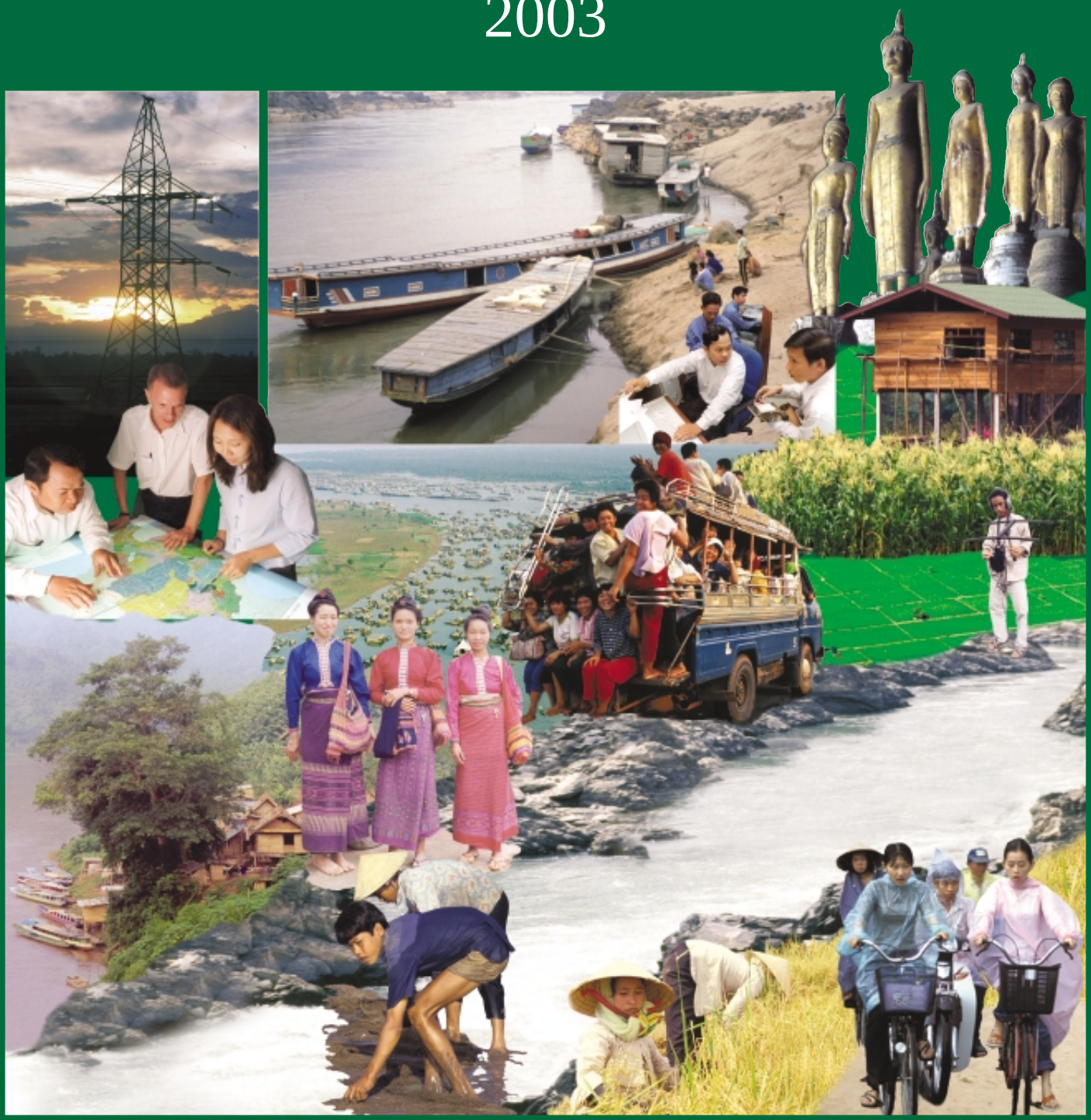
Mekong River Commission

State of the Basin Report

2003



Meeting the needs, keeping the balance

Mekong River Commission

State of the Basin Report

2003

The Mekong River Commission
June 2003

Published in Phnom Penh in June 2003 by
the Mekong River Commission

This document should be cited as MRC. 2003. State of the Basin Report: 2003.
Mekong River Commission, Phnom Penh, 316 pages. ISSN: 1728:3248

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Preface

The Mekong River and its tributaries comprise one of the largest river systems in the world. As a result of decades of war and isolation that ended just a few years ago, the Mekong's water and related resources are largely undeveloped. The volume of water flowing down the Mekong has been little reduced by dams and irrigation and, overall, water quality is good. The Mekong's fish are among the most diverse and abundant in the world.

Development of the Mekong Basin is necessary and it is also inevitable. Due to a wealth of unexploited resources, pressure from investors, and a rapidly growing population in need of livelihoods and better in standards of living, the pace development in the basin is increasing rapidly.

Although exploitation of the basin's resources could be of tremendous benefit to the peoples of the Mekong Basin, who are among the poorest in the world, it could also cause tremendous hardship if it is not properly planned, managed and monitored. More than 70 percent of the people who live in the Lower Mekong Basin (LMB) are subsistence farmers. They supplement the rice they grow with the wild fish they catch and plants and animals foraged from nearby forests and wetlands for use as food, materials and medicines. If the volume of water in the river system declines and/or the timing of the seasonal rise and fall of water changes, these wild resources may decline along with the livelihoods of the millions who depend on them for food security and household use. Changing water levels could also adversely impact agriculture, aquaculture, navigation, and water supplies for household, commercial and industrial use.

Because the potential as well as the risks of exploiting the Mekong are great, it is important that decision-makers have timely and accurate information on water-related sectors and the impact that developing these is having and could have on the economy, environment and human welfare. In support of this objective, the Mekong River Commission (MRC) is launching a series of reports on the State of the Mekong Basin.

The objective for this initial report and those subsequent, is to provide readers with an understanding of:

- the important role that the Mekong system plays in lives of most of the 55 million people who live in the basin and depend on its water and related resources
- the present state of, and trends, in water related resources within the basin
- the need to develop water-related resources in ways which are equitable and sustainable from an economic, social and environmental point of view.
- the importance of planning and monitoring development on a basin-wide scale so that gains in one sector or one geographic area do not result in losses in others.

This initial report focuses on the Lower Mekong Basin for several reasons. Firstly, the impacts of development in the basin are likely to be greater in the lower basin than in the upper. Secondly, the Mekong River Commission serves the four governments in the LMB. Thirdly, the data on which this report is based are most readily-available for the four lower Mekong countries. In future editions, however, it is hoped that considerably more data will be available on the two upper Mekong countries.

The governments in the LMB have recently signed an agreement committing themselves to sharing data on a wide range of topics. As data collection and analysis in the countries becomes more detailed, data specific to the territory within the basin should become more readily available and this in turn will improve the data presented in subsequent State of the Basin Reports. In this edition national level data have sometimes been used where more appropriate basin-specific data were not available. There are also a number of important aspects of the basin for which there are no data as yet or data are inadequate. This report may provide incentive to improve data collection and analysis in future.

The focus of this report is on the sustainable use of water and related resources because that is the mandate of MRC. Although the report covers current and possible impacts on the environment, the focus is on development. The standard of living for most of the people living in the basin is unacceptably low and as the population expands (as much as 50 percent by 2025), the numbers living below the poverty line will be even greater unless opportunities for livelihoods increase.

This report is divided into two main sections. The first provides chapters on physical landforms of the basin, water flows and quality, and biota. It also includes chapters on trends in economic as well as social development. The second main section of the report concerns the uses of water and related resources. Chapters cover fisheries and other aquatic products, forestry, agriculture, hydropower, domestic water and sanitation, floods and trade and transport. The report concludes with a chapter on the efforts of a number of agencies, including MRC, to promote cooperation in the Mekong Basin.

In conclusion, MRC hopes that readers will contribute to the success of future editions of the State of the Basin Report by suggesting topics to add, errors to correct and additional sources of relevant data. MRC's first State of the Basin Report is very much a work in progress and it is hoped that future editions will reflect the valuable advice provided by its readers.

Joern Kristensen
Chief Executive Officer
Mekong River Commission
June 2003

Acknowledgements

The credit for MRC's first State of the Basin Report goes to many people. Foremost are the authors and contributors, many of whom were MRC staff. Important too were the MRC staff members who served on the advisory committee that defined the scope of the report, recommended authors and reviewed outlines. Valuable contributions were also made by more than 60 MRC staff members, advisors and collaborators who reviewed individual chapters. The names of the advisory committee members are listed on the copyright page and the authors, contributors and reviewers are in the appendices at the back of the report.

