

## SECTOR ASSESSMENT (SUMMARY): AGRICULTURE, NATURAL RESOURCES AND ENVIRONMENT<sup>1</sup>

### A. Water Resources in the Region

1. **Greater Mekong Subregion.** The Greater Mekong Subregion (GMS) covers six countries—Cambodia, the Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, Viet Nam, and Yunnan Province and Guangxi Zhuang Autonomous Region of the People's Republic of China (PRC). The Mekong River flows through the center of the subregion and is an important source of livelihood and socioeconomic development for the GMS. While much of the total area of Cambodia and the Lao PDR is within the Mekong River Basin, only parts of the other countries fall within the basin. In a regional context, the Mekong River is an important transboundary river with scope for regional cooperation and development, as envisaged by the establishment of the Mekong River Commission (MRC) in 1995.

### B. Flood and Drought in the Lower Mekong Basin

2. Extreme floods and droughts create losses and damage to livelihoods, agriculture, and infrastructure. The severe floods of 1996, 2000, and 2001 caused extensive losses in terms of human casualties, production loss, and damage to infrastructure and property. However, the annual flood pulse is extremely important for the ecology of the floodplain and fishery. During the wet season, 1 million–4 million hectares (ha) of floodplain are submerged, including the Tonle Sap Great Lake.

#### 1. Floods

3. Floods are most often measured in terms of maximum or peak discharge. While this is appropriate for tributaries or rivers with small catchments in steep topography, it is not a good measure for large rivers such as the Mekong because other aspects of a flood are often as important or more important. For example, the duration of the flow above a critically high threshold can cause long periods of inundation and the collapse of protection dykes. Rice paddies can be submerged for 8–10 days, but the crop begins to die if the inundation period is longer. Flood volume is also an important indicator of the extent and length of time that natural wetlands are flooded and the degree to which a flood event can be modified by natural over-bank storage.

4. The average annual direct cost of flooding to agriculture, infrastructure, and buildings in the Lower Mekong Basin (LMB) is \$60 million–\$70 million a year (Cambodia and Viet Nam account for two-thirds of the total). The average annual value of flood benefits is \$8 billion–\$10 billion, i.e., about 100 times the cost.<sup>2</sup> The challenge for better flood risk management is to reduce the costs and impacts of flooding while preserving the benefits.

#### 2. Droughts

5. Meteorological droughts, defined by low rainfall over the wet season (May–November), reduce the yields of rain-fed rice and other crops. The agricultural impacts of hydrological

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<sup>1</sup>This summary is based on the national road maps and sector analyses for Cambodia, the Lao PDR, and Viet Nam (prepared under the ADB. 2008. *Technical Assistance for Preparing the Greater Mekong Subregion Flood and Drought Risk Management and Mitigation Project*. Manila). Available on request.

<sup>2</sup> MRC. 2010. *State of the Basin Report, 2010*. Vientiane.

droughts are most severe during the dry season, when below-normal streamflows reduce irrigation and the yield of dry season crops. Hydrological droughts also occur during the wet season, when below-normal streamflows reduce the volume and extent of floodwater stored in the Tonle Sap Lake and the yield of its fishery. Saline water intrusion in the coastal areas of Viet Nam, which is exacerbated by low river flows, is another cause of concern.

## **C. Flood and Drought in the National Context**

### **1. Cambodia**

6. The exposure to flood risks in terms of gross domestic product in Cambodia is 14%—the highest among the LMB countries—while the absolute exposure is estimated to be \$0.9 million per annum.<sup>3</sup> Cambodia also has the highest number of people killed (87 per flood event) and affected (733,355 people per flood event) among the four riparian countries.<sup>4</sup> The MRC estimates that during 1996–2008 total flood damage amounted to \$380 million and 603 people were killed by floods (footnote 2). The country witnessed its worst flood disaster in 2000 when about 3.5 million people (750,618 households) were affected and 347 people died (80% were children). The total damage was estimated at \$150 million, which is about 40% of the total flood damage (\$400 million) in the four countries of the LMB. Other major flood events occurred in 1996 (1.3 million people affected) and in 2001 (2.1 million people affected). On 29–30 September 2009, Typhoon Ketsana hit Cambodia, causing huge damage and losses. It affected 50,000 families and left 43 people dead and 67 severely injured. Total damage and losses to social infrastructure (housing, health, and education); agriculture; and industry were estimated at \$132 million.

