ISSN 1560-7607 / ISBN 978-99950-52-05-8

A Publication of CDRI—
Cambodia's leading independent
development policy research institute

CAMBODIA DEVELOPMENT REVIEW

VOLUME 16, ISSUE 4 DECEMBER 2012 $4.00

CLIMATE CHANGE AND WATER GOVERNANCE IN CAMBODIA[1]

Climate Change Matters

Climate change is expected to result in modified weather patterns in the Lower Mekong Basin (LMB), in terms of both temperature, rainfall and wind and also the intensity, duration and frequency of extreme events, affecting ecosystems, agriculture and food production and livelihoods. Typical livelihoods in the LMB are reliant on natural resources and therefore likely to be adversely affected by the impacts of these shifts. Current predictions of how the climate is likely to have changed in the LMB by 2030 indicate mean temperature rise of 0.79°C, precipitation increase (mainly in the wet season) of 20 cm (13.5 percent), and Basin runoff rising by up to 21 percent (107,000 million cubic metres). Increased flooding will likely affect all parts of the LMB, but especially downstream areas (Eastham *et al*. 2008). Cambodia is no exception with regard to these climate change phenomenon.

Cambodia's Tonle Sap Lake is the largest freshwater lake in Southeast Asia. Part of the Mekong system, the Lake's resources directly or indirectly benefit the livelihoods of almost half of Cambodia's population, particularly fishers and farmers. While climate change will likely alter the lake-floodplain system over the next few decades, new hydropower developments could have immediate adverse consequences for local livelihoods and food security. The Lake is particularly vulnerable as climate change will affect the Basin's unique flood pulse system, subsequently altering water regimes (Eastham *et al*. 2008).

Damnak Ampil Scheme, Pursat province, November 2012

Cambodia has experienced increasingly frequent flooding, drought and windstorms since 1989, such as the 2000 and 2011 floods. Indicative of the changing climate, disasters and climate-related hazards exact huge socio-economic costs on the country. The floods in 2000 and 2011 were perhaps the most devastating in recent history, displacing hundreds of thousands of people, causing hundreds of deaths and other losses. The extensive flooding in 2011 destroyed much of the past 10 years investment in infrastructure in both rural and urban

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areas of the Tonle Sap and Mekong Floodplains. Because of immediate daily dependence on natural resources availability and agricultural farming along with low adaptive capacities arising from low social economic status, rural Cambodian livelihoods are exceptionally vulnerable to climate change (Yusuf & Francisco 2009).

The urgent need for a proper study of adaptive capacity and vulnerability at national, regional and community levels is confirmed by many contemporary studies on hydrological changes resultant of climate change and economic infrastructure development. For example, a recent comprehensive assessment of human-induced change at catchment level highlights the vulnerability of local fishing and farming communities and reports that the Tonle Sap Basin (TSB) is undergoing worrying hydrological change (Chem & Someth 2011a). Many farmers face water excesses in the wet season and severe water shortages in the dry season, leading to mounting tension and conflicts over agricultural water supplies between upstream and downstream farmers. AusAID's "Exploring the Tonle Sap Futures" study reports similar hydrological changes in the TSB (Keskinen *et al.* 2011). Infrastructure development rather than climate change is more likely to cause changes in the Tonle Sap flood pulse and water regime over the next 30 years. There is an imperative therefore to model infrastructure developments as variables and to advance understanding of climate change (Keskinen *et al.* 2011).

During recent field reconnaissance to make a preliminary assessment of issues related to water governance, climate change and adaptive capacities in Kampong Chhnang, Pursat and Kompong Thom provinces, almost all the locals consulted believe that the climate is changing. For example, the timing of the monsoon seasons has shifted with the early dry season from November to February being less cool than usual, and the rainfall pattern has also changed in the last few years in that the rains start late and end late. These changes, however, may vary depending on location. The shift in the timing of the rainy season has implications for both wet and dry season farming. Wet season farmers have had to switch to short and medium maturing crop varieties to cope, whereas dry season farmers have had to delay rice cultivation because of continuing rain. Some dry season broadcasted rice has been lost to irregular and unpredictable weather. Local people's concerns lay in the more frequent occurrence of flooding and lightning storms that affect their livelihoods, especially agricultural production, and which they view as part of their vulnerability to climate change. So far, there is no mechanism to cope with these anomalies.

