

The Vulnerability Assessment and Adaptation Programme
within the Coastal Zone of Cambodia Project

Vulnerability Assessment and Adaptation Planning Training Manual



April
2013



Preface

The Coastal Zone of Cambodia has its own distinct agenda for climate change adaptation and resilience. It features precious marine and coastal habitats and ecosystems, including mangroves, as well as cultivated areas and production systems that contribute to economic growth and prosperity. At the same time, however, it is exposed to a range of climate-related pressures, such as sea level rise, which cause increased flooding, impeded drainage, coastal erosion and saline intrusion, as well as an increased frequency of storms and other weather irregularities. These pressures, in turn, affect habitats and production systems, and hereby the livelihoods.

The '*Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia Considering Livelihoods Improvement and Ecosystems*' is implemented by the Coastal Coordination Unit (CCU) of the Ministry of Environment, with financial support from GEF under the LDCF. Its objective is to increase the resilience of coastal ecosystems and reduce the vulnerability of coastal communities to climate change impacts and risks. This is being achieved by measures such as strengthened institutional capacity; improved adaptation planning; reduced vulnerability of cultivation systems and other resource-based production systems; and improved resilience to climate change of coastal buffers; with improved livelihoods as an over-all, cross-cutting perspective.

The work is related to (and co-managed with) the '*Coastal Adaptation and Resilience Planning*' (CARP) component of Cambodia Climate Change Alliance. It takes place with active participation by the inter-ministerial Provincial Working Groups (PWGs), and with guidance and support from line ministries, provincial departments, the offices of the provincial governors, the National Disaster Management Committee and its sub-national bodies, non-governmental development organizations, and national knowledge centres and technical service institutions.

May I, on behalf of the CCU, take the opportunity to extend our sincere gratitude to all partners and stakeholders for their indispensable contributions and support to the work. We look forward with confidence to continued, successful progress towards social, economic and environmental benefits for the Coastal Zone.

Dr. Vann Monyneath
Director, Coastal Coordination Unit (CCU),
Ministry of Environment

Acknowledgement

This Report was produced under the The Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia, implemented for UNEP by the Coastal Coordination Unit of Ministry of Environment, Cambodia. The work is comprehensively based on findings of a recent capacity needs assessment conducted under the Coastal Adaptation and Resilience Planning (CARP) Component of the Cambodia Climate Change Alliance.

The Team gratefully acknowledges the support and guidance provided by HE Dr. Mok Mareth, Senior Minister and Minister of Environment; HE Dr. Lonh Heal, Director General of MOE; Mr. Sum Thy, Director of Climate Change Department, MOE, and Dr. Vann Monyneath, National Project Coordinator, MOE.

Valuable guidance was provided during the Joint Programme Review of the UNEP-GEF/LDCF and CCCA-funded Coastal Zone Projects in Cambodia on 2-4 July 2013 with participation by (In alphabetic order) Mr. Julien Chevillard, CCCA Trust Fund Administrator; Mr. Lars Christiansen, Task Manager, UNEP; Ms. Kalyan Keo, Programme Analyst, UNDP; Mr. Koen Everaert, Attaché, EU delegation; Ms. Soma Dor, Programme Officer, Government of Sweden; and Dr. Tin Ponlok, Head of the CCCA Trust Fund Secretariat.

The Team sincerely thanks everyone who shared their time and knowledge, and look forward with enthusiasm and confidence to a continued fruitful dialogue.

The Vulnerability Assessment and Adaptation Programme for Climate Change
within the Coastal Zone of Cambodia

**Vulnerability Assessment and Adaptation Planning:
Training Manual**

Part A: Climate Change and Adaptation Planning

Version 2, June 2013

Contents

Key messages.....	ii
Acronyms and Abbreviations.....	iii
1 Introduction	1
2 Climate Change Concepts and Terminology	1
3 Climate Change in the Coastal Zone of Cambodia.....	6
4 Sensitivity to Climate Change.....	9
5 Adaptation Planning	12
6 Opportunities and Entry Points.....	14
References and Literature	18
Appendix A: Glossary.....	21
Appendix B: Cambodia's Millennium Development Goals	26
Appendix C: Overview of Sub-national Planning Procedures	35
Appendix D: Examples of Climate-related Strategies and Plans.....	38
Appendix E: Climate-related Opportunities and Risks	39
E.1 Examples of Opportunities	39
E.2 Examples of Interventions That May Require Caution and Further Consideration.....	40
E.3 Examples of Steps to Take	41
Appendix F: Climate Screening of Development Initiatives.....	42

Key messages

1	Climate mitigation can have local as well as global benefits	3
2	The climate change agenda of Cambodia includes many attractive ' <i>no-regrets solutions</i> '	5
3	The coastal zone has its own distinct CC agenda	8
4	The rate of climate change is uncertain	9
5	Climate resilience and poverty are closely related	11
6	Timely and appropriate decisions are supported by good knowledge	11
7	The future will be different from today	13
8	The household and community levels can contribute significantly to climate adaptation	15
9	The private sector can highly assist with climate adaptation	15
10	Hard and soft hard adaptation measures can add value to each other	16
11	Efficiency improvements provide safe win-win strategies	16
12	Climate screening can add value to investments	17

Acronyms and Abbreviations

CARP	:	Coastal Adaptation and Resilience Planning Component (of CCCA)
CC	:	Climate change
CCCA	:	Cambodia Climate Change Alliance
CCSAP	:	Cambodia Climate Change Strategy and Action Plan
CDB	:	Commune Database
CSO	:	Civil society organization
D&D	:	Decentralization and deconcentration
DEM	:	Digital elevation model
DIW	:	District Integration Workshop
EEPSEA	:	Economy and Environment Program for Southeast Asia
EIA	:	Environmental impact assessment
ENSO	:	The El Niño-Southern Oscillation
GEF	:	Global Environment Facility
IPCC	:	Intergovernmental Panel on Climate Change
LDCF	:	The Least Developed Countries Fund
MRC	:	Mekong River Commission
NAPA	:	National Adaptation Programme of Action to Climate Change
NCDD	:	National Committee for Democratic Development
NGO	:	Non-governmental organization
PIP	:	Public Investment Programme
PPCR	:	Pilot Programme for Climate Resilience
RGC	:	Royal Government of Cambodia
UNEP	:	United Nations Environment Programme
UXO	:	Unexploded ordinance

1 Introduction

Background

The '*Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia Considering Livelihood Improvement and Ecosystems*' has been approved by the GEF under the LDCF to address the vulnerability of Cambodia's Coastal Zone.

The programme is implemented by the United Nations Environment Programme (UNEP) and is executed by the Coastal Coordination Unit of the Cambodian Ministry of Environment in close cooperation with sectoral ministries as well as sub-national and local leaders. It is closely coordinated with the Coastal Adaptation and Resilience Planning (CARP) Component, implemented by the same unit for the Cambodia Climate Change Alliance (CCCA).

The programme aims to increase the resilience of natural ecosystems, such as mangrove forests, along the coast (as well as their functioning as buffer systems) and reduce the vulnerability of coastal communities to climate change impacts and risks.

The present document reflects one of the specified tasks:

Preparation of a training manual to be used in on-the-job training in vulnerability assessment and adaptation planning for the National Focal Points and Provincial Technical Working Groups and with consideration of present capacity on climate change.

About This Document

The present document is intended as a reference for training-of-trainers and training of professional practitioners. It builds comprehensively on recent studies and documentation prepared by Ministry of Environment in connection with the PPCR (Phase 1) and the CARP. A related manual, addressing training and awareness-building at the commune level, is in preparation under the CARP.

The document is divided into 2 parts, intended for related but distinct applications:

- A: Climate Change and Adaptation Planning (with a glossary)
- B: Vulnerability Assessment and Reporting

2 Climate Change Concepts and Terminology

This chapter introduces some basic climate concepts and terminology. Please refer to Appendix A (glossary) for additional information.

Weather and Climate

One may ask '*how will the weather be for the weekend?*', whereas you would not ask '*how will the climate be for the weekend?*' Similarly, one may ask '*how will the climate be when our grandchildren grow up?*' The '*weather*' relates to local and immediate conditions, whereas the '*climate*' describes long-term conditions over larger areas (like a river basin, a country, a region, or the entire northern hemisphere).

'Weather' and 'climate'

The '*weather*' is the air temperature, wind, rain, cloud cover, fog, sunlight and air pressure at a given location and a given time or over relatively short periods of time (hours, days, weeks or years).

The '*climate*' is the weather considered over longer periods of time (decades or centuries), and perhaps over a large area.

Both the weather and the climate will influence the hydrological and oceanographic conditions, and hereby the various natural resources, the environment, and human activities and health

Causes of Climate Change

Greenhouse gases (in the atmosphere) are gases that transmit short-wave heat radiation (from the Sun to the Earth) but retain long-wave heat radiation (from the Earth to the outer space). Greenhouse gases include water, carbondioxide, methane and ozone. Carbondioxide levels have escalated over recent decades due to human emissions. Increased concentrations of greenhouse gases will accumulate heat in the atmosphere and generate *global warming*. This, in turn, will cause melting of ice in polar and mountainous areas, which will increase the heat absorption capacity of the surface of the Earth and further contribute to the global warming. In the process, the sea level will rise, due to expansion caused by higher temperatures as well as melting of the ice.

The global temperature is determined by several other factors than the greenhouse gas level. Both natural phenomena and human activity play a role, and the governing cause-effect relationships are complex and not yet fully understood.

Adaptation and Mitigation

Climate change adaptation covers measures that address the *effects* of climate change - such as floods, saline intrusion, or coast erosion. *Climate change mitigation* covers measures aiming at the *causes* of climate change - such as reduced emissions of CO₂ and other greenhouse gases. Adaptation efforts tend to be '*local*' and site-specific, whereas mitigation efforts tend to be '*global*' and general.

Key message 1:**Climate mitigation can have local as well as global benefits**

Control of the causes of climate change is an international challenge that reaches far beyond Cambodia. Never the less, some measures are clearly beneficial, because they serve other good purposes in addition to climate mitigation:

- Saving fuel in general and electricity in particular
- Improved over-all efficiencies of cultivation and industrial production systems
- Recycling of chemical waste, including from refrigerators and aircons
- Tree planting, reforestation, sustainable commercial forestry

Vulnerability

An area can be vulnerable to climate change, like it may be vulnerable to specific exposures such as floods, drought or pests. The vulnerability is determined by

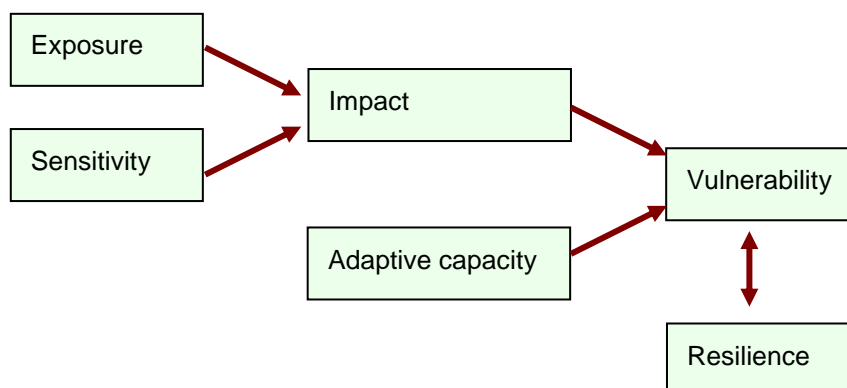
- the impact: A high impact will increase the vulnerability; and
- the adaptive capacity: A high adaptive capacity will reduce the vulnerability.

The impact, in turn, is determined by

- the exposure: A high exposure will increase the impact; and
- the sensitivity: A high sensitivity will also increase the impact.

This is illustrated in the figure below.

Figure 1: Vulnerability to climate change



Many studies¹ confirm Cambodia's high vulnerability to climate change, and also determine that the vulnerability is related to a high sensitivity and a low adaptive capacity, as much as to a high level of exposure.^{2 3}

Adaptive Capacity

Adaptive capacity is *'the ability of a system to adjust to climate change (including climate variability and extremes), to moderate the potential damage from it, to take advantage of its opportunities, or to cope with its consequences'*.⁴

Hereby, the adaptive capacity depends on socio-economic factors, technology and infrastructure.

The adaptive capacity is important because it is *manageable* - at least to some extent - provided that adequate (human and financial) resources are available.

'No-regrets Solutions'

'No-regrets solutions' are solutions that not only support the climate resilience, but other good purposes as well. They are robust to quantitative assumptions about the climate change - and are feasible and beneficial even if the climate doesn't change in the way that is presently expected.

-
- 1 For example MOE and UNDP (August 2011): Cambodia Human Development Report 2011. Building resilience: The future of rural livelihoods in the face of climate change. Ministry of Environment of Cambodia and UNDP Cambodia; MOE (December 2009): Second National Communication of Cambodia under the United National Framework Convention on Climate Change (UNFCCC) (draft). Part 1: Vulnerability, impact and adaptation assessment to climate change. Ministry of Environment; and Yusuf, Arief Anshory and Herminia A Francisco (January 2009): Climate change vulnerability mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA)
 - 2 Se for example Yusuf, Arief Anshory and Herminia A Francisco (January 2009): Climate change vulnerability mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA)
 - 3 HE Mr Keo Vy, Cabinet Chief at the NCDM, observes that *'Cambodia is a poor country and it is difficult for us to adapt to the changed climate; but compared to other countries in the region, we are only a little bit affected'* (Cambodia Daily, 28 November 2012)
 - 4 According to Yusuf and Herminia (January 2009), quoting IPCC

Key message 2: The climate change agenda of Cambodia includes many attractive 'no-regrets solutions'⁵

Examples include:

- Improved water and energy efficiencies of production systems (and at household level)
- reduction of existing flood exposure and vulnerability;
- improved drought resilience (including increased storage capacity and contingency planning);
- improved urban drainage;
- improved groundwater management;
- institutional strengthening; and
- education, capacity-building, research, monitoring, knowledge-sharing and dialogue.

The National Adaptation Programme of Action to Climate Change (NAPA) was promulgated in 2006 with 20 high priority adaptation projects, many of which were of a 'no-regrets' character (see box below). Some of these projects have been implemented (although with certain modifications as compared with the original proposals).

Also, Appendix E.1 lists several examples of 'no-regrets solutions'.

5 See for example MOE and UNDP (August 2011): Building Resilience: The Future of Rural Livelihoods in the Face of Climate Change. Also, the National Adaptation Programme of Action to Climate Change (NAPA) is based on 'no-regrets solutions'

NAPA Priority Adaptation Projects

- 1 Rehabilitation of a multiple-use reservoir in Takeo Province
- 2 Rehabilitation of a multiple-use dams in Takeo and Kampong Speu Provinces
- 3 Community and household water supply in coastal provinces
- 4 Development and rehabilitation of flood protection dikes
- 5 Rehabilitation of Upper Mekong and Provincial waterways
- 6 Rehabilitation of multiple-use canals Banteay Meas District, Kampot Province
- 7 Vegetation planting for flood and windstorm protection
- 8 Strengthening of community disaster preparedness and response capacity
- 9 Water gates and water culverts construction
- 10 Safe water supply for rural communities
- 11 Development and improvement of small-scale aquaculture ponds
- 12 Promotion of household integrated farming
- 13 Rehabilitation of coastal protection infrastructure
- 14 Development and improvement of community irrigation systems
- 15 Community mangrove restoration and sustainable use of natural resources
- 16 Community-based agriculture soil conservation in Srea Ambel District, Koh Kong Province
- 17 Production of biopesticides
- 18 Development of healthcare centres and posts
- 19 Provision of safe water in high risk malaria regions
- 20 Malaria education and mosquito habitat clearance campaigns

Source: <http://www.adaptationlearning.net/cambodia-napa>

3 Climate Change in the Coastal Zone of Cambodia

The 'Global Climate Risk Index'⁶ places Cambodia as no. 28 out of 179 countries in terms of weather-related damage and losses relative to the size of the country, as an average for the 20-years period from 1992 to 2011.

Cambodia's potential exposure to climate change may be summarised as follows:⁷

- Temperatures, having increased since 1960, are predicted to escalate from 2030 onwards;⁸

6 Harmeling, Sven and David Eckstein (November 2012): Global Climate Risk Index 2013. Who suffers most from extreme weather events? Weather-related loss events in 2011 and 1992 to 2011. Briefing paper published by Germanwatch

7 Extracted from PPCR (April 2013b)

8 MOE (December 2009): Second National Communication of Cambodia under the United National Framework Convention on Climate Change (UNFCCC) (draft). Part 2: Historical and future climate change of Cambodia. Ministry of Environment

- Changes are expected in the seasonal distribution of rainfall, with drier and longer dry seasons, and shorter, more intense wet seasons.⁹ This, in turn, will affect the hydrology of major rivers and tributaries, as well as groundwater recharge, and hereby the quantity, quality, availability and distribution of water.¹⁰
- A clear potential exposure is an escalating frequency of extreme climate events (such as drought and floods), including ENSO (meso-scale climate fluctuation) events (that are otherwise unrelated to global climate change).¹¹

For the Mekong Basin (which includes 86 percent of Cambodia's area) climate change is expected to cause higher flood season flows and largely unaffected dry season flows.

The Coastal Zone and the Delta are highly vulnerable to sea level rise¹², causing flooding, saline intrusion, coastal erosion (and habitat degradation), and drainage problems for urban areas and cultivated areas.

9 (same as above)

10 MOE and UNDP (August 2011): Cambodia Human Development Report 2011. Building resilience: The future of rural livelihoods in the face of climate change. Ministry of Environment of Cambodia and UNDP Cambodia

11 MOE (December 2009): Second National Communication of Cambodia under the United National Framework Convention on Climate Change (UNFCCC) (draft). Part 1: Vulnerability, impact and adaptation assessment to climate change. Ministry of Environment

12 MRC (January 2011): IWRM-based Basin Development Strategy for the Lower Mekong Basin. Mekong River Commission

Key message 3:**The coastal zone has its own distinct CC agenda**

Particular climate-related concerns in the Coastal Zone include

- Sea water intrusion control
- Coast erosion control
- Drainage, flood control
- Health of mangroves and seabed habitats
- Land subsidence caused by drainage

Concerns shared with the inland (Mekong Basin) parts off the country include

- Access to safe water, sanitation and electricity
- Water resources management, water efficiencies
- Rice cultivation technology, production efficiency, and related threats
- Livestock breeding, production efficiency, and related threats
- Efficiency of other production systems
- Generation and disposal of wastewater and solid waste from households, farms and industries
- Soil quality and soil improvement
- Knowledge-building and data management

Potential (but not immediate) concerns include

- Drought preparedness and drought mitigation
- Land subsidence caused by groundwater abstraction

In Cambodia (as in many other countries) the CC agenda is highly water-related - and comes on top of a context of finite availability of land and water. Drought, inland and coastal floods, and saline intrusion are well-known challenges that will be enhanced by pressures due to increased weather irregularities, as well as sea level rise.¹³

The water-related challenges interact with others that are not directly water-related, for example

- lowering trade barriers (and increased competition);
- increasing urbanization; and
- higher demands for food & energy, and higher waste production.

Cambodia is particularly vulnerable (by Asian standards) due to a low adaptive capacity (see box below), and also because of a comparatively low efficiency of its traditional production systems.

Climate Change Vulnerability in Southeast Asia

A study by Yusuf, Arief Anshory and Herminia A Francisco (January 2009)

Following a concept proposed by IPCC, this study considers vulnerability as determined by exposure, sensitivity and adaptive capacity. The adaptive capacity is related to socio-economic factors, technology and infrastructure.

It was concluded that all the regions of the Philippines; the Mekong River Delta in Vietnam; almost all the regions of Cambodia; North and East Lao PDR; the Bangkok region of Thailand; and West Sumatra, South Sumatra, West Java, and East Java of Indonesia are among the most vulnerable regions in Southeast Asia.

According to the study, the high vulnerability of Cambodia (and Laos) is not so much due to a high exposure or high sensitivity, but to a *low adaptive capacity*.

Key message 4: The rate of climate change is uncertain

There is no doubt that the climate will change. It has always done, and will continue to do so.

But it is not known how, and how fast, the climate will change in Cambodia.

There are strong indications, however, that

- extreme weather events - storms, floods, drought - will become more frequent and more severe; and
- the sea level will increase.

4 Sensitivity to Climate Change

General

Agriculture accounts for some 75 percent of Cambodia's livelihoods.¹⁴ Drought, inland and coastal floods, and saline intrusion, are existing challenges to production systems and livelihoods that will be exacerbated by climate-related changes and weather irregularities.^{15 16}

Climate Change and Poverty

'Cambodia has achieved remarkable levels of economic growth and has made notable reductions in poverty. Institutions have been strengthened and

14 Van Ngo, Thi Thanh (April 2010): Paddy cultivation - 20 years from now. CRBOM Small Publications Series no. 20. Centre for River Basin Organizations and Management, Solo, Central Java, www.crbom.org/SPS/

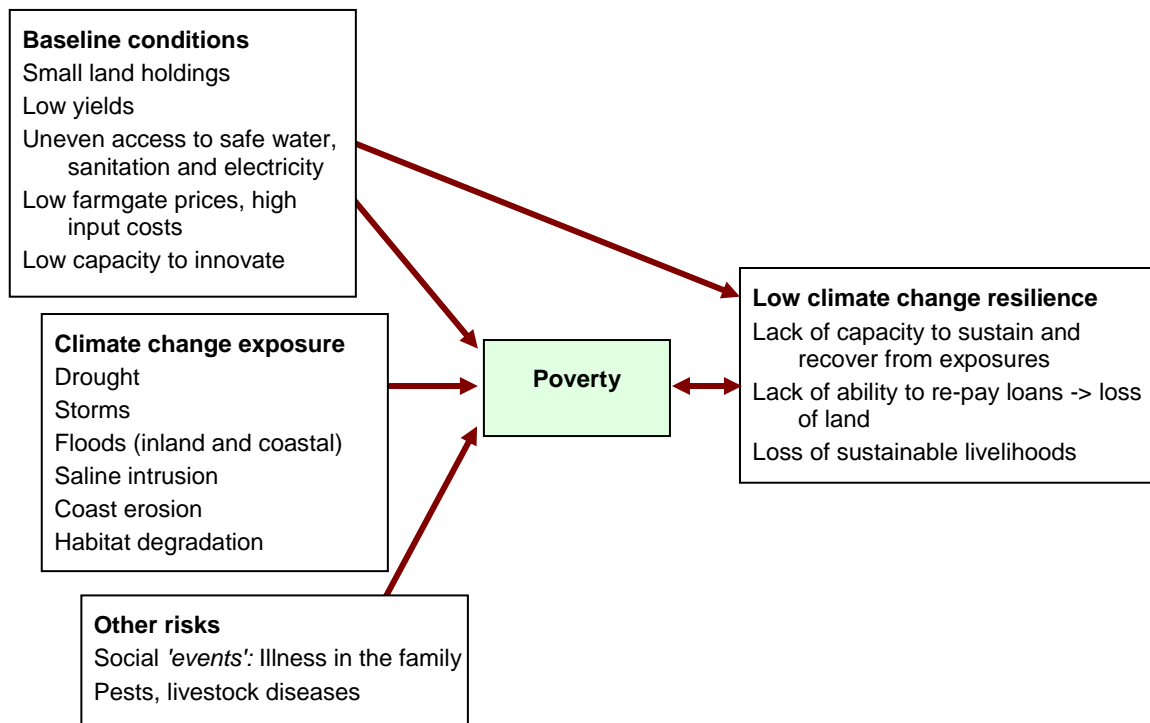
15 Extracted from PPCR (April 2013b)

16 See for example Danida (June 2008): Climate change screening of Danish development cooperation with Cambodia (104.DAN.4-52-9-2)

*infrastructure improved. But climate change threatens to undermine this progress ...'*¹⁷

The figure below provides a simplified illustration of typical relations between various pressures, including but not limited to climate change exposure on the one hand, and poverty and climate change resilience on the other.

