

## **1.2 Zonation of the Mekong Drainage Basin**

### *1.2.1 Geographic Subdivisions*

The Greater Mekong Sub-Region (GMS) is a term coined by the Asian Development Bank (ADB) for an economic development planning and investment zone, comprising the entirety of the Mekong Drainage Basin plus peripheral provinces in China, Cambodia, Lao PDR, Myanmar, Thailand and Vietnam. The Mekong Drainage Basin itself is split between the Upper Mekong Basin (UMB) located entirely in the People's Republic of China and the Lower Mekong Basin (LMB), incorporating the majority of Lao PDR and Cambodia, and parts of Thailand, Vietnam and Myanmar. River Gauging Stations have been installed at intervals along the mainstream and tributaries throughout both the UMB and LMB. They are identified by place name and by distance from the river source. The cumulative catchment area pertaining to each station has been listed.

### The Upper Mekong Basin (UMB)

This area is divisible into three geographically distinct sub-areas, namely: the Tibetan Plateau Snowfields, the Gorges and Cataracts Reach, and the Sip-song Panna ("Twelve Thousand Rice-fields") Plain.

### The Lower Mekong Basin (LMB)

In the LMB, the drainage network has been numerically coded with the Mekong mainstream being coded 101, the Bassac 301 and the Xe Bangfai 3201. Each major tributary sub-catchment has a code number with corresponding code numbers for the sub-tributaries, e.g., the Nam Kading tributary basin is coded as number 27, the Nam Kading mainstream is 2701 and the Nam Muan sub-tributary is 2703, etc. The distance in kilometres from the river source is registered for each major tributary confluence and each reach of the Mekong mainstream has been assigned a code number.

Utilising remote sensing with ground truthing, the MRC has classified the entirety of the LMB into five major Watershed Classes (WSC), based primarily on landforms:

- Watershed Class 1 - Areas with very steep slopes and rugged landforms
- Watershed Class 2 - Areas with steep slopes, usually at higher elevation
- Watershed Class 3 - Areas with moderate to steep slopes and less erosive landforms
- Watershed Class 4 - Gently sloping lands
- Watershed Class 5 - Gently sloping land and flat areas.

This may be termed "micro" landform classification.

At the macro level, the MRC has grouped similar climatic and geomorphological characteristics (i.e. similar mixes of the Watershed Classes) into nine sub-areas as per Table I - 1 below. The sub-areas of the LMB are grouped into four "regions", namely: A - Northern Highlands, B - Central Plateau and Highlands, C - Southeast Highlands and D - Southern Region.

**Table 1: MRC National Sub-areas**

Sub-area No.	Sub-area Name	Area (sq. km.)	Forested (sq. km.)	Rainfed Agriculture (sq. km.)	Present Irrigated Area (sq. km.)	Potential Irrigation Expansion (sq. km.)	Remarks
<b>A: Northern Highlands</b>							
1L (+1V)	Northern Laos	82,682*	72,098*	10,974	570	n/a	Includes 1,395 km <sup>2</sup> of 1V
2T	Chiang Rai	17,333	†	2,529	1,500	300	
<b>B: Central Plateau and Highlands</b>							
3T (+3L)	Songkhram / Nong Khai	51,515	†	29,366	>6,000	n/a	Includes 9% in Lao PDR
4L (+4V)	Central Laos	82,614	66,651	9,977	1,150	n/a	Includes 733 km <sup>2</sup> of 4V
5T	Mun Chi	119,122	†	83,331	18,777	n/a	
<b>C: Southeast Highlands</b>							
6L	Southern Laos	19,688	27,006 *	*	386	n/a	Includes 1,220 km <sup>2</sup> of 6C. Forest & ag. data include 7L (?)
6C	Southern Laos	3,218	2,961 *	119	0	n/a	Not including the 1,220 km <sup>2</sup> under 6L (?)
7C	Se San, Sre Pok, Se San	25,958	24,219	1,375	0	n/a	
7L	Se San, Sre Pok, Se San	21,491	*	*	*	n/a	Area by interpolation of data. Forest, Agricultural data probably with 6L (?)
7V	Se San, Sre Pok, Se San	30,384	16,499	3,439	860	n/a	
<b>D: Southern Region</b>							
8C (+8V)	Kratie	20,236*	18,496	1,060	33	58	May include 8V (?)
9C (+9T)	Tonle Sap	81,679*	54,969	19,042	403	1,140	May include 9T (?)
10C	Delta	25,307	9,304	13,235	734	1,287	
10V	Delta	34,210	1,283	0	28,734	n/a	