7. The likelihood of drought in Cambodia is once in 3 years. Although national data on drought impacts are limited, the 2004 drought event affected 2 million people (442,419 households) in 14 provinces, and damaged 62,702 ha of rice crop. The total damage was estimated at \$21 million. The drought in 2001 led to food shortage, affecting about 0.5 million people, and destroyed 8,698 ha of rice seedlings and 45,291 ha of rice plantations. Droughts also led to a reduction in livestock and fishery yields. In Cambodia, the annual fish take fell to 10,400 tons per year in the drought years of 1998–1999, 2004–2005, and 2007–2008 compared to the annual average take of 22,900 tons per year during 1998–2008, amounting to a loss of \$14.5 million per year.

### **2. Lao People's Democratic Republic**

8. The Lao PDR faces mainstream flooding in the Central Region (Vientiane Plain), flash floods in the highlands, and flooding at the confluence of tributaries and the Mekong River. Floods generally occur as a result of a combination of high rainfall caused by typhoons and the occurrence of the southwest monsoon. More than 200 millimeters of rainfall in 2 days leads to floods along the Mekong Plain. Natural disasters resulting from climate abnormalities have been occurring more frequently, especially floods. Since 1966, the country has experienced 25 floods of different magnitude and duration. In the northern part of the country, Luang Namtha, Phongsaly, and Houaphanh provinces have witnessed flash floods every year. In the central part,

<sup>3</sup> P. Peduzzi, United Nations Environment Programme Global Resource Information Database–Europe, cited in Economic and Social Commission for Asia and the Pacific and the United Nations International Strategy for Disaster Reduction. 2010. *The Asia-Pacific Disaster Risk Report, 2010*. Bangkok.

<sup>4</sup> EM-DAT: Emergency Events Database. Center for Research on the Epidemiology of Disasters International Database University Catholique de Louvain, Brussels, Belgium. [www.em-dat.net](http://www.em-dat.net)

the Vientiane Plain was flooded in 9 years of the last 42 years (1966, 1971, 1978, 1996, 2000, 2001, 2002, 2007, and 2008).

9. Drought has also occurred in the Lao PDR. The highest damage costs were \$40 million in 1988 and \$20 million in 1989. Since the majority of the population lives in rural areas and depends largely on subsistence agriculture, they are most vulnerable to periodic droughts. Extreme low flows in the Mekong River during March–April 2010 adversely impacted dry season crops along the Mekong River as pumping stations were not able to draw water.

### **3. Viet Nam**

10. The location and topography of Viet Nam make it one of the most hazard-prone countries in the world. More than 80% of the population is at risk of direct impacts from natural hazards. In the 10 years from 1997 to 2006, natural disasters caused more than 5,000 deaths and destroyed more than 6,000 fishing boats, nearly 300,000 houses, and 4 million ha of paddy rice, with a total damage cost of over D50,000 billion (about \$2.5 billion). The flood hazards in the various zones of the country can be summarized as follows: (i) mountainous areas of Northern Viet Nam: flash floods and floods; (ii) Red River Delta and midland of Viet Nam: floods, storms, and typhoons; (iii) coastal areas of northern Viet Nam: storm surges, typhoons, and floods; (iv) coastal areas of central Viet Nam: storms and typhoons, floods, storm surges, flash floods, and saline water intrusion; (v) central highlands: droughts and flash floods; (vi) east of southern Viet Nam: storms, typhoons, and saline water intrusion; and (vii) internal areas of Cuu Long (Mekong) River Delta: floods, droughts, storms, and typhoons. Storms and typhoons are common in Viet Nam and they cause flash floods and inundation because of the intense rainfall associated with them.