Special thanks go to Ms Ann Bishop, for her role as editor and project coordinator, Mr. Boonruang Song-ngam for design and layout, and Mr. Paul Matthews, Resident Coordinator of the United Nations system in Cambodia from May 1996 to June 1999, for his independent review of the report.

MRC gratefully acknowledges the generous contributions of DANIDA and the Swiss Agency for Development Cooperation for their financial support through the MRC Environment Programme.

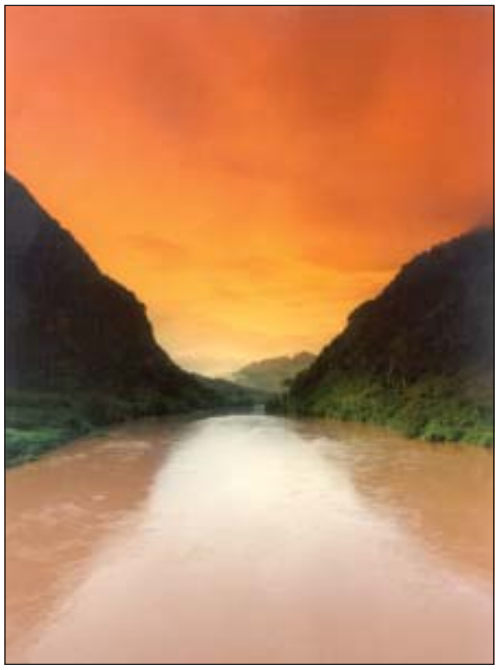
Acronyms and abbreviations

$	US dollar
ADB	Asian Development Bank
ADR	age dependency ratio
AIDS	acquired immunodeficiency syndrome
ASEAN	Association of Southeast Asian Countries
DDT	dichlorodiphenyltrichloroethane
DWS	domestic water and sanitation
DWT	dead weight tonne
ECAFE	Economic Commission for Asia and the Far East
EIA	environmental impact assessment
ESCAP	Economic and Social Commission for Asia and the Pacific
EUS	epizootic ulcerative syndrome
FAO	Food and Agriculture Organisation
FCMP	forest cover monitoring project
FDI	foreign direct investment
FMM	flood management and mitigation
GDI	Gender Development Index
GDP	gross domestic product
GMS	Greater Mekong Sub-region
GNI	gross national income
GWh	giga watt-hour
Ha	hectare
HALE	health-adjusted life expectancy
HDI	Human Development Index
HIV	human immunodeficiency virus
HP	horsepower
ICLARM	International Centre for Living Aquatic Resource Management
IMR	infant mortality rate
IPM	integrated pest management
IPP	independent power producers
IUCN	World Conservation Union
IWT	inland water transport
Kg	kilogram
KWh	kilowatt-hour
Lao PDR	Lao People's Democratic Republic
LDM	long distance migratory
LMB	Lower Mekong Basin
m	meter
MDG	Millennium Development Goals

MMR	maternal mortality rates
MRB	Mekong River Basin
MRC	Mekong River Commission
MW	megawatt
NER	net primary enrolment rate
NMC	National Mekong Committee
NSR	net secondary enrolment rate
NTFP	non-timber forest product
PPP	purchasing power parity
PRC	Peoples' Republic of China
RGC	Royal Government of Cambodia
SOE	state-owned enterprise
t	tonne
TBM	trans-boundary migratory
TFR	total fertility rates
TSS	total suspended solids
U5MR	under-five mortality rate
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
WHO	World Health Organisation
WWF	World Wide Fund for Nature

Introduction 1

There is evidence of human settlement in the Mekong Basin dating back 6,000 years,[1] and people have certainly been living along the river far longer than that. More than a dozen sites of human habitation dating from 8,000-10,000 years ago are known in Thailand and Viet Nam, and although none are yet known in the Mekong Basin, it is probably just a matter of time before they are discovered. Indeed, it seems likely that the basin was inhabited by human ancestors such as *Homo erectus* about one million years ago.[2]



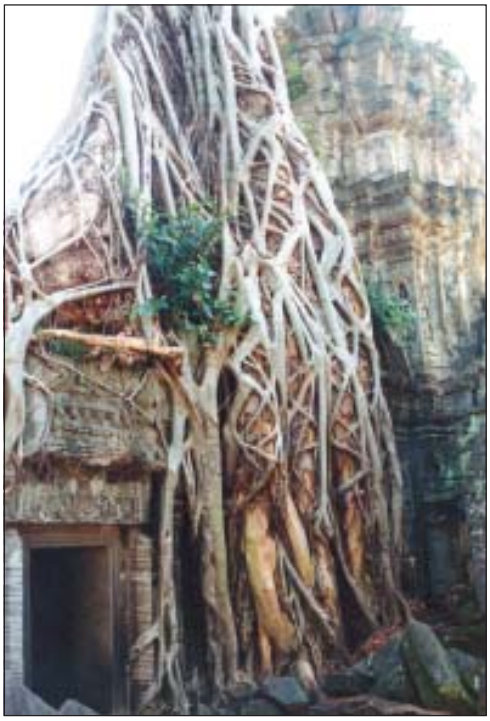
Although human settlement in the basin could date back a million or more years, until recently population densities have been low and their impact slight

But although the basin has an undoubtedly long history of human occupation – far longer than that for most other river basins outside of Africa, the impact of humans on the basin was slight. Until quite recently, population densities in most of the basin were quite low, although from the time agriculture and domesticated animals were available, the region had the capacity in terms of potential food production to support larger and denser populations than most other regions of the world.[3] For example, Thailand is estimated to have been 70 percent forested in 1936, with relatively few areas cleared, most of which were along the rivers, most notably the Chao Phraya.[4] The wars fought in the 17th and 18th centuries between the various kingdoms that today would be part of Myanmar, Thailand, Lao PDR and Cambodia, were fought largely to obtain population, not land.[5]

The Lower Mekong Basin has a rich cultural heritage dating back many centuries

During the Angkor Period, from the 9th to the 15th century, there was an extensive empire established in the lower Mekong area, extending at times at least from Phimai near Korat in what is now Thailand, to Angkor in what is now Cambodia, and down to the Mekong Delta. The development of the very extensive complex of temples, cities and

townships around Angkor itself is thought to have been based on an extensive irrigation system watering the flat fertile land, and the abundance of fish provided by the Tonle Sap Great Lake.



After Angkor Wat was abandoned in the 15th Century, the palaces and temples were reclaimed by forest

Although the population in the basin during the Angkorian period was likely to have been higher than during the subsequent centuries, its footprint on the landscape was likely to have been light in the context of the basin as a whole. The extent of forest clearing around Angkor was likely to have been no more than a radius of one or two hundred kilometers. With the decline of the Angkorian Empire, the area was largely reclaimed by forest.

At the time of early European accounts written during the 16th and 17th centuries, the population of the basin was relatively small and distributed in small settlements, separated by extensive areas of forest. Presumably diseases, including malaria and other parasitic infections, and warfare provided significant limitations on human populations. Trade had become an increasingly important activity within the basin by that time, but the arrival of the European colonial powers marked a significant change in the economic exploitation of the lower Mekong.

Following the establishment of a British colony in Myanmar and French colonies in what are today Lao PDR, Cambodia and Viet Nam, the basin began for the first time to export its resources to a significant extent. Thailand remained free of colonial occupation, but signed the Anglo-Siamese treaty in 1826 and the Bowring treaty in 1855, which connected Thai resources to western markets. Prior to that time, products such as spices had been exported, but these were in relatively small amounts. With the coming of the colonial powers, timber, most notably teak, began to be exported in significant amounts. Thus for the first time, the resources of the basin were being used to support a population larger than that living in the basin.

Following the Second World War, the basin began to see relatively rapid increases in population and extensive conversion of forest to agricultural land. This was particularly true in Northeast Thailand, which now has little forest cover remaining and one of the highest population densities in the basin. The 1980s and 1990s saw rapid industrial development in some of the countries in the region, most notably Thailand and Viet Nam. However, relatively little of that development has taken place within the Mekong Basin.

With rapid population growth in the LMB, pressure to develop resources is rapidly increasing as well

Rapid population growth and industrialisation in the countries that share the Mekong Basin have meant that the basin has continued to act as a resource

"mine" for economies outside the basin. As the population has increased, and the technology available for exploiting resources has become more sophisticated, pressures on resources within the basin have become greater. Many of the people of the basin remain poor, and there is a widespread perception that the per capita availability of resources in the basin is declining. This has lead to growing concerns within governments and civil society organisations about increased human impacts on the basin's environment, and the consequences that this may have for people. The challenge for the Mekong countries is how to develop and improve the economic conditions and livelihoods of their people whilst maintaining the biodiversity and ecological health of the Mekong Basin.

