key environmental features of the areas so that tourism continues its steady growth while moving agriculture more into a market economy.

Kratie and Stung Treng Provinces

Project 1:

Date:	September 2004
Raised by:	Provincial Departments of Agriculture, Forestry and Fisheries
Working title:	Natural Capture Fisheries and Fish Spawning Ground Protection and Conservation Project
Development objectives:	This project is aiming at enhancing economic, social and cultural significance of the Mekong natural fish resources through the protection and conservation of its habitats and ensuring sustainable development and utilization of the resources, which must be based on good knowledge about opportunities and threats.
Background and justification:	The fisheries are extremely important to food security, and to subsistence and to national economies in general. The fisheries are under pressure in connection with the general infrastructure and land use development in the Region. The two main determinants of the gross fishery yield are (i) the state of the habitats; and (ii) the state of the migration routes.
Strategic relationship:	The project would be related to the MRC Fisheries Programme and Environment Programme, and must fit seamlessly into parallel national fisheries programmes of MAFF
Priority:	High
Expected outputs:	The project would yield the following outputs: (i) Physical, legal, economic and social conservation measures to protect and preserve these species and areas will be recommended including community-based participatory natural resource management, awareness raising and promotion of good practices. (ii) The potential links to eco-tourism and how to maximize the benefits from this to assist in funding local people to cooperate in the protection of the resource will be examined and enhanced.
Time frame:	5 years
Cost sharing:	National contribution (in kind): 40,000 US$ External fund required: 200,000 US$ Total cost: 240,000 US$
Location map for project:	N/A

Project 2:

Date:	September 2004
Raised by:	Provincial Departments of Agriculture, Forestry and Fisheries
Working title:	Deep Pools and Dolphins – Flagship Species Conservation Project
Development objectives:	Protect and conserve deep pools and dolphin habitats and numbers.
Background and justification:	The Irrawaddy Dolphin is among the "flagship" species that live in the Mekong River, meaning that these are rare and large animals that are at or near the top of the food chain. As a result, they both attract a lot of attention internationally and are indicators of the overall health of the river system. The numbers of dolphins are in serious decline, and there are concerns that the species could face extinction if nothing is done to conserve their habitat and reduce their number of deaths from contact with people. There are also the deep pools along this stretch of the river that form the richest habitat for a diverse range of fisheries that are critical to the overall resource and a refuge for aquatic animals throughout the year. These pools too are under threat mainly from people who illegally fish with explosives. The dolphins are a source of pride and of eco-tourism revenues in an area where tourism is at an early stage but which has much potential. It is vital that they are protected to ensure the continued growth of tourism. Similarly, the health and conservation of the deep pools is important for the livelihoods of the people in the region, as fish comprise the majority of the source of protein for their diet. The project would include community-based participatory natural resource management, awareness raising and promotion of good practice, preparation of policy and laws against illegal fishing and support for enforcement of rules and improved regulations. It would include promotion of eco-tourism and other possible tourist sites in the region. It would include production of locally produced handicrafts and foods to market to tourists and training of local guides to increase local revenue generation from the tourists. The project has a trans-boundary impact as the protection of the deep pools and health of the flagship species impacts upon the fisheries resource throughout the Mekong River basin.
Strategic relationship:	The project would be related to the MRC Fisheries Programme and Environment Programme, and must fit seamlessly into parallel national fisheries programmes of MAFF and MOE
Priority:	High
Expected outputs:	A participatory management plan agreed to with the government and including a set of policies, regulations and enforcement measures to ensure that they are implemented. A community-based natural resource management project working

	with the local fishers to ensure that proper practices are followed and to include local revenue generating activities from tourism.
Time frame:	5 years
Cost sharing:	National contribution (in kind): 40,000 US$ External fund required: 760,000 US$ Total cost: 800,000 US$
Location map for project:	N/A

Kratie Province

Project 3:

Date:	September 2004
Raised by:	Provincial Department of Tourism
Working title:	Sambhupura Tourism Development Project
Development objectives:	Environmental and cultural awareness and education expanded to sustain tourism market and attractions.
Background and justification:	This Sub-area is one that has until recently been very remote and disconnected from the road network so has not had many visitors. However, this has changed with the construction of good quality all-weather highways from Phnom Penh that will soon extend to Stung Treng. With the attraction of the dolphins already well established, the many other interesting features of the region need to be developed to increase the numbers of tourists, their average length of stay and the amount of funds they spend in the area for the development of the local economy. The ancient Kingdom of Sambhupura was located at Sambor, just north of Kratie town where the dolphins are as is one of the most famous Wats in Cambodia. The provincial town of Kratie is considered one of the most charming in Cambodia with its old French architecture and beautiful river setting. There are the old rubber plantations in Snuol and elsewhere and the remnants of the Ho Chi Minh Trail that would appeal to regional and international tourists. These should be better-developed and prepared to take advantage of the increasing tourist traffic. The project would include development of regional heritage programs and education and awareness campaigns to raise the understanding of and pride in the areas culture and history. The riverbanks that are eroding in Kratie town and elsewhere and thereby threatening the roads and old buildings would be protected. The rich forest areas need to be protected for eco-tourism purposes and to enable the local communities to continue to gain the benefits from their resources. This project would reduce the erosion and sedimentation of the mainstream Mekong and thereby have a trans-boundary impact as well as enabling the local communities to better deal with the changes in the rivers' flow from upstream that have caused the riverbanks to erode.
Strategic relationship:	The project would be related to the Flood Management and Mitigation Program, MRC; Fisheries Program; MRC Environment Program, MRC Tourism Programme
Priority:	High
Expected outputs:	The project would provide the following outputs: i. River bank protection works in Kratie and Stung Treng towns and other identified locations;

