THE LOWER MEKONG RIVER:
INTERNATIONAL COLLABORATION FOR SUSTAINABLE DEVELOPMENT

1. BACKGROUND

Study area: location and geography

The Mekong River is the longest river in south-eastern Asia and one of the longest in the world. It rises in eastern Tibet, flows through China and between Laos and Myanmar, and then through Laos and Thailand. It then meanders through the plains of Cambodia before being joined by the Tonle Sap River at Phnom Penh. The river then splits into several distributaries, to form the Mekong Delta in Vietnam before flowing into the South China Sea. Cambodia, Laos, Thailand and Vietnam are the riparian countries of the Lower Mekong Basin.

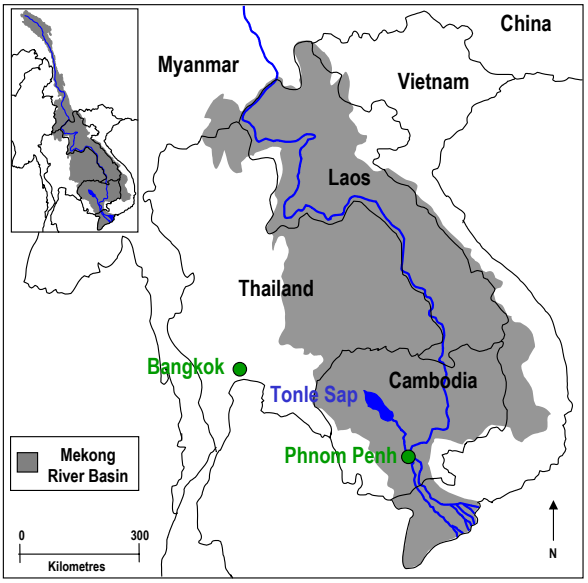

Figure 1. The Lower Mekong River Basin in southeast Asia

The Lower Mekong experiences two monsoon periods, from May to October and from November to March, with the former bringing most of the annual rain. Water levels reach their highest in September and October, when extensive flooding occurs, particularly in Cambodia. At this time, flow in the Mekong forces water back up the Tonle Sap River to the Great Lake, which is the largest natural freshwater lake in Southeast Asia. With this reverse flow, the Lake expands from 0.3 million ha to as much as 1.3 million ha. When the rains cease and water levels drop in the Mekong, flow in the Tonle Sap River reverses again and water flows from the Great Lake to the Mekong - an event of great cultural significance for the Cambodian people. In this way, the lake system naturally regulates downstream flows to the Mekong Delta by storing flood flows during the rainy season and releasing them downstream in the dry season.

The riparian countries of the lower Mekong include some of the poorest in the world, and have high rates of population growth. Water-resource developments to address this are imperative. Of the sixty million people who live in the Lower Mekong Basin, however, three-quarters rely directly on agriculture and the natural resources of the Mekong system for food and livelihoods. These resources could be impacted by developments, and so decisions are needed on how developments can proceed while holding changes in the river and in its resources at acceptable levels. It is recognised that an appropriate balance must be sought between power, agriculture, fisheries, flood management, transportation, and the well-being both of the local communities and the natural environment.

Proposed water-resource developments

As with any international river, water-resource developments in the Mekong River Basin could affect countries other than the one undertaking the development. Existing dams presently regulate less than 5% of the water in the Mekong River Basin, but in recent decades more than 100 large dams have been proposed. The Basin's countries also have different priorities and concerns for the river (Box 1), creating further complexity in management issues.

There is a clear conflict between some of the national goals of the four countries of the lower

Mekong. The two most downstream countries, for instance, require river flows to continue at close to natural levels, to maintain the fisheries and rice production in the Delta and prevent salinity intrusion in the estuary. Upstream, Thailand would like to take more water from the river, whilst Laos and China propose to build

Box 1. Country-specific uses of water in the Mekong River Basin

China	• Source of hydro-electric power and as a trade route.
Laos	• Source of hydro-electric power.
Thailand	• Water source for the central region around Bangkok and for north-eastern regions along the Mekong.
Cambodia	• Maintenance of the fisheries (400,0000 tonnes of the annual wild-caught fish catch of 1.2 million tonnes per annum is harvested in Cambodia). • Source of water for irrigated and naturally watered crops. • Navigation - Phnom Penh serves as a port for ocean-going ships.
Vietnam	• Source of water for the rice crop in the Delta, which constitutes 40% of the Vietnamese agricultural production. • To prevent seawater encroachment into the Delta waterways. • Source of hydroelectric power.

dams that will change flow patterns and volumes. An economic-hydrological analysis suggested that the benefits from some developments could be outweighed by losses. For instance, irrigated rice production could nett less in income than the loss it could cause in fish, invertebrates, plants and other nutritional resources.