In 1997, the Mekong River Commission (MRC) published the final report of the Mekong River Basin Diagnostic Study. That study analysed existing data to identify key environmental and quality of life issues in the Mekong Basin. The priority issues identified in the report were:

- Deteriorating water quality threatens resources and sustainability.
- Changes in hydrological regimes due to development projects.
- Sedimentation is critical and intensifying.
- Deteriorating groundwater quality threatens resource use and sustainability.
- Soil quality is expected to further deteriorate in some areas.
- Terrestrial ecosystems in the Mekong River Basin (MRB) are being continually degraded.
- Aquatic ecosystems are being degraded by development activities.
- Fish throughout the MRB are adversely impacted by development activities and unsustainable harvesting.
- Wetlands are threatened by population growth, increased exploitation of biological resources, timber harvest and development activities.
- Wildlife throughout the MRB is adversely impacted by development activities and unsustainable hunting.
- Biodiversity throughout the MRB is declining.
- Populations with subsistence economies in areas of limited natural resources threaten sustained environmental quality and sustained quality of life.
- Land and water related diseases are degrading public health.
- Rural women have low social position, inadequate work skills, and poor awareness of methods for sustainably using natural resources.
- There is a need to preserve environmentally sound cultural heritage, which contributes to the stability of socio-ecological systems.[6]

Detrimental changes in the Mekong's hydrology is a long-term rather than a short-term concern

The present report was not explicitly intended as an update of the 1997 study. That study was conducted jointly with the United Nations Environment Programme (UNEP) and included consideration of the entire basin, including the parts in Myanmar and China. However this report will allow a re-evaluation of some of the priority issues identified in the 1997 report. Several of the priority issues, notably those on water quality and sedimentation, may now be identified as less of a concern and therefore lower priority based on the data and analyses

included in this report. Others, such as concern about hydrological change, remain important but are now seen as long-term rather than short-term issues. Some issues such as the impacts of floods and how those impacts can be mitigated, received relatively little attention in the 1997 report, but are now seen as high priority, particularly by Cambodia and Viet Nam.

The environment and society in the Mekong Basin are both still poorly understood. Data essential to understanding them are often absent, patchy or unreliable. The priorities and aspirations of the people within the basin may also change with time. It is therefore important that we take time and make the effort to regularly take stock of the information we have. As data accumulate, what does it tell us about the basin and how the basin is changing? Does it confirm our opinions or cast doubt on them? Do governments and communities still have the same goals and aspirations they had ten years ago? Are there new ways of achieving these goals?

This report tries to provide a brief introduction to the Lower Mekong Basin and its people. It then provides reviews of a number of key environmental issues in the basin in sectors such as fisheries, agriculture, forestry, hydropower and navigation. In keeping with the mandate of the Mekong River Commission, the emphasis is on issues that relate directly to the river and its management.

In 1995, the four lower Mekong countries, Cambodia, Lao PDR, Thailand and Viet Nam signed an agreement to cooperate in using, managing and conserving the water and related resources of the Mekong River Basin. This report should be considered as one step in the process of reviewing the condition of the basin and how it is changing. We hope that it will assist in promoting better informed dialogue between the stakeholders who will determine the future of the Mekong River Basin.

Endnotes

[1] Chandler 1996
[2] Anderson 1989
[3] Bronson 1989
[4] Ramitanondh 1989
[5] Wyatt 1986
[6] MRC 1997, p. 19

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Physical landforms of the Mekong Basin 2

The Mekong River Basin stretches about 2,600 km from the Tibetan Plateau to the South China Sea and comprises some 795,000 km², ranking it the 21st largest river basin worldwide.[1] It incorporates areas of six countries (Table 1), including six broad physiographic regions which are briefly described below (Figure 1).

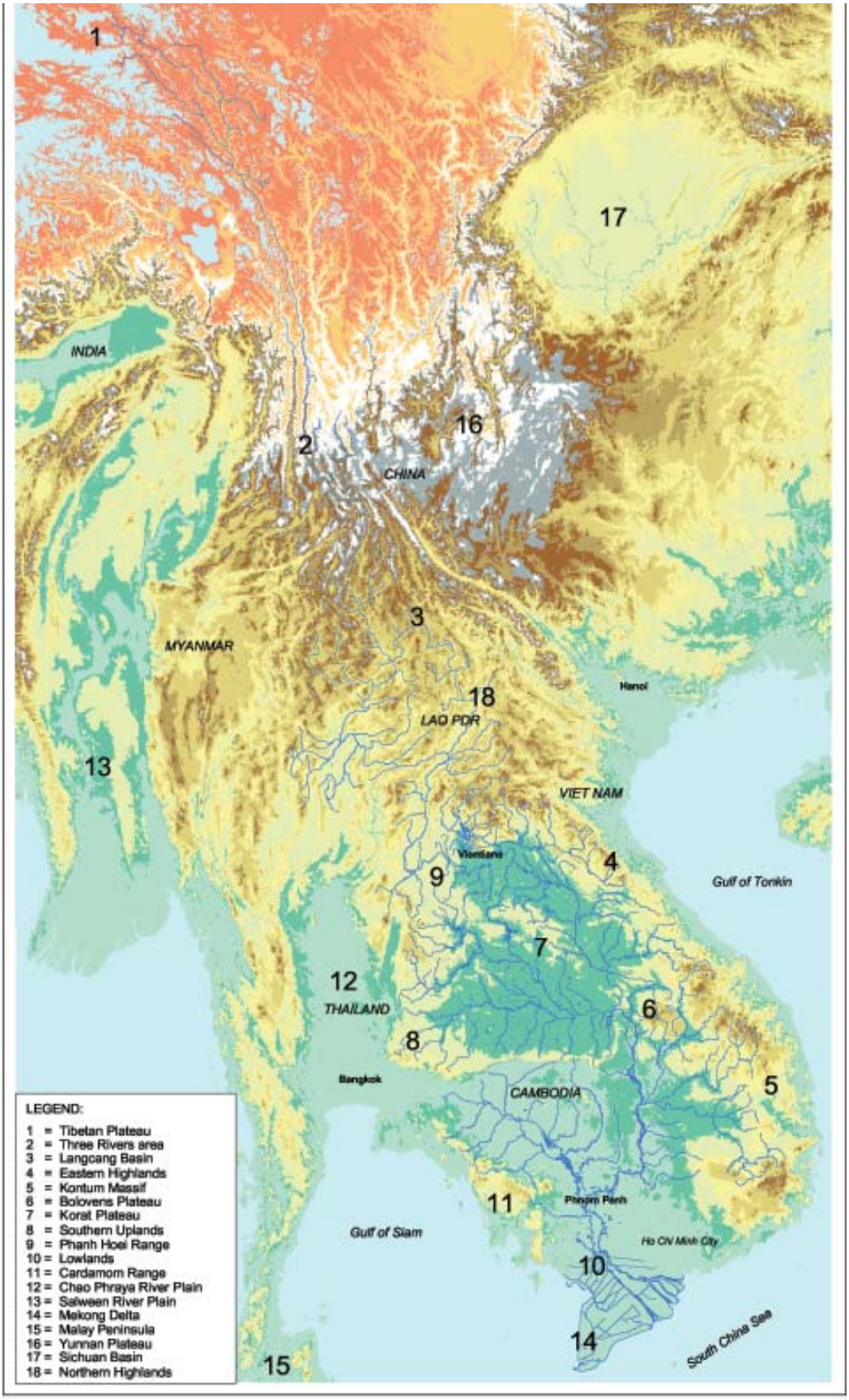
Table 1. Territory of the six Mekong River Basin Countries within the catchment

Description	Country or province						
	Yunnan Province, PRC	Myanmar	Lao PDR	Thailand	Cambodia	Viet Nam	Mekong River Basin
Area (km²)	165,000	24,000	202,000	184,000	155,000	65,000	795,000
Catchment as % of country or province	38	4	97	36	86	20	
Catchment as % of MRB	21	3	25	23	20	8	100

Two primary forces have structured the basin. In the upper basin, tectonic forces arising from the northeastward movement of the Indian continental plate pushing against the Asian mainland have created mountain ranges and deep valleys. Rivers and erosion from high rainfall is the other major factor and has been especially important in the lower basin. Consequently, there are three major geological components: the older rocks of the Indian subcontinental plate; the younger geological strata from the Asian continental block which have been uplifted and folded; and the more recent sedimentary deposits that have filled the depressions and lowlands created by the uplift and folding.

