

# Executive summary

The 4 900 km long Mekong River is an international water body having its source in China's Qinghai province from where it flows southwards through the Tibet Autonomous region and Yunnan province of China, the eastern portion of Myanmar and the four countries of the Southeast Asian peninsula. It discharges to the South China Sea through the Mekong Delta to the south of Ho Chi Minh City in Vietnam. The Mekong River and its network of tributaries form the Mekong River Basin (MRB), draining parts of six countries: Cambodia, China, Lao PDR, Myanmar, Thailand, and Vietnam. The boundary of this region includes the entire Mekong River Basin and the coastal area surrounding the Mekong Delta.

The part of the MRB in China and eastern Myanmar are known as the Lancang or Upper Mekong River Basin (UMRB), and the lower part, the Lower Mekong River Basin (LMRB). The LMRB covers about 70% of the entire MRB and is more important, both socio-economically and environmentally, than the UMRB. The terrain of the UMRB is largely mountainous while in the LMRB there are vast areas of lowland and floodplain. The coastline of the Mekong Delta extends to around 650 km, of which about 350 km flank the South China Sea, and 300 km the Gulf of Thailand. The associated coastal area is characterised by large estuaries, sand dunes, tidal marshes, and mangrove forests.

The climate of the region ranges from cold temperate and tundra in the UMRB to tropical, monsoonal in the LMRB. The southwest monsoon (May to October) provides the rainy season, and the northeast monsoon (November to March), the dry season. The total water catchment area of the region is 795 000 km<sup>2</sup>. Surface water resources are abundant with run-off amounting to approximately 475 billion m<sup>3</sup> in the rainy season and 78.8 billion m<sup>3</sup> in the dry season. Flooding occurs almost every year, particularly in the LMRB, when heavy rainfall prevails. Groundwater is an important resource in the alluvial deposits of northeast Thailand and in the Delta. The total potential capacity of groundwater resources

is estimated to be about 60 million m<sup>3</sup> per day. In the MRB as a whole, fish are the principal aquatic living resource. It is estimated that there are 1 200 to 2 000 fish species, the majority of them freshwater and many of them migratory species travelling far in search of food and spawning grounds. Other important natural resources include minerals and timber.

The population of the MRB in 2000 was estimated to be approximately 65 million people. About 80% of this population live in rural areas, the great majority being farmers and fishermen. Crop cultivation is the main livelihood, with rice and other food crops grown primarily for household consumption. There are 71 cities with populations in excess of 100 000 with Phnom Penh in Cambodia and Vientiane in Lao PDR being the two largest urban centres. The population density is generally low, about 59 person/km<sup>2</sup> in the UMRB and 88 person/km<sup>2</sup> in the LMRB. The MRB is home to more than 70 ethnic groups, most practicing subsistence agriculture.

Hydropower is the major energy resource in the MRB. Large amounts of surface water are utilised to irrigate rice cultivation. However, water resources are still under-exploited. Groundwater resources in the region are used mainly for domestic and industrial consumption, with some used for irrigation. Almost all sections of the Mekong River and its associated main tributaries are navigable during the rainy season with the exception of the Khone Falls in southern Laos PDR.

The GIWA Task team selected Freshwater shortage, Pollution, Habitat and community modification, and Unsustainable exploitation of fish and other living resources as the priority environmental concerns affecting the transboundary waters of the region. This decision was justified by the assessment of their impacts on environmental, economic, social and health issues both as currently reported and anticipated for the future.

Currently, freshwater shortage per se does not appear to be a significant problem for the region. However, the impact of the Modification of stream flow has been considered severe. This is evidenced by changes in the flow volume of the Mekong River and its tributaries caused not only by changes in rainfall but also by development activities, notably the construction of dams for hydropower development, the improvement of river navigation routes and the diversion of river water for irrigation. Economic development and population growth will increase water demand, and the extensive development of hydropower schemes will significantly alter the hydrological cycle.