Figure 2: Poverty and climate change



The climate change exposure varies significantly from one place to another - for example between the inland (Mekong Basin) parts of the country and the Coastal Zone - but also from one province to another, or often within a province. The same is the case for the incidence of poverty, with clear differences between urban and rural areas, and depending on aspects such as water availability, infrastructure, and soil conditions.

Key message 5: Climate resilience and poverty are closely related

Poverty reduces the climate resilience; and improved climate resilience will support poverty reduction.

A positive interaction can be achieved by

- access to sustainable livelihoods, including resource-based livelihoods;
- resource conservation: Water, energy, habitats and ecosystems (inland, coastal and marine);
- risk reduction and contingency planning (floods, drought, etc.); and
- broad education and awareness-building.

Key message 6:

Timely and appropriate decisions are supported by good knowledge

Much of Cambodia's recent, impressive infrastructural development has taken place on a basis of less than perfect knowledge, because data do either not exist, or are not easily accessible. A good basis for feasibility studies and design will increase the cost-benefit ratio of infrastructural developments, reduce the risks, and add to a good investment climate.

Important knowledge can be obtained from elsewhere in Cambodia (and from other countries), but it must be remembered that the Coastal Zone has its own, distinctive CC agenda.

Valuable information is available from the Commune Database (CDB).

Additional information can be compiled directly from the communes at the annual *District Integration Workshops*.

5 Adaptation Planning

Background

Cambodia's adaptive capacity is related to its general socio-economic development. MOE and UNDP¹⁸ note that

'limited adaptive capacity'¹⁹ is arguably the main factor in Cambodia's vulnerability to climate change. This is related to limited capacity at all levels, and deep-rooted and longstanding challenges: persistent poverty according to key indicators; inequality; insecure access to land and key productive resources; and institutional and governance constraints.

At the same time, Cambodia is becoming well positioned to deal with these challenges and to respond to climate change effectively. There has been significant progress in reducing many aspects of poverty and generating economic development. The ongoing public administration and decentralization reforms provide a framework for improving governance'.

Two main vehicles for improving Cambodia's adaptive capacity to climate change are

- The National Adaptation Plan of Action to Climate Change (NAPA) (2006)
- The Strategic National Action Plan for Disaster Risk Reduction (2008)

Benefits of Adaptation

The clear objective of CC adaptation is to reduce the adaptation deficit in support of the country's social and economic development and a healthy environment. Many of Cambodia's Millennium Development Goals will be supported by a low vulnerability and a high resilience to climate change and climate-related challenges.

In the coastal zone, as elsewhere in the country, a distinction can be made between immediate, medium-term and long-term aspects:²⁰

- Immediate concerns include public health (safe water and sanitation); livelihoods and production systems; and environmental health of coastal and marine habitats, including the mangroves.
- Medium- and long-term concerns include the smooth transition to a society that is visibly different from today's. In the future, most people will live in towns, rather than in rural areas. Agriculture will remain an important sector

18 MOE and UNDP (August 2011): Cambodia Human Development Report 2011. Building resilience: The future of rural livelihoods in the face of climate change. Ministry of Environment of Cambodia and UNDP Cambodia

19 Yusuf and Francisco (January 2009) used three sets of indicators for adaptive capacity to analyse the vulnerability context of different countries in Southeast Asia, covering socioeconomics, infrastructure and population. Other analyses apply related indicators for adaptive capacity. These include considering policy-based institutional arrangements such as agricultural and land tenure policies, public-private investment in technologies such as building infrastructure, irrigation systems or livelihood-based approaches that emphasize indicators related to livelihood security and diversification, health, education, and poverty rates, as well as access to common property, and rates of poverty alleviation and achievement of CMDG goals

20 This and the following paragraphs quoted from CARP (August 2012)

but will employ far less people than today, and the national economy will be supported by manufacturing, industries and the service sector - including tourism. This development is in full swing and is desirable in many ways. *The challenge is to conduct a smooth transition, without excessive adverse social side effects, where a part of the population is left behind during the transition.*

Key message 7:

The future will be different from today

Rice will remain the favoured staple food. Revenues of the agricultural sector will increase, but a large part of the value will be generated by crops other than rice, as well as meat, and, quite likely, biofuel.

The agricultural sector will diversify, and the thrust of its development may occur for production systems other than rice. Food production will increase, but the process will see a big loss of employment in traditional paddy cultivation.

Farm sizes will increase, and perhaps dramatically so, driven by new technology that requires less labour but more capital, combined with a need of higher production efficiencies - more output and higher value per unit of input. Labour-intensive production systems - such as the System of Rice Intensification (SRI) - will be marginal.

Lower trade barriers will increase the exposure to price fluctuations. Also, there will be a much higher exposure to competition, which will benefit the more efficient production systems at the cost of less efficient ones.

The use of pesticides (and fertilisers) will escalate, partly necessitated by the diversification. Pesticides can end up in the environment and can contaminate edible fish and water used for drinking.

Towns will continue to grow, and so will the need of urban infrastructure and services: Water, electricity, sewage and solid waste disposal.

Source: CARP (July 2012)

6 Opportunities and Entry Points

Adaptation opportunities exist within

- public health;
- production systems (improving their efficiency and resilience);
- water resources, flow, storage capacity;
- waste generation and waste management;
- land use;
- disaster preparedness and disaster risk reduction; as well as
- various cross-cutting aspects, such as institutional capacity-building.

Please refer to Appendix E for an elaboration.

Governance

The *Rectangular Strategy of the RGC* provides powerful and clear directions for national development. The Strategy has *good governance* as the central perspective.²¹ It provides a concise framework for national development with four strategic '*growth rectangles*': (1) Enhancement of the agricultural sector; (2) further rehabilitation and construction of the physical infrastructure; (3) private sector development and employment; and (4) capacity building and human resource development.

Good governance relies on adequate and responsive institutional capacity, and any efforts in this respect will inevitably contribute to a healthy and prosperous society, for example by supporting the investment climate in general, and investment in resource-based (or resource-related) production systems in particular. Also, good governance will assure a healthy environment and orderly (and profitable) natural resources utilization. This will generate livelihoods, including rural livelihoods - which, in turn, will moderate a (possibly rapid) urban migration, leaving time for the related urban infrastructural development.

Cambodia's ongoing *decentralization and deconcentration (D&D)* process interacts positively with adaptation planning in the Coastal Zone, allowing for adaptation initiatives that reflect the particular needs and opportunities, while implemented in harmony with national policies and strategies. The process can be supported by

- sub-national capacity-building, including the Provincial Technical Working Groups and the Technical Support Units of the provincial administrations;
- by collaboration with the private sector; and by
- awareness-building and active collaboration with communes, communities and households.

21 The current Rectangular Strategy for Growth, Employment, Equity and Efficiency Phase II was presented by the Prime Minister, Samdech Hun Sen, on 26 September 2008. It is an update of the 1st National Rectangular Strategy from 2004

Key message 8:**The household and community levels can contribute significantly to climate adaptation**

Spontaneous adaptation is adaptation initiatives made by households and communities acting on their own, without public interventions but within an existing public policy framework and guidance. Examples include tree planting; improved water and sanitation; water and energy saving; improved use of fertilizers and pesticides; and waste recycling and orderly waste disposal. Spontaneous adaptation can have a high relevance and attractive benefits achieved at a low cost (or sometimes even generating economic benefits of their own).

Private Sector Collaboration

A study conducted by the EMCZ Project in 2007²² showed that some, but far from all coastal districts and communes collaborated with the private sector in different ways, for example in connection with road construction. A scope was indicated for broader dialogue. In the coastal zone, this may involve small enterprises (like rural roads and water supplies) as well as big ones (like land use developments, urban water supplies and electricity generation).

Key message 9:**The private sector can highly assist with climate adaptation**

Much of Cambodia's impressive development is generated by the private sector - in many cases without much involvement by the state.

The private sector has its own (profit-oriented) development agenda, sometimes (but not always) with a shorter time horizon, and its own particular sources of financing.

There are many examples of overlaps of interest between the state and the private sector, for example related to reducing the investment risk:

- protection against disasters;
- access to, and sustainable use of various resources (land, water, energy, ...);
- orderly waste disposal; and
- transparent and predictable environmental regulation and land use regulation.

Such collaboration may proceed in many ways. In some cases, the private and public sector may engage in '*hard*' investments while the public sector engages in related '*soft*' investments, like education and capacity-building oriented towards new opportunities generated by the over-all social and economic progress.

NGO and CSO Collaboration

NGOs and CSOs can from case to case contribute significantly to various climate adaptation initiatives, with their particular perspective and experience, and insight into local and site-specific needs and opportunities.

Examples of collaboration include (but are not limited to) facilitation of stakeholder involvement; education and awareness-building; and promotion (or '*social marketing*') of good practices. In some cases supportive attitudes are at least as efficient as stringent regulation - this is the case for orderly waste disposal, and orderly use of pesticides and fertilizers. In some cases, NGOs and CSOs can improve the implementation prospects and support the protection and maintenance of structural developments (for example embankments and reservoirs).

Water user communities (like the Prey Nob Polder Community) and farmers' communities are examples of highly relevant implementation partners.

Key message 10:

Hard and soft hard adaptation measures can add value to each other

Hard measures include dykes, embankments, shore and bank protection structures, reservoirs, and irrigation and drainage facilities.

Soft measures include good resource utilization practices (including efficient production systems), environmental regulation, and land use (and flood risk) management.

Examples: New irrigation facilities will create larger benefits if the farmers learn how to adjust their cultivation practices. The lifetime of a reservoir depends highly on orderly land use in its catchment area (preventing soil erosion and siltation).

Production Systems

Agricultural production systems provide a range of entry points to climate adaptation in the Coastal Zone. As compared with its neighbouring countries, Cambodia has a scope for improved efficiencies (in terms of volume, if not necessarily in terms of quality). This may involve adjustment of practices and technology, as well as gradual innovation, learning from each other and from elsewhere.

Key message 11:**Efficiency improvements provide safe win-win strategies**

Efficient production systems - in agriculture as well as industries - will improve their competitiveness as well as their climate resilience.

This comprises the water and fuel efficiency - ton output per m³ of water or kWh or unit of fuel - - as well as the economic efficiency - value generated per m³ of water or kWh or unit of fuel.

Efficiency improvement of cultivation systems serves several good purposes. It will improve the income of the farmers, in an increasingly competitive environment, while, at the same time, producing more food with less water, and maintaining food prices that are affordable to everyone.

Efficiency improvements of industries and transport systems will reduce their unit costs and generate less sewage and solid waste, while improving the air quality.

Climate Screening

Climate screening of planned investments can extend their benefits and reduce or eliminate adverse side effects. The screening will simply determine whether there are any potential climate-related implications of the intervention. If so, a more detailed assessment should be recommended to the developer.

For example, a planned development (a road embankment or a land reclamation) may affect the drainage needs and flood risk in adjacent areas. A planned hydropower reservoir may offer opportunities for flood control and a more reliable water availability.

The climate screening closely resembles a screening of whether an EIA is required, and can be conducted at the same time.

A climate screening toolkit has recently been prepared under the PPCR (PPCR, April 2013d). Please refer to Appendix F for additional information.

Key message 12: Climate screening can add value to investments

A simple screening can be made of planned development initiatives at an early stage of the project cycle. The screening would consider whether there are climate-related concerns and opportunities (possibly inter-sector and/or cumulative) that might warrant an assessment.

At the sub-national level, the screening may be conducted by provincial Departments of Environment, or by the Technical Support Units of the Provincial Administrations.

In due time, the screening should be extended to cover private sector investments.

References and Literature

Most titles are available from the Internet

ADB (February 2013): Investing in Resilience - Ensuring a Disaster-Resistant Future

ADB (2009): The Economics of Climate Change in Southeast Asia: A Regional Review

Agrawala S., A. Matus Kramer, G. Prudent-Richard and M. Sainsbury (November 2010): Incorporating climate change impacts and adaptation in Environmental Impact Assessments: Opportunities and Challenges. OECD Environmental Working Paper No. 24

CARDI, GEF and UNDP (November 2010): Listen to Villagers on Climate Change - Vulnerability Reduction Assessment (VRA)

CARE (2009): Climate Vulnerability and Capacity Analysis (CVCA)

CARP (August 2012): Implementation capacity of demonstration activities. Working paper prepared under the Coastal Adaptation and Resilience Planning (CARP) Component of Cambodia Climate Change Alliance

CARP (July 2012): Vulnerability of existing agricultural practices. Working paper prepared under the Coastal Adaptation and Resilience Planning (CARP) Component of Cambodia Climate Change Alliance

CNMC (December 2010): The state of climate change management in Cambodia. Cambodia National Mekong Committee and Cambodia Water Partnership

Danchurch (September 2011): Climate change and disaster management policy mapping and analysis in Cambodia

Danida (June 2008): Climate change screening of Danish development cooperation with Cambodia (104.DAN.4-52-9-2)

Danida (2008): Risk Screening Matrix

EMCZ (November 2007): Commune development planning in the coastal zone: Case study of resource-based development opportunities, prepared under the Environmental Management in the Coastal Zone (EMCZ) Project, Ministry of Environment

EU (May 2012): Country Environment Profile, Royal Kingdom of Cambodia. Final Report prepared by Steffen Johnsen and Greg Munford, Euronet Consortium, for the European Union Delegation To Cambodia

Harmeling, Sven and David Eckstein (November 2012): Global Climate Risk Index 2013. Who suffers most from extreme weather events? Weather-related loss events in 2011 and 1992 to 2011. Briefing paper published by Germanwatch

Hornig Vuthy and David Craig (July 2008): Accountability and planning in decentralised Cambodia. CDRI Working Paper Series No. 39, Phnom Penh

IISD, IUCN, SEI et al, (2007): Community-based Risk Screening Tool – Adaptation and Livelihoods (CRISTAL)

MAFF (December 2011): Climate change adaptation training needs assessment guideline - developing multi-scale climate change adaptation strategies for farming communities in Cambodia. Prepared by the Department of Agricultural Extension (DAE) project team

Ministry of Planning (November 2003): Cambodia Millennium Development Goals report 2003

- MOE (2013): Cambodia Climate Change Strategic Plan (CCCSP) 2013 – 2023. Complete draft prepared for the Royal Government of Cambodia
- MOE (December 2009): Second National Communication of Cambodia Under United Nations Framework Convention on Climate Change (UNFCCC) (draft). Part 1: Vulnerability, impact and adaptation assessment to climate change; Part 2: Historical and future climate change of Cambodia; Part 3: Impact of climate change on rice production of Cambodia. Ministry of Environment
- MOE and UNDP (August 2011): Cambodia Human Development Report 2011. Building resilience: The future of rural livelihoods in the face of climate change. Ministry of Environment of Cambodia and UNDP Cambodia
- NCDD Secretariat (September 2011): Local Governments and Climate Change (LGCC) Project Document. Attached as Annex 1 to Memorandum of Understanding (MOU) between the United Nations Capital Development Fund (UNCDF) and the Royal Government of Cambodia on the support to the climate change adaptation grants for sub-national administrations
- NIS (March 2012): Economic Census of Cambodia 2011. National Institute of Statistics, Ministry of Planning
- OECD (2008): Economic Aspects of Adaptation to Climate Change; Costs, Benefits and Policy Instruments
- OECD (2008): Strategic Environmental Assessment and Adaptation to Climate Change
- PPCR (April 2013a): Synthesis report. Prepared under Pilot Program for Climate Resilience (PPCR) Project - Phase 1, Components 1 and 2: Mainstreaming Climate Resilience into Development Planning at the National and Sub-National Levels
- PPCR (April 2013b): Final report. Prepared under Pilot Program for Climate Resilience (PPCR) Project - Phase 1, Components 1 and 2: Mainstreaming Climate Resilience into Development Planning at the National and Sub-National Levels
- PPCR (April 2013c): Guidance on Mainstreaming Climate Resilience and Disaster Risk Reduction into Sub-national Development and Investment Planning. Prepared under Pilot Program for Climate Resilience (PPCR) Project - Phase 1, Components 1 and 2: Mainstreaming Climate Resilience into Development Planning at the National and Sub-National Levels
- PPCR (April 2013d): Climate Screening Toolkit. Prepared under the Pilot Program for Climate Resilience (PPCR) Project - Phase 1, Component 2, Mainstreaming Climate Resilience into Development Planning at the Sub-National Level
- PPCR (October 2012): Synthesis Report on Vulnerability and Adaptation Assessment for Key Sectors Including Strategic and Operational Recommendations. Prepared by Hatfield Consultants for Ministry of Environment under Pilot Program for Climate Change Resilience
- Rizvi, A.R. and Singer, U. (2011): Cambodia Coastal Situation Analysis. Building Resilience to Climate Change Impacts, Coastal Southeast Asia No.6, Published by IUCN, Gland, Switzerland
- RGC (June 2010): National Strategic Development Plan. Update 2009-2013. Royal Government of Cambodia
- RGC (January 2009): Commune/sangkat fund project implementation manual. 2nd revision, prepared by the National Committee for the Management of Decentralization & Deconcentration Reform

- RGC (May 2009): Public Investment Programme, 3-years-rolling, 2010-2012. Prepared by Ministry of Planning for the Royal Government of Cambodia, approved by the Council of Ministers
- RGC (October 2006): National Adaptation Programme of Action to Climate Change (NAPA). Prepared by Ministry of Environment for the Royal Government of Cambodia
- Srun Darith and Sann Vathana (November 2009): Climate change - a challenge for food security and nutrition in Cambodia. Council for Agricultural and Rural Development (CARD)
- Tes Sopharith and Jorma Koponen (August 2012): Climate downscaling for Cambodia. Presentation at the Workshop on Science-Based Climate Change Adaptation and Outreach Activities, Himawari Hotel, Phnom Penh, held under PPCR Components 4 and 5
- The World Bank (August 2010): The economics of adaptation to climate change; a synthesis report
- Trærup, Sara and Anne Olhoff (September 2011): Climate risk screening tools and their application - a guide to the guidance. UNDP, UNEP and UNEP Risoe Centre
- TWGAW (April 2010): Program design document for strategy for agriculture and water 2010-2013. Prepared for Ministry of Agriculture, Forestry and Fisheries and Ministry of Water Resources and Meteorology ... with Annexes 1-5 in a separate volume
- UNDP (March 2012): Small Grants Programme, Cambodia. Guidebook for Practitioners – Implementing the Vulnerability Reduction Assessment
- UNDP (May 2010): A toolkit for designing climate change adaptation initiatives
- UNDP (2010): Screening Tools and Guidelines to Support the Mainstreaming of Climate Change into Development Assistance – A Stocktaking Report
- USAID (2007): Adapting to Climate Variability and Change: A Guidance Manual for Development Planning
- Van Ngo, Thi Thanh (April 2010): Paddy cultivation - 20 years from now. CRBOM Small Publications Series no. 20. Centre for River Basin Organizations and Management, Solo, Central Java, www.crbom.org/SPS/
- Yusuf, Arief Anshory and Herminia A Francisco (January 2009): Climate change vulnerability mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA)

Appendix A: Glossary

This glossary is based on one compiled (but not published) under PPCR Phase 1, Components 1 & 2

- Adaptation: Adjustment to new circumstances - actual or expected. This can be in terms of behaviour, technology or structural interventions. Examples include introduction of better suited production systems and infrastructure. See *climate change adaptation*
- Adaptation deficit: The case of being underprepared for (present and/or future) climate conditions. This can be related to a less than optimal allocation of limited resources resulting in, say, insufficient urban drainage infrastructure or water storage capacity
- Adaptive capacity (according to Yusuf and Herminia, January 2009, quoting IPCC): *'The ability of a system to adjust to climate change (including climate variability and extremes), to moderate the potential damage from it, to take advantage of its opportunities, or to cope with its consequences'*. Hereby, adaptive capacity depends on socio-economic factors, technology and infrastructure
- CCCA: Cambodia Climate Change Alliance - an initiative based in the Climate Change Department of Ministry of Environment, addressing climate resilience in Cambodia using a programme-based approach. CCCA was launched in February 2010 with financial support from EU, UNDP, SIDA and Danida. It includes a multi-donor trust fund for the Climate Change Support Program and a demand-driven grant facility for access by sector ministries and civil society
- CCTT: Climate Change Technical Team, a network of ministerial representatives assisting the NCCC
- Climate: The general weather conditions in a medium- or long-term perspective. Compare with *weather*
- Climate change: Systematic long-term climate trends, whether natural or generated by human activities, for example increased temperature (*'global warming'*), increased weather irregularities, changed rainfall, and sea level rise
- Climate change adaptation: Measures that address the *effects* of climate change - as compared with *climate change mitigation*
- Climate change mitigation: Measures that address the *causes* of global warming, by reducing greenhouse gas emissions and the greenhouse gas levels in the atmosphere. Compare with *climate change adaptation*
- Climate resilience: (1) The ability to recover from an adverse (climate-related) event; (2) the ability to withstand a (climate-related) pressure. A high resilience is related to a low vulnerability, and the other way around
- Cumulative impacts: Environmental and/or climate-related impacts of separate (and perhaps otherwise unrelated) development initiatives that add to the significance of each other. Each of these discrete impacts may be insignificant, but the cumulative impact may be significant. Example: Many small water abstractions from a river
- Demand (of water): The amount of water required for a given purpose, for example litre 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 raw water shortage). Off-stream demand (e.g. for irrigation) relates to water that must be removed from the river, while in-stream demand (e.g. for fisheries or for navigation) relates to water that remains in the river. The serviceable (part of the) demand is limited both by infrastructure and raw water availability. The demand depends on consumer lifestyles; land use; crops and cultivation routines; and infrastructural and industrial development and technology. It

can be estimated by various techniques, often with a large uncertainty. Availability and demand of water are largely independent