Mainland Southeast Asia is characterised by a series of high mountain ridges and deep valleys which extend from the northwest to the southeast (Fig 1). The mountains of the Tibetan Plateau form an eastern extension of the Himalayas, and the deeply incised valleys which fan out from it, form the headwaters of a number of major rivers. These include the Irrawaddy, the Salween, the Mekong, the Red and the Yangtze.[2]

Figure 1. Topography of the mainland portion of Southeast Asia



In the lower part of the basin, the boundaries of the catchment are formed by mountainous extensions from these same uplands. One of these, extending southwards from the Laotian Highlands, forms a discontinuous range of hills through the Phanh Hoei Range in Northeast Thailand, south to the Cardamom Mountains in western Cambodia. The other, more continuous range extends more southeasterly from the Laotian Highlands through the Annamite Cordillera in Viet Nam to the Bolovens Plateau and the Kontum Massif.

In China, the Mekong River is called the Lancang

The present Mekong River and its tributaries are a related group of rivers, created when the steep slopes of the mountains of the region were eroded to form deep ravines and valleys. Prior to the Pleistocene, the Mekong was not likely to have been a major river. Its modern configuration appears to have been created as a result of a number of important stream captures, including the headwaters of the Chao Phraya in Thailand. Changes in elevation of the Korat Plateau and movements and lava flows on the Cambodian Plain during this time further assisted in the formation of the Mekong. Since physiography and geology have been discussed elsewhere, [3] this account is restricted to a broad overview.

1. Lancang River Basin

The Lancang, as the Mekong is called in the Peoples' Republic of China (PRC), drains from an altitude of 4,970 m on the Tibetan Plateau, where the river rises, down to 310 m at the port at Simao. The topography is steep and the river falls 6.5 m per kilometre. Population density near the headwaters is relatively sparse, increasing downstream where the river flows through wider river valleys that range in elevation between 1,000 and 3,000 m. Forest clearing for agriculture, rubber plantations and urban development, combined with steep topography, have contributed to significant soil erosion in this region of the basin.

Rice terraces line the Mekong in Yunnan Province in China

2. Northern Highlands

The Northern Highlands include the region from southern Yunnan through Myanmar, Lao PDR and northern Thailand, eastwards into the northern end of the Annamite Cordillera in Viet Nam. Elevations reach 2,800 m and topography is generally steep. Geology is complex with extensive areas of Permian limestone, which form the spectacular karst topography seen across Lao PDR and northern and central Viet Nam, but also with granites, sandstones and gneisses, as well as some volcanic basaltic overlays.

Spectacular limestone hills are seen across Lao PDR and in northern and central Viet Nam

3. Korat Plateau

The Korat Plateau is an elevated area of triassic sandstone sloping gently to the east, with scattered lava flows distributed mainly along the southern boundary. The Mekong River cuts deeply into the eastern rim of the plateau, forming sheer cliffs above the river in places and underwater canyons up to 100 m deep in others. Most of the plateau lies within Thailand and has been extensively cleared for agriculture and is now relatively densely populated. Parts of the plateau are underlain by saline evaporates which are mined for salt. During the dry season, saline water seeps through the topsoil resulting in soil salinity, which may be exacerbated by irrigation. The climate of the Korat Plateau is relatively dry (see Chapter 3), so although tributaries like the Mun and Chi Rivers, which drain this region, have large catchment areas, they contribute a relatively small proportion of the river flow. The area has a wide variety of soils, but mostly of the solonetz type, with subsurface clay accumulations that are high in sodium and generally of low fertility.

4. Eastern Highlands

The Eastern Highlands form a southern extension of the Northern Highlands. The mountains extend about 700 km from Lao PDR through Viet Nam, reaching altitudes of up to 2,800 m. Granites in the region of the Kontum Massif are thought to be some of the earliest in Southeast Asia, dating to the Precambrian, 2.3 billion years ago. A number of the larger tributaries arise in this part of the basin, including the Se Kong, Se San and Sre Pok Rivers.

5. Lowlands

The lowlands include two subcomponents: the Cambodian floodplains and the delta. Both are formed from the deposition of recent sediments over older bedrock. The area is essentially flat with occasional older rock outcrops projecting above the floodplain. The floodplain shows evidence of numerous recent changes in river course, and, because of the flat terrain, large areas are submerged during the high flow period.

The Tonle Sap Great Lake is the largest body of freshwater in Southeast Asia and forms one of the key features of the lowlands. During the flood season, water flows from the Mekong mainstream northwest to contribute most of the water that fills the Great Lake. As the river level falls in the dry

season the flow reverses and water from the lake flows southeast to Phnom Penh, where it meets the Mekong mainstream and the Bassac at Chuktomuk junction.

The river branches at Phnom Penh, with the Bassac forming the western arm of the delta, and the Mekong proper forming the eastern arm. The delta area extends across some 65,000 km². In the upper delta, the river channels are lined by natural levees formed through silt deposition. Lower down within the Vietnamese section of the delta, there is an elaborate network of canals.

During the rainy season, the area of open water in Tonle Sap Great Lake increases from approximately 2500 km² to 13,000 km²

6. Southern Uplands

The southern uplands of southeastern Cambodia constitute one of the extensions of the Northern Highlands. They include the Cardamom and Elephant ranges, and consist of granite ridges with a maximum altitude of just over 1,800 m. Both these ranges are still densely forested, with low population densities, and are considered significant areas for conservation.

Endnotes

[1] MRC 1997
[2] MRC and Hatfield Group 2003
[3] e.g. MRC 1997; Hori 2000; Rainboth 1996

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Water in the Mekong Basin 3

1. Climate

The Mekong basin encompasses a range of climates, from tropical to cool temperate. Some of the higher peaks in the Tibetan Plateau are permanently snow-capped, and much of this part of the basin is under snow in winter. Downstream dry season flows are maintained partly by snowmelt. As the altitude of the river drops through Yunnan Province in the People's Republic of China, the climate becomes warmer and precipitation increases, with some areas experiencing 1,700 mm of annual rainfall, mainly between May and October.[1]

The Mekong begins on the Tibetan Plateau at an altitude of nearly 5000 metres

In the Lower Mekong Basin, maximum temperatures are encountered in the inland areas of Lao PDR, Thailand and Cambodia in March and April. Depending on the location and altitude, temperatures range from 30°C up to 38°C . Coolest temperatures occur between November and February, with the lowest temperatures at high elevations. Average daily minimum temperatures are often below 20°C and as low as 15°C in parts of Lao PDR. During the rainy season, between June and October, temperatures are usually in the range 25-30°C, with relative humidities between 80-95 percent.

The delta and coastal areas are subject to marine influences. Between November and February, the Northeast Monsoon brings cooler temperatures, while the wet season is a product of the Southwest Monsoon between June and September.

Figure 1. Rivers and water bodies in the Mekong Basin

Rainfall generally peaks between April and August (Figure 2). The driest region within the basin is the Korat Plateau where annual rainfall is mostly between 1,000 mm and 1,600 mm. The Northern and Eastern Highlands are the wettest regions within the basin with 2,000-2,800 and 2,000-3,000 mm respectively. Over the period since 1996, there have been no statistically detectable trends in the pattern of annual rainfall for any of the sites examined (Figure 3).

In the LMB, rainfall generally peaks between April and August

Figure 2. Seasonal pattern of rainfall at four sites in the Lower Mekong Basin: Pakse (pink line), Chiang Saen (dark blue), Nong Khai (yellow) and Mukdahan (turquoise).

