

Causal chain analysis

This section aims to identify the root causes of the environmental and socio-economic impacts resulting from those issues and concerns that were prioritised during the assessment, so that appropriate policy interventions can be developed and focused where they will yield the greatest benefits for the region. In order to achieve this aim, the analysis involved a step-by-step process that identified the most important causal links between the environmental and socio-economic impacts, their immediate causes, the human activities and economic sectors responsible and, finally, the root causes that determine the behaviour of those sectors. The GIWA Causal chain analysis recognises that, within each region, there is often enormous variation in capacity and great social, cultural, political and environmental diversity. The Causal chain analysis uses a relatively simple and practical analytical model. For further details on the methodology, please refer to the GIWA methodology chapter.

Habitat modification was identified as a priority concern for the GIWA Mekong River region. Changes in habitats and the modification of communities are being caused by changes in the fluxes of water and sediment, particularly suspended solids, by increased pollution from diffuse and point sources, and by the introduction of new species into the aquatic environment. The Causal chain analysis of the Mekong River region focuses on two of the prioritised GIWA issues which have caused habitat modification in the MRB - stream flow modification (Freshwater shortage) and suspended solids (Pollution). For details of the environmental and socio-economic impacts of these prioritised issues, please refer to the Assessment section, and for background information on the sectors responsible for the immediate causes, please refer to the Regional definition.

Stream flow modification (Freshwater shortage) and suspended solids (Pollution)

Immediate causes

The flow regime of the Mekong River and its tributaries has been modified by changes in precipitation patterns and by human activities, particularly the construction of dams for hydropower development, the modification of rivers to improve navigation, and the diversion of river water for irrigation, industrial development and human settlements. The raising of embankments or levées along the mainstream and

tributaries of the Mekong River is resulting in a significant reduction in the volume of floodplain storage, causing increased rates of river discharge and high flood levels.

Deforestation in the catchments is the principal cause of increased rates of surface water run-off that may increase the frequency and intensity of flooding in the basin. Locally, the built environment of urbanisation is also causing increased rates of run-off. The increased erosion caused by deforestation and land clearance in upland areas of the MRB is causing the entrainment of suspended and bed-load sediments into water courses. Except where they are trapped in reservoirs or deposited on floodplains and riverbeds, the sediments are transported through the basin to the Delta, where they are deposited in mangrove forests or discharged to the sea.

Root causes

Population growth

The population of the MRB has experienced rapid growth in the past decade, ranging from 1.4% per year in Myanmar's Shan state (a Myanmar state that lies within the MRB) to 2.8% per year in Cambodia, with growth averaging about 2% per year. By the year 2010, the population in MRB is expected to increase to 75-90 million people (MRC 1997a, MRC 2003). A growing population uses more drinking

water and consumes more food which, in turn, requires larger volumes of water. Population growth has led to the colonisation of forests, which has increased erosion rates and surface run-off, thus modifying the sediment loads and flow volume of the region's rivers. Over the next 20-30 years, demand for water and the pressure on natural resources will continue to increase in parallel with rapid population growth, despite the fact that birth rates are falling.

Economic development

Urbanisation, human settlement and industrial development activities have substantially increased water demand in the MRB. Ringler (2001) estimated that domestic and industrial water demand in the MRB would double from 1.89 billion m³ in 1990 to 4.1 billion m³ in 2020. Agriculture is a dominant economic sector and the largest consumer of water in the MRB. In the economic development strategies of the riparian countries agriculture is always considered as one of the key sectors and therefore is allocated increasing quantities of water.

Demand for electricity has surged in the past two decades in response to the rapid economic development experienced in the riparian countries of the MRB and elsewhere in Southeast Asia. Although at present, per capita electricity consumption in the riparian countries of MRB is generally low, except for Thailand, demand is increasing rapidly. In the Thai portion of the MRB, demand is expected to reach about 411 300 GWh per year by 2020, representing more than a six-fold increase over its 1993 level. Demand in parts of the MRB in Vietnam and Yunnan province is expected to increase to 72 300-93 000 GWh per year in 2020 but in Cambodia and Lao PDR demand is likely to remain low at around 1 800-4 900 GWh per year.