	ii. Regional heritage and education projects raising the profile of the area and pride and knowledge of the local communities; iii. Increased tourist traffic and economic gains; and iv. Improved upper watershed land use and forest conservation for reduced flooding and sedimentation downstream.
Time frame:	5 years
Cost sharing:	National contribution (in kind): 50,000 US$ External fund required: 350,000 US$ Total cost: 400,000 US$
Location map for project:	N/A

Project 4:

Date:	September 2004
Raised by:	Provincial Department of Industry, Mines and Energy
Working title:	Small-Scale Hydropower Development Project along the Stream in Prek Te, Prek Kampi, Prek Chlong, Prek Chrey Maing, and Prek Odambal
Development objectives:	The project is aiming to provide rural population living along the above-mentioned stream flows with reliable electricity, which is a key factor in the rehabilitation and development of rural economy toward the improvement of living standards and an important infrastructure requirement for agricultural and small-scale industrial development in the areas with minimal negative impacts on the environment and local people, thereby promoting economic growth for the country.
Background and justification:	The areas where located near by the stream flows where the water is available for the entire year the micro-hydropower development is very sanctify. The micro hydropower potentials in the area have not been thoroughly studies, evaluated and developed. Micro hydropower stations require less capital for investment but provide great benefits to the rural populace. They will be ideal for small rural communities. If a micro hydropower capability exists in the vicinity of a village, it should be exploited for providing supply.
Strategic relationship:	The project would be related to the MRC Hydropower Programme. National power generating authorities of Cambodia in collaboration with the CNMC and MRC
Priority:	High
Expected outputs:	The project may have a total installed capacity of 8.5 MW. With this capacity, approximately 80 percent of population in the province will access to the energy supply, which would help to promote small-scale industry, handicrafts, tourist sectors, and agricultural production
Time frame:	10 years
Cost sharing:	National contribution (in kind): 3, 600,000 US$ External fund required: 25,000,000 US$ Total cost: 28,600,000 US$
Location map for project:	N/A

Project 5:

Date:	September 2004
Raised by:	Provincial Department of Water Resources and Meteorology
Working title:	River Bank Protection Project of the Mekong river bank in the Provincial Town
Development objectives:	The project is aiming to put into an end the problem imposed by the morphological changes of the Mekong river, and to protect the continuity of river bank erosion in the provincial town that have caused lose of city land and altered the ecological condition of the river.
Background and justification:	Apparently escalating problem is imposed by the morphological alteration, which led to the problem of the Mekong river bank erosion and other associated physical, social and economic loses of the people living along the Mekong river bank in the provincial town. Timely intervention is required to avoid major consequences in the future.
Strategic relationship:	The work can be implemented by national line agencies (MOWRAM, MPWT), if so desired with coordination by the CNMC and MRC
Priority:	Medium
Expected outputs:	The project would provide the following outputs: (i) Morphological processes and their determinants studied; and potential mitigation measures, aiming at recommendations on practical stabilization schemes recommended to based upon economic, social and environmental assessment of preferred scheme(s); and (ii) Detailed design, preparation of tender documents and construction of 2,500 meters of river bank along the main street of the city.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 200,000 US$ External fund required: 1,000,000 US$ Total cost: 1,200,000 US$
Location map for project:	N/A

Stung Treng Provinces

Project 6:

Date:	27th September 2004
Raised by:	Provincial Department of Industry, Mines and Energy
Working title:	Hydropower Development Project for the Lower Se San II
Development objectives:	The project is aiming: (i) to ensure the increasing demand for affordable electric energy in the country is met with minimal negative impacts on the environment and local people, thereby promoting national economic growth, development of rural economy towards the improvement of rural living standards and improved infrastructure for agricultural, industrial and tourism development; and (ii) Potential hydropower resources of the Mekong river basin in Cambodian are developed according to true least-cost planning, fully considering environmental and social impacts.
Background and justification:	85% of the population of Cambodia is located in rural areas and cannot access to the electricity. At present, only 2 percent has been developed of the hydropower potential and at the same time, there is a huge power demand in Cambodia, an unserved immediate demand is a visible constraint to national development particularly the growth of rural economy towards poverty alleviation. This project aims at serving the demand of electricity in northeast Cambodia as well as distribution to the southern Lao PDR. As a continued shortage in the electricity supply will seriously restrain the ongoing reconstruction and socio-economic development of the country Cambodia needs to use its hydropower potential to meet future electricity demand and to reduce its dependence on imported fuel and for the power trade with neighboring countries.
Strategic relationship:	The project would be related to the MRC Hydropower Programme. National power generating authorities of Cambodia in collaboration with the CNMC and MRC
Priority:	High
Expected outputs:	For the Lower Se San II, the project has total installed capacity of 207 MW, an effective head of 28 m and an average discharge of 840 m3/s. With this capacity, all population in the province will access to the energy supply, which would help to promote small-scale industry, handicrafts, tourist sectors, and agricultural production.
Time frame:	10 years
Cost sharing:	National contribution (in kind): 10,000,000 US$ External fund required: 363,000,000 US Total cost: 373,000,000 US
Location map for project:	Available for detailed project proposal