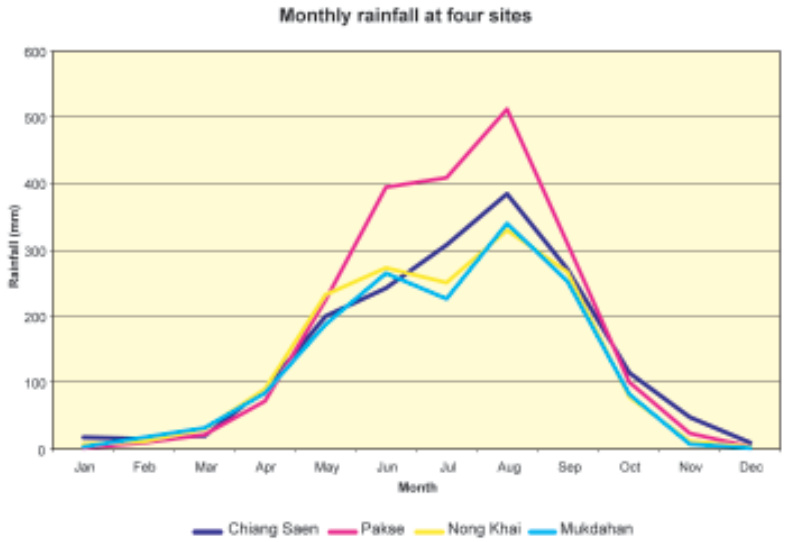
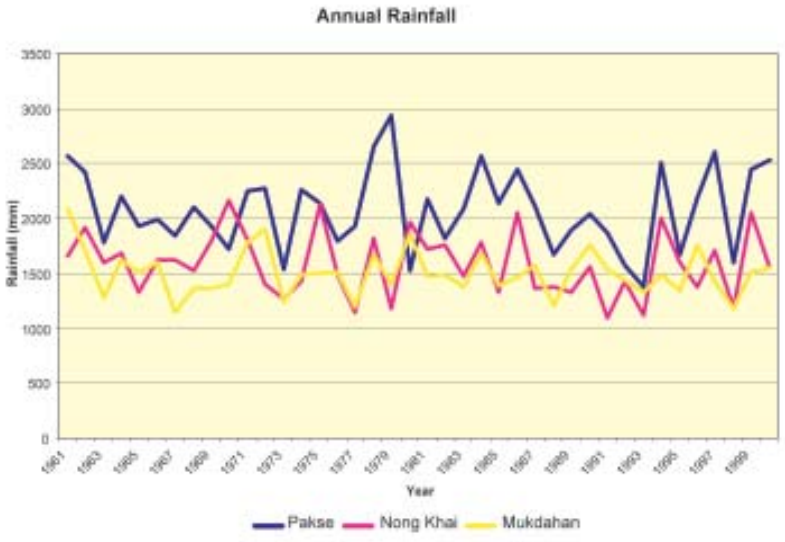


Figure 3. Annual rainfall since 1961 at three sites in the lower Mekong Basin: Pakse (dark blue), Nong Khai (pink) and Mukdahan (yellow).



2. Annual runoff

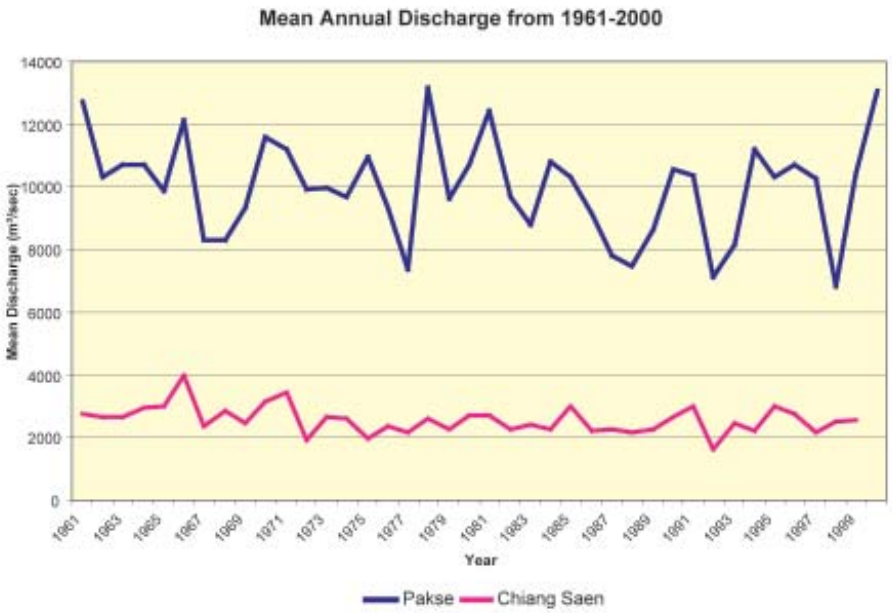
The mean annual discharge of the Mekong is approximately 475 x 10^9 m^3. China contributes 16 percent of the discharge and Myanmar 2 percent, with the remainder arising from the four countries of the lower basin (Table 1). About 55 percent of the water in the lower basin arises from the mountainous regions along the eastern rim of the basin, with Northeast Thailand contributing only 10 percent.

Table 1. Approximate distribution of MRB water resources by country

	Country or province						
	Yunnan Province, PRC	**Myanmar**	**Lao PDR**	**Thailand**	**Cambodia**	**Viet Nam**	**Mekong River Basin**
Catchment area as % of MRB	22	3	25	23	19	8	100
Average flow (m^3/sec) from area	2410	300	5270	2560	2860	1660	15,060
Average flow as % of total	16	2	35	18	18	11	100

Over the period from 1960 to 1999, discharge at selected stations within the Lower Mekong Basin has remained relatively constant (Figure 4). The variation of the annual flow from year to year is very low by world standards. The coefficient of variation (C_v) of the annual flow at Chiang Saen is 0.2, while the average C_v for rivers with catchments larger than 10^5 km^2 is 0.33, and the average for rivers with catchments of that size in Asia is 0.28.[2] This means that the river flows tend not to differ much between high flow years and low flow years. Compared with other rivers, the annual flow of the Mekong is relatively predictable and not highly variable.

Figure 4. Annual variation in discharge from 1961 to 2000 at Chiang Saen (pink) and Pakse (dark blue).

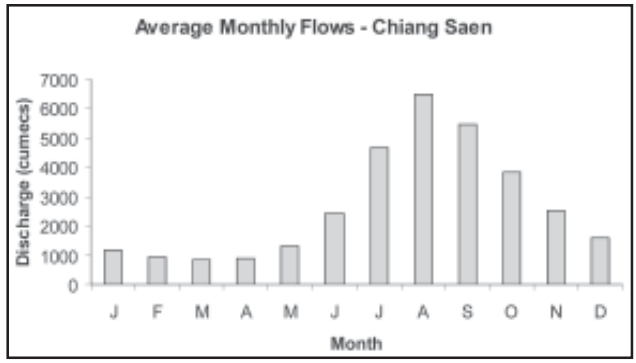


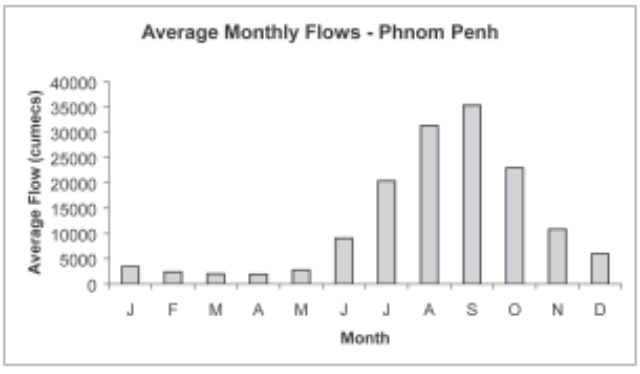
Two other useful indicators of the variability of flood flow behaviour are the Index of Variation (I_v), which is the standard deviation of the annual flood series in the log domain, and the ratio of the flood with a 100 year return period to the mean annual flood. For the Mekong at Chiang Saen, the I_v is 0.12 and the ratio of the 100 yr ARI flood to the mean annual flood is 2.3. By comparison, the world average I_v is 0.17 and the Asian average 0.16, while the ratio of the 100 year ARI flood to the mean annual flood, is 4.5 for world rivers and 3.4 for those in Asia.[3] These data demonstrate that, relative to many other rivers, when exceptional floods do occur in the Mekong, they are not very much larger than the normal average flood.

3. Seasonal runoff patterns

Patterns of discharge in the mainstream of the Mekong are seasonal (Figure 5a & 5b) with the flood peaking in August in the upper part of the lower Mekong basin and in September in the lower part. Note that the flow peak in Phnom Penh does not coincide with peak rainfall, which occurs in October (Figure 5c).

Figure 5. Average monthly flows for the Mekong River at (a) Chiang Saen and (b) Phnom Penh, and (c) monthly average rainfall for Phnom Penh.