**Predominant Geomorphology**

SA1 - 85% mountainous with mainly narrow valleys. SA2 - extensive lowlands rimmed with cultivated hills. SA3 - flat to rolling plains, interspersed with flood reticulation wetlands. SA4 - flat to rolling plains, steepening to hills and the Annamite Mountains in the east; interspersed with flood reticulation wetlands and karst outcrops. SA5 - Flat to rolling cultivated plains; good soils in the west, becoming poorer in structure and fertility with easting; some salinity. SA6 - mountain plateaux and cultivated foot-slopes, predominantly good soils. SA7 - rolling to hilly plateau soils of good fertility. SA8 - flat to rolling cultivated hills, steepening to mountain forests in the east. SA9 - large areas of flat to rolling farmlands, seasonally inundated near the lake and watercourses, bounded by the Cardamom Mountains in the south and the Khorat Plateau escarpment in the north. SA10 - seasonally flooded flatlands, tidally influenced towards the south.

Source: MRC Data set.

\*: Conflicting data

†: No information

### 1.2.2 *Administrative Sub-divisions*

Available maps for the Basin delineate national, provincial district and municipal boundaries. In Thailand, administrative boundary mapping goes down to *Tambon* "sub-district or commune" level. In Lao PDR, it can vary, however, largely due to communalisation under previous regimes. Village territorial boundaries are only now being delineated (in Lao PDR, under the Land and Forest Zonation and Allocation Programme) and there remain numerous inter-village territorial overlaps to be resolved. In some cases (such as on the western escarpment of the Nakai Plateau), uncertainties regarding village territorial boundaries extend to district territorial boundaries, especially when unlogged forestland is involved.

MRC mapping depicts the point location of such features as villages and irrigation system headworks, while the accompanying databases provide information on population estimates and village names, type of irrigation project, etc. and even rough estimates of population density, also irrigated hectareage of farmlands. Without village boundary delineation, however, population density per unit area of cultivable farmland cannot be calculated and this is an essential tool for prioritised integrated rural development and management planning.

Similarly, it is not at this time possible to relate various irrigation projects to the territories of the villages that operate them. Two mainstays of the MRC Basin Development Planning campaign will be the elaboration of the Decision Support Framework (DSF) and Resource Allocation Optimisation Model (RAOM). In the long-term, the modality and sustainability of rural landuse, particularly in reservoir catchments, will have significant influence upon downstream basin hydrology and sedimentation. This has been dramatically illustrated by the case of the Manwan Hydropower Project in southwest China, where under-planned and under-funded resettlement into the catchments, with insufficient integration of agriculture and forestry has led to catastrophic erosion and landsliding. The resulting sedimentation has reduced the planned lifespan of the hydropower scheme to 30% of the original estimate. Long-term planning for environmentally sustainable settlement and rural landuse in strategic river catchments requires both land capability assessment and demographic projection, referenced to the territorial extent of each present and planned rural village.

A next important step in MRC's Basin Development Planning campaign, therefore, would be to follow the lead of European and Scandinavian countries by defining and mapping Basic Statistical Units (BSUs): city blocks, suburbs and rural village territorial boundaries as zones of reference for statistical recording, development planning and management-oriented monitoring. This augmentary mapping can be performed using stereoscopic interpretation of the most recently available aerial photographs supported by ground-truthing, involving the participation of local government officials and the elders of neighbouring villages.

### 1.2.3 *Climatic Zonation*

The climatic regime of any particular landscape (in terms of temperature, rainfall, humidity, wind-run, sunshine hours, etc.) helps determine, not only what the various soil types clothing the various landforms in that landscape will produce in the form of subsistence and economic commodities, but also how much, where and when run-off and stream-flow will emanate from that landscape. The following Koppens Climatic Zones are applicable to the Lower Mekong Basin:

- Aw - Tropical Wet-Dry - Savannah
  - all average monthly temperatures greater than 18°C

- more than 2 months have less than 6cm precipitation; distinct dry season during low sun season (winter);
- distinct wet season high sun season (summer);
- Cwa - Humid Subtropical - Warm with distinctly dry Winter
  - average temperature of warmest month averages over 22°C
  - average temperature of coldest month is under 18°C and above 3°C
  - winter drought; at least 10 times as much precipitation during wettest summer month as in driest winter month.