Project 7:

Date:	27th September 2004
Raised by:	Provincial Department of Industry, Mines and Energy
Working title:	Hydropower Development Project for the Lower Sre Pok II
Development objectives:	The project is aiming: (i) to ensure the increasing demand for affordable electric energy in the country is met with minimal negative impacts on the environment and local people, thereby promoting national economic growth, development of rural economy towards the improvement of rural living standards and improved infrastructure for agricultural, industrial and tourism development; and (ii) Potential hydropower resources of the Mekong river basin in Cambodian are developed according to true least-cost planning, fully considering environmental and social impacts.
Background and justification:	85% of the population of Cambodia is located in rural areas and can not access to the electricity. At present, only 2 percent has been developed of the hydropower potential and at the same time, there is a huge power demand in Cambodia, an unserved immediate demand is a visible constraint to national development particularly the growth of rural economy towards poverty alleviation. This project aims at serving the demand of electricity in northeast Cambodia as well as distribution to the southern Lao PDR. As a continued shortage in the electricity supply will seriously restrain the ongoing reconstruction and socio-economic development of the country Cambodia needs to use its hydropower potential to meet future electricity demand and to reduce its dependence on imported fuel and for the power trade with neighboring countries.
Strategic relationship:	The project would be related to the MRC Hydropower Programme. National power generating authorities of Cambodia in collaboration with the CNMC and MRC
Priority:	High
Expected outputs:	For the Lower Sre Pok II, the project has total installed capacity of 222 MW, an effective head of 18.6 m and an average discharge of 1350 m3/s. With this capacity, all population in the province will access to the energy supply, which would help to promote small-scale industry, handicrafts, tourist sectors, and agricultural production.
Time frame:	10 years
Cost sharing:	National contribution (in kind): 10,000,000 US$ External fund required: 323,900,00 US$ Total cost: 338,900,000 US$
Location map for project:	Available for detailed project proposal

Project 8:

Date:	27th September 2004
Raised by:	Provincial Department of Industry, Mines and Energy
Working title:	Small-Scale Hydropower Development Projects in Srok Siem Bok, Srok Stung Treng and Srok Se San
Development objectives:	The project is aiming to provide rural population living in the above-mentioned Sroks (districts) with reliable electricity, which is a key factor in the rehabilitation and development of rural economy toward the improvement of living standards and an important infrastructure requirement for agricultural and small-scale industrial development in the areas with minimal negative impacts on the environment and local people, thereby promoting economic growth for the country.
Background and justification:	The areas where located near by the stream flows where the water is available for the entire year the micro-hydropower development is very sanctify. The micro-hydropower potentials in the area have not been thoroughly studies, evaluated and developed. Micro hydropower stations require less capital for investment but provide great benefits to the rural populace. They will be ideal for small rural communities. If a micro hydropower capability exists in the vicinity of a village, it should be exploited for providing supply.
Strategic relationship:	The project would be related to the MRC Hydropower Programme. National power generating authorities of Cambodia in collaboration with the CNMC and MRC
Priority:	High
Expected outputs:	The project has a total installed capacity of 80 KW, and can generate the power for year round. With this capacity, approximately 60 percent of population in aforesaid Sroks will access to the energy supply, which would help to promote small-scale industry, handicrafts, tourist sectors, and agricultural production.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 20,000 US$ External fund required: 81,239 US$ Total cost: 101,239 US$
Location map for project:	N/A

Project 9:

Date:	27th September 2004
Raised by:	Provincial Department of Water Resources and Meteorology
Working title:	River Bank Protection Project of the Mekong river bank
Development objectives:	The project is aiming to put into an end the problem imposed by the morphological changes of the Mekong river, and to protect the continuity of river bank erosion that have caused the loses of village land and altered the ecological condition of the river.
Background and justification:	Apparently escalating problem is imposed by the morphological alteration, which led to the problem of the Mekong riverbank erosion and other associated physical, social and economic loses of the people living along the Mekong riverbank. Timely intervention is required to avoid major consequences in the future.
Strategic relationship:	The work can be implemented by national line agencies (MOWRAM, MPWT), if so desired with coordination by the CNMC and MRC
Priority:	Medium
Expected outputs:	The project would provide the following outputs: (i) morphological processes and their determinants studied; and potential mitigation measures, aiming at recommendations on practical stabilization schemes recommended to based upon economic, social and environmental assessment of preferred scheme(s); and (ii) Detailed design, preparation of tender documents and construction of 4,000 meters of river bank.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 300,000 US$ External fund required: 1,700,000 US$ Total cost: 2,000,000 US$
Location map for project:	N/A