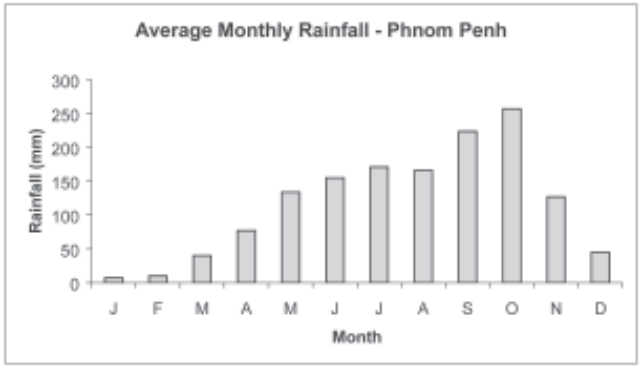


Figure 6. Extent of flooding in Cambodia and the Viet Nam Delta, 2000

The four months from July to October account for 64 percent of the annual flow at Chiang Saen and 74 percent of the average annual flow at Phnom Penh. During this period, extensive areas of the floodplain, particularly in the region from the Khone Falls to the sea, are inundated. The total area of floodplain submerged in any given year ranges from 1 to 4 million hectares.[4]

The Tonle Sap Great Lake and the floodplain around Phnom Penh act as flood buffers for the delta in Viet Nam. From mid-May to early October, as the water in the Mekong rises, it spreads across the floodplain and up the Tonle Sap River into the Great Lake. The depth of the Great Lake increases from a dry season maximum of 3.6 m to more than 10 m, and the area of open water increases from approximately 2,500 km^2 to as much as 13,000 km^2 (Figure 6). As the Mekong River water levels fall in later October and November, much of the water flows off the floodplain and down the Tonle Sap River. Water from the Great Lake continues to supplement the flow of the Mekong downstream through the dry season, contributing 16 percent of the flow.[5]

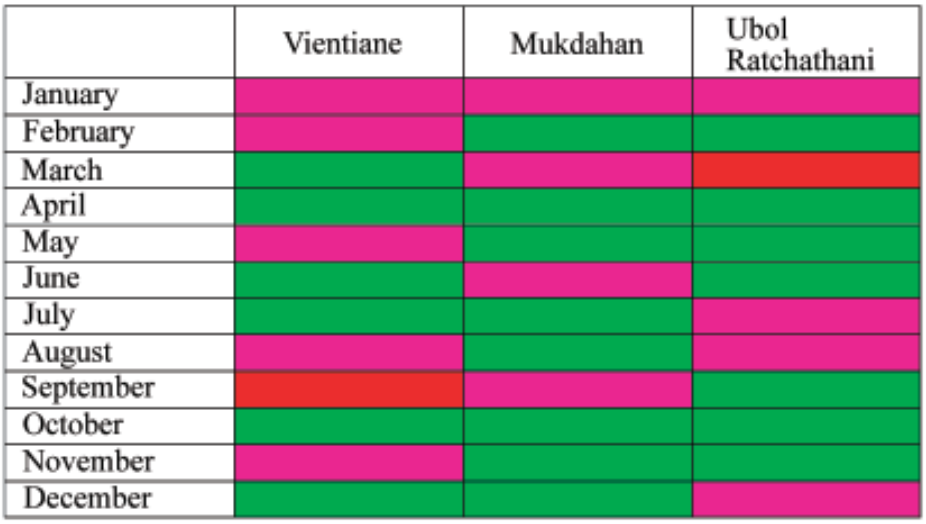
In the dry season months of March to May, there has been an increase in monthly discharge over time at Chiang Saen, Mukdahan and Pakse. In the wet season months of June to November, there has been a decrease at these same sites based on data from 1950 (1961 from Chiang Saen). The trend becomes stronger at the downstream sites.

At Chiang Saen, the decline was statistically significant during August, but not for any other month (Figure 7). March, April and May have positive slopes for the regression lines, while the months from June to December have negative slopes.

Figure 7. Pattern of change in discharge at Chiang Saen (1961-1999), Mukdahan (1950-2000) and Pakse (1950-2000)

Note : Pink and red areas indicate negative slope to regression lines (i.e. discharge decreasing over time), green areas indicate positive slope (i.e. discharge increasing over time). Red and dark green areas indicate that the slope of the line was statistically significantly different from 0 ($p < 0.05$).

Figure 8. Pattern of change in rainfall for three sites with continuous records since 1950



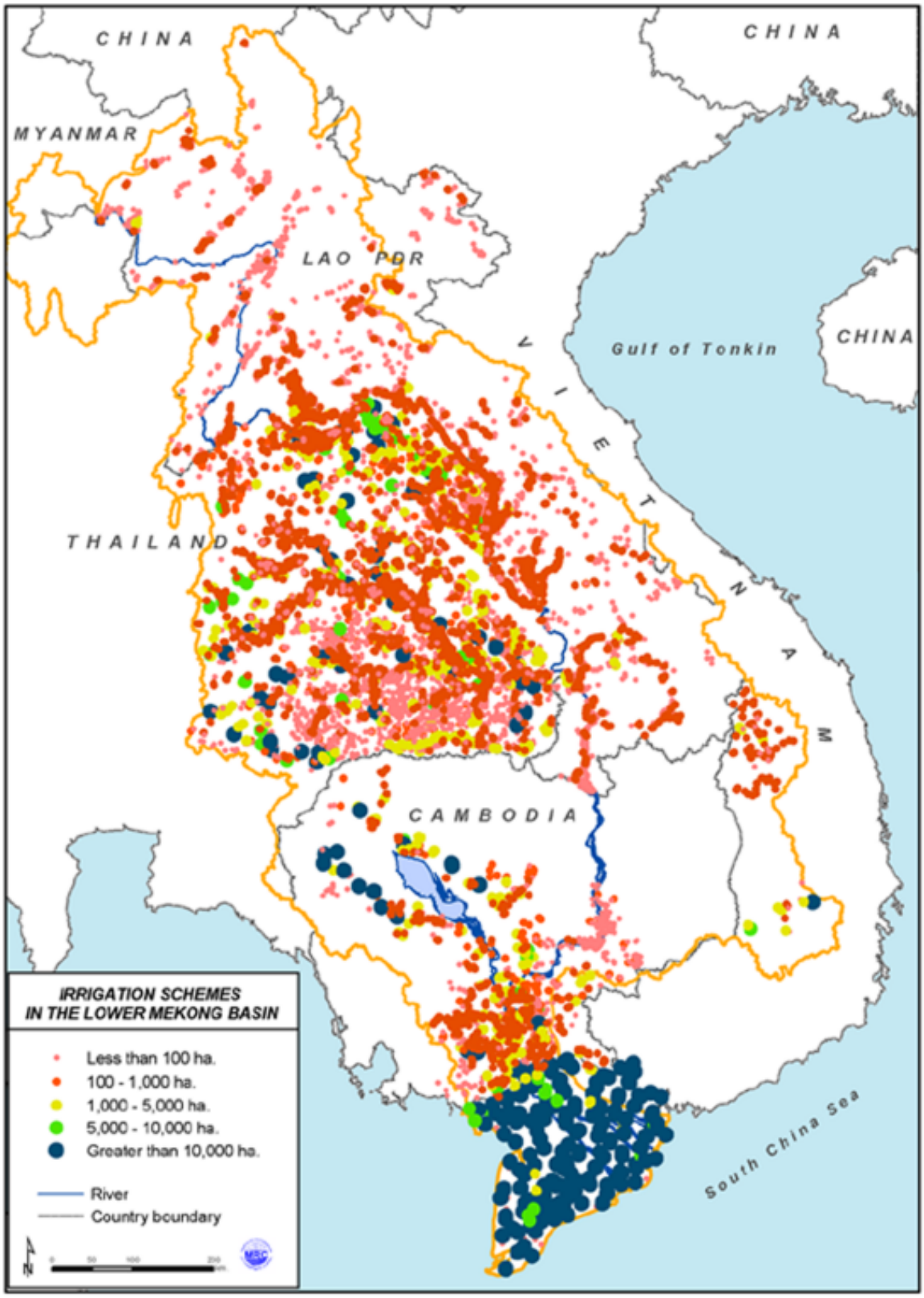
Note: As for Figure 7, in months indicated in red there was a statistically significant decrease in rainfall over the period, while months indicated in pink had a decrease in rainfall that was not statistically significant. Months indicated in bright green showed a statistically significant increase in rainfall, while those in pale green showed an increase which was not statistically significant.

Downstream, at Mukdahan and Pakse, the patterns are similar for most months (Figure 8). At Mukdahan, significant dry season increases occurred in March and April, and significant decreases occurred in September and October. At Pakse, there has been a significant decline in discharge in October and November and increases in March, April and May. The pattern is more strongly developed at Mukdahan and Pakse, than at Chiang Saen, with significant changes apparent in four months at Mukdahan and five at Pakse. The same pattern was apparent, but less prominent, especially in the dry season at Nong Kai. Data from Luang Prabang did not show the pattern at all, but there are concerns about the quality of data at both of these last two sites.

This pattern of decreased flows in the wet season and increases in the dry season, was not caused by changes in rainfall patterns. An analysis of the monthly rainfall records from Vientiane, Mukdahan and Ubon Ratchathani did not find trends consistent with the trends in discharge (Figure 8). At Ubon there was a significant decrease in rainfall in March, which is not consistent with the increase in discharge at Pakse in the same month. At Mukdahan a significant increase in rainfall occurred in November, a month for which there was a significant decrease in discharge. The only consistency is a significant decrease in rainfall at Vientiane in September that is consistent with a decrease in discharge in Mukdahan in the same month. From this data it appears that changes in rainfall have not been responsible for the pattern of change in river discharge.

