

## Country Paper: Cambodia

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### I. Country Background

The Kingdom of Cambodia is located in mainland Southeast Asia between latitudes 10° and 15° N and longitudes 102° and 108° E. Cambodia covers an area of 181,035 km<sup>2</sup> with a total population projected at about 13.4 million people in 2008 (NIS, 2008). Approximately 80 % of this population lives in rural areas. Cambodia shares its border with Thailand in the west and north, with Laos in the north, and with Vietnam in the east and south/southeast and has a coastline in the south/southwest, in the Gulf of Thailand Cambodia has a coastal line of approximately 435 km in the south and southwest of the country. Economic Exclusive Zone in the Gulf of Thailand is estimated to be 42,000 km<sup>2</sup>.

Cambodia is a least developed country, with a GDP per capita of US\$297 in 2002 and increased to US\$594 by 2007. The agriculture sector has accounted for approximately 60.4% of employment, industry sector for 14% and services sector for 25.6% in 2007(NIS, 2003, 2008). Agricultural production is dependent on the annual flooding and recession of the Tonle Sap Lake and the Mekong River, which brings fertile alluviums to the central plains. In 20004, 19.7% of population lived below the national food poverty line (RGC, 2007).

According to the Cambodia socio-economic survey in 2007 related to drinking water indicated that the main sources of drinking water during rainy season was raining water (26.8%), tube/piped wells or borehole (22.9%), pond/river or stream (12.6%), piped in dwelling on premises (14.4%), protected dug well (12.5%), unprotected dug well (5.8%) and in dry season: tube/piped wells or borehole (26.8%), pond/river or stream (22.2%) by households especially in rural areas (NIS, 2008).

### II. Historical Information on Climate Change, Climate Variability and Climate Extremes

#### 1. Climate and Climate Extreme

Cambodia's climate is dominated by the tropical monsoon with distinct rainy/wet and dry seasons. During the rainy season (May to October), winds blow from the Indian Ocean southwest landward bringing heavy rains. During the dry season (November to May) winds blow from the northeast. Hot air dominates from April to May and cooler air from November to March.

The average maximum temperature is around 28°C and the average minimum temperature around 22°C. April is the warmest month, and January is the coldest. Maximum temperatures exceeding 38°C are recorded every year during the dry season just before

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starting raining season (March-April). Minimum temperatures rarely fall below 10°C in the central plains.

From 1994 to 2006, the average annual rainfall has fluctuated between 1,400 mm and 1,926 mm. The spatial distribution of rainfall is unequal. Precipitation in the coastal areas may be as high as 5,000 mm per year. The central agricultural plains, stretching from the southeast to the northwest, receive less than the annual average but benefit from flood water. The rainy season accounts for 90% of annual rainfall.

Although Cambodia has an extensive coastline along the Gulf of Thailand, the country is not bordered by the Pacific Ocean. Thus, the direct impacts of typhoons are buffered by mountainous regions and highlands to the east. Flood and drought are the most common natural disasters and results in loss of lives, crop failures, and destruction of property and infrastructure (NAPA 2006).

## **2. Floods and Droughts**

The Mekong, Bassac, Tonle Sap Rivers, and Tonle Tap Lake constitute a unique hydrological system and have played a central role in Cambodia's agriculture and traditional livelihoods. The Mekong River and the Tonle Sap Lake are connected by the Tonle Sap River which reverses its flow annually. From July to October, as the Mekong swells with monsoon rains, waters flow into the Tonle Sap River to fill Lake Tonle Sap, increasing its size three times from 2,600 km<sup>2</sup> to 10,500 km<sup>2</sup>. With an estimated storage capacity of 72 km<sup>3</sup>, Lake Tonle Sap becomes the largest body of freshwater in Asia during the wet season. As the floods of the Mekong subside in November and water levels decrease, the Tonle Sap River reverses its flow. The seasonal floods of the Mekong and its tributaries and Tonle Sap Lake provide nutrients essential to agricultural soils, and breeding and nursing grounds for fish. Tonle Sap Lake is one of the most productive freshwater fisheries in the world (Worldfish 2008).

Annual flooding provides nutrients to soils, water rice farming and agriculture, and habitat for fish breeding. Cambodia's rural communities have traditionally lived by regular patterns of flooding by the Mekong River, its tributaries and Tonle Sap Lake. Rural livelihoods have adapted to floods, which are considered beneficial as long as they are predictable in terms of frequency, timing, duration and intensity. However, the frequency of severe floods has increased since the 1990s (NAPA 2006).