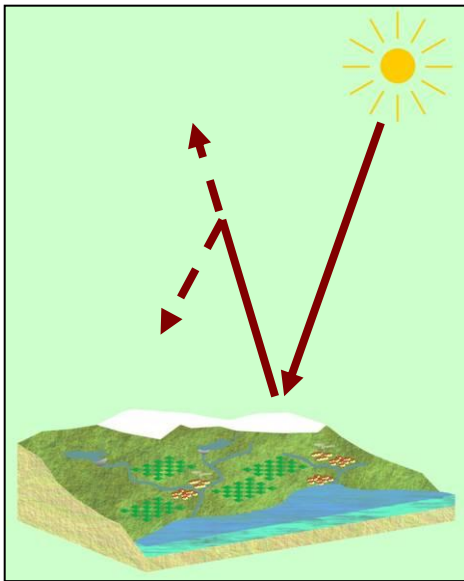
- Demand management:** Intervention in order to reduce the consumption of water, in order to meet a water shortage, or a shortage of funds for infrastructural development, or to improve the water efficiency. Demand management can comprise improved operation and maintenance of distribution systems (including reduction of water losses), green taxes to reduce the demand, awareness campaigns to change consumer habits, introduction of new crops or cultivation routines, etc.
- Disaster:** A sudden event that causes great damage and/or loss of life (for example a flood or a drought)
- Disaster mitigation:** Measures to reduce the consequences (or *impacts*) of a disaster once it has occurred
- Disaster preparedness:** Measures in place for timely and appropriate response to a disaster, once it has occurred, such as evacuation procedures, relief, and rehabilitation of cultivation (such as seeds) and other production systems
- Disaster risk:** The probability that a certain adverse event (disaster) will occur at a given location. The risk can be reduced by structural measures (storage capacity can reduce the risk of drought; dikes, drainage and flood retention facilities can reduce the risk of floods; control structures can reduce the risk of saline intrusion)
- Disaster risk reduction:** Measures to reduce the probability that a disaster occurs - for example appropriate land use planning and supportive location and design of structural developments
- Drought:** 'A *period with an extraordinary water shortage*' (due to the rainfall being less than expected)
- Ecosystem:** See *habitat*
- EIA:** Environmental impacts assessment - required by law for many investment projects, whether public or private. An EIA will normally identify social and environmental consequences of a planned development; involve public stakeholder participation; and make suggestions on mitigation measures and monitoring
- Efficiency:** Water efficiency is the output (for example kg of rice) per m³ of water. The economic efficiency of water utilization is the value generated per m³ of water
- Entry point:** A good starting point for implementation of a policy or a strategy - for example awareness-building and/or institutional capacity development
- ENSO:** The El Niño-Southern Oscillation. A warm eastward surface current across the Pacific Ocean (near Equator), occurring every 2-7 years. If it lasts for many months it affects the temperature and rainfall in tropical countries around the Earth (including Cambodia), in some cases causing severe floods and drought. The same is the case for a reverse flow pattern called La Niña, a cold westward surface current
- Environment:** The land, water and air around us, and their various living organisms
- Exposure** (according to Yusuf and Herminia, January 2009, quoting IPCC): '*The nature and degree to which a system is exposed to significant climatic variations*'. The exposure can be seasonal and depends to a large extent on the geographic location
- Flood preparedness:** Due awareness of the flood risk, and knowledge and ability of appropriate response. An appropriate flood preparedness is supported by measures such as awareness campaigns, education, and flood forecasting services, as well as flood proofing measures
- Flood proofing (or flood protection):** Preventive (structural and non-structural) measures to reduce the vulnerability to floods

Flood risk: The general probability that a location or an area will be flooded, expressed as a frequency of occurrence, or sometimes as the relation between inundation depth, duration, and frequency of occurrence. The flood risk can be influenced in many ways by human activities

Flood vulnerability: The value lost due to a given flood (depending on the population density, land use, and infrastructure in the area)

Flood-prone: With a high flood risk

Greenhouse effect: The atmosphere retaining long-wave heat radiation (like the glass roof of a greenhouse), thereby increasing the temperature and causing global warming. See *greenhouse gas*

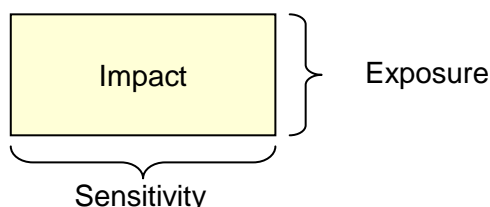


GHG: *Greenhouse gas*

Greenhouse gas: A gas component of the atmosphere that retains long-wave heat radiation (like the glass roof of a greenhouse), thereby increasing the temperature. Greenhouse gases can be natural or emitted by humans. Examples are water vapour, carbon dioxide, methane and ozone

Habitat: The physical features and vegetation of a place where animals live. An *ecosystem* is a habitat and the animals that live in it and depend on it; for example a forest; a wetland; an active floodplain; or a mangrove area

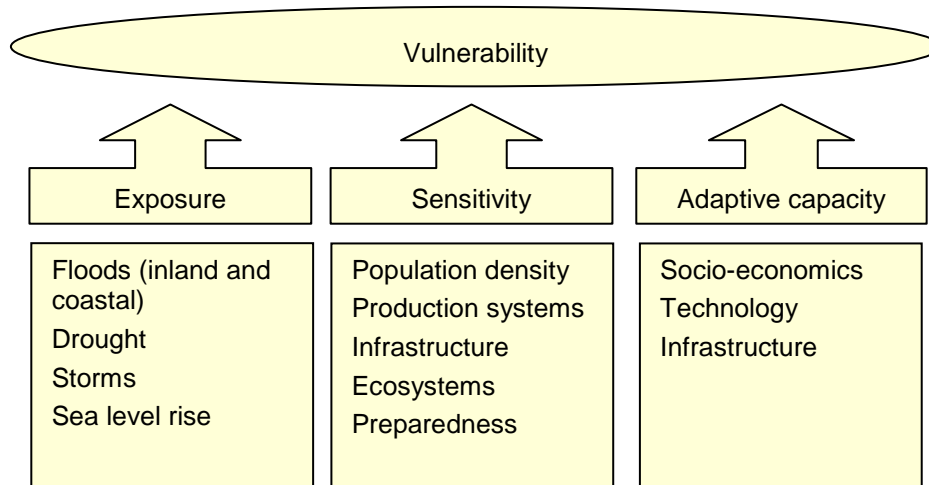
Impact: Same as effects. These can be positive and negative; and can be actual effects (of an actual event or development) or potential effects (of a given, hypothetical event or development). The impact depends on the *exposure* and the *sensitivity*



Irrigation: Deliberate supply (or retention) of water for cultivation, as a supplement to or replacement of direct rainfall. FAO makes a distinction between 5 possible sources of irrigation water: Surface water, renewable groundwater, fossil water, treated wastewater and desalinated water

- Mitigation: To neutralize or alleviate some undesired consequences of an event or a development. See *climate change mitigation*
- NAPA: National Adaptation Programme of Action to Climate, launched by Ministry of Environment in 2006
- NCCC: National Climate Change Committee, an inter-agency body established in 2006, and chaired by the Minister of Environment. It comprises high-level representatives from 20 ministries. Since 2009 the Prime Minister has served as honorary chairman, emphasizing its significance. Its work is coordinated by MOE and is supported by the inter-ministerial Climate Change Technical Team (CCTT)
- NCDD: National Committee for Democratic Development (NCDD), formed by the 2008 Organic Law, chaired by the Minister of Interior
- No-regrets solution (for climate adaptation): A solution that is robust to quantitative assumptions about the climate change; solutions that are valuable even if the climate doesn't change in the way that is presently expected (or doesn't change at all, for that sake); a solution that not only supports climate resilience and/or disaster risk reduction but other good purposes as well
- NP-SNDD: National Program for Sub-National Democratic Development, a 10-years programme based on the Organic Law from 2008, which in turn builds on the '*Strategic Framework for Decentralization and Deconcentration Reform*' from 2005
- Opportunity costs: The costs of doing something as compared with the costs of doing something better. There can be an opportunity cost of doing nothing, or of doing something later on, rather than now
- PPCR/SPCR: The (international) Pilot Program for Climate Resilience (PPCR) was approved in November 2008 as the first programme under the Strategic Climate Fund (SCF). According to the SCF website it aims '*to pilot and demonstrate ways in which climate risk and resilience may be integrated into core development planning and implementation. In this way, the PPCR provides incentives for scaled-up action and initiates transformational change*'. The PPCR in Cambodia was approved in 2010. It is structured in two phases, with financial support from the World Bank and ADB, respectively. Phase 2 is known as *Strategic Program for Climate Resilience* (SPCR)
- Resilience: (1) The ability to recover from an adverse (climate-related) event; (2) the ability to withstand a (climate-related) pressure. A high resilience is related to a low vulnerability, and the other way around
- Sensitivity (according to Yusuf and Herminia, January 2009, quoting IPCC): '*The degree to which a system is affected, either adversely or beneficially, by climate-related stimuli*'
- SEA: Strategic environmental assessment - an assessment of environmental impacts of a policy, a plan or a programme, applied in the early stages of formulation, in order to improve the understanding of the consequences and as a basis for adjustments. May include social implications and climate change implications. See also EIA
- SESA: Strategic environmental and social assessment. See SEA
- SNAP: Strategic National Action Plan for Disaster Risk Reduction, launched in 2008 by the National Committee for Disaster Management (NCDM) and Ministry of Planning
- SNIF: The Sub-national Investment Facility (under the NP-SNDD)
- Stakeholder: An individual, a government body or any private or public organization with a particular interest in a decision to be made, and/or in a position to influence the decision and/or its implementation
- Triple bottom line: The combined range of social, economic and environmental benefits (of a policy, a plan, a programme or a specific project)

Vulnerability: The possible damage (social, economic and/or environmental) related to a given location or area. The vulnerability depends on the *exposure*, the *sensitivity* and the *adaptive capacity* - which in turn depend on the population density, the land use, the value of buildings and infrastructure, the cultivation systems and other production systems, the preparedness, and the resilience. The vulnerability can be seasonal. Cambodia's high sensitivity is related to a moderate exposure, a high sensitivity and a low adaptive capacity



Modified after Srun Darith and Sann Vathana (November 2009): Climate change - a challenge for food security and nutrition in Cambodia. Council for Agricultural and Rural Development (CARD)

Water security (according to ADB's Asian Water Development Outlook, in preparation):
'Societies can enjoy water security when they successfully manage their water resources and services to (1) satisfy household water and sanitation needs in all communities; (2) support productive economies in agriculture and industry; (3) develop vibrant, liveable cities and towns; (4) restore healthy rivers and ecosystems; and (5) build resilient communities that can adapt to change'

Weather: The conditions of the atmosphere at a given location and a given time:
 Temperature, precipitation, cloud cover, fog, sunlight, air pressure and wind.
 Compare with *climate*

Yield (of rice): Production (in t/ha/crop or t/ha/year). In SE Asia, yields are higher in the dry season (provided that water is available) than in the wet season, because the solar radiation from the clear sky is higher in the dry season, even if the day length is shorter

Appendix B: Cambodia's Millennium Development Goals

The Cambodia Millennium Development Goals were published in November 2003. Cambodia has defined its own set of Millennium Development Goals. As compared with the Universal Millennium Development Goals, Cambodia applies 7 identical goals, 1 similar goal and 1 new goal (about land mines and UXO), totalling 9 goals; and 9 identical indicators, 9 similar indicators, 1 indicator split into 2, and 6 new indicators, totalling 25 indicators.

Sources: (1) PPCR (April 2013), Appendix 4; (2) Ministry of Planning (November 2003): Cambodia Millennium Development Goals report 2003

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>CMDG 1: Eradicate extreme poverty and hunger Overall target 1: Halve, between 1993 and 2015, the proportion of people whose income is less than the national poverty line</p> <p>Target 1.1: Decreasing the proportion of people whose income is less than the national poverty line from 39% in 1993 to 19.5% in 2015</p> <p>Target 1.2: Increasing the share of poorest quintile in national consumption from 7.4% in 1993 to 11% in 2015</p> <p>Target 1.3: Decreasing the proportion of working children aged between 5-17 years old from 16.5% in 1999 to 8% in 2015</p>	<p>CC impacts will likely affect the poorest and most vulnerable in both urban and rural areas of Cambodia.</p>
<p>Overall target 2: Halve, between 1993 and 2015, the proportion of people who suffer from hunger</p> <p>Target 1.4: Decreasing the prevalence of underweight (weight for age <2 SD) children under-five years of age from 45.2% in 2000 to 22% in 2015</p> <p>Target 1.5: Decreasing the proportion of population below the food poverty line from 20% in 1993 to 10% in 2015</p> <p>Target 1.6: Decreasing the prevalence of stunted (height for age <2 SD) children under five years of age from 44.6% in 2000 to 22% in 2015</p> <p>Target 1.7: Decreasing the prevalence of wasted (weight for height <2 SD) children under five years of age from 15% in 2000 to 9% in 2015</p> <p>Target 1.8: Increasing the proportion of households using iodised salt from 14% in 2000 to 90% in 2015</p>	<p>CC and climate-related disasters can affect nutrition and via disruptions to production and livelihood systems</p>

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>CMDG 2: Achieve universal nine-year basic education</p> <p>Overall target 3: Ensure all children complete primary schooling by 2010 and nine-year basic schooling by 2015</p> <p>Target 2.1: Improving net admission rate from 81% in 2001 to 100% in 2010</p> <p>Target 2.2: Improving net enrolment ratio in primary education from 87% in 2001 to 100% in 2010</p> <p>Target 2.3: Improving net enrolment ratio in lower-secondary education from 19% in 2001 to 100% in 2015</p> <p>Target 2.4: Reducing the proportion of 6-14 years old out of school from 35% in 1999 to 0% 2015</p> <p>Target 2.5: Increasing the survival rate from grade 1 to 5 from 58% in 2001 to 100% in 2010</p> <p>Target 2.6: Increasing the survival rate from grade 1 to 6 (last grade of primary cycle) from 51% in 2001 to 100% in 2010</p>	<p>Education services could be disrupted by disaster events, but most effects of CC are indirect on these CMDGS</p>
<p>Target 2.7: Increasing the survival rate from grade 1 to 9 (last grade of basic cycle) from 33% in 2001 to 100% in 2015</p> <p>Target 2.8: Increasing the literacy rate of 15-24 years old from 82% in 1999 to 100% in 2015</p> <p>Overall target 4: Eliminate gender disparity in nine-year basic education by 2010</p> <p>Target 2.9: Improving the ratio of girls to boys in primary education from 87% in 2001 to 100% in 2010</p> <p>Target 2.10: Improving the ratio of girls to boys in lower-secondary education from 63% in 2001 to 100% in 2010</p>	

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>CMDG 3: Promote gender equality and women's empowerment</p> <p>Overall target 5: Reduce significantly gender disparities in upper secondary education and tertiary education</p> <p>Target 3.1: Improving the ratio of girls to boys in upper secondary education from 48% in 2001 to 100% in 2015</p> <p>Target 3.2: Improving the ratio of girls to boys in tertiary education from 38% in 2001 to 85% in 2015</p> <p>Target 3.3: Improving the ratio of literate females to males 15-24 years old from 87% in 1998 to 100% in 2010</p> <p>Target 3.4: Improving the ratio of literate females to males 25-44 years old from 78% in 1998 to 100% in 2010</p> <p>Overall target 6: Eliminate gender disparities in wage employment in all economic sectors</p> <p>Target 3.5: Increasing the female share in wage employment in agriculture (primary sector) from 35% in 1998 to 50% in 2005</p> <p>Target 3.6: Increasing female share in wage employment in industry (secondary sector) from 44% in 1998 to 50% in 2005</p> <p>Target 3.7: Increasing the female share in wage employment in services (tertiary sector) from 21% in 1998 to 50% in 2015</p> <p>Overall target 7: Eliminate gender disparities in public institutions</p> <p>Target 3.8: Increasing the proportion of seats held by women in the National Assembly from 12% in 2003 to 30% by 2015</p> <p>Target 3.9: Increasing the proportion of seats held by women in the Senate from 13% in 2003 to 30% by 2015</p> <p>Target 3.10: Increasing the proportion of female ministers from 8% in 2003 to 15% by 2015</p> <p>Target 3.11: Increasing the proportion of female secretaries of state from 6% in 2003 to 18% by 2015</p> <p>Target 3.12: Increasing the proportion of female under secretaries of state from 5% in 2003 to 20% by 2015</p>	<p>CC impacts on these targets would be indirect</p>
<p>Target 3.13: Increasing the proportion of female provincial governors from 0% in 2003 to 10% by 2015</p> <p>Target 3.14: Increasing the proportion of female deputy provincial governors from 1% in 2003 to 15% by 2015</p> <p>Target 3.15: Increasing the proportion of seats held by women in commune councils from 8% in 2003 to 25% by 2015</p>	

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>Overall target 8: Reduce significantly all forms of violence against women and children</p> <p>Target 3.16: Increasing the proportion of cases of domestic violence counselled by qualified personal to 100 by 2015</p> <p>Target 3.17: Increasing the population % aware that violence against women is wrongful behaviour and a criminal act to 100 by 2015</p> <p>Target 3.18: Developing and implementing laws against all forms of violence against women and children according to international requirements and standards by 2005</p> <p>Target 3.19: Collecting annual statistics to monitor violence against women by 2005</p> <p>Target 3.20: Developing and Implementing a Prevention Plan by 2005</p>	
<p>CMDG 4: Reduce child mortality</p> <p>Overall target 9: Reduce the under-five mortality rate</p> <p>Target 4.1: Reducing the under-five mortality rate from 124 in 1998 to 65 per 1,000 live births by 2015</p> <p>Target 4.2: Reducing infant mortality rate from 95 in 1998 to 50 per 1,000 live births by 2015</p> <p>Target 4.3: Increasing the proportion of children under 1 year immunized against measles from 41.4% in 2000 to 90% by 2015</p> <p>Target 4.4: Increasing the proportion of children aged 6-59 months receiving Vitamin A capsules from 28% in 2000 to 90% by 2015</p> <p>Target 4.5: Increasing the proportion of children under 1 year immunized against DPT3 from 43% in 2000 to 90% by 2015</p> <p>Target 4.6: Increasing the proportion of infants exclusively breastfed up to 6 months of age from 11.4% in 2000 to 49% in 2015</p> <p>Target 4.7: Increasing the proportion of mothers who start breast-feeding newborn child within 1 hour of birth from 11% in 2000 to 62% in 2015</p>	<p>Child mortality rates affected in part by malaria, dengue fever and TB incidence (see Overall target 12)</p>

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>CMDG 5: Improve maternal health</p> <p>Overall target 10: Reduce the maternal mortality ratio</p> <p>Target 5.1: Reducing the maternal mortality ratio from 437 in 1997 to 140 per 100,000 live births in 2015</p> <p>Target 5.2: Reducing the total fertility rate from 4 in 1998 to 3 in 2015</p> <p>Target 5.3: Increasing the proportion of births attended by skilled health personnel from 32% in 2000 to 80% in 2015</p> <p>Target 5.4: Increasing the proportion of married women using modern birth spacing methods from 18.5% in 2000 to 60% by 2015</p> <p>Target 5.5: Increasing the percentage of pregnant women with 2 or more ANC consultations from skilled health personnel from 30.5% in 2000 to 90% in 2015</p> <p>Target 5.6: Reducing the proportion of pregnant women with Iron Deficiency Anaemia from 66% in 2000 to 33% in 2015</p> <p>Target 5.7: Decreasing the proportion of women aged 15-49 with BMI<18.5Kg/Sq. meter from 21% in 2000 to 8% in 2015</p> <p>Target 5.8: Decreasing the proportion of women aged 15-49 with Iron Deficiency Anaemia from 58% in 2000 to 19% in 2015</p> <p>Target 5.9: Increasing the proportion of pregnant women who delivered by Caesarean Section from 0.8% in 2000 to 4% in 2015</p>	<p>CC impacts mainly indirect</p>
<p>CMDG 6: Combat HIV/AIDS, malaria and other diseases</p> <p>Overall target 11: Decreasing the spread of HIV/AIDS</p> <p>Target 6.1: Reducing HIV prevalence rate among adults aged 15-49 from 2.6% in 2002 to 1.8% in 2015</p> <p>Target 6.2: Reducing the HIV prevalence rate among pregnant women aged 15-24 visiting ANC from 2.7% in 2002 to 1.5% in 2015</p> <p>Target 6.3: Increasing the condom use rate among commercial sex workers during last commercial sexual intercourse from 91% in 2002 to 98% in 2005</p> <p>Target 6.4: Increasing the percentage of young people aged 15-24 reporting the use of a condom during sexual intercourse with a non-regular sexual partner from 82% in 2002 to 95% in 2015</p> <p>Target 6.5: Increasing the proportion of condom use reported by married women who identified themselves at risk from 1% in 2000 to 10% in 2015</p> <p>Target 6.6: Increasing the percentage of HIV infected pregnant women attending ANC receiving a complete course of antiretroviral prophylaxis to reduce the risk of MTCT from 2.7% in 2002 to 50% in 2015</p> <p>Target 6.7: Increasing the percentage of people with advanced HIV infection receiving antiretroviral combination therapy from 3% in 2002 to 75% in 2015</p>	

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>Overall target 12: Decreasing the spread of malaria, DF and TB</p> <p>Target 6.8: Decreasing the malaria case fatality rate reported by public health sector from 0.4% in 2000 to 0.1% in 2015</p> <p>Target 6.9: Increasing the proportion of population at high risk who slept under insecticide-treated bed nets during the previous night from 57% in 2002 to 98% in 2015</p> <p>Target 6.10: Decreasing the number of malaria cases treated in the public health sector per 1 000 population from 11.4 in 2000 to 4.0 in 2015</p> <p>Target 6.11: Increasing the proportion of public health facilities able to confirm malaria diagnosis according to national guidelines with 95% accuracy from 60% in 2002 to 95% in 2015</p> <p>Target 6.12: Decreasing the number of dengue cases treated in the public health sector per 1000 population from 1 in 2001 to 0.4 in 2015</p> <p>Target 6.13: Decreasing the dengue case fatality rate reported by public health facilities from 1.5% in 2003 to 0.3% in 2015</p> <p>Target 6.14: Decreasing the prevalence of smear-positive TB per 100 000 population from 428 in 1997 to 135 in 2015</p> <p>Target 6.15: Decreasing the TB deaths rate per 100 000 population from 90 in 1997 to 32 in 2015</p> <p>Target 6.16: Increasing the proportion of all estimated new smear-positive TB cases detected under DOTS from 57% in 2002 to more than 70% in 2010 and 2015</p> <p>Target 6.17: Maintaining the proportion of registered smear-positive TB cases successfully treated under DOTS above 85% through 2005</p>	<p>Malaria, dengue fever and TB incidence directly affected by floods and standing, stagnant water status etc</p>
<p>CMDG 7: Ensure environmental sustainability</p> <p>Overall target 13: Integrate the principles of sustainable development into country policies and programmes and reverse the loss of environmental resources</p> <p>Target 7.1: Maintaining forest coverage at the 2000 level of 60 % of total land area through 2015</p> <p>Target 7.2: Maintaining the surface of 23 protected areas at the 1993 level of 3.3 million ha through 2015</p> <p>Target 7.3: Maintaining the surface of 6 new forest-protected area at the present level of 1.35 million ha through 2015</p> <p>Target 7.4: Increasing the number of rangers in protected areas from 600 in 2001 to 1,200 by 2015</p> <p>Target 7.5: Maintaining the number of rangers in forest protected areas at the level of 500 through 2015</p>	<p>Forest and protected areas' status can be impacted by disasters (especially fires, increased logging and other pressures)</p>