Local people associate adaptation to natural system changes resultant of climate change and human activities with the hard and soft mechanisms already in place at provincial and community levels to address vulnerability to climate change, e.g., water scarcity and increasing irrigation demand in the dry season. These adaptation mechanisms include: government policy and intervention to encourage more water storage in the catchment; strengthening management by improving the capacity of local farmer water-user communities (FWUC); integrating adaptive capacity into local planning such as the adoption of drought-tolerant crop varieties, water-saving irrigation practices, and soil and water conservation techniques: increasing local incomes through intensifying and diversifying cropping; and migrating to work in urban and agricultural development areas.

The Research

With funding support from the International Development Research Centre (IDRC), the Cambodia Development Resource Institute (CDRI) and several of its partners are undertaking a research project on the theme "Improving Water Governance and Climate Change Adaptation in Cambodia". Started in October 2012 with expected completion in September 2015, the project is taking place in three provinces around the Tonle Sap Lake: Kampong Chhnang, Pursat and Kampong Thom. The aim is to gain a better understanding of the livelihood implications of hydrological and ecosystem changes caused by climate change and human system change in the TSB and to improve methods of integrating these findings into Cambodia's policy and planning frameworks.

The research project consists of three studies. The first aims to identify (i) knowledge gaps by reviewing existing research on water-related impacts of climate change, and (ii) sound research methods to improve consistency, validity and reliability of future climate change adaptation studies through examining the qualitative and quantitative methods used in vulnerability studies. Drawing on the results of this first study, the second will evaluate hydrological change in three sub-catchments to understand the livelihood implications of the interactions between climate change and human activity and economic development in the Basin. At the same time, the third study will assess the efficiency and effectiveness of existing policies and institutional arrangements for water governance at local and provincial levels, and formulate strategies to bridge identified gaps. The results of these three studies will be synthesised and recommendations will inform local and provincial adaptation planning and initiatives.

To ensure that the research findings are well integrated and inform Cambodia's water management and climate change adaptation policies, and to contribute to knowledge of climate change in the country and the region, CDRI is collaborating with three government ministries, two universities and one regional institution. They are the Ministry of Water Resources and Meteorology (MoWRAM), Tonle Sap Authority (TSA), Ministry of Environment (MoE), Royal University of Agriculture (RUA), Institute of Technology of Cambodia (ITC), and the Mekong Programme on Water, Environment and Resilience (M-POWER).

Conceptual Framework

There is increasing concern about the possible damaging effects of climate change such as flood and drought. Cambodia contributes very little to the causes of climate change, yet stands to be disproportionately affected by the negative impacts of climate change due to low adaptive capacity and dependence on climate-sensitive livelihoods (MRC 2010; Yusuf & Francisco 2009; Keskinen *et al.* 2011). Climate change eventually affects water availability and, ultimately, livelihoods. It is therefore vital to link water availability and the need for sustainable livelihoods, i.e. water security, and especially to understand how water security relates to livelihoods, hazards and sustainability.

Water security is defined as access to adequate affordable safe water to maintain ecological health and meet human needs, which emphasises sufficient supplies of quality water for environmental flow requirements, human daily needs (drinking, hygiene, washing) and livelihoods. It covers the broad range of ecosystem protection, accessibility, affordability, food security, human health and development. Thus, ensuring sufficient quantity of adequate quality water at an affordable price to meet both short- and long-term needs to protect the health, safety, welfare and productive capacity of the population is a valid basis for any further study of the climate (Cook & Bakker 2012: 97).

The issues of protecting water systems from hazards such as flood, drought and infrastructure development, and safeguarding access to water functions and services need to be further explored. It is also important to examine water security in relation to prevention and protection against contamination and terrorism. The key message is that water security relates to sustainability and combines the above two perspectives to assess water security at all levels – from household to global needs. That is because every person should have access to adequate safe and affordable water while ensuring that environmental needs are met and ecosystems are protected (Global Water Partnership 2000 cited in Cook & Bakker 2012: 97).