The other possible causal factor for the change is human activity. The pattern is consistent with the operation of reservoirs storing wet season flows and releasing them during the dry season. The pattern does not appear to have been caused by a single large event, such as the commencement of operation of a single large dam. Rather, it appears to have been relatively continuous over several decades, but to have possibly stabilised since the early 1970s. Changes of this kind have been demonstrated in the Mekong mainstream, for example following the enlargement of Nam Ngum Dam in Lao PDR[6], but the many smaller water control structures known to have been constructed in the basin have probably had far greater impact (Fig.9).

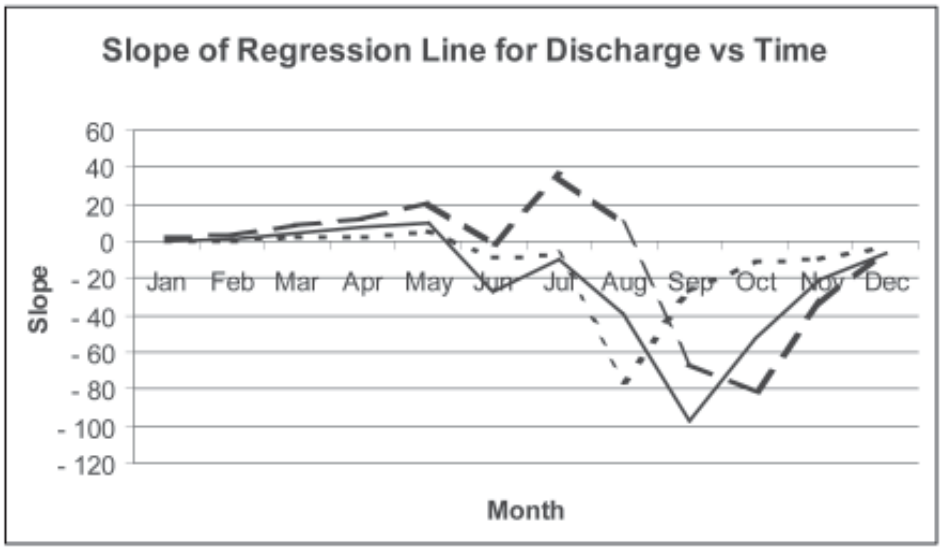
Figure 9. Irrigation schemes in the Lower Mekong Basin



The pattern is not consistent with changes caused by irrigation or catchment vegetation clearance. Irrigation extractions involving direct pumping from the river or diversions from a reservoir would be expected to reduce dry season flows. In some cases, increased water is released downstream from an irrigation dam during low flow periods to ensure sufficient water is available for farmers to pump from the river, but this pattern of water release is not known from this region. Forest clearing would tend to increase runoff during wet periods and reduce dry season runoff, the opposite of the pattern found here.

The negative regression slopes are far steeper than the positive slopes (Figure 10). This indicates that there has been a more pronounced change in wet season flows than in the dry season, since the regression lines indicating the trend are steeper. If water during the wet season were being stored in rice fields or reservoirs and then lost either to groundwater or through evaporation, that would explain this pattern.

Figure 10. A plot of the slopes of the regression lines of monthly discharge vs year for data from Chiang Saen (short dashes), Mukdahan (solid line) and Pakse (long dashes).



Note: The slope of the line is plotted against month, with positive values indicating a trend to increasing monthly discharge and a negative slope indicating a decreasing monthly discharge.

In summary, there are clear patterns of change in the hydrology of the river since about 1950. The changes do not appear to be consistent with the perceptions and fears of the river community – in particular there is no evidence of reduced dry season flows. The causes of the changes are not clear but appear to be from direct human intervention in the catchment rather than climate change. Clearly there is a need for a great deal more field investigation before we can be confident that we can predict and manage changes in flow in the Mekong River.

MRC and its predecessor the Mekong Committee, have been monitoring Mekong River water levels since the 1960s

4. Water quality

At Kratie, the chemical composition of the Mekong is remarkably similar to the mean composition of world river waters (Table 2). The composition changes upstream, particularly between Kratie and Pakse, reflecting the influence of the large tributaries flowing in from eastern Cambodia which drain the Eastern Highlands. The upper Mekong flowing from Yunnan shows the influence of limestone in the upper catchment, with relatively high concentrations of calcium, which are only slightly diluted by the large tributaries in northern and central Lao PDR. Concentrations of nitrogen are well below the world average (Table 2). However, concentrations of total phosphorus are relatively high (Table 3). These concentrations are almost certainly associated with suspended solids in the water.

Table 2. Mean composition of river waters of the world, Asia and three sites on the Mekong. Data for the world and Asia from Wetzel (1983)

	Ca^{2+}	Mg^{2+}	Na^{+}	K^{+}	Fe^{3+}	SO_4^{2-}	Cl^{-}	SiO_2	NO_3^{-}	HCO_3^{-} CO_3^{2-}
Asia	18.4	5.6	5.5	3.8	0.01	8.4	8.7	11.7	0.7	79
World Average	15	4.1	6.3	2.3	0.67	11.2	7.8	13.1	1	58
Mekong (Chiang Saen)	28.0	6.6	9.9	1.9	0.06	17.8	8.8	11.4	0.3	109
Mekong (Pakse)	23.1	4.6	6.7	1.6	0.18	17.1	8.0	12.2	0.1	83
Mekong (Kratie)	15.5	4.1	6.9	1.4	1.21	9.3	5.0	11.4	0.1	62

***Note**:* Data from the Mekong are means of the MRC monthly measurements from 1985-1999 for Chiang Saen and Pakse and from 1992-1999 for Kratie.

***Source**:* Wetzel 1983

For all the parameters listed in Table 3 and for total phosphorus, there was no appreciable difference between mean and median values at any of the three sites. This indicates that there were few extreme values (either high or low) within the data set. Where extreme values are present, the median and mean values tend to deviate from each other.

Values for Total Suspended Solids (TSS) did show appreciable differences between the mean and median values (Table 3), with the means substantially higher than the median values. This results from a relatively small number of very high TSS measurements during high flow events and is a common phenomenon in rivers. It is likely that the difference in pattern between TSS and the Total P, which is normally associated with suspended particles, is due to elevated TSS levels being caused mainly by an increase in larger particles, fine sand and upwards. Phosphorus is mainly associated with fine particles such as clay, so elevated TSS concentrations caused by larger particles would not be accompanied by major increases in Total P.

Table 3. Mean and median values for total suspended solids and total phosphorus from samples collected at Chiang Saen, Pakse and Kratie

	TSS (mgL^{-1})		**Total P (mgL^{-1})**	
	mean	median	mean	median
Mekong (Chiang Saen)	397	222	0.06	0.05
Mekong (Pakse)	215	130	0.04	0.04
Mekong (Kratie)	122	74	0.02	0.02

5. Trends in water quality

At present the MRC monitors chemical water quality once or twice per month at 98 sites, although not every parameter is measured at each site. Sampling has been conducted since 1985 in three LMB countries, and since 1992 in Cambodia (which was not a member of the Mekong Committee when sampling commenced). A number of water quality issues have been identified as issues of concern to the Lower Mekong Basin countries. Consequently a preliminary analysis of the data has been carried out to determine trends in parameters related to some of those water quality issues.

From its network of 98 stations along the Mekong, MRC tests water quality once or twice per month

Three commonly identified water quality issues are sediment in the water, salinity, especially in Northeast Thailand and the delta in Viet Nam, and eutrophication. The parameters analysed in this exercise are total suspended solids, conductivity, total phosphorus and total nitrogen.

Total suspended solids is a parameter which reflects the sediment load carried by the water. The data collected under the MRC sampling programme are taken just below the water surface, so the measures do not necessarily reflect the concentrations in the whole water column, and give no indication of the bedload transport of sediment. Nevertheless, the measure should act as a reasonable indicator of the amount of sediment in the water.