11. In Viet Nam, drought is estimated to reduce food production by 20%–30% some years and drought-induced losses and damages are the third-highest after those of storms and floods. Irrigated areas suffer from frequent water shortages and agricultural areas suffer from acid sulfate problems caused by drought conditions. Saltwater intrusion in estuaries and coastal areas creates freshwater shortages and adversely impacts agricultural production. Low flows in the Red River, central coastal areas, and the Mekong and Bassac rivers in the Cuu Long Delta are important in terms of controlling saltwater intrusion and soil salinity. Late and low rainfall and low river flows adversely impact winter–spring rice in these areas. With the increasing water demand to meet the socioeconomic development of the upstream areas, management and protection of water resources at the basin level are urgent requirements. Sea level rise and the Impacts of climate change on low flows have created fresh water shortages in the Red River Delta, the central coastal region, and the Long Delta. Drought risks are more severe in the central highlands and the Cuu Long River Delta.

## **D. Key Issues**

### **1. Regional Level**

12. Floods have both positive and negative impacts in the countries of the LMB, as they nourish the wetlands that sustain fisheries and biodiversity. Abstraction of water for irrigation during the dry season is a priority for Cambodia, Thailand, and Viet Nam; while for Viet Nam this interest must be traded off against the damage caused by saltwater intrusion into the delta. Cooperation on flood prevention and mitigation measures during the wet season, and competition for abstraction of Mekong water resources during the dry season, are two major drivers for water resources relations among the LMB countries. An acute sense of competition

has not yet materialized. However, as most of the natural buffer capacity in the river flow has been appropriated, such competition and trade-offs will become inevitable in the near future.<sup>5</sup>

13. The MRC, formed on 5 April 1995 by an agreement between the governments of Cambodia, the Lao PDR, Thailand, and Viet Nam, provides a framework for cooperation for the sustainable development of the Mekong River Basin through joint management of their shared water resources and development of the economic potential of the river. In 1996, the PRC and Myanmar became dialogue partners of the MRC and all six countries now work together within a cooperation framework. The MRC secretariat has 11 programs: the basin development plan; water utilization; environment; flood management and mitigation; fisheries; agriculture, irrigation, and forestry; navigation; hydropower; information and knowledge management; and integrated capacity building.

14. The Regional Flood Management and Mitigation Centre of the MRC, based in Phnom Penh, (i) maintains the availability of flood-related tools, data, and knowledge at national and regional levels; (ii) produces accurate regional flood forecasts with timely and effective dissemination; and (iii) provides accurate and consistent tools for basin-wide flood risk assessment and transboundary impact analysis. Since the MRC flood forecasting and warning system focuses only on the Mekong mainstream, the riparian countries, especially Cambodia and the Lao PDR, lack effective flood forecasting and warning systems in the tributaries, which leads to substantial flood damage each year. Cambodia and the Lao PDR feel the need for national flood forecasting and warning systems to be operated in conjunction with the MRC regional flood forecasting systems.

15. In terms of drought forecasting and warning, little work is done either at the regional or national level, although the MRC has initiated some drought assessment activities recently.