Project 10:

Date:	27th September 2004
Raised by:	Provincial Department of Industry, Mine and Energy
Working title:	Improvement of Domestic Water Supply in the Province
Development objectives:	The present project aims at increasing availability of safe water sources in rural areas using groundwater, surface water and rainwater, improving facility maintenance, increasing awareness of sanitation issues.
Background and justification:	Water supply for maintenance and development of rural livelihoods is a particularly important management concern. Adequate access to water is a key determinant of rural development. It would support the over-all national economic development, the food security, and alleviation of rural poverty. Also, it would contribute to a reduced rate of the (possibly inevitable) migration from the countryside to urban centers, which, if out of control, can induce severe negative social and economic side effects both in towns and in the countryside. The rural water availability must meet domestic demands, as well as a variety of production demands (for agriculture and aquaculture) and non-consumptive demands (for fisheries, habitat preservation, navigation, and so forth).
Strategic relationship:	National water supply, groundwater and river management agencies and implemented by water supply agencies with coordination by CNMC and MRC
Priority:	Medium
Expected outputs:	The project would provide the following outputs: (i) an evaluation of potential water sources, both quality and availability of surface and groundwater resources will be evaluated and assessed in the province; (ii) detailed domestic water supply plan drafted; and (iii) Prioritization and selection of highly potential projects and preparation of tender documents and construction.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 300,000 US$ External fund required: 700,000 US$ Total cost: 1,000,000 US$
Location map for project:	N/A

Preah Vihear Province

Project 11:

Date:	28th September 2004
Raised by:	Provincial Department of Environment
Working title:	River Bank Protection Project of the Lor Peouv River
Development objectives:	The project is aiming to put into an end the problem imposed by the morphological changes of the river, and to protect the continuity of river bank erosion that have caused the loses of village land and altered the ecological condition of the Lor Peouv river.
Background and justification:	Both villages, Kampong Pror En and Kampong Samey, a major (and apparently escalating) problem is imposed by the morphological alteration, which led to the problem of riverbank erosion and other associated physical, social and economic loses. Timely intervention is required to avoid major consequences in the future.
Strategic relationship:	The work can be implemented by national line agencies (MOWRAM, MPWT), if so desired with coordination by the CNMC and MRC
Priority:	Medium
Expected outputs:	The project would provide the following outputs: (i) morphological processes and their determinants studied; and potential mitigation measures, aiming at recommendations on practical stabilization schemes recommended to based upon economic, social and environmental assessment of preferred scheme(s); and (ii) Detailed design, preparation of tender documents and construction of 1,000 meters of river bank.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 200,000 US$ External fund required: 800,000 US$ Total cost: 1,000,000 US$
Location map for project:	N/A

Project 12:

Date:	28th September 2004
Raised by:	Provincial Departments of Environment and Tourism
Working title:	Community-based Natural Resources Management Project
Development objectives:	The project is aiming to enhance the sustainable management and utilization, protection and conservation of natural resources such as forest, wildlife and grassland located in the natural protected areas for the sake of rural socio-economic development and tourist sector promotion.
Background and justification:	There is need for protection and conservation of critical habitats and protect forest and national parks in order to maintaining the unique and rich biodiversity of wildlife and other plant species that provide valuable resources for sustaining rural livelihood and for the promotion of eco-tourism. To protect and to make best use of these resources, a community-based natural resource management, project focusing on the national parks and protected forest for wildlife and plant species conservation is proposed.
Strategic relationship:	The project would be related to the MRC Environment Programme, and AIFP programmes of MRC. The work can be implemented by concerned Line Ministries and CNMC in liaison with MRCS
Priority:	Medium
Expected outputs:	The project would provide the following outputs: (i) natural forests, wildlife and other biodiversity will be protected and conserved through community organization and capacity building in natural resource development and management for public servants and local community; and (ii) An effective community-based natural resource management structure established and functioning.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 500,000 US$ External fund required: 1,000,000 US$ Total cost: 1,500,000 US$
Location map for project:	N/A

Mondulkiri Province

Project 13:

Date:	28th September 2004
Raised by:	Provincial Department of Agriculture, Forestry and Fisheries
Working title:	Lowland and Highland Region Poverty Alleviation and Agricultural Development Project
Development objectives:	The project is aiming to improve food security among the poor living in the highland and lowland region and to promote rural economic growth through crop diversification, gradual development of crops, cultivation practices and farming systems, added value of agricultural production, development of processing industries, and by extension services, marketing support, and education.
Background and justification:	The lowland highland peoples who are living in the northeast of Cambodia are among the poorest in the Mekong River basin, and their traditional way of life is under great stress. This includes particularly their swidden agricultural systems, also known as "slash and burn", which is of particular concern to resource managers now that the population density cannot sustain the system as in the past. Much work on addressing the issues of poverty and stabilizing the agriculture of the highland people has been done in the LMB and in China. Many lessons can be learned and applied in Mondulkiri to preserve the uplands and thereby improve the watershed and natural resource protection of the Mekong River Basin.
Strategic relationship:	The project would be related to the MRC Agriculture, Irrigation and Forestry Programme and the MRC Environment Programme
Priority:	High
Expected outputs:	The project would provide the following outputs: (i) rehabilitation of existing irrigation schemes and construction of pump irrigation following the participatory process, improved quality seed and inputs, increased rice production; (ii) cash cropping of high value vegetable, fruit, grain and industrial crops; and (iii) farmer cooperatives and farmer water user community formation, organic farming training, post-harvest processing, linking to private sector and high-value livestock production.
Time frame:	3 years
Cost sharing:	National contribution (in kind): 500,000 US$ External fund required: 1,500,000 US$ Total cost: 2,000,000 US$
Location map for project:	N/A

Project 14:

Date:	28th September 2004
Raised by:	Provincial Department of Environment
Working title:	Community-based Natural Resources Management Project
Development objectives:	The project is aiming to enhance the sustainable management and utilization, protection and conservation of natural resources such as forest, wildlife and grassland located in the natural protected areas for the sake of rural socio-economic development and tourist sector promotion.
Background and justification:	There is need for protection and conservation of critical habitats and protect forest and national parks in order to maintaining the unique and rich biodiversity of wildlife and other plant species that provide valuable resources for sustaining rural livelihood and for the promotion of eco-tourism. To protect and to make best use of these resources, a community-based natural resource management, project focusing on the national parks and protected forest for wildlife and plant species conservation is proposed.
Strategic relationship:	The project would be related to the MRC Environment Programme, and AIFP programmes of MRC. The work can be implemented by concerned Line Ministries and CNMC in liaison with MRCS
Priority:	High
Expected outputs:	The project would provide the following outputs: (i) natural forests, wildlife and other biodiversity will be protected and conserved through community organization and capacity building in natural resource development and management for public servants and local community; and (ii) an effective community-based natural resource management structure established and functioning.
Time frame:	10 years
Cost sharing:	National contribution (in kind): 500,000 US$ External fund required: 1,600,000 US$ Total cost: 2,100,000 US$
Location map for project:	N/A

CHAPTER 16: GLOSSARY

Acid soils (or sulphur acid soils): Soils that have been rendered acid due to formation of sulphuric acid by oxygenation of pyrite (natural iron sulphide, FeS_2), often due to human interference (lowering of the groundwater table by drainage, or excavation of ponds for aquaculture). Such soils are unsuited for cultivation, effluents leaking from such areas can be poisonous to fish (because acid can dissolve aluminium), and the process can be practically irreversible.

Alluvial: Formed by river sediments. An alluvial river flows in a landscape formed by its own sediments.

Analysis (of hydrological data): Processing, involving a sometimes comprehensive transformation and interpretation, in order to arrive at some desired knowledge. Data analysis is often carried out stage-wise and in different contexts: On-line processing in the field, off-line processing, further synthesisation for model input, etc. In general, data analysis involves both hidden and explicit assumptions about the relation between primary data and final results. (As one example, a flow rate in a river can be calculated assuming that the current measurements were made simultaneously, even if they took a whole day). Such assumptions can affect both the accuracy and the validity of the results. A suitable quality is supported by an adequate transparency of the analysis.

Aquaculture: Cultivation, aiming at commercial production, of aquatic plants or animals, such as fish, prawns, shellfish, etc.

Aquaculture: Cultivation, aiming at commercial production, of aquatic plants or animals, such as fish, prawns, shellfish, etc.

Basic minimum needs: These can comprise food and water, shelter, primary education, vital health care, and personal integrity.

Biodiversity: The number of species (of plant and animals) that actually live in an area (or biotope) where they belong. Agenda 21 (Chapter 17.7) states about coastal biodiversity: 'Coastal States, with the support of international organizations, upon request, should undertake measures to maintain biological diversity and productivity of marine species and habitats under national jurisdiction. Inter alia, these measures might include: surveys of marine biodiversity, inventories of endangered species and critical coastal and marine habitats; establishment and management of protected areas; and support of scientific research and dissemination of its results'.

Brackish water: A mixture of sea water and freshwater, found at places where inland waters discharge into the sea: River mouths, fjords, estuaries, lagoons, inland seas, etc. The salinity will be higher than nil, but lower than the ocean salinity of 35 PPT.

Stratification is common in brackish areas, and the salinity will often vary highly, both in time and place.

Catchment (or drainage area): An area (delineated by a watershed) that drains through a specific river cross-section.

Development objective (or overall objective, or development goal, or mission): A desired future situation, which is supported by a plan (or programme or project) that is targeted towards it. The plan (or programme or project) cannot in itself assure achievement of the development objective - this is subject to a number of assumptions on related developments that are outside the control of the plan (or programme or project). Some authors recommend that only one development objective be applied from case to case, and that it be specified in time, space and quantity. See also immediate objective.