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>Target 7.6: Increasing the proportion of fishing lots released to local communities from 56% in 1998 to 60% in 2015</p> <p>Target 7.7: Increasing the number of community-based fisheries from 264 in 2000 to 589 in 2015</p> <p>Target 7.8: Increasing the surface of fish sanctuaries from 264500 ha in 2000 to 580800 ha in 2015</p> <p>Target 7.9: Reducing the fuel wood dependency from 92% of households in 1993 to 52% in 2015</p>	
<p>Overall target 14: Halve by 2015 the proportion of people without sustainable access to safe drinking water</p> <p>Target 7.10: Increasing the proportion of rural population with access to safe water source from 24% in 1998 to 50% in 2015</p> <p>Target 7.11: Increasing the proportion of urban population with access to safe water source from 60% in 1998 to 80% in 2015</p> <p>Overall target 15: Halve by 2015 the proportion of people without sustainable access to improved sanitation</p> <p>Target 7.12: Increasing the proportion of rural population with access to improved sanitation from 8.6% in 1996 to 30% in 2015</p> <p>Target 7.13: Increasing the proportion of urban population with access to improved sanitation from 49% in 1998 to 74% in 2015</p> <p>Overall target 16: Increase the proportion of the population in both urban and rural areas with access to land security by 2015</p> <p>Target 7.14: Increase the percentage of land parcels having titles in both urban and rural areas from 15% in 2000 to 65% in 2015</p>	<p>Drinking water and sanitation services all affected by disasters (especially floods)</p>
<p>CMDG 8: Forge a global partnership for development</p> <p>Overall target 17: Develop further an open, rule-based, predictable, non-discriminatory trading and financial system</p> <p>Indicator 8.1: Net ODA as percentage of DAC donors' GNI [targets of 0.7% in total and 0.15% for LDCs]</p> <p>Indicator 8.2: Proportion of ODA to basic social services (basic education, primary health care, nutrition, safe water and sanitation)</p>	<p>Indirect</p>

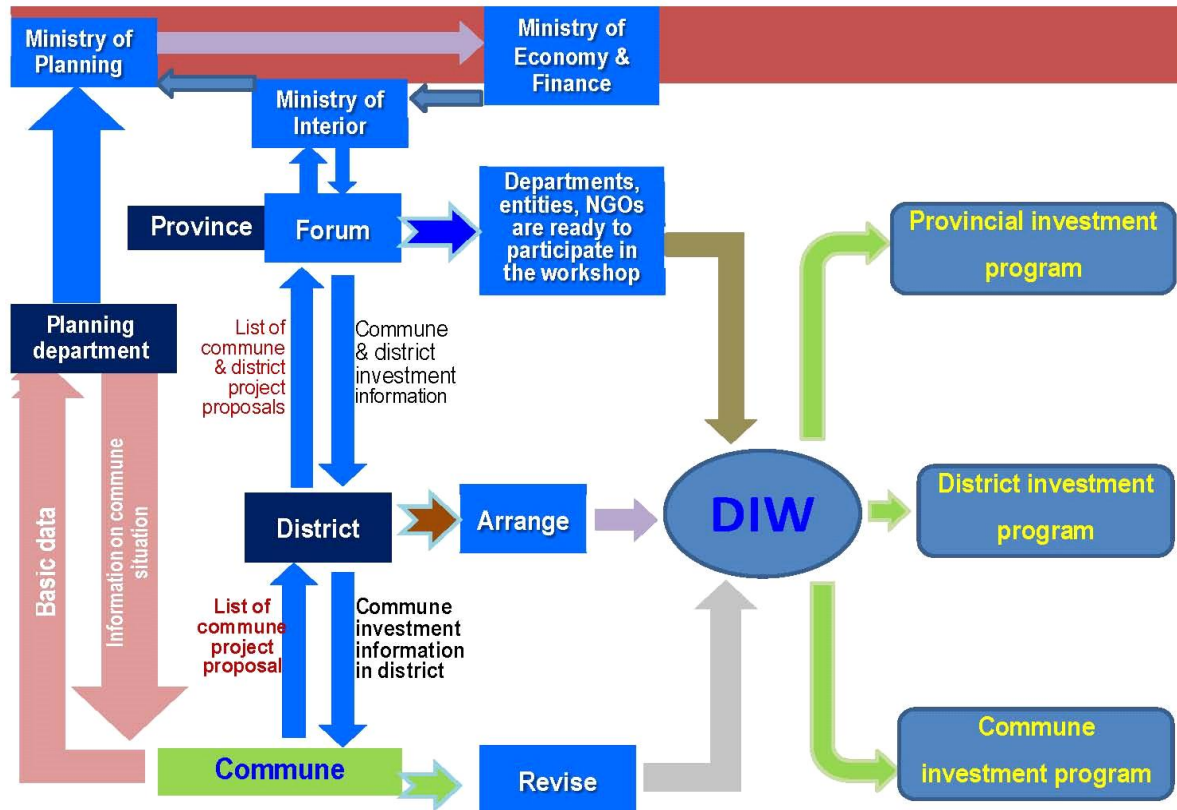
Cambodia Millennium Development Goals and Targets	CC Impacts
<p>Overall target 18: Address the Special Needs of the Least Developed Countries</p> <p>Indicator 8.3: Proportion of ODA that is untied</p> <p>Indicator 8.4: Proportion of ODA for environment in small island developing states</p> <p>Indicator 8.5: Proportion of ODA for transport sector in land-locked countries</p> <p>Indicator 8.6: Proportion of exports (by value and excluding arms) admitted free of duties and quotas</p> <p>Indicator 8.7: Average tariffs and quotas on agricultural products and textiles and clothing</p>	
<p>Overall target 19: Address the Special Needs of landlocked countries and small island developing states</p> <p>Indicator 8.8: Domestic and export agricultural subsidies in OECD countries</p> <p>Indicator 8.9: Proportion of ODA provided to help build trade capacity</p> <p>Overall target 20: Deal comprehensively with the debt problems of developing countries through national and international measures in order to make debt sustainable in the long term</p> <p>Indicator 8.10: Proportion of official bilateral HIPC debt cancelled</p> <p>Indicator 8.11: Debt service as a percentage of exports of goods and services</p> <p>Indicator 8.12: Proportion of ODA provided as debt relief</p> <p>Indicator 8.13: Number of countries reaching HIPC decision and completion points</p> <p>Overall target 21: In co-operation with developing countries, develop and implement strategies for decent and productive work for youth</p> <p>Indicator 8.14: Unemployment rate of 15-24 year old</p> <p>Overall target 22: In co-operation with pharmaceutical companies, provide access to affordable, essential drugs in developing countries</p> <p>Indicator 8.15: Proportion of population with access to affordable essential drugs on a sustainable basis</p> <p>Overall target 23: In co-operation with the private sector, make available the benefits of new technologies, especially information and communications</p> <p>Indicator 8.16: Telephone lines per 1000 people;</p> <p>Indicator 8.17: Personal computers per 1000 people</p>	

Cambodia Millennium Development Goals and Targets	CC Impacts
<p>Cambodia MDG9: De-mining, UXO and Victim Assistance</p> <p>Overall target 24: Moving towards zero impact from landmines and UXOs by 2012</p> <p>Target 9.1: Reduce the annual number of civilian casualties recorded to 0 by 2012</p> <p>Target 9.2: Clear completely all high/medium/low suspected contaminated areas by 2012</p> <p>Overall target 25: Eliminate the negative humanitarian and socio-economic impacts of landmines and UXOs by 2025</p> <p>Target 9.3: Develop a comprehensive victim assistance framework by 2005 and fully implement it.</p> <p>Target 9.4: Increase the numbers of landmine/UXO victims receiving an assistance package and integrated into the society (to be set).</p>	N/A

Appendix C: Overview of Sub-national Planning Procedures

Source: PPCR (April 2013c): *Guidance on Mainstreaming Climate Resilience and Disaster Risk Reduction into Sub-national Development and Investment Planning*.

Figure 3: Planning Process and Budget Allocation



DIW: District Integration Workshop

Source: NCDDDS presentation paper for PPCR component 1 & 2 provincial consultations, September-October, 2012

National planning process and budget allocation

Ministry of Planning (MOP) plays a main role, with responsibility to provide resource persons to facilitate and build the capacity of sector line ministries to develop their own development plan and operational plan. Each line ministry has its own planning office or department and planning team to develop its development plan and operational plan under MOP's guidance. Then, each ministry requires sending its own development plan to Ministry of Planning to combine them in to one development plan called "National development plan" together with the operational plan. Normally, the Ministry of Planning submits the plan around the end of November. The final step is the submission of these plans to Ministry of Economy and Finance (MEF).

MEF plays the important role of checking and verifying the proposed activities and budget against the available budget for the next year. Hereby, MEF discusses with each ministry (together with MOP) to verify the amount of proposed budget in order to reach a common agreement on the plan before submitting to the National Assembly and Senate. Normally,

MEF submits the plan and the proposed budget to the Council of Ministers, National Assembly and Senate around end of November and December. After approval by the Council of Ministers, the National Assembly and the Senate, MEF allocates the budget. Then each ministry allocates the received budget to its provincial departments, including the district offices and the commune council office. However, Ministry of Interior (MOI) allocates the budget to the provincial governors' offices and the district governors' office, including the commune development fund.

National and sub-national planning

National

- 5-years sequential development plan; present one covers 2009-13 (synchronized with the mandate of the government)
- 3-years rolling Public Investment Plans (PIPs), revised annually

Province level

- 5-years sequential development plan; the present one covers 2011-15 (synchronized with the mandate of the government)
- 3-years rolling Public Investment Plans (PIPs), revised annually

District level

- 5-years sequential development plan
- 3-years rolling Public Investment Plans (PIPs), revised annually

Commune level

- 5-years sequential development plan; the present one covers 2008-12, synchronized with the mandates of the commune councils. A new plan will be prepared after the commune elections on 3 June 2012)
- 1-years rolling Public Investment Plans (PIPs), revised annually

The province level

Provinces prepare

- 5-years sequential development plans. The present ones cover 2011-15 (synchronized with the mandate of the government); and
- 3-years rolling Public Investment Programmes (PIPs), revised annually

The 5-years plans take around 3 months to prepare. The work is prepared by a technical drafting group (which also compiles basic planning data). It has representatives by relevant provincial departments. The plan is edited by a committee and is reviewed by another committee. All 3 committees are headed by the provincial governor.

The PIPs take around 1.5 months to prepare.

Communes and districts

Districts prepare

- 5-years sequential development plans; and
- 3-years rolling Public Investment Programmes (PIPs), revised annually.

Communes prepare

- 5-years sequential development plan; the present one covers 2008-12, synchronized with the mandates of the commune councils. A new plan will be prepared after the commune elections on 3 June 2012)
- 1-years rolling Public Investment Programmes (PIPs), revised annually

The commune planning process takes place as follows:

- 1 The commune council members together with technical support team from the district identify the issues and challenges for the commune.
- 2 The proposed issues and challenges require discussing with the villagers to get a common understanding reflecting their demands.
- 3 As the final step, the commune council members, with assistance from the technical support team, need to come up with their own commune development plan with many project proposals, activities and budget. This process normally takes about 3 months (August-October).

After receiving all commune plans, the district administrative office conducts the *District Integration Workshop (DIW)*, normally at the end of October, to seek support from sector line departments, NGOs, donors and the private sector. This workshop is a one day event. Any project which does not get support during the workshop is moved to next year's planning.

On this basis, the commune and district investment programmes have been established, ready for implementation.

Appendix D: Examples of Climate-related Strategies and Plans

Source: PPCR (April 2013c): *Guidance on Mainstreaming Climate Resilience and Disaster Risk Reduction into National Development Planning*

December 2002	National Poverty Reduction Strategy (with comprehensive focus on the water sector)	Council for Social Development
November 2003	Cambodia Millennium Development Goals report 2003	MOP
April 2003	Roadmap for national water sector reform	ADB, MOWRAM
2004	National Rectangular Strategy	
April 2005	Tonle Sap Basin Strategy	ADB
December 2005	Strategic directions for IWRM in the Lower Mekong Basin	MRC
2006	The National Adaptation Programme of Action (NAPA) and the Climate Change Strategy and Action Plan (CCSAP)	RGC
June 2006	The Mekong Water Resources Assistance Strategy (MWRAS) (carried forward to the Mekong Water Resources Partnership Programme, MWARP)	ADB and The World Bank
February 2006	Strategic Development Plan 2006-2010	MOWRAM
June 2006	IWRM strategy and roadmap in Cambodia	MOWRAM
June 2006	National Programme for Household Food Security and Poverty Reduction 2007-2011	MAFF
June 2006	National Programme for Household Food Security and Poverty Reduction 2007-2011	MAFF
February 2007	Joint Strategy for Agriculture and Water 2006-2010	MAFF and MOWRAM
September 2008	Rectangular Strategy for Growth, Employment, Equity and Efficiency (updated)	
March 2009	Strategic National Action Plan for Disaster Risk Reduction, 2008-2013 (SNAP)	RGC
May 2009	Public Investment Programme, 3-years-rolling, 2010-2012	MOP
October 2009	Policy and strategy study of rural development for Cambodia	MRD
April 2010	Strategy for agriculture and water 2010-13	MAFF and MOWRAM
May 2010	Pilot Program for Climate Resilience - proposal for Phase 1	RGC
June 2010	National Strategic Development Plan. Update 2009-2013	RGC
July 2010	Policy on promotion of paddy rice production and export of milled rice	Council of Ministers
2010	National Forestry Program	MAFF
January 2011	IWRM-based Basin Development Strategy for the Lower Mekong Basin	MRC
May 2011	Strategic Program for Climate Resilience (SPCR)	RGC
In preparation	Various sector CC strategies	Supported by CCA
In preparation	Cambodia Climate Change Strategy and Action Plan (CCCSAP)	RGC/MOE, supported by CCA

Note: Climate aspects are also covered by many other sector/subsector plans

Appendix E: Climate-related Opportunities and Risks

This appendix lists some examples of development initiatives with particular climate-related opportunities and others with potential risks.

Source: PPCR (April 2013c): Guidance on Mainstreaming Climate Resilience and Disaster Risk Reduction into National Development Planning

E.1 Examples of Opportunities

The following development initiatives can potentially improve climate resilience, and/or reduce the disaster risk, even if they are promoted for other purposes. This may, from case to case, warrant attention to such possible benefits.

Public Health

- Continued improvements of supplies of safe water and sanitation, gradually extending to remote rural areas
- Mosquito/dengue/malaria control

Production Systems

- Developments that improve production system efficiencies: (as measured by output per unit of water, land, energy, etc).
- Continued improvements of irrigation infrastructure; and related cultivation technology and O&M, preferably community-based (or at least involving the water users). Support to implementation of MAFF and MOWRAM's Joint Strategy for Agriculture & Water (2010-13)
- Shifts - on a well-informed basis - from traditional rainfed long-term rice varieties to high-yield medium- and short-term varieties, using new seeds and fertilizer as appropriate, with 2 crops per year where this is practical
- General diversification of agricultural production systems, growing crops other than rice, livestock; and aquaculture

Water Resources, Flow, Storage Capacity

- Increased storage capacity; reservoir operation on a well-informed basis
- Developments that increase the minimum flow in lower reaches affected by saline intrusion
- Morphological management, on a well-informed basis, of rivers and the coastline

Waste Generation and Waste Management

- Waste re-cycling; on-site pre-treatment of sewage; management of non-degradable contaminants

Land Use

- Improved urban drainage (on a well-informed basis)
- Soil mapping and soil management

- Tree planting (for storm protection and runoff control); mangrove preservation

Cross-cutting

- Continuously improved flood and drought preparedness
- Institutional capacity-building

Institutional capacity

- Staffing; human skills;
- availability of relevant data and information, including maps and weather data;
- facilities (such as computer hardware and software, transport, equipment for monitoring and analysis);
- tools: Guidelines; decision-support tools;
- financial resources: (1) for routine operation and maintenance; and (2), for implementation of development initiatives according to plans;
- networking modalities (for dialogue with other management levels and with other agencies at the same level); and
- relations with (1) the service users; (2) the private sector; and (3) other stakeholders.

- Knowledge base and knowledge-sharing (including improved access to trivial basic data such as rainfall); research, monitoring, knowledge-sharing and dialogue; national and international networking and study visits

E.2 Examples of Interventions That May Require Caution and Further Consideration

Below are examples of development initiatives that may negatively affect climate resilience, or add to disaster risk. Possibly, a feasibility and/or impact study may be needed (unless conducted already).

Production Systems

- Major, abrupt changes of agricultural production systems (considering various risks, and loss of livelihoods in the medium term)
- Coastal aquaculture (considering the risk of pollution and spread of diseases)
- Biofuel production (considering market risks)
- Major mining and sand extraction operations, including operation in rivers and coastal areas

Land Use

- Major land use changes (particularly if affecting forests or wetlands, or stormwater runoff)

- Pressures (including sewage and dredging spoils disposal) on coastal and marine ecosystems: Mangroves, coral reefs, sea grass beds, etc.
- Developments in flood-prone areas

Waste Generation and Emissions

- Developments that will generate sewage or gas emissions
- Developments that involve hazardous substances or non-degradable pollutants
- Major sewage and solid waste disposal/sludge disposal schemes

Water Management

- Interventions that affect the stormwater runoff (dykes, embankments (for flood protection, roads and other purposes), landfill operations, coastal land reclamation)
- Interventions that change (increase or reduce) the flow resistance of a river/watercourse section
- Groundwater exploitation (considering the risk of land subsidence)
- Reservoir operation (on a well-informed basis) (for hydropower, water storage, and flood control)

E.3 Examples of Steps to Take

Opportunities

- Adjust the proposal, highlighting climate-related benefits
- Plan for a prefeasibility/impact study of potential benefits

Risks

- Conduct EIA (including cumulative impacts if relevant)
- Conduct climate-related risk assessment (including cumulative impacts if relevant)

Institutional

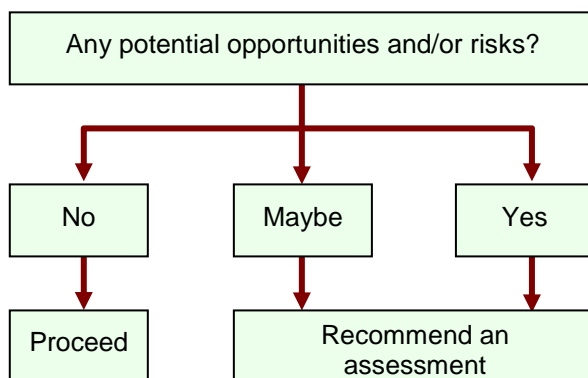
- Consider whether one or several agencies, other than the assumed implementing agency, should be involved in some way (perhaps via formulation of separate stand-alone initiatives that would activate potential benefits or mitigate risks)

Appendix F: Climate Screening of Development Initiatives

A screening of climate-related implications (concerns and opportunities) can be conducted in the early stage of the project cycle, for example in connection with an EIA.²³

A simple procedure for the screening is illustrated in the figure below. Details are provided in a '*Climate Screening Toolkit*' recently prepared under the PPCR (PPCR April 2013d).

Figure 4: Climate Screening



Potential climate-related implications - positive as well as negative - include for example:

Basic knowledge

- Monitoring (rainfall, sea levels, floods,)
- Interactions and cumulative effects

Water availability and water-sharing

- Access to safe water and sanitation
- Drought vulnerability and exposure
- Groundwater management (paying attention to land subsidence)
- Entitlements, water fees, monitoring and enforcement
- Storage capacity, reservoir operation
- Efficiency of production systems

Habitats and ecosystems

- Habitat degradation due to various pressures (from CC and others)
- Reduced fish yields (inland and coastal)

23

For a comprehensive discussion, please refer to Agrawala S., A. Matus Kramer, G. Prudent-Richard and M. Sainsbury (November 2010): '*Incorporating climate change impacts and adaptation in Environmental Impact Assessments: Opportunities and Challenges*', OECD Environmental Working Paper No. 24

Waste disposal, pollution and water quality

- Emissions from households, industries and agriculture
- Entitlements, fees, monitoring and enforcement
- Treatment capacity (including on-site pre-treatment)
- Sludge disposal
- Solid waste disposal, re-cycling
- Management of non-degradable contaminants

Flow regime and flood risk

- Changes to flow resistance caused by structures or siltation
- Peak flows
- Flood risk changes caused by the project (for example reclamation, road embankments)
- Exposure of the project to flood risk changes caused by other interventions and/or CC
- Stormwater drainage needs and drainage capacity
- Saline intrusion in lower parts of the rivers

Morphological impacts (sediment yield, siltation and erosion)

- Reservoir siltation
- Land use degradation
- Sand mining (coastal and inland)
- Coastal erosion, river bank erosion

The Vulnerability Assessment and Adaptation Programme for Climate Change
within the Coastal Zone of Cambodia

**Vulnerability Assessment and Adaptation Planning:
Training Manual**

Part B: Vulnerability Assessment and Reporting

Version 2, June 2013

Contents

Acronyms and Abbreviations	ii
1 Introduction	1
2 Vulnerability Assessment Objectives	2
3 Data Sources	2
4 Indicators	3
5 Vulnerability Mapping	5
6 Vulnerability Reporting	5
References and Literature	6
Appendix A: Administrative Units in the Coastal Zone	8
Appendix B: Commune Database Indicators	13
Appendix C: Examples of Composite Indicators	16
Appendix D: Proposed District Integration Workshop Questionnaire	19
Appendix E: Vulnerability Assessment Reporting	21
E.1 General	21
E.2 Data Reporting	22
E.3 Synthesis Reporting	22
E.4 Suggestions	23

Acronyms and Abbreviations

CARP	:	Coastal Adaptation and Resilience Planning Component (of CCCA)
CC	:	Climate change
CCCA	:	Cambodia Climate Change Alliance
CCSAP	:	Cambodia Climate Change Strategy and Action Plan
CDB	:	Commune Database
DEM	:	Digital elevation model
DIW	:	District Integration Workshop
EEPSEA	:	Economy and Environment Program for Southeast Asia
EIA	:	Environmental impact assessment
ENSO	:	The El Niño-Southern Oscillation
GEF	:	Global Environment Facility
IPCC	:	Intergovernmental Panel on Climate Change
LDCF	:	The Least Developed Countries Fund
MRC	:	Mekong River Commission
NAPA	:	National Adaptation Programme of Action to Climate Change
NCDD	:	National Committee for Democratic Development
PIP	:	Public Investment Programme
PPCR	:	Pilot Programme for Climate Resilience
RGC	:	Royal Government of Cambodia
UNEP	:	United Nations Environment Programme

1 Introduction

Background

The '*Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia Considering Livelihood Improvement and Ecosystems*' has been approved by the GEF under the LDCF to address the vulnerability of Cambodia's Coastal Zone.