#### 1.2.4 Ecological Landscapes & Ecoregions

It may be said that the one certainty in life is the constancy of change! The temperature of Planet Earth and the temperature and humidity of its atmosphere have been fluctuating for millions of years. It is the rapidity of such fluctuation that determines the integrity of the ecosystems supporting the food chains. The more species that co-exist in an ecosystem, and the more the genetic variation, the more likely it is that the food chain will remain productive. Humankind is one of, if not the only, form of life that can plan for and actively influence future scenarios through technologisation. Most animals are protective of their offspring in the immediate present, but only humankind exhibits communicable concerns for the welfare of future generations. In the absence of definitive data on very complex environmental and ecological parameters and their interactions, the Precautionary Principle dictates that a viable proportion of each landscape or sub-area be reserved and protected under pristine natural vegetation as inter-connected biogenetic reserves, facilitating adaptation of components of the food chain to climatic changes.

The World Wildlife Fund (WWF) has classified ecoregions as "*relatively large units of land or water containing a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of natural communities prior to major land-use change*" (WWF, 2004). The WWF has delineated the following ecoregions in the LMB:

Code	Ecoregion
IM0106	Cardamom Mountains Rain Forests
IM0121	Luang Prabang Montane Rain Forests
IM0136	Northern Annamites Rain Forests
IM0137	Northern Indochina Subtropical Forests
IM0138	Northern Khorat Plateau Moist Deciduous Forests
IM0139	Northern Thailand-Laos Moist Deciduous Forests
IM0152	Southern Annamites Montane Rain Forests
IM0164	Tonle Sap Freshwater Swamp Forests
IM0165	Tonle Sap-Mekong Peat Swamp Forests
IM0202	Central Indochina Dry Forests
IM0210	Southeastern Indochina Dry Evergreen Forests
IM0211	Southern Vietnam Lowland Dry Forests

#### 1.2.5 Future Landuse Zonation

This accumulative impact assessment report propounds a qualitative prediction of the situation that could prevail in the Nam Theun 2 Hydropower Project (NT2-HPP) wider impact zone by the year 2025. The available data is not yet sufficiently complete or

organised to permit of a quantitative prediction at this time. The necessary tools and instruments are available however, in the form of aerial photographs, satellite imagery-based maps, meteorological and hydrometric stations, trained socio-economic enumerators and GIS technicians.

Ideally, the prime outputs of the MRC's Basin development planning programme should be a Visionary Landuse Zonation Scenario mapped for each province throughout the entire basin, founded on land capability assessment, combined with demographic projection and socio-economic titling. In cases such as the NT2-HPP, where trans-basin diversions are involved, and/or several private sector or joint-venture entities may in the future be operating water resources and schemes on the same river system (which may also involve one or more adjacent provinces), then the planning module for Visionary Landuse Zonation should incorporate the entirety of all provinces concerned .

In Lao PDR, the Visionary Landuse Planning process has been piloted in connection with resettlement planning for several hydropower projects and in project preparation for the Project for Poverty Alleviation, Land Use Stabilization and Environmental Protection in the Upper Nam Ha Watershed, Northern Economic Highway Corridor (ADB Route 3) (ADRA, 2003).

For example, the Visionary Landuse Zonation map for a typical province in the MRC Area 'A', Northern Highlands, would delineate the year 2025 zonation scenario agreed by representative stakeholders (villagers, local and central government, businesspersons, traders, police, military, etc.) for devotion to the following categories of landuse:

- transportation corridors,
- urban areas (including residential, commercial, administrative, industrial, recreational),
- irrigated agriculture,
- other agriculture,
- tree plantation,
- production forestry,
- watershed protection,
- nature conservation.

Quantification of the developmental and management inputs required to achieve this visionary situation would provide a necessary framework for informed political and investment decisions for the achievement of their environmentally sustainable and socially equitable future.