Floods affected 1.6 million Cambodians in 1996, 3.4 million in 2000 and 1.7 million in 2001 (CRED, NCDM & WFP, 2005). Intense and prolonged flood periods are characterised by mass displacement of populations, and water and food shortages. The results are increased poverty and chronic food insecurity. The year 2000 floods were the worst to hit Cambodia in seventy years, and were followed by similarly severe floods in 2001 and 2002. The NCDM put the death toll at 347 fatalities (80% of whom were children), 317,975 houses damaged or destroyed. Total direct physical damages to infrastructures, properties and crops were estimated at US \$150 million. The 1990-2000 records suggest that floods have resulted in average annual losses of 100 lives and financial losses in the range of US \$100 to 170 million.

All provinces in Cambodia are vulnerable to floods, but the general pattern differs between four broad clusters of provinces (NAPA, 2006). Cluster 1 consists of provinces located north of Phnom Penh, upstream along the Mekong and Tonle Sap Rivers. Cluster 2 consists of provinces located south of Phnom Penh, downstream along the Mekong and Tonle Bassac

Rivers. Cluster 3 consists of provinces located around Tonle Sap Lake. Cluster 4 consists of the coastal provinces.

While floods affect lowland areas bordering the Mekong and its tributaries, drought is geographically widespread and affects a larger number of people (NCDM, 2002; MoP, 2005). The same provinces may be affected successively by drought and flood in the same year. Provinces vulnerable to drought are equally vulnerable to flood (NAPA, 2006). The 1995, 1996 and 1998 drought led to widespread crop failure and famine. An estimated 2.5 million people were affected each year by the droughts of 1995, 1996 and 2002.

The household survey conducted as part of the NAPA report preparation found that nationwide, some 71% of villagers had noticed an increase in the frequency of droughts in recent years, compared with 58% for floods. Water shortages are common all-year around for 81% of households, which significantly limits local capacity to cope with drought. Since only a third of rural Cambodians have access to safe drinking water, and less than 34% of cultivated land is irrigated, Cambodia ability to cope with drought is severely limited (CIPS 2004, WFP 2005).

### **III. Projections of Future Climate, Climate Change and Climate Change Impacts**

The projection of future climate, climate change and its impact of Cambodia which were conducted for the Cambodia's Initial National Communication to the UNFCCC by using two General Circulation Models CCSR and CSIRO indicated that the mean annual temperatures could increase between 0.3 to 0.6°C by 2025 and 1.6 to 2.0°C by 2100; and mean annual rainfall could increase between 3% to 35% by year 2100 with the magnitude of change varying with time and location. Lowland areas would have higher increase in rainfall than highlands. The modelling of changes in precipitation projected that the increase would mainly be in the central agricultural plains stretching from the southeast to the northwest, where rainfall has historically been below the national average. These areas are already vulnerable to floods and drought. These may yield clues as to the impact of increased precipitation on wet season floods and dry season droughts.

The main finding of the projection of Cambodia climate which conducted by Oxford University shows that: the mean annual temperature is projected to increase by 0.7 to 2.7°C by the 2060s, and 1.4 to 4.3 degrees by the 2090s. The range of projections by the 2090s is around 1.0 to 1.5°C. All projections indicate substantial increases in the frequency of days and nights that are considered hot in current climate. Projections of mean annual rainfall from broadly indicate increases in rainfall. This increase is mainly due to the projected increases in wet season rainfalls, partially offset by projected decreases in dry season rainfalls (McSweeney, New & Lizcano 2008).

### **IV. Sensitivity and Vulnerability of Water Related Sectors to Climate Change**

As part of its Initial National Communication, Cambodia conducted a Vulnerability and Adaptation Assessment (V&A) which examined the impacts of climate change on agriculture (rice production), forestry (forest types), human health (malaria) and coastal zone (sea level rise) (INC 2002). This section reports the projected impacts on agriculture, forestry and the coastal zone, in particular with regards to water resources management.