Lao PDR, Myanmar and Yunnan province, China, are planning to harness their great hydropower potential by developing hydroelectricity schemes to meet the increasing market demand for electricity in neighbouring countries including Thailand, Vietnam, Malaysia and Singapore (Crousillat 1998). To date, only 11 hydropower facilities have been constructed in the MRB, representing only 5% of the hydropower potential. An additional 240 000 GWh per year could be exploited to meet the increasing demand.

Economic development has also led to deforestation for timber or fuelwood supplies, agricultural expansion and urban development, all contributing to increased erosion and, consequently, sediment loads in the aquatic environment. Forest reserves and agricultural lands occupied by illegal squatters create environmental problems such as forest destruction and land degradation, (MRC 1997a, Chu et al. 2003). The lack of alternative energy supplies for rural communities results in

the excessive use of fuelwood contributing to deforestation and further watershed degradation.

Technical

Currently the irrigation schemes in the MRB face some technical problems. Irrigation reservoirs are 3-5 times larger than necessary due to the overuse of water by farmers, and there is currently a lack of efficient mechanisms to control and measure water use by farmers (MRC 2003). Because most irrigation systems were designed for rice production, switching their use for the production of less water-intensive crops is difficult (MRC 2003). In the Mekong Delta of Vietnam there is extensive irrigated agriculture. Despite more than half of the land in the delta being flooded during the rainy season, farmers are unable to store water for intensive rice cropping after the floods recede (Ringler 2001).

Governance

Even though all the riparian countries in the MRB develop strategies and action plans for environmental management, the development goals differ between countries. In the past, the needs of civil society groups were rarely incorporated into governmental policy. The impact on the human well-being of communities downstream of hydropower schemes was often not considered during the planning process. However, the MRC has recognised that, in the planning of policies, strategies and development plans for managing the MRB, it is necessary to involve all stakeholders. Consequently, the Basin Development Plan project as developed by MRC is a recent initiative that is working to develop an inclusive planning process (MRC 2003).

Government institutions and agencies often lack the institutional capacity to control water use and effectively manage the rivers of the MRB. For example, in Thailand, the Ministry of Science, Technology and Environment has to share the implementation of environmental management policies with other agencies, such as the Ministry of Industry and Ministry of Interior. This dilutes its power of implementation. The current sectoral approaches of the riparian governments hinder cross-sectoral integration, as does the lack of coordination between donors. Further, ecosystem protection measures aimed at controlling erosion in the region appear to be relatively weak.

Generally, cooperation between government agencies and NGOs is limited. In the Lao PDR, Yunnan province in China, and Vietnam, apart from international NGOs which are increasing rapidly in number, there are very few national NGOs that are clearly independent from the government. Instead, there are some parastatal or mass organisations which are more or less attached to the government, such as the Women's Union in Vietnam. However, increasingly they provide opportunities

for cooperation on environmental management initiatives as trust has been fostered between these organisations and their governments.

Lack of public awareness

Public awareness of environmental issues and the willingness to address them varies between the riparian countries of the MRB. Environmental awareness is relatively high in Thailand as a result of public information campaigns at all levels of society throughout the country (MRC 1997a). In other riparian countries of the MRB, public engagement is limited, particularly in environmental assessment activities.

Economic

The utilisation of water resources for hydropower is a key transboundary issue in the MRB. In terms of cross-border trade in energy, vast energy resources (mainly from hydropower development) in Yunnan province, Lao PDR and Myanmar can be developed for export, with Thailand being the most likely importer. Many hydropower projects in

these riparian countries are being planned expressly for this purpose. In exchange for the economic benefits they receive, the exporting countries suffer from the impacts associated with the development of hydropower projects, such as the resettlement of people, the inundation of land and reduced fisheries productivity (ADB/UNEP 2004).

Prices, subsidies and taxes often inadvertently discourage efficient water use. Fees charged for irrigation water are too low to encourage efficiency or to generate sufficient revenues to invest in new, and maintain existing, water distribution and irrigation systems (MRC 2003). In Thailand, water management is dominated by command-and-control instruments with limited use of market-based incentives to encourage water efficiency. The current legal framework in Vietnam also lacks economic incentives to encourage compliance with environmental regulations.