The programme is implemented by the United Nations Environment Programme (UNEP) and is executed by the Coastal Coordination Unit of the Cambodian Ministry of Environment in close cooperation with sectoral ministries as well as sub-national and local leaders. It is closely coordinated with the Coastal Adaptation and Resilience Planning (CARP) Component, implemented by the same unit for the Cambodia Climate Change Alliance (CCCA).

The programme aims to increase the resilience of natural ecosystems, such as mangrove forests, along the coast (as well as their functioning as buffer systems) and reduce the vulnerability of coastal communities to climate change impacts and risks.

The present document reflects one of the specified tasks:

Preparation of a training manual to be used in on-the-job training in vulnerability assessment and adaptation planning for the National Focal Points and Provincial Technical Working Groups and with consideration of present capacity on climate change.

About This Document

The present document is intended as a reference for training-of-trainers and training of professional practitioners. It builds comprehensively on recent studies and documentation prepared by Ministry of Environment in connection with the PPCR (Phase 1) and the CARP. A related manual, addressing training and awareness-building at the commune level, is in preparation under the CARP.

The document is divided into 2 parts, intended for related but distinct applications:

- A: Climate Change and Adaptation Planning (with a glossary)
- B: Vulnerability Assessment and Reporting

2 Vulnerability Assessment Objectives

Knowledge about CC vulnerability is needed for several good reasons:

- Improved basic understanding of the extent and character of the vulnerability, including cause-effect relationships, as part of the basis for
- improved understanding of management options and related benefits; as well as
- understanding of the extent (and causes) of changes over time.

A good basis for feasibility studies and design will increase the cost-benefit ratio of infrastructural developments, reduce the risks, and add to a good investment climate.

3 Data Sources

It is a practical precondition that the vulnerability assessment is based on data that either exist and are readily available; or data that can be achieved with a limited effort:

- The Commune Database (CDB), compiled and maintained by Ministry of Planning, provides 876 social, economic and geographic indicators at commune level. These provide a detailed picture of socio-economic conditions, including livelihoods, cultivation, public health and education. Several of the indicators are directly climate-related. Please refer to Appendix B for an overview.
- Elevation data are important for assessment of coastal flood risk and vulnerability to sea level rise. Such data can be achieved from several global digital elevation models (DEMs) accessible on the Internet, with resolutions ranging from 1 km down to 90 m (NASA's Shuttle Radar Topography Mission).

An additional, potential source of district- and commune-level data and information is the annual 1-day *District Integration Workshops (DIWs)*, held in each district around late October every year, with participation by commune representatives, provincial line departments, the private sector and various other stakeholders, with the purpose of reviewing, calibrating and coordinating the commune development plans. Between them, the participants in these workshops hold a comprehensive knowledge about local development needs and opportunities. It may be considered to tap into this knowledge, for example using a simple questionnaire as exemplified in Appendix D. This could be done by the provincial technical working groups and perhaps in collaboration with the local disaster management committees.

4 Indicators

Indicators are measures for comparing actual and intended, eventual, complete progress. They support timely and appropriate decisions on development initiatives.

The applied indicators must first and foremost be *practical*: Easy to establish and revise, with a realistic workload, and with due attention to readily available data and information. It is an advantage (but not strictly necessary) if *historical records* are available.

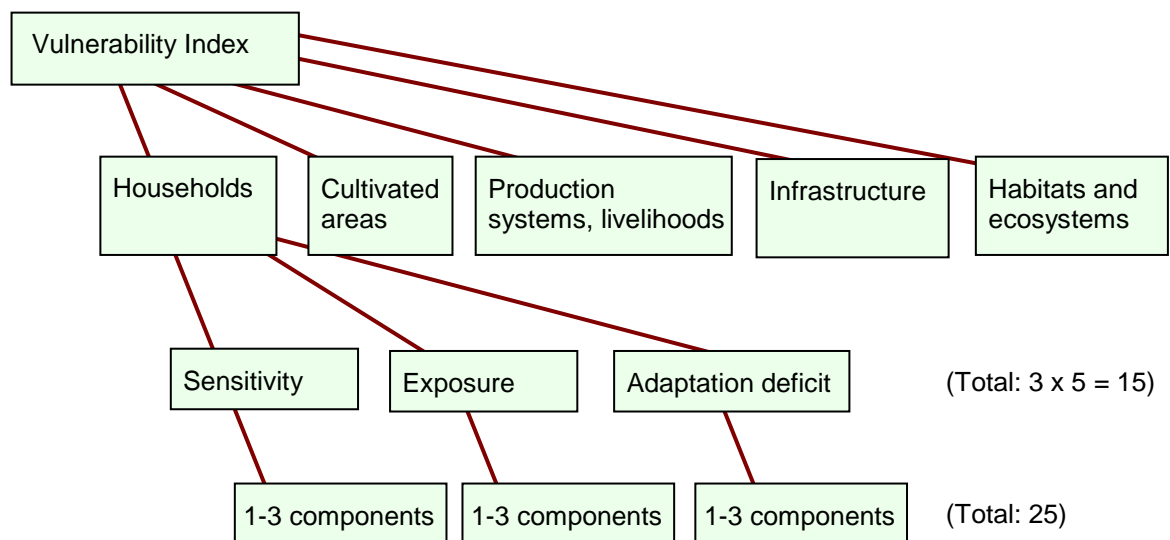
Due diligence is needed when selecting an indicator, because there is a tendency that practical indicators tend to be less relevant, whereas relevant indicators tend to be less practical.

Indicators available from the Commune Database (CDB) are summarised in Appendix B.

A Vulnerability Index for the Coastal Zone of Cambodia

A Vulnerability Index for the Coastal Zone of Cambodia can be compiled over a hierarchy of 4 levels, as shown in the figure below. The indicators and the basic indicator components are listed in the following table.

Figure 1: Composition of proposed Vulnerability Index



Hereby, the *adaptation deficit* is taken as the complementary value of the adaptive capacity (to avoid dividing by zero): Adaptive capacities between 0 and 1 reflect adaptation deficits between 1 and 0.

Table 1: Proposed climate vulnerability indicators

Indicator (0-1)	Indicator component (0-1)	Source
1 Households		
Sensitivity	+ Population x population density - Access to safe water and sanitation	CDB; GIS CDB
Exposure	+ Actual exposure to floods, rainstorms, drought and pollution	CDB
Adaptation deficit	- Protective measures in place - Awareness of adaptation needs and options	Estimate Estimate
2 Cultivated areas (0-1)		
Sensitivity	+ Percent of area less than x m above sea level + Percent cultivated area (wet & dry season)	DEM CDB
Exposure	- Actual yield (t/ha/crop)	CDB
Adaptation deficit	- Awareness of mitigation needs and options	Estimate
3 Production systems, livelihoods (0-1)		
Sensitivity	+ Percent of population with primary occupation outside the household	CDB
Exposure	+ Incidence of floods + Incidence of power cuts	Estimate Estimate
Adaptation deficit	- Protective measures in place - Awareness of mitigation needs and options - Community participation	Estimate Estimate CDB
4 Infrastructure (0-1)		
Sensitivity	+ Length of roads per km ² + Length of dykes per km ²	CDB ?
Exposure	+ Infrastructure affected by floods	CDB
Adaptation deficit	- Protective measures in place	Estimate
5 Habitats and ecosystems (0-1)		
Sensitivity	+ Length of coastline + Mangrove area + Forest area	GIS GIS GIS
Exposure	+ Area within x km from the coast	GIS
Adaptation deficit	- Protective measures in place - Regulation in place and functional	Estimate Estimate

+ = adding to the indicator value; - = reducing the indicator value

5 Vulnerability Mapping

Calculation of the Vulnerability Index

The index can be calculated in different ways that need to be tested for relevance and resolution: ¹

By multiplication: $Index (0-1) = I1 (0-1) \times I2 (0-1) \times I3 (0-1) \dots$

As an average: $Index (0-1) = average [I1 (0-1) \times I2 (0-1) \times I3 (0-1) \dots]$

As the critical value: $Index (0-1) = maximum [I1 (0-1) \times I2 (0-1) \times I3 (0-1) \dots]$

The data are (mostly) available at commune level, so the basic analysis will be made at this level. For mapping purposes, the commune-level results can be aggregated at district level, by one of the algorithms listed above.

An impression of the workload is provided by the following table.

Table 2: Districts and communes in the Coastal Zone

Province	No. of districts	No. of communes
Koh Kong	7	28
Preah Sihanouk	4	26
Kampot	8	93
Kep	2	5
Total	21	152

6 Vulnerability Reporting

The vulnerability assessment is reported for two good reasons:

- 1 Documentation of the data collection and data processing, for making the results available to parallel and future applications. This may involve clear descriptions of the origin of the data, the procedures, and tables with all primary data.
- 2 Relay of findings to decision-makers, stakeholders and others involved in policy formulation and in development and investment planning. This may require conceptualization and synthesization, nice graphics, and clear communication of assumptions and uncertainties.

Some notes on reporting are provided in Appendix E.

¹ The difference is quite visible. Consider two indicator components with values of 0.6 and 0.4, respectively. The maximum value is 0.6, the average value 0.5, and the product is 0.24

References and Literature

Most titles are available from the Internet

ADB (April 2013): Asian Water Development Outlook 2013 - *'Measuring Water Security in Asia and the Pacific'*

Agrawala S., A. Matus Kramer, G. Prudent-Richard and M. Sainsbury (November 2010): Incorporating climate change impacts and adaptation in Environmental Impact Assessments: Opportunities and Challenges. OECD Environmental Working Paper No. 24

CARDI, GEF and UNDP (November 2010): Listen to Villagers on Climate Change - Vulnerability Reduction Assessment (VRA)

CARE (2009): Climate Vulnerability and Capacity Analysis (CVCA)

CARP (July 2012): Vulnerability of existing agricultural practices. Working paper prepared under the Coastal Adaptation and Resilience Planning (CARP) Component of Cambodia Climate Change Alliance

Danchurch (September 2011): Climate change and disaster management policy mapping and analysis in Cambodia

Danida (June 2008): Climate change screening of Danish development cooperation with Cambodia (104.DAN.4-52-9-2)

Danida (2008): Risk Screening Matrix

EU (May 2012): Country Environment Profile, Royal Kingdom of Cambodia. Final Report prepared by Steffen Johnsen and Greg Munford, Euronet Consortium, for the European Union Delegation To Cambodia

Harmeling, Sven and David Eckstein (November 2012): Global Climate Risk Index 2013. Who suffers most from extreme weather events? Weather-related loss events in 2011 and 1992 to 2011. Briefing paper published by Germanwatch

IISD, IUCN, SEI et al, (2007): Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL)

MAFF (December 2011): Climate change adaptation training needs assessment guideline - developing multi-scale climate change adaptation strategies for farming communities in Cambodia. Prepared by the Department of Agricultural Extension (DAE) project team

MOE (December 2009): Second National Communication of Cambodia Under United Nations Framework Convention on Climate Change (UNFCCC) (draft). Part 1: Vulnerability, impact and adaptation assessment to climate change; Part 2: Historical and future climate change of Cambodia; Part 3: Impact of climate change on rice production of Cambodia. Ministry of Environment

MOE and UNDP (August 2011): Cambodia Human Development Report 2011. Building resilience: The future of rural livelihoods in the face of climate change. Ministry of Environment of Cambodia and UNDP Cambodia

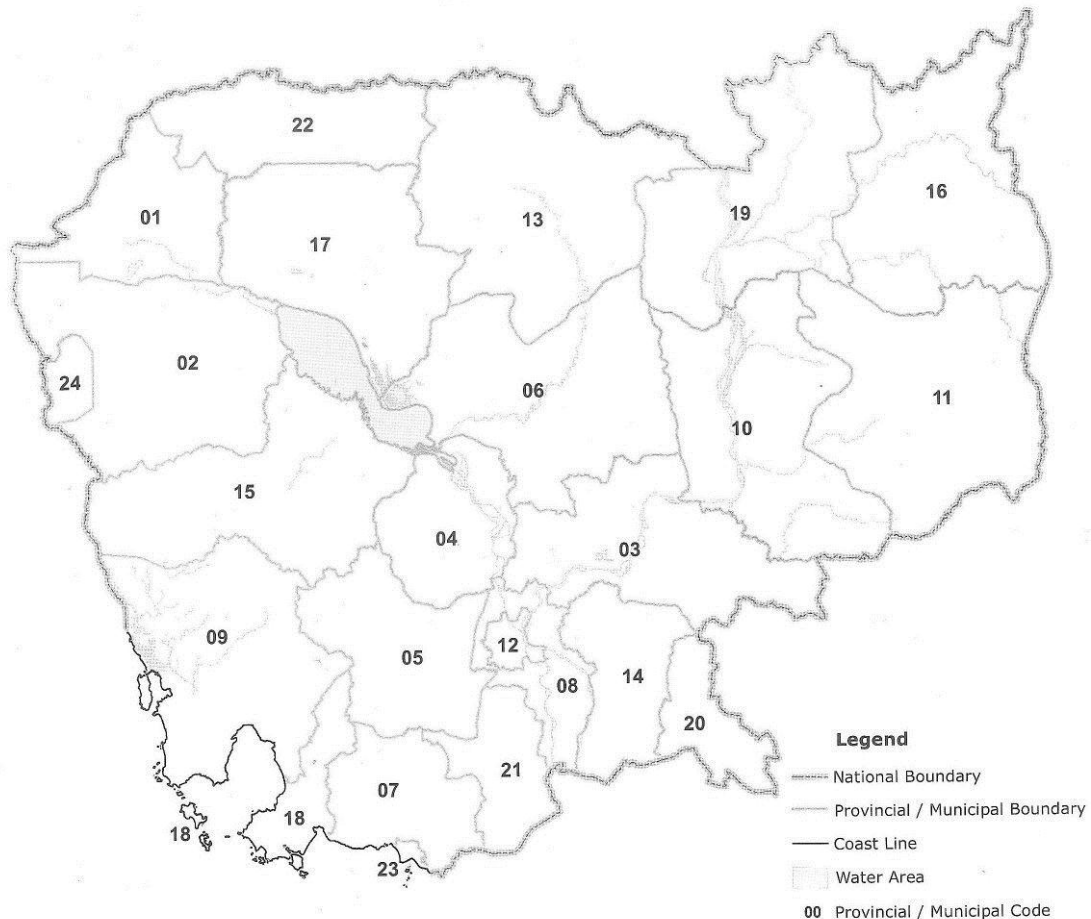
NCDD Secretariat (September 2011): Local Governments and Climate Change (LGCC) Project Document. Attached as Annex 1 to Memorandum of Understanding (MOU) between the United Nations Capital Development Fund (UNCDF) and the Royal Government of Cambodia on the support to the climate change adaptation grants for sub-national administrations

- NIS (March 2012): Economic Census of Cambodia 2011. National Institute of Statistics, Ministry of Planning
- Olhoff, Anne and Caroline Schaer (February 2010): Screening tools and guidelines to support the mainstreaming of climate change adaptation into development assistance – a stocktaking report. Published by the Environment & Energy Group of the United Nations Development Programme
- PPCR (October 2012): Synthesis Report on Vulnerability and Adaptation Assessment for Key Sectors Including Strategic and Operational Recommendations. Prepared by Hatfield Consultants for Ministry of Environment under Pilot Program for Climate Change Resilience
- Rizvi, A.R. and Singer, U. (2011): Cambodia Coastal Situation Analysis. Building Resilience to Climate Change Impacts, Coastal Southeast Asia No.6, Published by IUCN, Gland, Switzerland
- RGC (January 2009): Commune/sangkat fund project implementation manual. 2nd revision, prepared by the National Committee for the Management of Decentralization & Deconcentration Reform
- RGC (October 2006): National Adaptation Programme of Action to Climate Change (NAPA). Prepared by Ministry of Environment for the Royal Government of Cambodia
- Srun Darith and Sann Vathana (November 2009): Climate change - a challenge for food security and nutrition in Cambodia. Council for Agricultural and Rural Development (CARD)
- Tes Sopharith and Jorma Koponen (August 2012): Climate downscaling for Cambodia. Presentation at the Workshop on Science-Based Climate Change Adaptation and Outreach Activities, Himawari Hotel, Phnom Penh, held under PPCR Components 4 and 5
- Trærup, Sara and Anne Olhoff (September 2011): Climate risk screening tools and their application - a guide to the guidance. UNDP, UNEP and UNEP Risoe Centre
- UNDP (March 2012): Small Grants Programme, Cambodia. Guidebook for Practitioners – Implementing the Vulnerability Reduction Assessment
- UNDP (May 2010): A toolkit for designing climate change adaptation initiatives
- UNDP (2010): Screening Tools and Guidelines to Support the Mainstreaming of Climate Change into Development Assistance – A Stocktaking Report
- USAID (2007): Adapting to Climate Variability and Change: A Guidance Manual for Development Planning
- Yusuf, Arief Anshory and Herminia A Francisco (January 2009): Climate change vulnerability mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA)

Appendix A: Administrative Units in the Coastal Zone

Source: NIS (March 2012): Economic Census of Cambodia 2011

Provinces and Municipalities

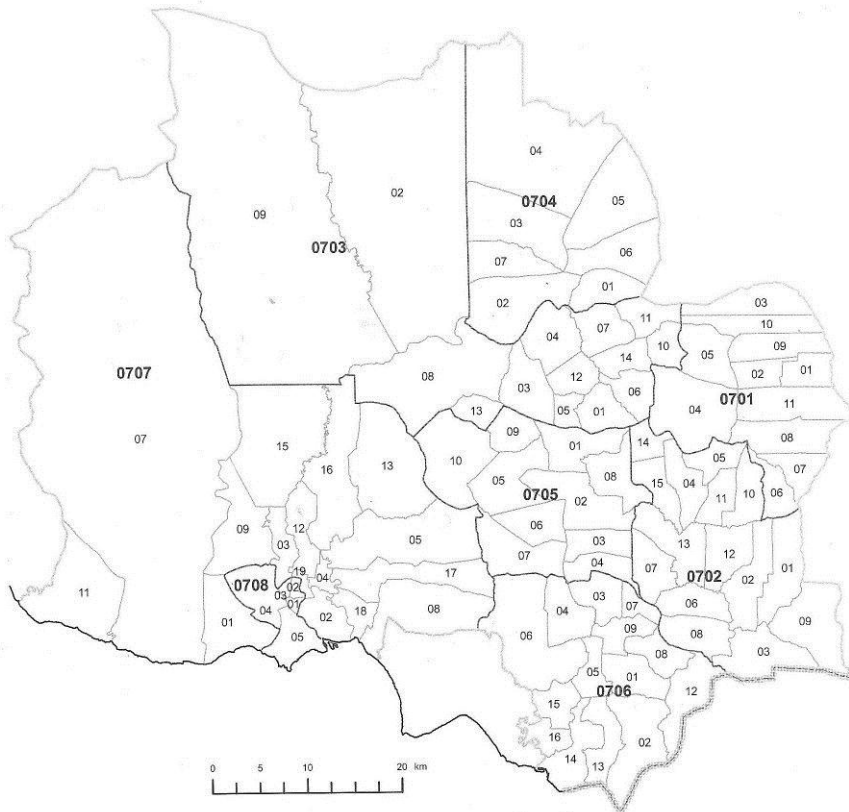


Code of Province / Municipality

01 BANTEAY MEANCHEY	09 KOH KONG	17 SIEM REAP
02 BATTAMBANG	10 KRATIE	18 PREAH SIHANOUK
03 KAMPONG CHAM	11 MONDUL KIRI	19 STUNG TRENG
04 KAMPONG CHHNANG	12 PHNOM PENH	20 SVAY RIENG
05 KAMPONG SPEU	13 PREAH VIHEAR	21 TAKEO
06 KAMPONG THOM	14 PREY VENG	22 OTDAR MEANCHEY
07 KAMPOT	15 PURSAT	23 KEP
08 KANDAL	16 RATANAK KIRI	24 PAILIN

* Codes and boundaries are as of May 18, 2011.

Kampot Province



Legend

- National Boundary
 - Provincial / Municipal Boundary
 - District Boundary
 - Commune Boundary
 - Coast Line
 - 0000** District Code
 - 00 The last two digits of Commune Code*
- * Commune Code consists of District Code and two digits.