#### **1. Agriculture**

The V&A assessment was conducted for rice cultivation, as it forms the backbone of traditional livelihoods and constitutes Cambodia's main staple food. Flood and rainfall patterns play a determining role in paddy cultivation. The absence of widespread irrigation

and water harvesting schemes in Cambodia makes this sector particularly vulnerable to climate change. Yield anomalies for wet season rice yield is correlated with May rainfall, when farmers start planting seedlings. Water shortages during this month have critical negative impacts on the early stages of plant growth. Under projected climate conditions, the variability in yields and crop output would increase. With the potential increase in the frequency and intensity of floods in the central agricultural plains, farmers would be exposed to higher risks of crop failure. The V&A identified the following adaptation options: genetic improvement of high yielding varieties, improvement of cultural practices, development of early warning system for climate extremes, development of irrigation, expansion of planting to other areas, and diversification of foods.

## **2. Coastal Zone**

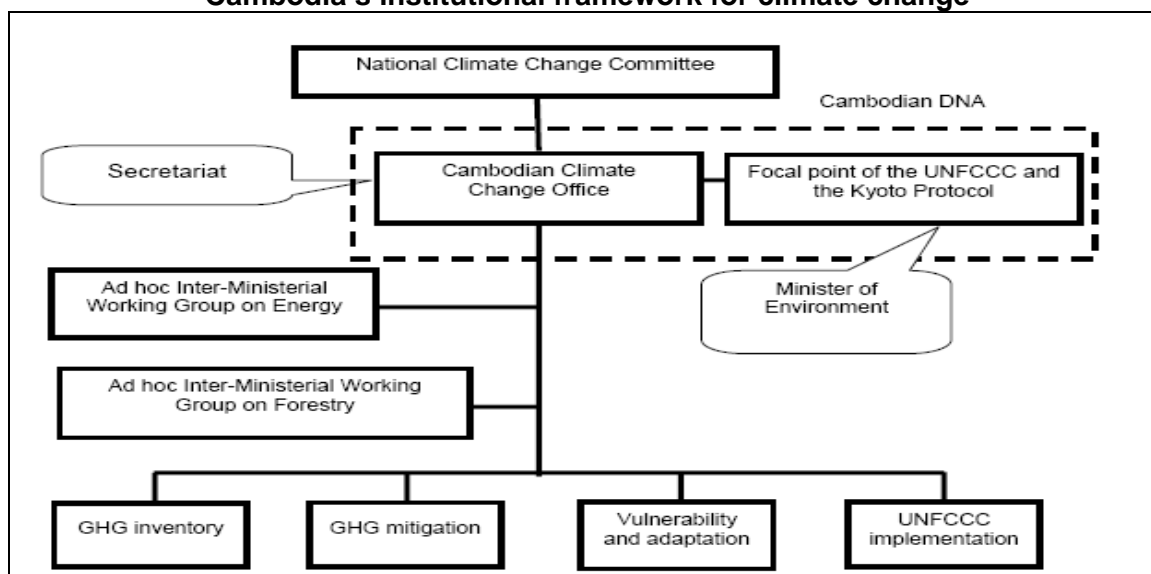
Cambodia's coastline is 435 km long. Coastal areas have not been traditionally densely populated and account for only 5% of the total population. In recent years, coastal zones have become more socio-economically important with developments in international trade, offshore oil and gas, tourism, fisheries and agriculture. Under changing climate, sea level rise would have significant negative impacts on fisheries, ports, tourism facilities, agriculture, salt farms and other coastal land uses. Mangroves and coral reefs, which support coastal communities, are the ecosystems most threatened by rises in sea level and temperatures. Projections made under the Initial National Communication show that a one-meter sea level rise would submerge about 56% of the low-lying coastal city of Koh Kong, located in the southwest. Other parts of the coastal zone are equally vulnerable and would require further studies. The recommendations of the V&A Assessment include: development of a national strategy to respond to sea level rise; investigation of the potential impacts of sea-level rise on coastal resources, infrastructure, settlements and agriculture; and increase of public awareness.

## **V. Institutional Framework to Address Climate Change and Adaptation in Cambodia**

Cambodia ratified the United Nations Framework Convention on Climate Change (UNFCCC) on December 18, 1995 and acceded to the Kyoto Protocol on July 2, 2002. The country's Initial National Communication (INC) was submitted to the UNFCCC on October 8, 2002. The INC was prepared by the Ministry of Environment (MOE), which is the National Climate Change Focal Point. The Second National Communication (SNC) was initiated in January 2007 and is expected to be completed in December 2009.