To address the need to develop whilst protecting natural resources, the four riparian countries of the Lower Mekong signed an Agreement on the Co-operation for the Sustainable Development of the Mekong River Basin in 1995 (Box 2). The Mekong River Commission (MRC) was created as the inter-governmental body to carry out trans-boundary co-operation on all issues of Basin-wide importance, such as the sharing of water-related resources. A National Mekong Committee in each of the riparian countries helps foster cooperation and partnership between the MRC and the member countries, and acts as a linkage between national agencies and the MRC Secretariat.

The need for an Environmental Flow Assessment (EFA)

Much of the past discussion about water developments in the Mekong took place without an understanding of the relationship between flow and the ecological functioning of rivers. Now it is recognised that flow manipulation could affect the nature of the river ecosystem and that this could in turn affect high numbers of subsistence users of the river. For example, the annual flooding of the Mekong – both in the Great Lake and upstream along the Mekong itself – inundates extensive areas even in years of average rainfall.

Box 2. The Agreement stipulates that the four countries will:

- "…protect the environment, natural resources, aquatic life and conditions and ecological balance of the Mekong River Basin…"
- "…make every effort to avoid, minimise and mitigate harmful effects that might occur to the environment, especially the water quantity and quality, aquatic (ecosystem) conditions, and ecological balance of the river system…"
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Article 6 commits the countries to:

co-operate in the maintenance of flows on the mainstream:

- of not less than the acceptable minimum monthly natural flows during each month of the dry season;
- to enable the acceptable natural reverse flow of the Tonle Sap to take place during the wet season;
- to prevent average daily flow peaks greater than what naturally occur on the average during the flood season.

These areas play a key role in both agriculture and fish production. During low flow periods, riparian communities cultivate vegetable gardens on riverbanks and sand bars that are inundated during high flows. The high flows replenish the banks and bars with silt and nutrients needed for the crops, thereby enhancing production. Fish production is also related to the extent of area inundated by floods, with many fish species cued to reproduce during the flooding events (Box 3). More than half the protein needs of the people of the Lower Mekong are provided by fish from the river, with as much as 1.75 million tonnes of fish caught annually with a market value of about US$1.45 billion.

Box 3. Fish movement in response to the flow regime

Wet-season migration	• Many fish species breed in the Mekong and floods carry their larvae into the Great Lake at the beginning of the wet season. Here the fingerlings move into newly inundated areas, where they feed and grow before moving back down the Tonle Sap River and into the main-stem of the Mekong as the waters recede at the end of the wet season. • *Clarias batrachus* (catfish) migrate laterally into small tributaries and floodplains, presumably because they are unable to cope with fast flowing water.
Dry-season migration	• *Bangana behri* (Cyprinidae) and several other cyprinids appear to have two migrations. There is a non-reproductive migration of smaller fish during the dry season between December and February, when they form an important part of the fish catch. This is followed by a reproductive migration at the beginning of the monsoon. The non-reproductive migration appears to be upstream in the mainstream, but downstream in of some tributaries.
Dry-season spawning	• Fish of the genus *Probarbus* migrate upstream from the end of the wet season and mainly spawn during low-flow periods in January and February. They are likely to be adversely affected by abnormally high dry-season flows.

The Mekong River is also of international significance as a 'hot spot" for aquatic biodiversity. Well known flagship species include the Irrawaddy dolphin (*Orcaella brevirostris*) and the Giant Mekong Catfish (*Pangasianodon gigas;* Box 4), and estimates of the fish diversity in the Mekong catchment range from 1,000 to 1,600 species (Box 5). In addition to the fish, the lower Mekong supports an extraordinary diversity of freshwater snails, with over 130 species known from just a few kilometres of river.

Box 4. Threatened fish species

The giant Mekong catfish *Pangasianodon gigas*, which can grow up to 3 metres long and 300 kg in weight, is now rarely seen in the Mekong. It is the only endangered fish species listed in Appendix 1 of the International Convention of Migratory Species (CMS). Other 'giant' fish species, including Julliens's golden carp (*Probarbus jullieni*), which grows up to 1 metre long, and the Siamese giant carp (*Catlocarpio siamensis*) which grows to a similar size, are also now increasingly rare. *Probarbus jullieni* is now listed as endangered. Siamese giant carp can be bred in captivity but require 7 years to become sexually mature. If maturation rates are similar in the wild they will be extremely susceptible to over fishing.

