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USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)

Climate Change in the Lower Mekong Basin

An Analysis of Economic Values at Risk

July 2014

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EXECUTIVE SUMMARY

Through a five year project funded by the United States Agency for International Development (USAID), Development Alternatives Inc. (DAI) is conducting research on the environmental, economic, and social effects of climate change in the Lower Mekong Basin (LMB) and assisting highly exposed and vulnerable rural populations in ecologically sensitive areas to increase their ability to adapt. A central objective of the USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC) project is to bridge the knowledge gap between high-level science and on-the-ground community responses. DAI has partnered with the International Centre for Environmental Management (ICEM) and World Resources Institute (WRI) to implement the USAID Mekong ARCC project.

A key role of WRI is providing economic analysis support for the USAID Mekong ARCC, including analysis of the likely consequences of climate change. This report presents some preliminary results. The economic impacts of climate change in LMB are expected to be wide-ranging, significant, and mostly negative. Of most concern are significant reductions in the yield of crops, fish, and non-timber forest products critical for livelihoods of over 60 million people, damages associated with floods and sea level rise, and an increase in the incidence and severity of climate-related disease. Understanding the potential magnitude of these impacts over time is critical for making wise investments in appropriate adaptation measures, but the range of uncertainty in climate models downscaled to any particular region remains too great for reliable estimates. These, in turn, lead to significant differences in estimates of economic losses (e.g. Tol 2012; Heal and Milner 2013).

The Values at Risk Approach

As a result of these uncertainties, a more tractable, and more reliable approach to understanding the economic consequences of climate change in any one particular region may be to simply understand the existing economic value of resources at risk rather than projecting into the future exactly how the value of that resource will change over decades given complex interactions across multiple economic sectors. Such a values-at-risk (VAR) approach can still make use of climate models downscaled to a particular region, country, or province to identify at-risk economic resources that are likely to be affected but without pinning predictions of economic costs on any particular level of impact or timing of impact. As such, in the VAR framework, there is less emphasis on sophisticated modeling of the various dimensions of climate change as it unfolds and the interactions between them and more emphasis on understanding the existing economic values of resources that are reasonably well known to be at risk given likely changes in temperature, rainfall patterns, and sea level rise.

This report presents preliminary VAR estimates for key resources expected to be impacted by climate change in the LMB. These include rural and urban infrastructure, worker productivity, crop production, hydroelectric power, and ecosystem services. To generate VAR estimates for each of these resources WRI utilized the climate modeling of USAID Mekong ARCC's Climate Change Impact and Adaptation Study for the LMB (hereafter referred to as *"Climate Study"*) used by ICEM to identify the geographic regions likely to be impacted by increases in flooding, drought, temperature extremes and sea level rise then applied existing methods local data sources to generate VAR estimates. For example, the USAID Mekong ARCC Climate Study team identified areas likely to be newly inundated by river flooding and sea level rise in the Tonle Sap and Vietnam Delta portions of the LMB (Carew-Reid et al. 2013). Within

these geographic areas, WRI estimated the existing value of both rural and urban infrastructure in these areas using FAO data and regional studies of exposed infrastructure assets (Figure 1). WRI used the Climate Study modeling of temperature extremes in combination with province-specific data on workers in outdoor occupations to identify worker productivity at greatest risk from heat stress (Figure 2). As another example, WRI used the Climate Study modeling to identify ecozones expected to be exposed to new flooding, sea level rise, or extreme temperatures. Using the results of ecosystem service valuation studies from across the region (e.g. Brander and Eppink 2012) WRI then tallied the annual ecosystem service values at risk in these areas (Figure 3). This generalized approach was applied to each of the five key resources addressed by the study.

Key Results

Table A below presents each of the mean annual VAR estimates for each of the five resources. All told, our analysis of five resource types suggests the minimum annual values at risk in the LMB are roughly US$16 billion per year. Worker productivity ranks as the most significant value at risk, accounting for more than half of the total, which is similar to findings of other regional assessments, such as the recent Climate Vulnerability Monitor (CVM) report (DARA 2012a).

We also corroborate CVM and other regional assessments (e.g. World Bank 2010; Costanza et al. 2011; Nicholls et al. 2008) that suggest there are significant values at risk for agriculture, infrastructure in coastal zone, and ecosystem services. Few other studies have attempted to quantify climate-related costs associated with hydro-electric power production. Our VAR analysis suggests that a more in-depth analysis of impacts to hydro-electric power is worth investigating, given that the value of production from just the few facilities located in areas at risk from increased evaporation and drought top US$434 million per year.

Table A: Summary of Minimum Annual Values at Risk

Excluding Infrastructure Assets (same as Table 9)

Values at risk component	Mean VAR-($2013-mil)
Non-agricultural infrastructure services	$3,426.67
Worker productivity	$8,370.67
Crop production	$2,545.75
Hydro-electric power generation	$434.17
Ecosystem services	$1,240.85
Totals	$16,018.11

To put these values into perspective, the US$16.02 billion annual VAR translates into roughly 7% to 30% of rural GDP in the LMB (PPP adjusted, Table B). If the US$18 billion of at risk infrastructure is included, this range increases to 14% to 61%. Typically, economists distinguish between impacts to capital assets like infrastructure and the annual service they generate (like crop production) and don't add the two together. But either way, the analysis indicates that climate change represents a profound risk to the economy of the LMB—one that warrants a more careful and robust analysis of that risk as well as alignment of adaptation strategies to reduce that risk where possible.

Table B: Minimum Annual Values at Risk – Share of Rural GDP (same as Table 10)

Country	Mean VAR- no infrastructure (% rural GDP per capita)	Mean VAR- w/ infrastructure (% rural GDP per capita)
Cambodia	29.01%	61.27%
Lao PDR	23.63%	49.92%
Thailand	6.72%	14.19%
Vietnam	18.77%	39.64%

The magnitude of these values at risk in the LMB justify significant investments in adaptation measures such as workplace heat assessments and protection measures, eco-resilient cropping techniques, and green infrastructure for storm surge protection.

Policy Implications

While the VAR approach does not generate precise estimates of how climate change costs will unfold over time or where such costs are likely to manifest at a fine spatial scale, it nonetheless provides useful information to guide policy choices. There are three general uses of a VAR assessment: (1) in setting priorities for adaptation investments; (2) to provide a preliminary test of cost effectiveness of these investments, and (3) to help inform planning and land use decisions to avoid unnecessary exposure to climate risks. LMB countries should invest in VAR assessments to achieve these policy goals. A robust VAR for each LMB country could help identify strategies that are missing or not getting the attention they deserve.

For example, adaptation strategies to reduce the economic costs of lost worker productivity were surveyed by Nilsson and Kjellstrom (2010) and include measures such as guidelines for workplace heat assessment and protection, strengthening national health systems to respond to the specific needs of working populations, and changes in work practices such as increased rest periods. Cambodia's current climate adaptation strategy (MOE 2006) does not incorporate these or any other measures related to worker productivity and so a VAR assessment can help make the case as to why such interventions are an economic imperative.

Next Steps

This report presents a rough, first pass at VAR for the LMB largely to demonstrate the approach. Data underlying the values at risk estimates were based on publically available information that is often aggregated up to broad geographic regions (i.e. the value of crop production is averaged country-wide)