In June 2003, the Cambodian Climate Change Office (CCCO) was established within the Ministry of Environment. CCCO has the broad mandate of carrying out all technical activities related to the implementation of the UNFCCC and other climate change-related tasks as assigned. CCCO acts as the secretariat of the UNFCCC, National Focal Point and a Designated National Authority under the Kyoto Protocol for Clean Development Mechanism (CDM) activities. CCCO's role is to facilitate and coordinate donor and private sector activities relevant to climate change. While CCCO is a technical unit, the National Climate Change Committee (NCCC), established by Ministerial Sub-decree on 24 April 2006, is a senior policy-making body. The Committee is an inter-ministerial mechanism with the mandate to prepare, coordinate and monitor the implementation of policies, strategies, legal instruments, plans and programmes of the Royal Government of Cambodia to address climate change. The NCCC is cross-sectoral and is composed of Secretaries and Under-Secretaries of State from 19 Ministries and government agencies whose mandates are relevant to climate change adaptation or mitigation activities. The NCCC meets at least twice yearly and more often if needed. Cambodia does not yet have a national climate change policy.

### Cambodia's institutional framework for climate change



## 1. National Adaptation Programme of Action to Climate Change (NAPA)

Cambodia was among the first least developed countries to complete its National Adaptation Plan of Action to Climate Change (NAPA) and submitted it in March 2007 to the UNFCCC. Approved by the Council of Ministers in October 2006, the implementation of the NAPA is designed to contribute significantly to the Cambodian Millennium Development Goals (MDGs) and national sustainable development objectives. The aim has been to develop a realistically achievable country-driven programme of action and priority activities addressing the needs for adapting to the adverse impacts of climate change. The climate hazards addressed by Cambodia's NAPA are flood, drought, windstorm, high tide, salt water intrusion and malaria.

The formulation of Cambodia's NAPA has relied on consultations from the grassroots level to policy-makers. Countrywide surveys of local authorities, non-governmental organisations, and more than 700 households were conducted in 17 provinces to identify existing coping mechanisms to climate hazards and climate change adaptation needs. The NAPA followed a participatory process involving the rural communities most likely to be affected by climate change (NAPA 2006). Provincial and national consultations were consulted to validate the prioritisation of Cambodia's proposed activities for adaptation to climate change. Adaptation projects were ranked according to criteria for improvement of livelihoods, food security, water availability, use of appropriate technology, responsiveness to immediate community needs, and sustainability.

The proposed projects are "no regrets" in nature, that is, they are already justified by current climate conditions and would contribute to national sustainable development regardless of the magnitude of climate change impacts on Cambodia. Under changing climate conditions, including higher frequencies of climate hazards, the selected priority activities would be even more attractive. A total of 39 project profiles were developed, amounting to an estimated budget of US \$130 million, of which 20 priority projects. Proposed activities in water resources management include rehabilitation and construction of reservoirs, dams, wells, ponds, flood protection dikes, provincial waterways, water gates, water culverts, and strengthening of community disaster preparedness.

The NAPA has also identified a number of barriers to the implementation of climate change adaptation projects in Cambodia. These include: (i) inadequate technical, financial and

institutional capacity of Government agencies and of local communities in dealing with climate hazards Government agencies, and limited coordination among them; (ii) limited integration of climate change issues into national policies and programmes; and (iii) limited awareness of climate change issues. Close to two years after the completion of the NAPA, the Royal Government of Cambodia (RGC) has had little success in attracting donor interest in funding the implementation of NAPA projects.

## **2. Research in Climate Change Adaptation Related to Water Resources**

To date, Cambodia's academic and scientific research capacity remains low. The bulk of research in climate change adaptation has been conducted as part of the Initial National Communication and the National Adaptation Programme of Action to Climate Change.

The NAPA provides the most up to date the synthesis of available information on the adverse impacts of climate change, climate variability and adaptation to climate hazards in Cambodia. The NAPA, through the implementation of surveys of households, NGOs, local authorities, and informal leaders in rural areas, provides a nationwide picture of existing climate hazards, and vulnerability and adaptation to climate change (MOE 2005a). A total of 17 hazard prone provinces were selected for questionnaire administration: 1,154 households, 82 local authorities and 10 NGOs were interviewed. Without exception, all seventeen provinces surveyed had suffered from both floods and droughts.

In addition to flood, in the 17 provinces surveyed, villagers considered drought to be an equally severe climatic hazard. The year 2003 was the year of most severe drought (50% of respondents), followed by 2004 (32% of respondents). Every single year since 2000 had experienced either severe droughts or floods. The main sources of irrigation water for agriculture are lakes (19%), rain (18%), rivers (13%), streams (12%), and reservoirs (11%). Piped water is an insignificant source of water. Water shortages are a common all year-round: 81% of households interviewed suffered from water shortages for agricultural uses, while 54% suffered from water shortages for personal uses.