Discharge: Net flow or net sediment transport through a fixed cross-section of a river.

Dispersion: Mass transport determined by the transverse current velocity gradient and the concentration gradient (and always in the direction of the concentration gradient).

Driving force: A circumstance that has a major (positive or negative) influence on pursuance of a set of planning goals. It can be physical, climatic, economic, social or political, and can appear as a trend, a cycle, or an event. A driving force cannot be fully controlled by the participants in the planning process. It can be unpredictable, or not well understood, or even unknown.

Dublin Principles (from International Conference of Water and the Environment, Dublin 1992): (1) Freshwater is a finite and vulnerable resource, essential to sustain life, development and the environment; (2) water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels; (3) women play a central role in the provision, management and safeguarding of water; (4) water has an economic value in all its competing uses and should be recognized as an economic good.

Ecological demand of stream flow: The minimum stream flow required for prevention of irreversible ecological degradation. This value varies over the year and from one place to another. To maintain a healthy environment, the flow must be higher in the wet season than in the dry season, because many aquatic species have annual cycles that reflect their natural habitat. Sometimes, the water-level is critical, rather that the flow rate.

Endemic: Occurring only in one specific geographical area (for example one country, one river basin, or one island).

Eutrophication: Excessive supply of nutrients, resulting in a high primary production. Eutrophication can have negative ecological effects, such as large fluctuations of dissolved oxygen between night and day, or damage to benthic vegetation due to shading by algae.

Flow: Volume transport per time unit (for example through a cross-section of a river).

Frequency: Number of cycles (or units or events) per unit time.

Gauging: Measuring at a fixed point; a gauge is a measuring device (e.g. for water-level or pressure).

Gross domestic product (GDP): the total output of goods and services for final use produced by an economy, by both residents and non-residents, regardless of the allocation to domestic and foreign claims. It does not include deductions for depreciation of physical capital or depletion and degradation of natural resources.

Immediate objective: The intended situation that is achieved as the direct result of orderly implementation of a plan (or programme or project). The immediate objective is the result of a number of outputs, which, between them, are necessary and adequate for achieving the immediate objective. Some authors recommend a maximum of 3 immediate objectives, and that these are specified in time, space, quantity, quality and target group. See also development objective.

Integrated farming: An area-intensive and labor-intensive combination of different parallel productions, like a fish pond, paddy, fruit trees, livestock, cash crops and vegetables. Integrated farming can give yields that highly exceed monoculture yields.

Integrated Water Resources Management (as defined by Global Water Partnership): A process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

Opportunity costs: The cost difference between one course of action and another (better) course of action. In a wider sense, the implications of one course of action relative to alternative strategies. In development projects, the opportunity costs can reflect the time lag from when a new technology emerges and until it becomes available to the target group. There is often an opportunity cost related to doing nothing.

Photosynthesis: The primary production (by plants, algae and some bacteria) of simple carbohydrates (such as sugar), normally from (inorganic) carbon dioxide, and using energy supplied by the sun.

Phytoplankton: Photosynthetic aquatic microorganisms (algae).

Pollutant: A compound that is harmful or otherwise undesired in the environment, either absolutely, or at an elevated concentration level. See also contaminant and xenobiotic compound.

Pollution: Release to the environment of a substance that can harm it.

Salinity (of sea water): Relative mass of the salt contents, given in PPT (parts per thousand) (kg per 1,000 kg), or in PSU (practical salinity units) (which is very nearly the same as PPT).

Scenario: A hypothetical combination of events and physical conditions, describing a possible future situation.

Sector planning: Planning for a specific source of income, like agriculture, fisheries, hydropower, industry, service, tourism, etc.

Seepage: Slow movement of water in the ground, or from the ground to the surface.

Stakeholder: A person, group or institution that has a particular interest in an activity, project, programme or policy. This includes both intended beneficiaries and intermediaries, winners and losers, and those involved in, or excluded from the decision-making process. A key stakeholder is one who can significantly influence or who is otherwise important to the success of the activity, project, programme or policy.

Strategy: (1) A conceptual plan for how to reach a goal; (2) a plan, method or series of actions designed to achieve a specific goal or objective.

Subsistence economy: An economy in which agricultural, hunting and other activities are undertaken primarily to meet household consumption requirements.

Transparency (of a procedure): The insight conveyed to the data user about how the data were produced, for example for assessing the validity of the data for a given, possibly unforeseen, purpose. An acceptable transparency is obtained by documentation and can be supported by using standard procedures.

Vector-borne disease: A disease transmitted by an organism (for example malaria).

Water availability: The flow into an area from upstream, plus the (surface and groundwater) resources generated by net rainfall in the sub-area, minus the ecological demand within the area and at its downstream boundary. The availability changes slowly, from one decade to the next, due to medium-term climate variations, or due construction of reservoirs or diversions. The availability can be measured, and/or determined by numerical modeling, often with a high accuracy (subject to the coverage and quality of the basic hydrological data).

Water demand: The amount of water required for a given purpose, for example liter per person per day, or mm per crop. The demand can be present or future, and it can be actual (i.e. related to an available infrastructure) or potential (assuming full infrastructural development and no water shortage). The serviceable (part of the) demand is limited both by infrastructure and water availability.