Other outstanding ecological and social attributes of the region are its rich bird life; a number of rare mammalian species; the listing of part of the Tonle Sap Great Lake by UNESCO as an international biosphere reserve; and the freshwater inflows into

Box 5. Fish biodiversity of the Lower Mekong Basin

- Possibly 1300 fish species in Lower Mekong Basin
- Cambodia: > 500 fish species
- Tonle Sap Great Lake: 280 – 400 fish species (60% migratory)
- 120 commercial species

the Delta that are important for maintaining its salinity profile.

Not developing the water resources of the Mekong is not an option, and developments will bring many benefits but could also cause changes to or losses of the above river attributes. Environmental flow assessments could define for decision makers the ecological and social costs of any proposed developments, for consideration against the benefits.

2. ENVIRONMENTAL FLOW APPROACH TO BE USED

In 2001 the Mekong River Commission began discussions with the World Bank regarding the use of environmental flow assessments to guide water-development decisions. An EFA was seen as a unifying concept that could provide information that would help the four countries negotiate on what were "acceptable flows" (Box 2) from a broad physical, biological and social perspective. Benefits of proposed developments could be compared with the costs, and an acceptable trade-off agreed on. The trade-off would guide establishment of rules for maintaining the mainstream flow, and formulation of a Basin Management Plan designed to enable sustainable use of the Mekong River. The MRC thus motivated to complete an EFA and received approval in principle in late 2002. The approach desired by the MRC was an holistic one, which would address how all parts of the river ecosystem and its subsistence users could be affected by any proposed flow change. Holistic approaches are becoming more prominent, especially in developing countries, where the accent is on maintenance of healthy rivers and the river resources used by riparian dwellers.

3. MANAGEMENT ACTIONS: DECISIONS TAKEN AND IMPLICATIONS

One of the first milestones faced by the EFA was a World Bank requirement that guidelines to ensure the flows listed in Box 2 be in place by July 2004. With limited knowledge and data on the system, and little idea of what relevant expertise might be available in the four countries, and where, a comprehensive EFA was not an option within that short time span. A two-phased approach was therefore adopted. Phase 1, approved by the World Bank in May 2003, is a short-term plan designed to meet the July 2004 deadline, whilst Phase 2 is a plan for the medium to long term. In Phase 1 all relevant data, knowledge and expertise will be sought within the four countries. Specialists from the four countries, working with international mentors and MRC staff in the different disciplines, will write reviews of this information. Based only on this available knowledge, an Expert Panel approach will be used to create scenarios of river response that address the criteria in Article 6 (Box 2). As what constitutes "acceptable flows" (Box 2) is essentially a political decision, the scenarios will describe possible conditions of the various resources and attributes of the river under a range of flow options. Eventually one or more scenarios will be submitted for consideration and, through negotiation by decision-makers at the national level, it is planned that one scenario will be selected that represents the overall most acceptable river condition and thus flow regime. The approved scenario will become the basis of an Interim Flow Plan by mid 2004, which will guide establishment of the flow rules and formulation of the Basin Management Plan. Phase 1 thus becomes a training phase for all groups, from scientists to water managers and politicians, and also forms the basis of a first negotiated flow management agreement.

Phase 2 is planned to start as Phase 1 nears completion. Riparian specialists in a range of disciplines will work with MRC staff and international mentors to collect and analyse flow-relevant data on all major aspects of the river and its subsistence users. It is planned that data will be collected over at least one full hydrological cycle at selected sites along the main-stem Mekong and major tributaries. These will be used within an holistic EFA approach to provide detailed scenarios of river-flow changes and social impacts of proposed developments. Each scenario will also be assessed in terms of its implications on regional macro-economics and its acceptability to society. The selected scenario will be the basis of a comprehensive integrated Flow Basin Management Plan, and will describe the agreed pattern and volumes of flow that

must be maintained at key points along the system. Future national development plans can then be assessed in terms of whether or not they threaten the Flow Plan.

4. KEY CHALLENGES

The Mekong is relatively undeveloped, and has few major water-quality problems. It is a very large river in good condition, with tens of millions of people dependent on its natural resources. Because of its size and condition, there is time to plan and manage the trade-off between development and natural-resource protection rather than leaving this to chance. But this should be done soon: human numbers are increasing, and many feel that water developments, such as dams, and land developments, such as deforestation, may already be impacting flows in the lower Mekong. There are three key challenges. First, four countries in a region that has just emerged from an extended period of political unrest and trauma must work together for the common good and, if necessary, develop a common negotiating position with countries of the Upper Mekong. Second, an holistic environmental flow assessment has never been done in Asia, or on a river the size of the Mekong, or on a major floodplain-dominated river; there are no precedents to follow. Third, there can be few rivers where the tangible and intangible (quality of life) issues of so many subsistence users are at stake. Ways need to be found to present these issues quantitatively and in detail so that they become a vital component of the decision-making process.

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