## **2. Lessons Learned**

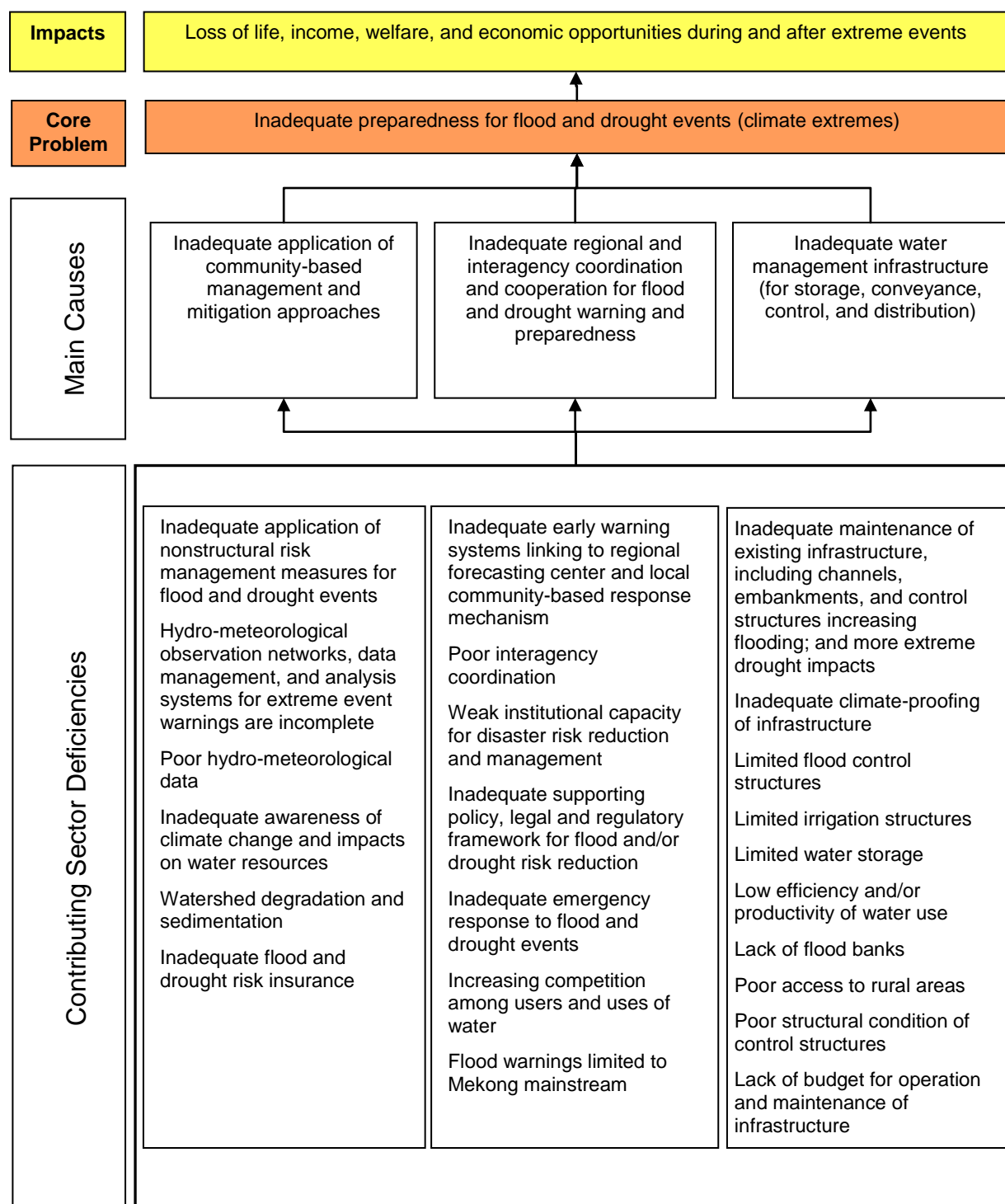
16. Lessons from previous Asian Development Bank investments in the sector include the following:

- (i) Physical improvement of irrigation schemes needs to be accompanied by a social, institutional, and regulatory framework.
- (ii) The capacity of executing and implementing agencies to incorporate social, environmental, and governance aspects needs to be enhanced with consultant assistance.
- (iii) Greater attention needs to be given to monitoring project performance, including establishing baseline conditions before project implementation.
- (iv) Investments in this subsector need to be integrated and more focused to reach a critical mass that will enhance the benefits to be gained from the investment.