Water pricing: A tool for management of water allocation between areas, sectors and individual users, assuming that an 'optimal' allocation (or just a sustainable allocation) can be determined on the basis of a water price that reflects the full costs (and hereby the full value) of water (for example, in economic theory, by charging the full costs and relying on free market mechanisms for allocation). Such a strategy can improve water efficiencies and reduce waste of water. It will often give preference to industrial allocations rather than irrigation. See valuation and cost of water.

Watershed: A line in the landscape (e.g. a ridge) that delineates a catchment. The surface runoff on each side of the watershed will proceed towards different locations.

Wetland: An area that is covered by water in at least a part of the year. A wetland can represent a special ecological habitat, sometimes with a high biodiversity, and can serve as a fish breeding ground. The Ramsar convention defines wetlands quite broadly as 'areas of marsh, fen, peat-land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including marine areas with a depth less than 6 m at low tide'.

REFERENCES

ADB. (2003). Water sector roadmap for Cambodia. Phnom Penh: Author.

Bottomley, R. (1999). Cambodian forests: The state, people and resource control, Ratanakiri province, northeast Cambodia, MA dissertation, graduate research Centre of Culture, Development and Environment, Sussex.

Bottomley, R. (1999). Contested forests: An analysis of the highlander response to logging, Ratanakiri province, northeast Cambodia, Mimeo, Phnom Penh.

Cambodian Researchers for Development. (2004). Garment employees in Cambodia: A socio-economic survey commissioned by ADB.

Cambodian Researchers for Development-CHHRA. (2001). The assessment of patient rights within the context of HIV/AIDS testing in Cambodia.

Chevey, P. et F. Le Poulain. (1940). La pêche dans les eaux douces du Cambodge. Travaux de l'Institut Océanographique de l'Indochine. 5è mémoire, Gouvernement Général de l'Indochine, Saïgon.

Chhea, V., & Sean, K. (2001). Fisheries preservation in the Mekong River Pools in Stung Treng and Kratie provinces. MRC/DoF/Danida Fisheries Project in Cambodia. Department of Fisheries, MAFF.

CNMC. (2003). National sector review. Phnom Penh: Author.

CNMC. (2004). The 8C Sub-area studies and analysis. Phnom Penh: Author.

Coates D. (2001). Biodiversity and fisheries management opportunities in the Mekong River Basin. "Blue millennium- Managing global fisheries for biodiversity". GEF-IDRC. 3-7 July 2001, World Fisheries Trust, Victoria, Canada.

Colm, S. (1996). Effects of oil palm plantation development on indigenous communities, Ratanakiri province, Cambodia, Natural Resource Management Project, Phnom Penh.

Colm, S. (1997). Options for land security among indigenous communities, NTFP, Ratanakiri.

Crocker, C.D. (1962). Soils of Cambodia-exploratory survey. Direction de l' Agriculture, Phnom Penh.

Department of Forestry and Wildlife, Wildlife Conservation Society Cambodia Programme and TRAFFIC. (2002). Wildlife Identification for Law Enforcement.

DoF-MAFF & MRC-DANIDA. (2001). Inland fisheries research and development institute: Cambodia fisheries technical paper series Vol. III.

FAO. (2001). Selected indicators of food and agriculture in the Asia-Pacific Region 1999-2000.

FAO-MRC. (2003). New approaches for the improvement of inland capture fisheries statistics in the Mekong Basin.

Global Witness. (1996). Corruption, war and forest policy: The unsustainable exploitation of Cambodia's forests. London: Author.

Hasselskog, M. (2000). Local governance in transition: Villagers' perceptions and Seila's impact, CARERE, Phnom Penh.

Himel, J. & Nhem, S. (1997). Balancing change: Paddy rice and water control in Ratanakiri, Phnom Penh.

IFReDI, MRC-DANIDA. (2000). Management aspects of Cambodia's freshwater capture fisheries, 11 presentations at the Annual Meeting of DoF, MAFF.

IRRI. (1997). Rice production in Cambodia: Cambodia – IRRI – Australia Project. IRRI, Manila.

Long P., & Pham, P.E. (1999). The existing challenges and future dangers to the Tonle Sap and the Mekong delta: Paper presented at the 1999 Mekong papers.

Mac Kenney, B. & Tola, P. (2002). Natural resources and rural livelihoods in Cambodia: a baseline assessment.

Mahfuzuddin, A.; Hap, N.; Ly, V. & Marites, T. (1998). Socioeconomic assessment of freshwater capture fisheries of Cambodia: Report on a household survey.

Monirith, I., H. Nakata, S. Tanaka & S.T. Touch, 1999, Persistent Organochlorine Residues in Marine and Freshwater Fish in Cambodia – Marine Pollution Bulletin.

MoP, NIS, & ADB. (2002). National accounts of Cambodia 1993-2001, Bul. #6.

MoP. (2001). Cambodia human development report 2001: Societal aspects of the HIV/AIDS epidemic in Cambodia.