Code of Province / Municipality, District, and Commune

07 KAMPOT

0701 Angkor Chey

- 070101 Angk Phnum Touch
- 070102 Ankor Chey
- 070103 Champel
- 070104 Dambouk Khpos
- 070105 Dan Koum
- 070106 Daeum Doung
- 070107 Mroum
- 070108 Phnum Kong
- 070109 Praphnum
- 070110 Samlanh
- 070111 Tani

0702 Banteay Meas

- 070201 Banteay Meas Khang Kaeut
- 070202 Banteay Meas Khang Lech
- 070203 Prey Tonle
- 070204 Samraong Kraom
- 070205 Samraong Leu
- 070206 Sdach Kong Khang Cheung
- 070207 Sdach Kong Khang Lech
- 070208 Sdach Kong Khang Tbound
- 070209 Tnoat Chong Srang
- 070210 Trapeang Sala Khang Kaeut
- 070211 Trapeang Sala Khang Lech
- 070212 Tuk Meas Khang Kaeut
- 070213 Tuk Meas Khang Lech
- 070214 Voat Angk Khang Cheung
- 070215 Voat Angk Khang Tbound

0703 Chhuk

- 070301 Banlev
- 070302 Takaen
- 070303 Boeng Nimol
- 070304 Chhuk
- 070305 Doun Yay
- 070306 Krang Sbov
- 070307 Krang Snay
- 070308 Lbaeuk
- 070309 Trapeang Phleang
- 070310 Mean Chey
- 070311 Neareay
- 070312 Satr Pong
- 070313 Trapeang Bai
- 070314 Tramaeng

0704 Chum Kiri

- 070401 Chres
- 070402 Chumpu Voan
- 070403 Snay Anhchit
- 070404 Srae Chaeng
- 070405 Srae Knong
- 070406 Srae Samraong
- 070407 Trapeang Reang

0705 Dang Tong

- 070501 Damnak Sokram
- 070502 Dang Tong
- 070503 Khcheay Khang Cheung
- 070504 Khcheay Khang Tbound
- 070505 Mean Ritth
- 070506 Srae Chea Khang Cheung
- 070507 Srae Chea Khang Tbound
- 070508 Totung
- 070509 Angk Romeas
- 070510 L'ang

0706 Kampong Trach

- 070601 Boeng Sala Khang Cheung
- 070602 Boeng Sala Khang Tbound
- 070603 Damnak Kantuot Khang Cheung
- 070604 Damnak Kantuot Khang Tbound
- 070605 Kampong Trach Khang Kaeut
- 070606 Kampong Trach Khang Lech
- 070607 Kanthaor Khang Cheung
- 070608 Kanthaor Khang Kaeut
- 070609 Kanthaor Khang Lech
- 070612 Preaek Kroes
- 070613 Ruessei Srok Khang Kaeut
- 070614 Ruessei Srok Khang Lech
- 070615 Svay Tong Khang Cheung
- 070616 Svay Tong Khang Tbound

0707 Tuek Chhou

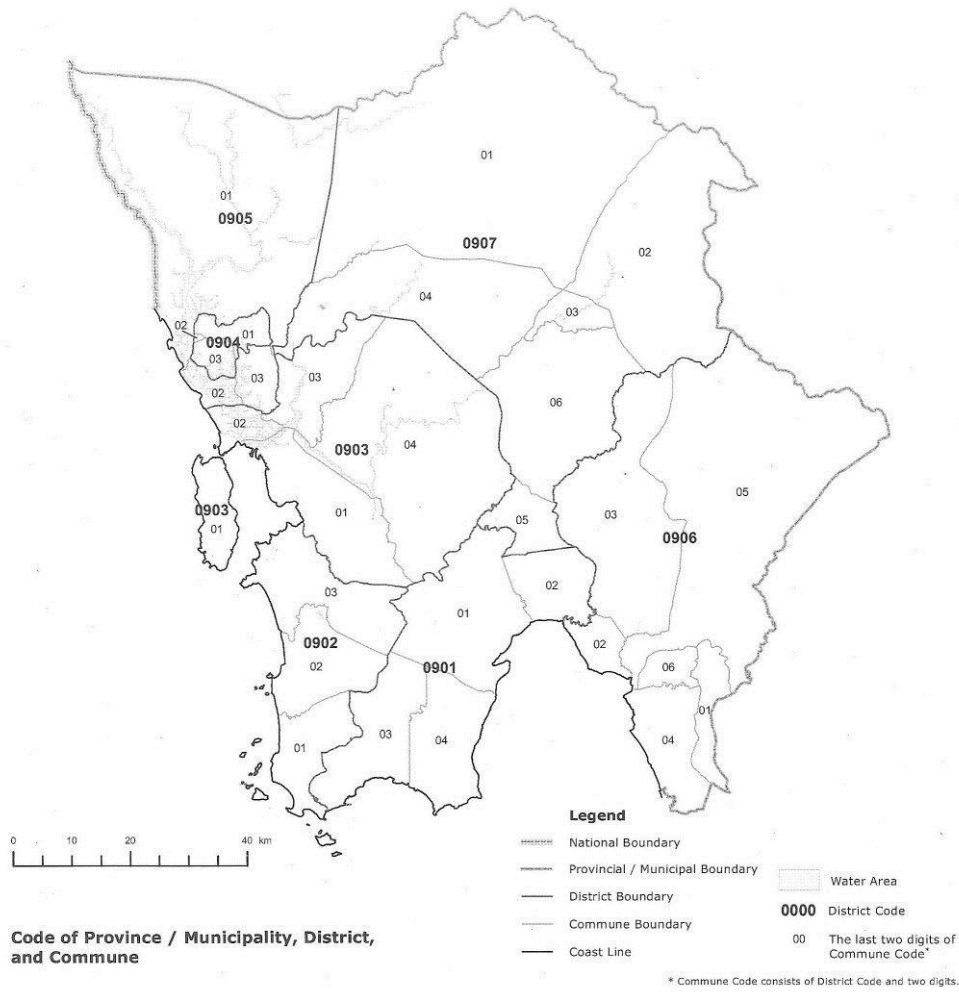
- 070701 Boeng Tuk
- 070702 Chum Kriel
- 070703 Kampong Kraeng
- 070704 Kampong Samraong
- 070705 Kandaol
- 070707 Kaoh Touch
- 070708 Koun Saty
- 070709 Makprang
- 070711 Preaek Tnoat
- 070712 Prey Khmum
- 070713 Prey Thnang
- 070715 Stueng Kaev
- 070716 Thmei
- 070717 Trapeang Pring
- 070718 Trapeang Sangkae
- 070719 Trapeang Thum

0708 Kampot

- 070801 Kampong Kandai
- 070802 Krang Ampil
- 070803 Kampong Bay
- 070804 Andoung Khmer
- 070805 Traeuy Kaoh

* Codes and boundaries are as of May 18, 2011.

Koh Kong Province



Code of Province / Municipality, District, and Commune

09 KOH KONG

0901 Botum Sakor

- 090101 Andaung Tuek
- 090102 Kandaol
- 090103 Ta Noun
- 090104 Thma Sa

0902 Kiri Sakor

- 090201 Kaoh Sdach
- 090202 Phnhi Meas
- 090203 Preaek Khsach

0903 Kaoh Kong

- 090301 Chrouy Pras
- 090302 Kaoh Kapl
- 090303 Ta Tai Kraom
- 090304 Trapeang Rung

0904 Khemarak Phoumin

- 090401 Smach Mean Chey
- 090402 Dang Tong
- 090403 Stueng Veaeng

0905 Mondol Seima

- 090501 Pak Khlang
- 090502 Peam Krasaob
- 090503 Tuol Kokir

0906 Srae Ambel

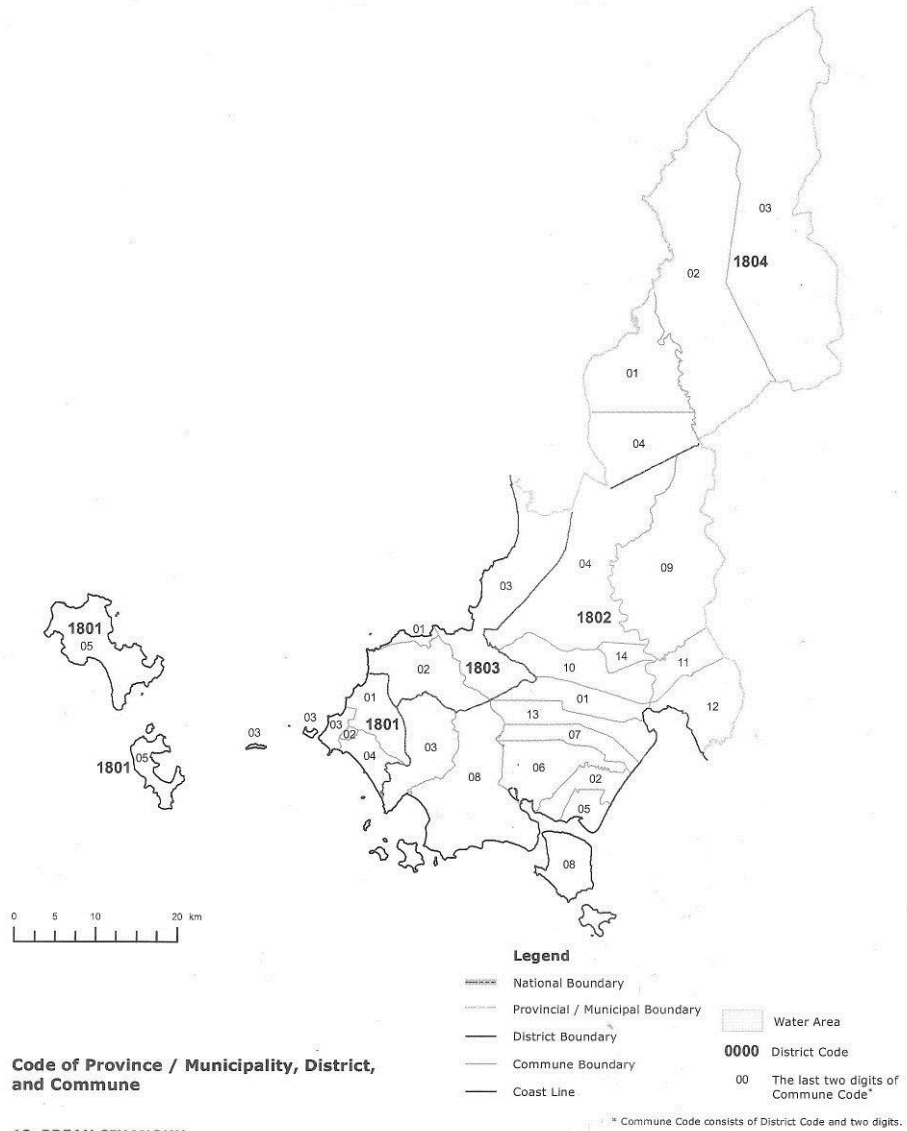
- 090601 Boeng Preav
- 090602 Chi Kha Kraom
- 090603 Chi Kha Leu
- 090604 Chrouy Svay
- 090605 Dang Peaeng
- 090606 Srae Ambel

0907 Thma Bang

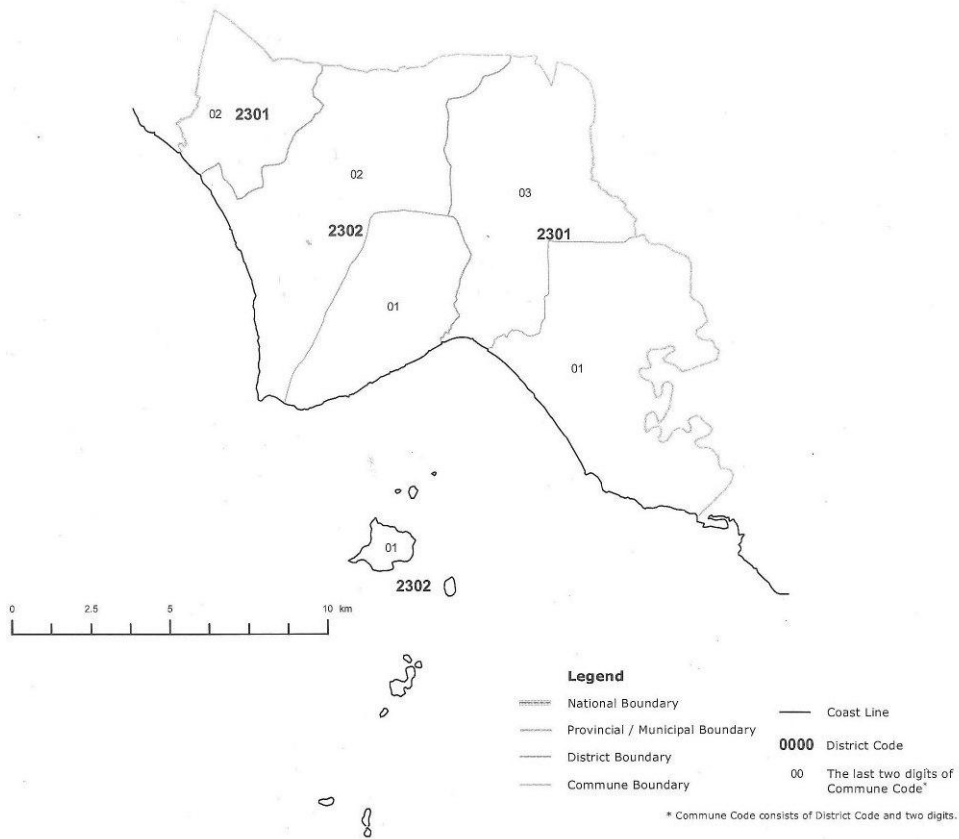
- 090701 Ta Tey Leu
- 090702 Pralay
- 090703 Chumnoab
- 090704 Ruessei Chrum
- 090705 Chi Phat
- 090706 Thma Daun Pov

* Codes and boundaries are as of May 18, 2011.

Preah Sihanouk Province



Kep Province



Code of Province / Municipality, District, and Commune

23 KEP

2301 Damnak Chang'eur
 230101 Angkaol
 230102 Ou Krasar
 230103 Pong Tuek

2302 Kaeb
 230201 Kep
 230202 Prey Thum

* Codes and boundaries are as of May 18, 2011.

Appendix B: Commune Database Indicators

Summary

Population and number of families	:	28	indicators
School attendance	:	28	indicators
Literacy	:	8	indicators
Distance to school	:	3	indicators
Primary occupation	:	39	indicators
Secondary occupation	:	39	indicators
Migration for work	:	4	indicators
Employment and employment opportunities	:	94	indicators
Land ownership, irrigation and cultivation	:	12	indicators
Use of fertilizer and pesticides	:	4	indicators
Cultivation machinery	:	16	indicators
Vehicles	:	19	indicators
Boats	:	15	indicators
Livestock	:	16	indicators
Housing type and standard	:	14	indicators
Access to electricity	:	7	indicators
Alternative power utilization: Batteries, solar panels, biogas	:	17	indicators
Households with TV	:	7	indicators
Unoccupied housing	:	5	indicators
Services for child birth and infants	:	14	indicators
Access to water and sanitation	:	21	indicators
Social challenges and hardships	:	41	indicators
Garbage collection	:	1	indicator
People living in protected areas/conservation zones	:	2	indicators
People affected by pollution, storms, floods, drought, or fires	:	9	indicators
Conflicts, violence, crime	:	19	indicators
Accidents (natural or human), serious diseases	:	33	indicators
Rice cultivation area	:	2	indicators
Commune/sangkat/village governance and services	:	7	indicators
Land use and productivity	:	60	indicators
Roads	:	10	indicators
Education attendance and facilities, including safe water and sanitation	:	101	indicators
Community participation	:	15	indicators

Exposure to floods, drought and pests	:	10	indicators
Births, marriages, deaths	:	4	indicators
Land titles issuing and coverage	:	3	indicators
Mines: Accidents, victims, mine clearance	:	8	indicators
Administrative staff	:	86	indicators
Vocational and administrative training	:	6	indicators
Tax revenue	:	11	indicators
NGOs	:	24	indicators
Orphanages, hospitals, clinics	:	11	indicators
Private universities: Availability and enrolment	:	3	indicators
Total	:	876	indicators

Indicators directly related to the climate

(Many more are indirectly climate-related).

People affected by pollution, storms, floods, drought, or fires
of families who effected by environmental pollution
of families affected by heavy storms
of persons affected by heavy storms
of families affected by heavy floods
of persons affected by heavy floods
of families affected by heavy droughts
of persons affected by heavy droughts
of families affected by severe fires
of persons affected by severe fires
Accidents, serious diseases
total deaths due to FLOODS in the current year below 18 years
of FEMALE deaths due to FLOODS in the current year below 18 years
total deaths due to FLOODS in the current year over 18 years
of FEMALE deaths due to FLOODS in the current year over 18 years
total deaths due to STORMS in the current year over 18 years
total deaths due to LIGTHNING in the current year below 18 years
of FEMALE deaths due to LIGTHNING in the current year below 18 years
total deaths due to LIGTHNING in the current year over 18 years
of FEMALE deaths due to LIGTHNING in the current year over 18 years
total deaths due to DENGUE FEVER in the current year below 18 years
of FEMALE deaths due to DENGUE FEVER in the current year below 18 years
total deaths due to DENGUE FEVER in the current year over 18 years
of FEMALE deaths due to DENGUE FEVER in the current year over 18 years
total deaths due to MALARIA in the current year below 18 years
of FEMALE deaths due to MALARIA in the current year below 18 years
total deaths due to MALARIA in the current year over 18 years
of FEMALE deaths due to MALARIA in the current year over 18 years
Exposure to floods, drought and pests
Size of areas affected by Floods
Size of rice areas affected by Floods
Size of other crops areas affected by Floods
Length of roads affected by Floods
Number of bridges affected by Floods
Size of rice areas affected by drought
Size of rice areas affected by pests
Number of cases of serious fires (burn houses and markets)
Number of Safety hills
Size of trees re-planting area

Appendix C: Examples of Composite Indicators

The Human Development Index (HDI)

An index for national welfare applied since 1990 by UNDP for ranking and trend analyses of national development.

For many years, the HDI was calculated as a simple average of three indicators: (1) Life expectancy (25 - 85 years); (2) literacy (0 - 100 percent) and school attendance (0 - 15 years), weighed at 2:1; and (3) Gross National Product (GNP) adjusted for national price level (called '*purchasing power parity*', or PPP) (200 - 40,000 USD/person/year).

Since 2010, however, a more complicated algorithm has been applied:

$$\text{LEI (Life Expectancy Index)} = (\text{LE} - 20) / (82.3 - 20)$$

LE = life expectancy at birth

$$\text{EI (Education Index)} = (\text{MYSI} \times \text{EYSI})^{1/2} / 0.951$$

MYSI (Mean Years of Schooling Index) = MYS/13.2

MYS (mean years of schooling) = Years that a 25-year-old person or older has spent in schools

EYSI (Expected Years of Schooling Index) = EYS/20.6

EYS (expected years of schooling) = Years that a 5-year-old child will spend with his education in his whole life

$$\text{II (Income Index)} = (\ln(\text{GNIpc}) - \ln(100)) / (\ln(107.71) - \ln(100))$$

GNIpc = gross national income per capita (USD/person at 2005 purchasing power parity)

$$\text{HDI (human Development Index)} = (\text{LEI} \times \text{EI} \times \text{II})^{1/3}$$

The EEPSEA Index of CC Vulnerability

This index is applied in a much quoted study by Yusuf, Arief Anshory and Herminia A Francisco (January 2009).

The vulnerability is regarded as a determined by 3 characteristics: Exposure, sensitivity, and adaptive capacity.

The adaptive capacity, in turn, is regarded as determined by socio-economic factors, technology and infrastructure.

This is illustrated in the figures below.

Figure 2: The EEPSEA Climate Change Vulnerability Index

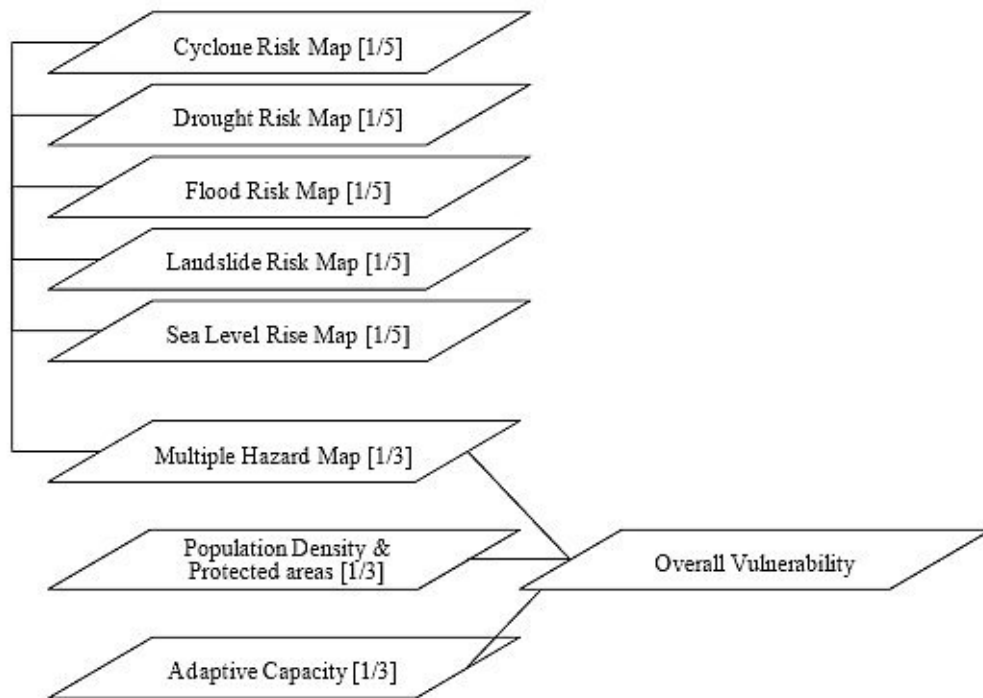
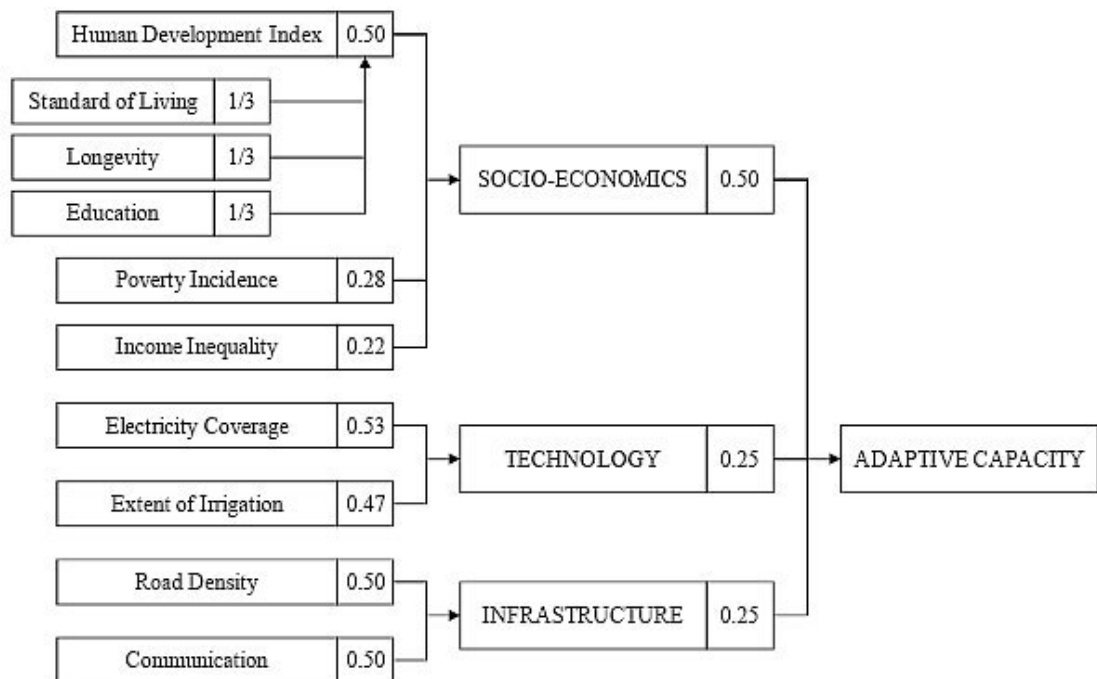


Figure 3: The EEPSEA Estimation of Adaptive Capacity



The National Water Security Index

This index was developed and applied in connection with ADB's Asian Water Development Outlook 2013 - '*Measuring Water Security in Asia and the Pacific*' (ADB, April 2013). It is composed of 5 '*key dimensions*':

- 1 Household water security
To satisfy household water supply and sanitation needs in all communities
 - Access to piped water supply
 - Access to improved sanitation
 - Hygiene

- 2 Economic water security
To support productive economies in agriculture, industries and energy
 - Agricultural water security
 - Industrial water security
 - Energy water security

- 3 Urban water security
To develop vibrant, liveable cities and towns
 - Water supply
 - Wastewater treatment
 - Drainage

- 4 Environmental water security
To restore healthy rivers and ecosystems
 - Watershed disturbance
 - Pollution
 - Water resource development
 - Biotic factors

- 5 Resilience to water-related disasters
To build resilient communities that can adapt to change
 - Exposure
 - Vulnerability
 - Hard coping capacities
 - Soft coping capacities

Appendix D:

Proposed District Integration Workshop Questionnaire

The annual District Integration Workshops - with participation by all communes in the district - offer a good opportunity for learning about climate-related concerns. The workshops have a tight schedule, and excessive additional tasks should be avoided. A minimalistic questionnaire like the one below may be considered; it should not take too long time to complete.