The impacts of pollution due to suspended solids have been considered to be severe. Development activities during the past decade including deforestation, mining, grazing and urbanisation have caused extensive soil erosion in many parts of the MRB resulting in high contents of total suspended solids (mainly suspended sediment) in the Mekong River and its major tributaries. The suspended solids are transported through the basin, altering channels and habitats and accreting in the Mekong Delta. The impacts of the loss and/or modification of ecosystems, categorised under the GIWA concern of Habitat and community modification, have been considered to be severe and are becoming major issues in the region. Modification or loss of the ecosystems has been found to deplete the living resources on which the rural communities depend for their subsistence. The impacts of Overexploitation and Impact on biological and genetic diversity have been evaluated as severe. The fisheries resources in the region have shown evidence of overexploitation, indicated by declining catches per fisherman and the great increase in the number of fishermen. The increasing population of the region also adds to the fishery pressure causing overexploitation. As with loss of ecosystems, these issues also deplete the resources on which rural communities depend.

Habitat modification was selected by the GIWA Task team as the main priority concern for the 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 point and diffuse sources, and by the introduction of new species into the aquatic environment. The Causal chain analysis of the Mekong River region in this report focuses on two of the factors causing habitat modification, stream flow modification (Freshwater shortage) and suspended solids (Pollution).

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. Deforestation in the catchments is the principal cause of increased rates of surface water run-off that is increasing the frequency and intensity of flooding. Locally, the built environment is also causing increased rates of run-off. The raising of embankments or levées along the Mekong River and its tributaries is resulting in a significant reduction in the volume of floodplain storage, causing increased rates of river discharge and high flood levels. The increased rates of surface water run-off resulting from deforestation and land clearance in upland areas of the MRB are causing increased soil erosion and the consequent 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 Mekong Delta, where they are deposited in mangrove forests or discharged to the sea. Suspended sediments are also being introduced to water courses from land disturbance through mining or urbanisation, for example.

The principal root causes of the modification of the water and suspended solid flow regimes through the MRB are population and economic growth. The population has grown rapidly in the past decade, and, by the year 2010, it is expected to have increased to 75-90 million people. Population growth has led to deforestation, increasing 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. Economic growth is a key driver of the changes affecting river fluxes in the MRB. Urbanisation, human settlement and industrial development activities have substantially increased water demand, while agriculture is a dominant economic sector and the largest consumer of water. Demand for electricity has surged in the last 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 in Thailand, demand is increasing rapidly. The great hydropower potential in Lao PDR, Myanmar and Yunnan province of China, and the increasing market demand for electricity in neighbouring countries including Thailand, Vietnam, Malaysia and Singapore, are promoting the development of lucrative hydroelectricity schemes in the MRB. To date, only 11 hydropower facilities have been constructed in the MRB, representing just 5% of its estimated hydropower potential. Many more facilities are planned. 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.

The importance of governance in addressing the transboundary environmental issues of the region is now widely appreciated and major steps have been taken in this regard. Various institutions and government agencies are involved in addressing and managing the water-related environmental issues and problems. Over recent decades all the riparian countries of the MRB have developed strategies, policies, laws, legislation and action plans, while numerous national and international donors, funding agencies and NGOs have initiated study programmes and assessments to facilitate and support the management of the region. External support agencies have contributed significantly to this process, providing support for capacity building, human resource development and technical studies related to environmental management. One agency, the Mekong River Commission, is a regional body responsible for the overall management of the MRB with the participation of four LMRB riparian countries, Thailand, Cambodia, Lao PDR and Vietnam.

The main policy relevant conclusions of the GIWA Mekong River Task team highlight the transboundary nature of the concerns and issues affecting, and forecast to affect, the region. Some environmental issues imply direct impacts on communities across national borders. Others are associated with decisions made at the regional scale, such as the development of transport and energy networks. With appropriate regional cooperation among the riparian countries, the transboundary impact of hydropower and other water-use development in the MRB can be limited by adopting integrated, multi-objective planning in order to optimise the utilisation of the region's water and living resources. Protected areas have been identified as a practical measure for conserving sensitive habitats and maintaining essential ecological processes. The GIWA Task team has recommended developing strategic action programs or policies based on further investigation of the driving forces behind the environmental problems in the region.