Another school of thought focuses on vulnerability to climate change, defined as the degree to which a system is susceptible to damage or adverse impacts from climate change (IPCC 2000 cited in Warrick 2000: 2). Vulnerability is shaped by the extent of exposure, sensitivity and adaptive capacity (Warrick 2000) to changes in human and natural systems. Such changes affect social and environmental conditions and lead to more frequent natural disasters. According to Lyalomhe (2011), vulnerability creates exposure to climate variability, climate change and associated hazards including socio-ecological hazards; the human system exacerbates susceptibility to these hazards. Lyalomhe (2011) further states that the interaction between climate and human systems implies that socio-ecological impacts vary spatially due to variability of the determinants of vulnerability (flood, drought, windstorm). Warrick (2000) reiterates that variations and changes in the climate system cannot be viewed in isolation from human systems, i.e., population growth and distribution, technological and economic development, and social and cultural organisation, which play a critical role in determining the degree of exposure and sensitivity to climate hazards and therefore vulnerability.

A concept that helps build resilience to vulnerability is adaptive capacity. Smit *et al.* (2001 cited in Engle 2011: 686) define adaptive capacity as the ability of a system to prepare for stresses and changes in advance or adjust and respond to the effects caused by the stresses. Adaptive capacity, on the other hand, refers to the ability of those impacted to manage and influence their resilience to the changes (Walker *et al*. 2006 cited in Engle 2011: 649). Changes in the physical and social dimensions of human systems and changes in natural systems affect water availability and demand (Eastham *et al*. 2008; Phalla & Paradis 2011). Changes in water availability and demand shape the social conditions that make humans vulnerable such as socioeconomic, infrastructure and governance characteristics. Therefore, adaptation has become an important concept in climate change resilience.

The concept of water security brings to the fore an integrated approach to water management which includes agriculture, engineering, environmental science, policy and water resources (Cook & Bakker 2012) and is the single most important component for sustainable rice production in Cambodia. Supplying sufficient water to meet increasing demand for agriculture involves engineering to develop water infrastructure. Regulating the quantity and quality of water functions and services for human consumption and environmental services, and minimising climate and hydrological variability relate to environmental science. Moreover, the modelling approach can identify spatiotemporal water distribution, which is essential information for decision-makers to balance the demands of economic growth with environmental requirements in the context of climate change. The modelling approach involves different scales of analysis (empirical study at community level and modelling at catchment level) and different disciplines (physical and social sciences). By examining the changes and interactions in human and natural systems, greater knowledge can be gained about climate change exposure, hazards and coping capacity. This leads to the development of vulnerability indicators and indices that characterise baseline conditions for the monitoring of future changes. Assessment of changes in water availability and demand in relation to main water-users in the Basin and environmental flow requirements are based on downscaled hydrological and climatic modelling (for 20-year, 50-year and 100-year timescales) and participatory approaches adopted by CDRI (Chem *et al*. 2011b) and other organisations in Cambodia.

Conclusion

The review of the different concepts of climate change and human-induced change debated in the literature has compiled enough background material to identify the factors and methods appropriate for use in the research on water governance and climate change adaptation in the three catchment areas around the Tonle Sap Lake in Kampong Chhnang, Pursat, and Kampong Thom provinces. In addition, the local perceptions of the impacts of natural and human system changes on livelihoods and food security noted during field reconnaissance in the three provinces provide valuable inputs for the design and development of research framework and qualitative and quantitative methods and tools.

The review also informs decision-makers of the knowledge gaps in previous studies that remain to be explored, especially the need to build the adaptation capacity of local communities to address water security and vulnerability or negative impacts of climate and human changes on sustainable agriculture and livelihood development in the catchments. Participatory action research not only engages different local stakeholders in the research process, more importantly it can help local people, authorities and other stakeholders to mitigate the impacts of climate and human systems change on their livelihoods and take appropriate actions to build their adaptive capacity for sustainable livelihood development. By understanding the need for improving water governance and climate change adaptation at grass-roots level, policy-makers in return can provide better policy intervention and support to local people.

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