Name of commune:

How is the **general access to safe water, sanitation and electricity?**

Safe water: Good - moderate - poor

Improving from year to year - no big changes - getting worse

Sanitation: Good - moderate - poor

Improving from year to year - no big changes - getting worse

Electricity: Good - moderate - poor

Improving from year to year - no big changes - getting worse

Are **households** affected by **floods, storms, water shortage, or pollution?**

Floods: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Storms: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Water shortage: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Pollution: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Are the **cultivated areas** affected by **floods, storms, water shortage, sea water intrusion or pollution?**

Floods: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Storms: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Water shortage: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Sea water intrusion: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Pollution: Very much - to some extent - not very much

Improving from year to year - no big changes - getting worse

Are **shops, markets, businesses, industries and clinics** affected by **floods, storms, water shortage, or pollution**?

*Floods: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

*Storms: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

*Water shortage: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

*Pollution: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

Are **roads, dikes, embankments, canals and/or reservoirs** affected by **floods, erosion or siltation**?

*Floods: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

*Erosion: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

*Siltation: Very much - to some extent - not very much
Improving from year to year - no big changes - getting worse*

Is there any **coast erosion or river bank erosion**?

*Very much - some - not very much
Improving from year to year - no big changes - getting worse
Not relevant in this commune*

How is the health of **rivers, forests, wetlands, mangroves, and/or marine areas**?

*Rivers: Good - moderate - poor
Improving from year to year - no big changes - getting worse
Not relevant in this commune*

*Forests: Good - moderate - poor
Improving from year to year - no big changes - getting worse
Not relevant in this commune*

*Wetlands: Good - moderate - poor
Improving from year to year - no big changes - getting worse
Not relevant in this commune*

*Mangroves: Good - moderate - poor
Improving from year to year - no big changes - getting worse
Not relevant in this commune*

*Marine areas: Good - moderate - poor
Improving from year to year - no big changes - getting worse
Not relevant in this commune*

Appendix E: Vulnerability Assessment Reporting

This appendix is an *indicative outline* of vulnerability reporting for the Coastal Zone.

A distinction is made between (i) *data reporting* (for the sake of documentation) and (ii) *synthesis reporting* (to communicate the findings to decision-makers and to carry the findings forward to the development planning and other implementation-oriented applications).

It is expected that the synthesis reporting be much more concise than the basic data reporting. Decision-makers have little time for lengthy documents!

The two lines of reporting must be fully consistent - but certain overlaps should be accepted in support of self-sustaining stand-alone documents.

E.1 General

Cover

Title; '*prepared under the The Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia, implemented by Ministry of Environment*'; month and year; inner cover with contact information (e-mail address)

List of contents

(One page if possible)!

Acknowledgement

For documents in Khmer: Be careful with Cambodian names translated first to English and then back to Khmer!

Key map

With a scale, and location names applied in the text; perhaps only at province level (with district/ commune maps in appendices)

List of acronyms and abbreviations

A summary

- A brief description of what was done, and when
- A few, carefully selected key messages for decision-makers and opinion leaders with suggestions and recommendations (perhaps including governance implications; and perhaps distinguishing between immediate and long-term implications).

The body text

Divided into chapters (and sub-chapters and sections, if relevant) (see below)

References and related literature

Appendices

E.2 Data Reporting

Summary

Including which data were collected and from where.

1 Introduction

- A description of background, context, purpose and origin of the document, and perhaps with an acknowledgement

The purpose may be something like

The present document presents the origin, collection and processing of data compiled in connection with vulnerability assessment for the Coastal Zone of Cambodia, together with comments on the data coverage and validity, uncertainties, and assumptions made.

2 Scope and approach

- Data sources, coverage and time of origin, with reference to data tables (in appendices)
- Introduction and description of applied indicators

3 Analysis

- A step-by-step description of data collection and processing
- A few summary maps and summary tables
- Introduction to more comprehensive maps and data tables (in appendices)
- Observations on patterns (including geographic variations) and trends (if possible)

Appendices

- Expectedly including a glossary explaining the applied terminology; detailed maps; and tables of primary and processed data

E.3 Synthesis Reporting

Summary

The summary is an important part of the synthesis report. It should be a few pages, with sections divided by sub-headers, and must clearly explain the findings; the related assumptions and uncertainties; and the related recommendations.

1 Introduction

- A description of background, context, purpose and origin of the document, and perhaps with an acknowledgement

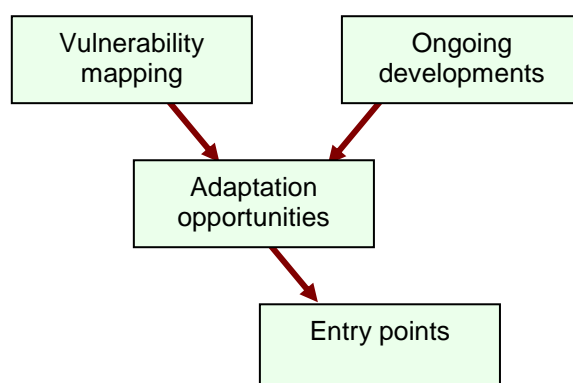
The purpose may be something like

The present document presents an assessment of the climate change vulnerability in the Coastal Zone of Cambodia, together with comments on assumptions made. It is intended for decision-makers and others involved

in climate-related development and investment planning, and others with an interest in climate adaptation in the Coastal Zone.

2 **Background**

- Applied terminology (perhaps in a text box): Vulnerability; exposure; sensitivity; resilience; adaptation; etc.
- Overview of the climate change agenda in the Coastal Zone
- Perhaps one or several small, simple concept diagrams illustrating cause-effect relationships, sequences of activities, or lines of thought:



3 **Observations and recommendations**

- Summary of findings
- Indications on future developments (if any) (presented with due caution)
- Observations on cause-effect relationships
- Observations on concerns and opportunities
- Observations on management options, including policy and development planning implications (if relevant)
- Recommendations (as prompted by the findings)

E.4 **Suggestions**

Illustrations and figures

- Use *figures, diagrams, photos, maps, text boxes*, as much as body text.
- Make diagrammes and tables *as simple as possible*. Split them in several separate ones if they are overly complex.
- Numbers: Don't use more digits than justified by the applied accuracy and resolution. Values should be rounded to the number of significant digits - for example '*around 5 percent*' - rather than '*around 4.973 percent*'.
- Scales: Always indicate the unit. Avoid unnecessary decimals (write '*0 - 1 - 2 - ...*' rather than '*0.0 - 1.0 - 2.0 ...*').

Other suggestions

- Beware of the documentation. Cut and paste as required, but always indicate the origin.
- To the extent possible, colour maps, diagrams, and photos should make sense also if copied in black-and-white.
- In English reports, use consistent spelling of location names. Use for example NIS (March 2012): Economic census of Cambodia 2011. District and commune report on final census results. National Institute of Statistics, Ministry of Planning (see Appendix B in the present document).
- Use simple language and short sentences. This will make the document easier to read, and facilitate translation between English and Khmer.
- Sometimes it is helpful to draft a document and a slide presentation in parallel - in support of clarity of thought, concept diagrammes, and highlighting of key messages.

The Vulnerability Assessment and Adaptation Programme for Climate Change
within the Coastal Zone of Cambodia

**Vulnerability Assessment and Adaptation Planning:
Training Manual**

Part C: Outline of a Vulnerability Report

Version 0, September 2013

Contents

Acronyms and Abbreviations.....	iii
Acknowledgement.....	iv
Executive Summary	iv
Cambodia's Coastal Provinces.....	v
1 Introduction	1
2 Data Sources	2
3 Climate-related Vulnerabilities in the Coastal Area.....	3
4 Households	8
5 Cultivation	9
6 Infrastructure and Coastline Stability	9
7 Habitats and ecosystems	9
8 Adaptation Needs and Management Options.....	10
References and Literature	11
Appendix A: Members of the Technical Working Groups.....	13
Appendix B: Vulnerability Maps	14
B.1 Households	14
B.2 Cultivation	15
B.3 Infrastructure and Coastline Stability.....	15
B.4 Habitats and Ecosystems.....	15
Appendix C: Vulnerability Data Tables	15
C.1 Koh Kong	15
C.2 Preah Sihanouk	16
C.3 Kampot	16
C.4 Kep	16

Maps

- xa Over-all climate-related vulnerability, Koh Kong Province
- xb Over-all climate-related vulnerability, Preah Sihanouk Province
- xc Over-all climate-related vulnerability, Kampot and Kep Provinces
- xa Vulnerability of households, Koh Kong Province
- xb Vulnerability of households, Preah Sihanouk Province
- xc Vulnerability of households, Kampot and Kep Provinces
- xa Vulnerability of cultivation systems, Koh Kong Province
- xb Vulnerability of cultivation systems, Preah Sihanouk Province
- xc Vulnerability of cultivation systems, Kampot and Kep Provinces
- xa Vulnerability of infrastructure, Koh Kong Province
- xb Vulnerability of infrastructure, Preah Sihanouk Province
- xc Vulnerability of infrastructure, Kampot and Kep Provinces
- xa Vulnerability of habitats and ecosystems, Koh Kong Province
- xb Vulnerability of habitats and ecosystems, Preah Sihanouk Province
- xc Vulnerability of habitats and ecosystems, Kampot and Kep Provinces

About This Document

A training manual was drafted in May 2013 and subsequently revised. It was divided into two parts, *Part A* being general (about climate change and adaptation planning) and *Part B* being more specific (about vulnerability assessment and reporting). The data availability has been clarified, as well as the collection of supplementary vulnerability data.

The present *Part C* has been drafted subsequently as an example of the possible vulnerability assessment reporting.

It is intended as an internal and temporary document, providing a starting point and serving as a guide for the reporting process.

Suggestions

Add several photos!

Include some short specific examples as text boxes!

Acronyms and Abbreviations

CARP	:	Coastal Adaptation and Resilience Planning Component (of CCCA)
CC	:	Climate change
CCCA	:	Cambodia Climate Change Alliance
CCSAP	:	Cambodia Climate Change Strategy and Action Plan
CDB	:	Commune Database
DEM	:	Digital elevation model
DIW	:	District Integration Workshop
EEPSEA	:	Economy and Environment Program for Southeast Asia
EIA	:	Environmental impact assessment
GEF	:	Global Environment Facility
IPCC	:	Intergovernmental Panel on Climate Change
LDCF	:	The Least Developed Countries Fund
MRC	:	Mekong River Commission
NAPA	:	National Adaptation Programme of Action to Climate Change
NCDD	:	National Committee for Democratic Development
PIP	:	Public Investment Programme
PPCR	:	Pilot Programme for Climate Resilience
RGC	:	Royal Government of Cambodia
UNEP	:	United Nations Environment Programme

Acknowledgement

Please include anyone (outside the programme team) who assisted with the work!

This Report was produced under the Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia, implemented by the Coastal Coordination Unit of Ministry of Environment, Cambodia.

The Team gratefully acknowledges the support and guidance provided by HE Dr. Mok Mareth, Senior Minister and Minister of Environment; HE Dr. Lonh Heal, Director General of MOE; Mr. Sum Thy, Director of Climate Change Department, MOE; Dr. Tin Ponlok, Head of the CCCA Trust Fund Secretariat; and Mr. Julien Chevillard, CCCA Trust Fund Administrator.

Indispensable support was provided by the communes in the coastal provinces, who contributed their first-hand insight in climate-related vulnerabilities.

The Team sincerely thanks everyone who shared their time and knowledge, and looks forward with enthusiasm and confidence to a continued fruitful dialogue.

Executive Summary

Cambodia's Coastal Provinces



Province	No. of districts	No. of communes	Population	Area (km ²)	Population per km ²
Koh Kong	7	29	139,722	11,160	12
Preah Sihanouk	4	26	199,902	868	230
Kampot	8	93	585,110	4,873	120
Kep	2	5	40,208	336	120
Total	21	153	964,942	17,237	56

Source: Wikipedia

1 Introduction

Knowledge about climate change vulnerability is needed for several good reasons:

- Improved basic understanding of the extent and character of the vulnerability, including cause-effect relationships, as part of the basis for
- improved understanding of management options and related benefits; as well as
- understanding of the extent (and causes) of changes over time.

A good basis for feasibility studies and design will increase the cost-benefit ratio of infrastructural developments, reduce the risks, and add to a good investment climate.

The '*Vulnerability Assessment and Adaptation Programme for Climate Change within the Coastal Zone of Cambodia Considering Livelihood Improvement and Ecosystems*' has been approved by the GEF under the LDCF to address the vulnerability of Cambodia's Coastal Zone.

The programme is implemented by the United Nations Environment Programme (UNEP) and is executed by the Coastal Coordination Unit of the Cambodian Ministry of Environment in close cooperation with sectoral ministries as well as sub-national and local leaders. It is closely coordinated with the Coastal Adaptation and Resilience Planning (CARP) Component, implemented by the same unit for the Cambodia Climate Change Alliance (CCCA).

The programme aims at four outcomes:

- 1: Institutional capacity to assess climate change risks and integrate them into national development policies strengthened.
- 2: Adaptation planning in the coastal zone improved.
- 3: Vulnerability of productive systems and livelihoods to increased floods reduced.
- 4: Resilience of coastal buffers to climate change increased and livelihoods improved.

The present vulnerability assessment has been produced and reported by the Technical Working Groups and the CCU Programme Team in support of these outcomes. It builds on previous vulnerability studies as reported by the CARP and others, as well as data and information about climate-related vulnerabilities collected for the purpose.

2 Data Sources

The present vulnerability study applies the commune as the basic unit. The following data sources have been applied:

- General information and analyses provided by the Technical Working Groups (2013).
- The Commune Database (CDB) (2011), compiled and maintained by Ministry of Planning, provides 876 social, economic and geographic indicators at commune level. These provide a detailed picture of socio-economic conditions, including livelihoods, cultivation, public health and education. Several of the indicators are directly climate-related, and many more are indirectly related.
- Elevation data have been achieved from the **xx m grid (specify)** digital elevation model (DEM), accessible on the Internet.
- Commune data collected in 2013 for the purpose of the present vulnerability study, as a supplement to the 2011 CDB data, providing information about various exposures and trends. These data are attached as Appendix C.

3 Climate-related Vulnerabilities in the Coastal Area

Background and Context

An area can be vulnerable to climate change, like it may be vulnerable to specific exposures such as floods, drought or pests. The vulnerability is determined by

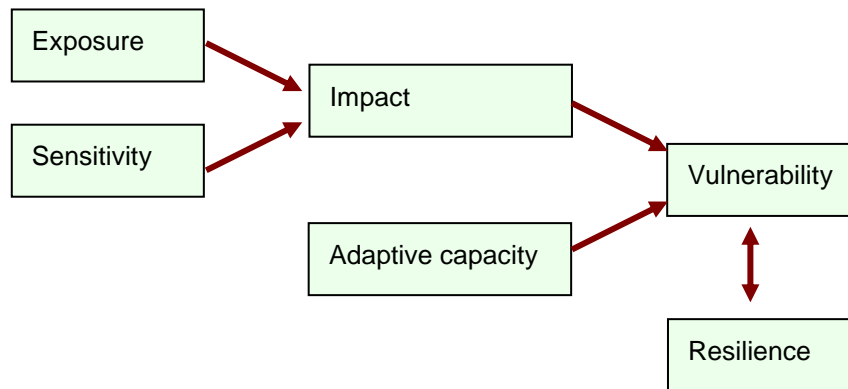
- the impact: A high impact will increase the vulnerability; and
- the adaptive capacity: A high adaptive capacity will reduce the vulnerability.

The impact, in turn, is determined by

- the exposure: A high exposure will increase the impact; and
- the sensitivity: A high sensitivity will also increase the impact.

This is illustrated in the figure below.

Figure 1: Vulnerability to climate change



The present assessment considers the particular climate-related vulnerabilities of

- households;
- cultivation systems;
- infrastructure and coast erosion; and
- habitats and ecosystems.

These vulnerabilities are related. They interact with other vulnerabilities such as a low baseline for access to safe water, sanitation and electricity; small land holdings; a scope for general efficiency improvements of cultivation systems and livestock breeding; and less supportive market mechanisms (including high input prices, low farmgate prices, and competition from neighbouring countries).

Also, from place to place, the coastal area is affected by

- increased generation of sewage and solid waste, adding to
- surface water pollution, caused by pesticides and fertilizers.

Significance of Climate Exposure

The vulnerability is related to the exposure (of storms, erratic rainfall, etc). The table below summarizes the significance of various exposures to social, economic and environmental vulnerabilities in the coastal area of Cambodia.

Table x: Significance of climate-related exposures in the coastal area

Significance	Exposure				
	Storms	Erratic rainfall	Floods	Sea level	Saline intrusion
Public health					
Safe water for households					
Roads, dykes, other structures, power supply					
Coast erosion					
Soil quality					
Cultivation					
Livestock					
Other production systems					
Urban drainage					
Marine habitats and ecosystems					
Mangroves					
Inland habitats and ecosystems					

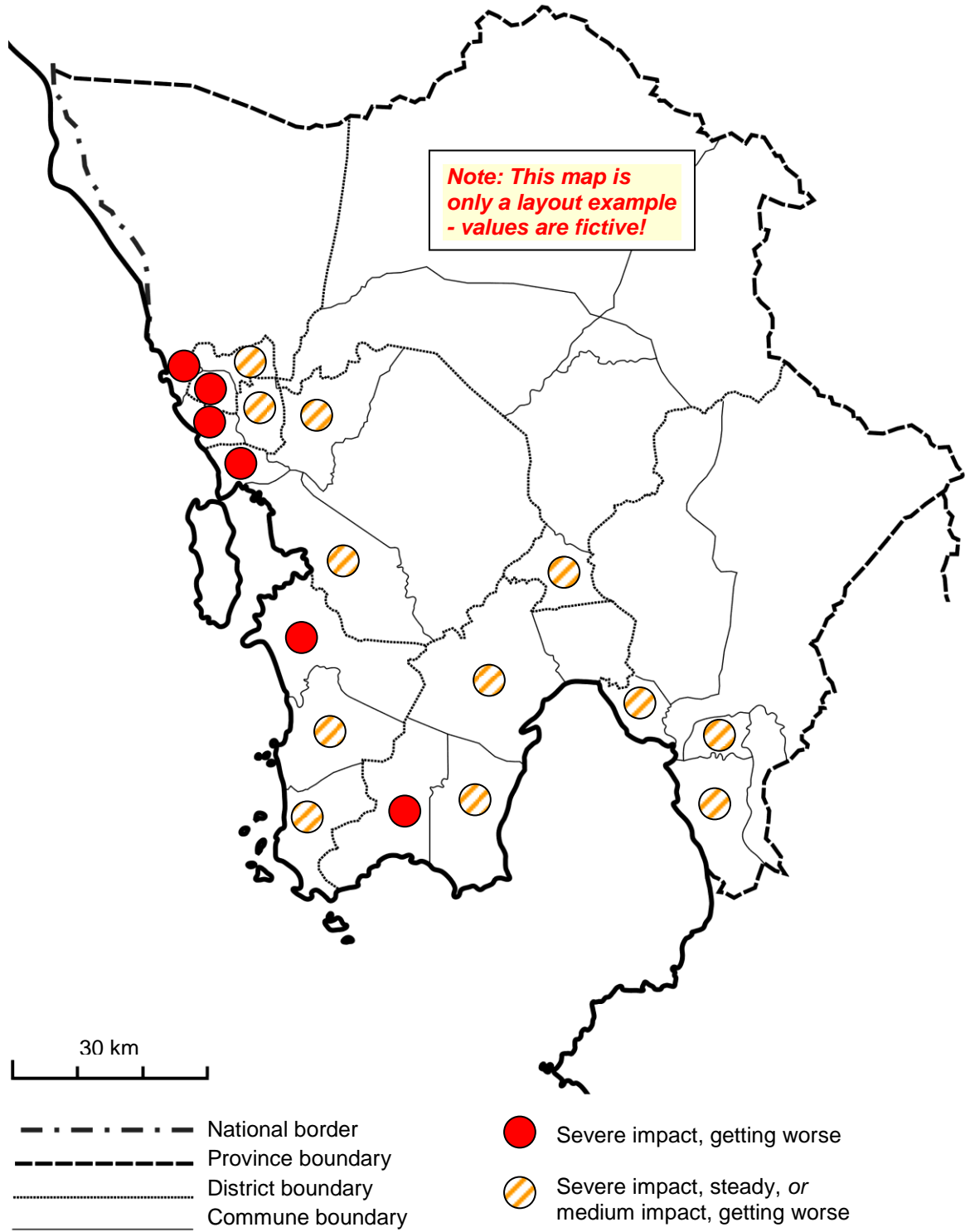
H = high, M = medium, L = low

Source: Compiled in 2013 by the Technical Working Groups

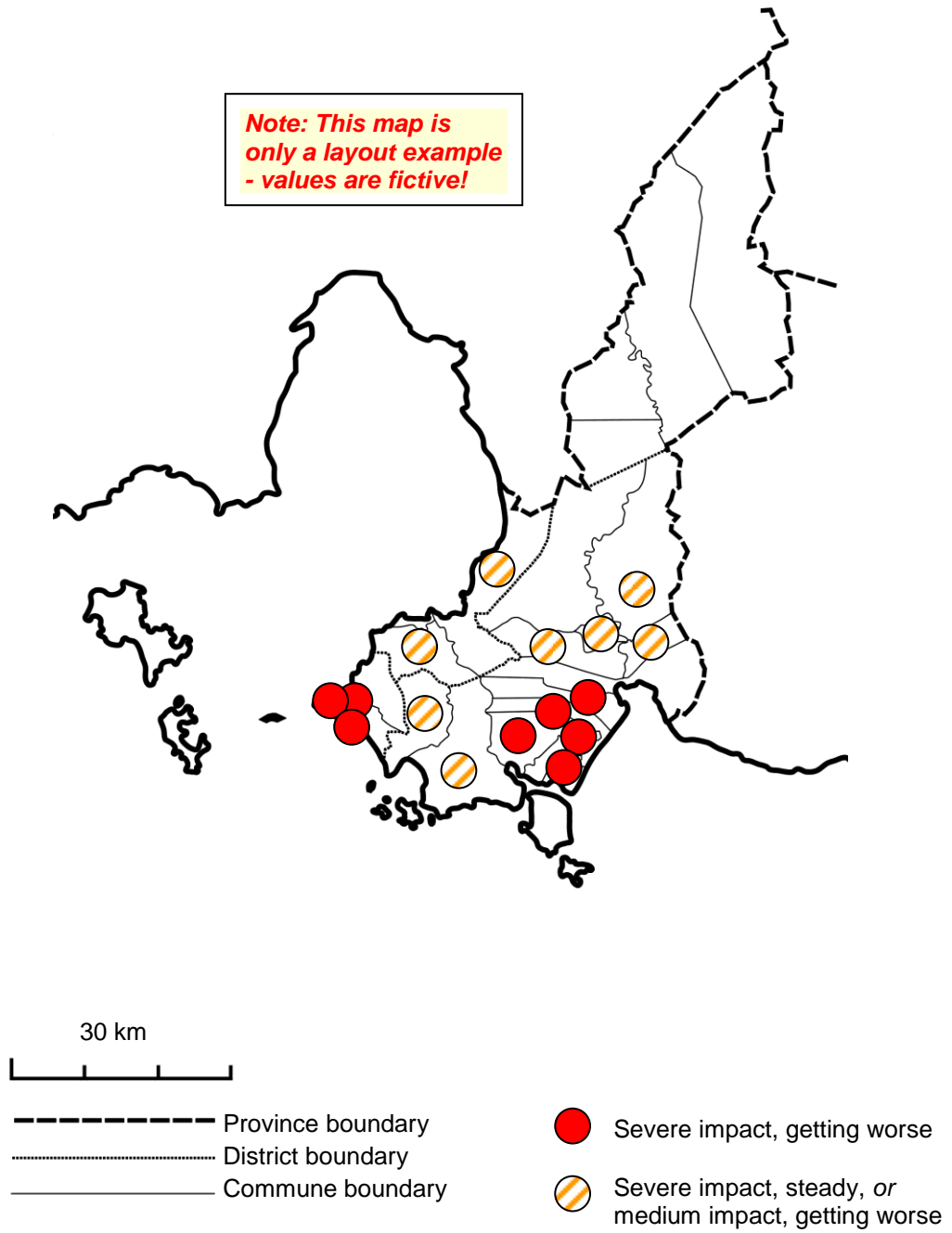
Summary of Climate-related Vulnerability

A summary of severe climate-related impacts (reflecting vulnerabilities and exposure) is provided in the following figures. They combine the various combinations of exposure and significance across the categories listed above, as summarised in the previous table. Detailed maps are attached as Appendix B.