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<sup>5</sup> World Bank and Asian Development Bank. 2006. *Joint Working Paper on Future Directions for Water Resources Management in the Mekong River Basin*. Mekong Water Resources Assistance Strategy. <http://siteresources.worldbank.org/INTTHAILAND/Resources/333200-1211794042917/5033487-1211795179460/gms-joint-wb-adb.pdf>

## Problem Tree for Agriculture, Natural Resources, and Environment



Source: Asian Development Bank

### Sector Results Framework: Agriculture, Natural Resources, and Environment

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Sector Outcomes with ADB Contribution	Indicators with Targets and Baselines	Sector Outputs with ADB Contribution	Indicators with Incremental Targets	Planned and Ongoing ADB Interventions	Main Outputs Expected from ADB Interventions
<b>Sustainable natural resource development, management, and conservation</b>  <b>Improved agricultural productivity, diversification, and commercialization</b>	<p>Appropriate policies, plans, and laws on water resources operational by 2013</p> <p>Forest cover maintained for inland forest (2008 baseline: 50%–60%, 2015 target 60%–65%)</p> <p>Agriculture productivity in rice equivalent increased from an average of 3 tons/ha in 2010 to 5 tons/ha in 2016</p> <p>28,000 km of rural roads rehabilitated:</p> <p>Irrigated area increased (2008 baseline 1,120,000 ha; 2013 target 1,245,000 ha)</p> <p>Agriculture productivity growth sustained</p>	<p>Improved policy, legal, and institutional framework for water resources management</p> <p>Reforestation and biodiversity conservation</p> <p>Increased food crop production through agricultural extension and support to farmer and water user organizations</p> <p>Agriculture commercialization and natural resources conservation</p> <p>Rural infrastructure rehabilitation</p> <p>Expansion of irrigation, drainage, and flood control, including rehabilitation of existing works</p> <p>Expansion of the use of improved technologies in agricultural production and post-harvest management</p>	<p>National water resources management bodies operational by 2013</p> <p>Reforestation (2008 baseline 10,810 ha; 2013 target 73,000 ha)</p> <p>Increased paddy yields (2008 baseline: 2.74 tons/ha; 2013 target 5.00 tons/ha)</p> <p>Community-based disaster risk management expanded</p> <p>Rehabilitation of 600 km of rural access roads</p> <p>Rehabilitation of 20,000 ha wet season and 5,000 ha dry season irrigation (2010 baseline: nil; 2013 target: 80,000 ha wet and 20,000 ha dry season)</p> <p>Gender-friendly technologies and safer practices</p> <p>Improved science and human resources</p>	<p><b>Key Support Areas</b></p> <p>Sustainable natural resource use and conservation</p> <p>Food security, improved agricultural productivity, diversification, and commercialization</p> <p>Rural infrastructure</p> <p><b>Pipeline Projects</b></p> <p>Agriculture Commercialization and Conservation (CAM)</p> <p>Flood and Drought (GMS)</p> <p>Irrigation and Water Resources II (CAM)</p> <p>Climate-Friendly Bio-Energy Project (GMS)</p> <p>Low Carbon/Climate Resilience (GMS)</p>	<p>Coordination of water resources management and Integrated water resources management improved (National Water Resources Management Committee operational)</p> <p>Organizational structure operations of Ministry of Water Resources and Meteorology improved</p> <p>5,600 ha natural forestland rehabilitated</p> <p>35,000 ha of small-scale irrigation schemes rehabilitated</p> <p>Wet and dry season paddy yield increased, cropping intensity increased, and diversified farming systems introduced</p> <p>600 km of rural access roads improved</p> <p>Reduced share of household income from rice</p> <p>Marketed farm and off-farm products increased</p> <p>10% increase in relevant graduate qualifications</p>

ADB = Asian Development Bank, CAM = Cambodia, GMS = Greater Mekong Subregion, ha = hectare, km = kilometer.

Sources: ADB. 2011. *Country Partnership Strategy: Cambodia, 2011–2013*. Manila. (Appendixes); ADB. 2011. *Country Partnership Strategy: Lao People's Democratic Republic, 2012–2016*. Manila; ADB. 2012. *Country Partnership Strategy: Viet Nam, 2012–2015*. Manila.