## **VI. Mainstreaming of Climate Change Adaptation Strategies or Policies into National Development Agenda**

The national development priority is to reduce poverty towards the achievement of Cambodia's Millennium Development Goals (CMDGs), which include the eight goals of the United Nations MDGs, and a ninth goal of zero impact from landmines and unexploded ordnance (UXO) by 2012. To achieve the CMDGs, total financial outlays of US \$3.5 billion are required for the period 2006-2010.

The first and second Socio-Economic Development Plans (SEDP) consist of five-year development goals and strategies for the periods 1996-2000 and 2001-2005. The National Strategic Development Plan (NSDP) 2006-2010 is a broad framework to harmonise development efforts and aid-effectiveness, and includes the goals and strategies of the SEDPs, the National Poverty Reduction Strategy (2002) and the CMDGs. The cornerstone of the NSDP is the government's Rectangular Strategy (RS) for growth, employment, equity and efficiency. The Rectangular Strategy consists of good governance and public sector reform, and covers agriculture, infrastructure, human resources, and employment through the private sector.

The negative impacts of climate change are only discussed briefly in the SEDP II, under goals and strategies for the environment, agriculture and disaster relief. Rural livelihoods are vulnerable to the adverse impacts of climate extremes, in particular flooding and drought. As agricultural development is central to poverty reduction efforts, the Government intends to strengthen disaster preparedness, and meteorological and hydrological networks.

Cambodia's constitution discusses environment and sustainable development issues. Numerous Royal Decrees and National Laws are relevant to environment and sustainable development, but do not explicitly mention climate change. These include the Royal Decree on the Creation and Designation of Protected Areas (1993), the Law on Environmental Protection and Natural Resource Management (1996), and the Forestry Law (2002). Thus, with the exception of the NAPA, climate change issues are yet to be fully included into the national development agenda.

## **VII. Conclusion**

The Mekong, Bassac, Tonle Sap Rivers, and Tonle Tap Lake constitute a unique hydrological system and play a central role in Cambodia's agriculture and traditional livelihoods. The seasonal floods of the Mekong and its tributaries and Tonle Sap Lake provide nutrients essential to agricultural soils, and breeding and nursing grounds for fish.

Increases in mean annual temperatures and the frequency of hot days and nights have already been observed in Cambodia since 1960. Climate projections forecast substantial increases in the frequency of days and nights that are considered hot in current climate conditions. The potential increase in the frequency and intensity of floods in the central agricultural plains would expose farmers to higher risks of crop failure. Floods and droughts are already the most common natural disasters and results in yearly loss of lives, crop failures, and destruction of property and infrastructure.

To cope with changing climatic conditions, Cambodia has completed a National Adaptation Programme of Action to Climate Change. The implementation of the NAPA would contribute significantly to the Cambodian Millennium Development Goals (MDGs) and national sustainable development objectives. The aim has been to develop realistically achievable country-driven priority activities addressing the needs for adapting to the adverse impacts of climate change. However, two years after the completion of NAPA, Cambodia has struggled to attract donor interest in financing the implementation of high priority adaptation activities.

With regards to adaptation to climate change in the water sector, Cambodia could suffer from the negative impacts of adaptation measures undertaken by its upstream neighbor's countries on the main rivers. Any development in hydropower, agriculture and industry that may have negative impacts on the hydrology of these main rivers would constraint Cambodia's ability to adapt to climate change itself. The most significant threat would be on inland fisheries and floodplain agriculture, particularly those relying on the flood regime surrounding Tonle Sap Lake.

In order to address the urgent climate change adaptation needs in Cambodia, stakeholder consultations under the MRC Climate Change Initiative project in January 2009 in Phnom Penh have prioritised the following activities for funding: (1) Implementation of NAPA priority activities, (2) Climate change awareness raising campaigns (3) Mainstreaming of climate change adaptation into development, (4) Institutionalisation of an inter-organisational climate change coordination mechanism, (5) Integration of climate change adaptation into the national budgetary process, (6) Formulation of climate change adaptation and climate change proofing legislation/policies, (7) Strengthening of climate change research, (8) Riparian country cooperation to address trans-boundary issues related to adaptation activities.

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