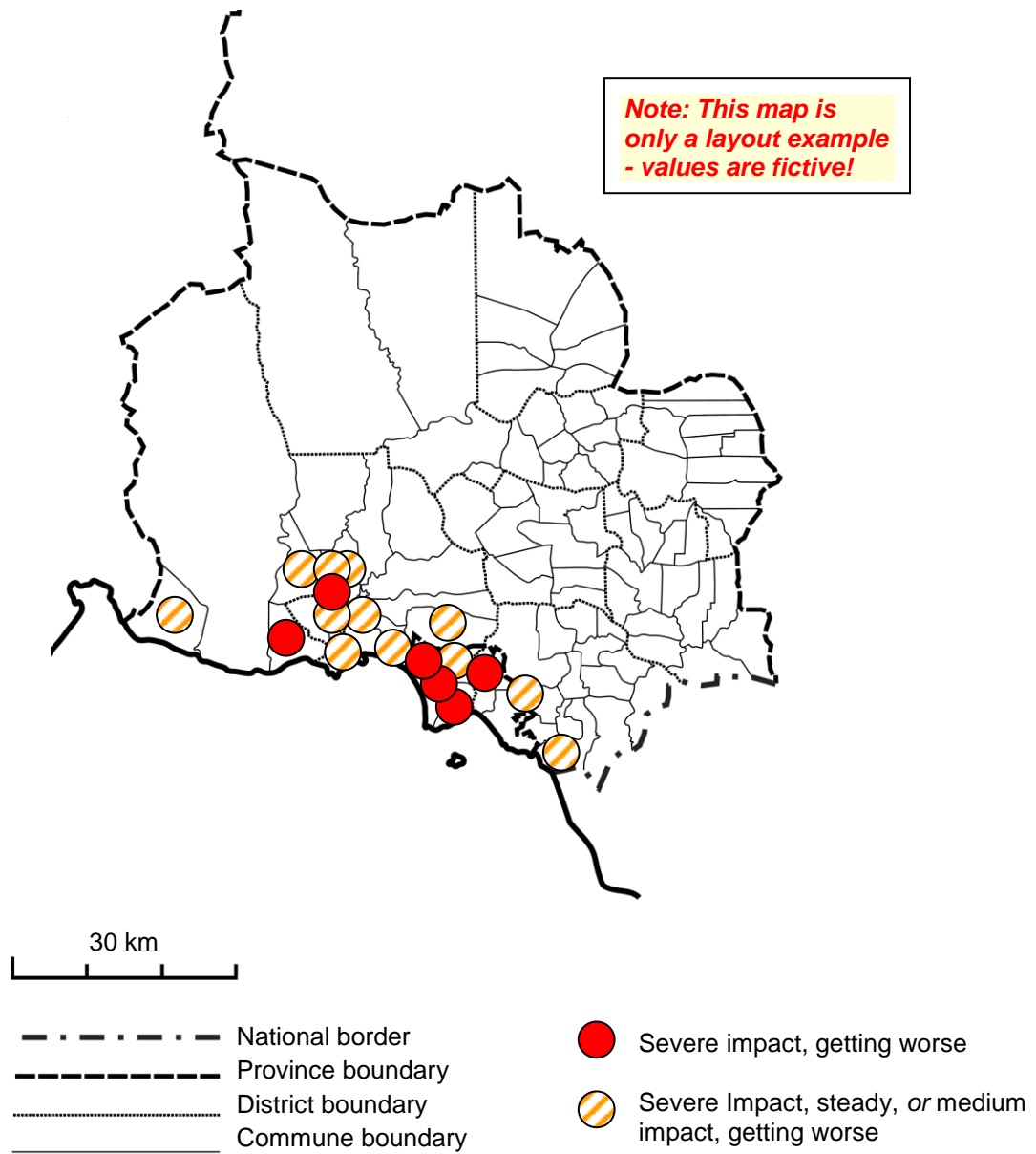
Map xa: Over-all climate-related vulnerability, Koh Kong Province



Map xb: Over-all climate-related vulnerability, Preah Sihanouk Province



Map xc: Over-all climate-related vulnerability, Kampot and Kep Provinces

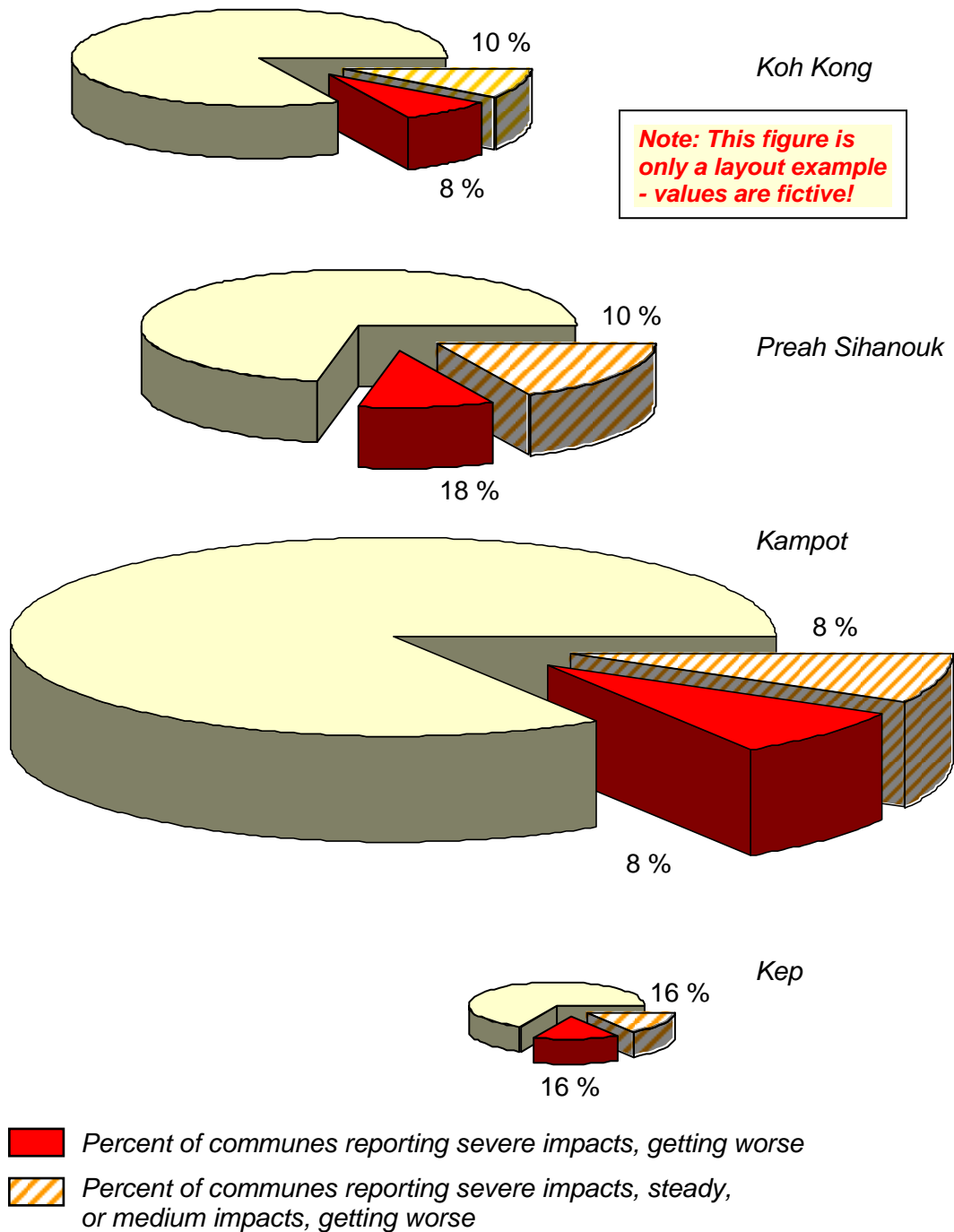


4 Households

Households are, from place to place, exposed to storms; erratic rainfall; floods; and saline intrusion; which directly affect important facilities such as access to safe water, sanitation and electricity. (Also, many households are exposed to vulnerabilities of cultivation systems, which can affect food security and livelihoods. These are covered in the following chapter).

An overview is provided in the figure below, with details in Appendix B.1.

Figure x: Vulnerability of households - overview



5 Cultivation

In the coastal area, cultivation systems are, from place to place, exposed to storms; erratic rainfall; floods; and saline intrusion. This, in turn, causes poor drainage, soil deterioration, and reduced yields (or failed crops).

An overview is provided in the figure below, with details in Appendix B.2

Figure x: Vulnerability of cultivation systems - overview

6 Infrastructure and Coastline Stability

Infrastructure - roads, dykes, canals, water gates, drainage systems, and water and power supplies- are, from place to place, exposed to storms; floods; and sea level rise. The coastline stability is vulnerable to increased sea level, storms, and floods.

This causes structural damage and a variety of consequential, severe social and economic impacts.

An overview is provided in the figure below, with details in Appendix B.3.

Figure x: Vulnerability of infrastructure and coastlines - overview

7 Habitats and ecosystems

In the coastal area, habitats and ecosystems include precious assets such as marine habitats (coral reefs and sea grass beds); coastal habitats (mangroves); inland aquatic habitats (wetlands and active floodplains); and forests. These systems are, from place to place, affected by storms, floods, and saline intrusion (as well as pollution).

An overview is provided in the figure below, with details in Appendix B.4

Figure x: Vulnerability of habitats and ecosystems - overview

8 Adaptation Needs and Management Options

Between them, the vulnerabilities indicate a suite of urgent adaptation needs, as indicated in the following table.

Table x: Potential adaptation measures

Households	• •
Cultivation systems	• •
Infrastructure, coast erosion	• •
Habitats and ecosystems	• •

The various options are partly related (as it is the case for the vulnerabilities) and can (in many cases) add value to each other. Also, many of the options have social, economic and environmental benefits that reach beyond the scope of climate adaptation.

Adaptation plans are in preparation as a separate activity.

References and Literature

Most titles are available from the Internet

- ADB (April 2013): Asian Water Development Outlook 2013 - *'Measuring Water Security in Asia and the Pacific'*
- CARDI, GEF and UNDP (November 2010): Listen to Villagers on Climate Change - Vulnerability Reduction Assessment (VRA)
- CARE (2009): Climate Vulnerability and Capacity Analysis (CVCA)
- CARP (July 2012): Vulnerability of existing agricultural practices. Working paper prepared under the Coastal Adaptation and Resilience Planning (CARP) Component of Cambodia Climate Change Alliance
- Danida (June 2008): Climate change screening of Danish development cooperation with Cambodia (104.DAN.4-52-9-2)
- Danida (2008): Risk Screening Matrix
- EU (May 2012): Country Environment Profile, Royal Kingdom of Cambodia. Final Report prepared by Steffen Johnsen and Greg Munford, Euronet Consortium, for the European Union Delegation To Cambodia
- IISD, IUCN, SEI et al, (2007): Community-based Risk Screening Tool – Adaptation and Livelihoods (CRiSTAL)
- MAFF (December 2011): Climate change adaptation training needs assessment guideline - developing multi-scale climate change adaptation strategies for farming communities in Cambodia. Prepared by the Department of Agricultural Extension (DAE) project team
- MOE (December 2009): Second National Communication of Cambodia Under United Nations Framework Convention on Climate Change (UNFCCC) (draft). Part 1: Vulnerability, impact and adaptation assessment to climate change; Part 2: Historical and future climate change of Cambodia; Part 3: Impact of climate change on rice production of Cambodia. Ministry of Environment
- MOE and UNDP (August 2011): Cambodia Human Development Report 2011. Building resilience: The future of rural livelihoods in the face of climate change. Ministry of Environment of Cambodia and UNDP Cambodia
- MOP and WFP (August 2012): IDPoor Atlas - Identification of Poor Households in Cambodia. Results from Data Collection Rounds 4 (2010) and 5 (2011). Ministry of Planning and World Food Programme
- NIS (March 2012): Economic Census of Cambodia 2011. National Institute of Statistics, Ministry of Planning
- Olhoff, Anne and Caroline Schaer (February 2010): Screening tools and guidelines to support the mainstreaming of climate change adaptation into development assistance – a stocktaking report. Published by the Environment & Energy Group of the United Nations Development Programme
- PPCR (October 2012): Synthesis Report on Vulnerability and Adaptation Assessment for Key Sectors Including Strategic and Operational Recommendations. Prepared by Hatfield Consultants for Ministry of Environment under Pilot Program for Climate Change Resilience

- Rizvi, A.R. and Singer, U. (2011): Cambodia Coastal Situation Analysis. Building Resilience to Climate Change Impacts, Coastal Southeast Asia No.6, Published by IUCN, Gland, Switzerland
- RGC (October 2006): National Adaptation Programme of Action to Climate Change (NAPA). Prepared by Ministry of Environment for the Royal Government of Cambodia
- Srun Darith and Sann Vathana (November 2009): Climate change - a challenge for food security and nutrition in Cambodia. Council for Agricultural and Rural Development (CARD)
- Trærup, Sara and Anne Olhoff (September 2011): Climate risk screening tools and their application - a guide to the guidance. UNDP, UNEP and UNEP Risoe Centre
- UNDP (March 2012): Small Grants Programme, Cambodia. Guidebook for Practitioners – Implementing the Vulnerability Reduction Assessment
- UNDP (May 2010): A toolkit for designing climate change adaptation initiatives
- UNDP (2010): Screening Tools and Guidelines to Support the Mainstreaming of Climate Change into Development Assistance – A Stocktaking Report
- USAID (2007): Adapting to Climate Variability and Change: A Guidance Manual for Development Planning
- Yusuf, Arief Anshory and Herminia A Francisco (January 2009): Climate change vulnerability mapping for Southeast Asia. Economy and Environment Program for Southeast Asia (EEPSEA)

Appendix A: Members of the Technical Working Groups

Koh Kong

Preah Sihanouk

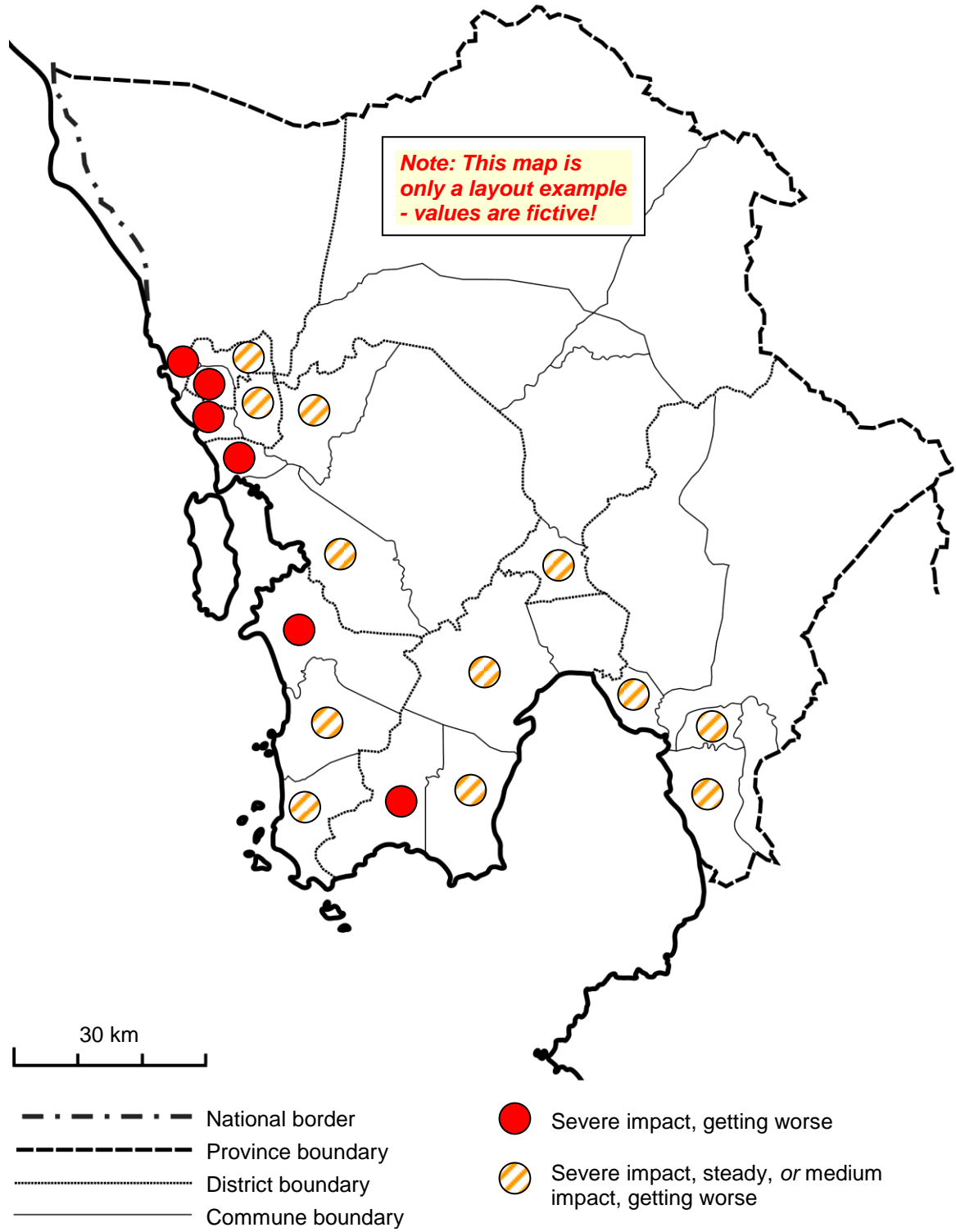
Kampot

Kep

Appendix B: Vulnerability Maps

B.1 Households

Map xa: Vulnerability of households, Koh Kong Province



Map xb: Vulnerability of households, Preah Sihanouk Province

Map xc: Vulnerability of households, Kampot and Kep Provinces

B.2 Cultivation

Map xa: Vulnerability of cultivation systems, Koh Kong Province

Map xb: Vulnerability of cultivation systems, Preah Sihanouk Province

Map xc: Vulnerability of cultivation systems, Kampot and Kep Provinces

B.3 Infrastructure and Coastline Stability

Map xa: Vulnerability of infrastructure and coastline stability, Koh Kong Province

Map xb: Vulnerability of infrastructure and coastline stability, Preah Sihanouk Province

Map xc: Vulnerability of infrastructure and coastline stability, Kampot and Kep Provinces

B.4 Habitats and Ecosystems

Map xa: Vulnerability of habitats and ecosystems, Koh Kong Province

Map xb: Vulnerability of habitats and ecosystems, Preah Sihanouk Province

Map xc: Vulnerability of habitats and ecosystems, Kampot and Kep Provinces

Appendix C: Vulnerability Data Tables

C.1 Koh Kong

Households

Note: This table is only a layout example - values are fictive!

Code	Name	Safe water	Sani-tation	Elec-tricity	Floods	Storms	Water short-age	Pollu-tion
0901	Botum Sakor District							
090901	Andaun Tuek	M →	M ↑	L →	L →	M →	M ↑	L →
090102	Kandaol	M →	H →	L →	L ↑	M ↓	M ↑	M ↑
090103	Ta Noun	M ↑	M ↑	L →	L →	H ↑	H ↑	L →
	... etc.							

H: High impact; M = medium impact; L = low impact

↑ : Increasing impact; → : steady impact; ↓ decreasing impact

Cultivation Systems

Infrastructure and Coast Erosion

Habitats and Ecosystems

C.2 Preah Sihanouk*Households**Cultivation Systems**Infrastructure and Coast Erosion**Habitats and Ecosystems***C.3 Kampot***Households**Cultivation Systems**Infrastructure and Coast Erosion**Habitats and Ecosystems***C.4 Kep***Households**Cultivation Systems**Infrastructure and Coast Erosion**Habitats and Ecosystems*