MOWRAM. (2001). National water sector profile. Phnom Penh: ADB.

MOWRAM. (2003). The state of the environment report (draft). Phnom Penh: NCDP.

MRC. (1995). Agreement on the sustainable development of the Mekong River Basin. In BDP Archive, Nov. 2003.

MRC. (1999). Public participation in the context of the MRC. In BDP Archive, Nov.2003.

MRC. (2001). Assessment of national legal and institutional frameworks of MRC member countries.

MRC. (2002a). BDP Data System: Draft guidelines and working paper.

MRC. (2002b). BDP planning process: Draft working paper.

MRC. (2002c). Draft guidelines: Sub-area analysis.

MRC. (2002d). Identification of Sub-Areas for the Basin Development Plan: BDP working paper.

MRC. (2002e). Regional sector overview: Agriculture and irrigation.

MRC. (2002f). Regional sector overview: Executive summary and sectors including fisheries and tourism development.

MRC. (2002g). Regional sector overview: Hydropower.

MRC. (2002h). Working paper on information needs assessment and information available at MRCS.

MRC. (2002i). Regional sector overview: Water supply.

MRC. (2002j). Basin development plan: Inception report. Phnom Penh: Author.

MRC. (2003a). BDP Archive. CD-Rom.

MRC. (2003b). Draft report on MRC participation in the ADB Meeting on the water sector "Roadmap" for Cambodia, April 7th 2003.

MRC. (2003c). Social atlas of the Lower Mekong Basin.

MRC. (2003d). State of the basin report.

MRC. (2003e). Water used for agriculture in Lower Mekong Basin. Phnom Penh: Author.

MRC. (2003f). Draft report on MRC participation in the ADB meeting on the water sector "Roadmap" for Cambodia. Phnom Penh: Author.

Nao, T., & Zalinge, N.V. (2000). Challenges in managing Cambodia's inland fisheries: How can we meet them? in Van Zalinge, N.P., T.Nao and S. Lieng (Eds), 2000. Management aspects of Cambodia's freshwater capture fisheries. MRC and MAFF, Phnom Penh, pp 10-22.

Nielsen, T. K. (2002). Water utilization in the LMB – DHI Water & Environment.

Öjendal, J. (2000). Sharing the good: Modes of managing water resources in the Lower Mekong River Basin. Ph D Thesis, University of Göteborg.

Öjendal, J., Hasselskog M., Lilja M., Sith S., & Wallgren P. (2001). Addressing anarchy. decentralization and natural resource management in Ratanakiri province, northern uplands of Cambodia. SEI-REPSI Report Series No.2, 2001.

PAD Partnership. (2003). Cambodia national report on protected areas and development.

Petillot, L. (1911). La pêche et les poissons, une richesse du Cambodge. Librairie Maritime et Coloniale, Paris.

Phnom Penh Post. (Sept., 2004). Dolphins and development in Kratie. Article by Liam Cochrane. Phnom Penh: Author.

Poulsen, A. F. et al. (2000). Fish migration and spawning habits in the Mekong Mainstream - a survey using local knowledge. Assessment of Mekong Fisheries: Fish migrations and spawning and the impact of Water Management Project (AMFC), Vientiane.

Provincial Offices. (2002). Provincial reports for BDP-CNMC-MRC, Provinces of Kratie, Mondulkiri, Preah Vihear and Stung Treng.

Provincial Offices. (2003). Provincial reports for BDP-CNMC-MRC, Provinces of Kratie, Mondulkiri, Preah Vihear and Stung Treng.

Provincial Offices. (2004). Provincial reports for BDP-CNMC-MRC, Provinces of Kratie, Mondulkiri, Preah Vihear and Stung Treng.

Ringler, C. (2001). Optimal allocation and use of water resources in the MRB: Multi-country and intersectoral analysis.

Ringler, C. (2001). Optimal water allocation in the Mekong River Basin ZEF-discussion report 38 on development policy.

Royal Government of Cambodia. (1991). Second five-year socio-economic development plan 2001-2005: National economic growth and poverty reduction strategy.

Sam Ath Sith et al. (2002a). Addressing anarchy: Decentralization and natural resource management in Ratanakiri province, northern uplands of Cambodia. SEI-REPSI Reports Series No.2.

Sam Ath Sith et al. (2002b) Going against the Grain: Decentralization and natural resource management in Ratanakiri province, upland Cambodia, presented at the International Symposium II on Montane Mainland Southeast Asia – Governance in the Natural and Cultural Landscape, at Chiang Mai University in Thailand, July 1-4, 2000.

Sverdrup-Jensen, S. (2002). Fisheries in the Lower Mekong Basin: Status and perspectives, MRC Technical Paper #6. Phnom-Penh: MRC.

Touch, S. T. (1996). Water quality impact on the fisheries and aquaculture of Cambodia freshwater systems – water report, 1996.

Touch, S.T. & Todd, B.H. (2001). The inland and marine fisheries trade of Cambodia.

UN-WFP-MoP-UNDP. (2001). Identifying poor areas in Cambodia.