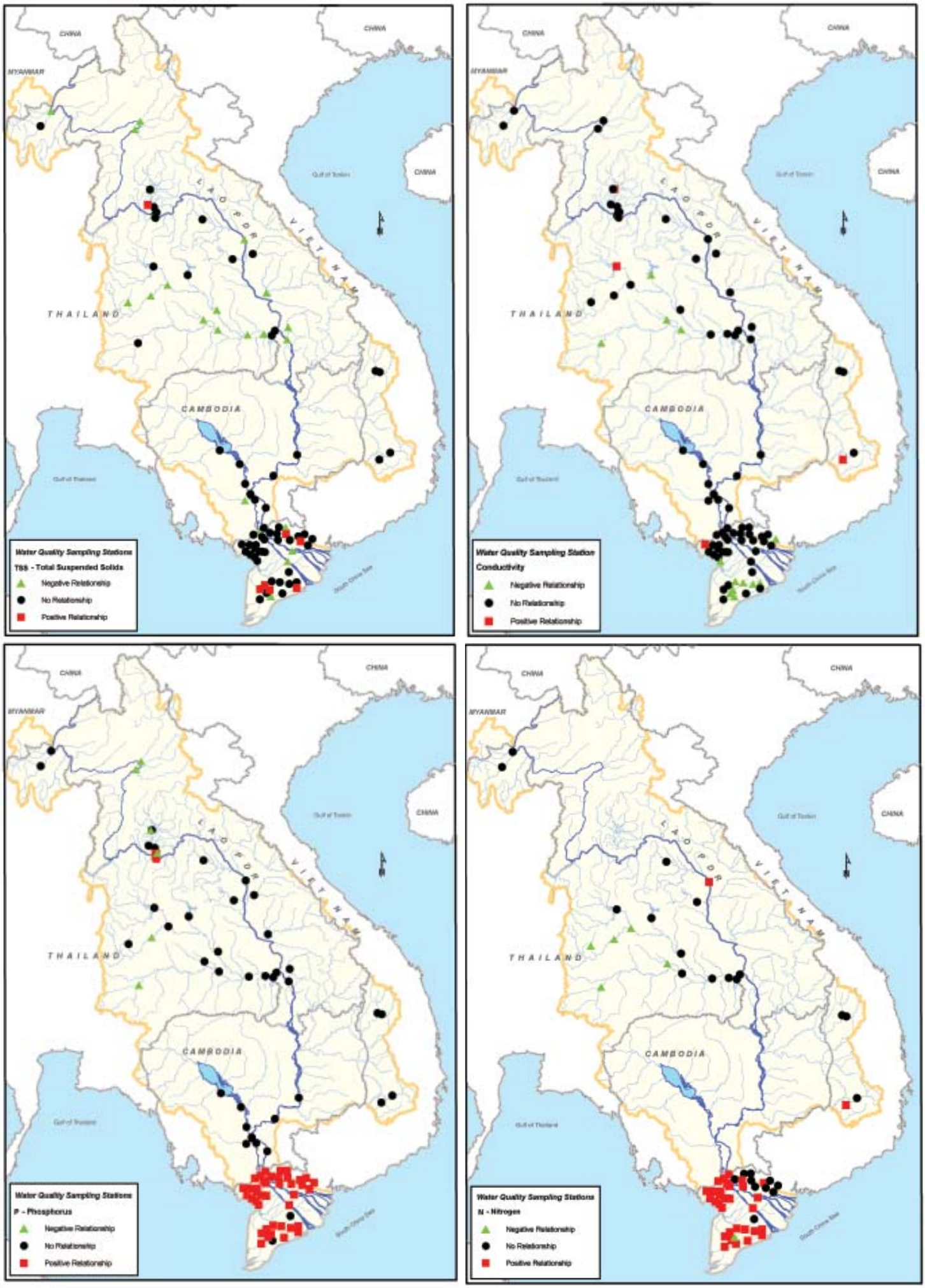
Conductivity is generally related to the amount of salt in the water, so concentrations at a particular sampling point give a direct indication of changes in salinity, although comparisons between locations would have to be made more carefully.

Phosphorus and nitrogen are the two most common nutrients limiting algal growth in aquatic ecosystems. If they are present in excessive amounts, algal blooms may result. Algae occurring in blooms may sometimes be toxic to aquatic life, livestock and people. Algae produce oxygen during daylight hours, but at night they are oxygen consumers and oxygen concentrations in water bodies can fall due to algal respiration, especially in still water when there is little wind and physical re-aeration rates are low. Dead algae can also sink to the bottom of water bodies where they decompose, which also consumes oxygen. If the algae are abundant, forming a bloom, the reduction in oxygen caused by respiration and decomposition processes may be so great as to kill fish and other aquatic life.

A simple linear regression of the concentrations of TSS showed a decrease at 23 sites and an increase at six (Figure 11a). Notable regions where TSS concentrations decreased were the entire set of Mekong mainstream sites between Chiang Saen and Pakse in Lao PDR, and eight of the 13 sites in northeastern Thailand.

Conductivity has also generally decreased right across the basin (Figure 11b). In Northeast Thailand, where there have been longstanding concerns about high salinity levels, four sites showed a decrease and only one showed an increase. Increases were also found at one site in Lao PDR and two in Viet Nam. Nine sites in the delta in Viet Nam showed a decrease in salinity.

Figure 11 (a): Total suspended solids (b): Conductivity (c): Phosphorus (d): Nitrogen

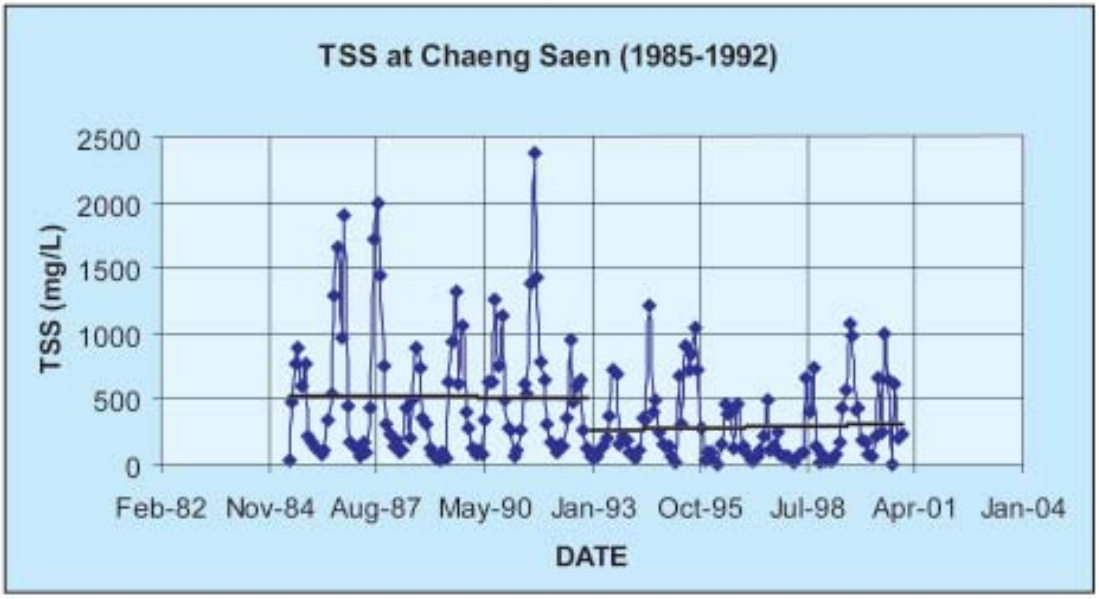


The trends in phosphorus and nitrogen were similar (Figure 11c & 11d). Outside the delta, nitrogen decreases were found at five of 15 sites in northeastern Thailand, and increases at one site on the mainstream in northeastern Thailand, and one in the highlands in Viet Nam. But within the delta, 31 sites showed a significant increase in total N, one site a decrease, and nine showed no change. For total P, two mainstream sites and two in northeastern Thailand showed a decrease, as did three other sites in Lao PDR. Two urban sites in Vientiane in Lao PDR showed increases. Increases outside the delta occurred at only two sites, both associated with urban areas or intensive agriculture. By contrast, significant increases occurred at 40 sites in the delta, while only two sites showed no change.

The most prominent change at mainstream sites was the decrease in TSS which extended from Chiang Saen downstream. At the Chiang Saen site, the decline in TSS concentrations is likely to be due to changes that have occurred in China. The portion of catchment downstream from the Chinese border within Myanmar and Lao PDR, has not changed in any way that would reduce riverine TSS levels. If anything, forest clearance in these areas would have caused a slight increase in TSS.

Two possible factors could contribute to a reduction in TSS levels – large-scale catchment re-vegetation, or the installation of dams. Were large-scale re-vegetation the primary factor, the change in TSS levels would be expected to be gradual as the vegetation became established. If installation of a large dam was responsible, the change would be rapid, occurring from the time the dam commenced to fill. The most likely dam that could have influenced the river is the Manwan Dam, constructed on the main stream of the river, more than 350 km upstream from the Chiang Saen monitoring site. Regression analyses on data before and after the dam started filling in 1992 [7] (Figure12) demonstrate that the decrease in TSS in the downstream sites has been caused by the entrapment of suspended sediment by the dam.

Figure 12. Suspended solids concentrations in the Mekong River at Chiang Saen, with liner regression lines fitted for the periods before and after the Manwan Dam commenced filling in 1992.

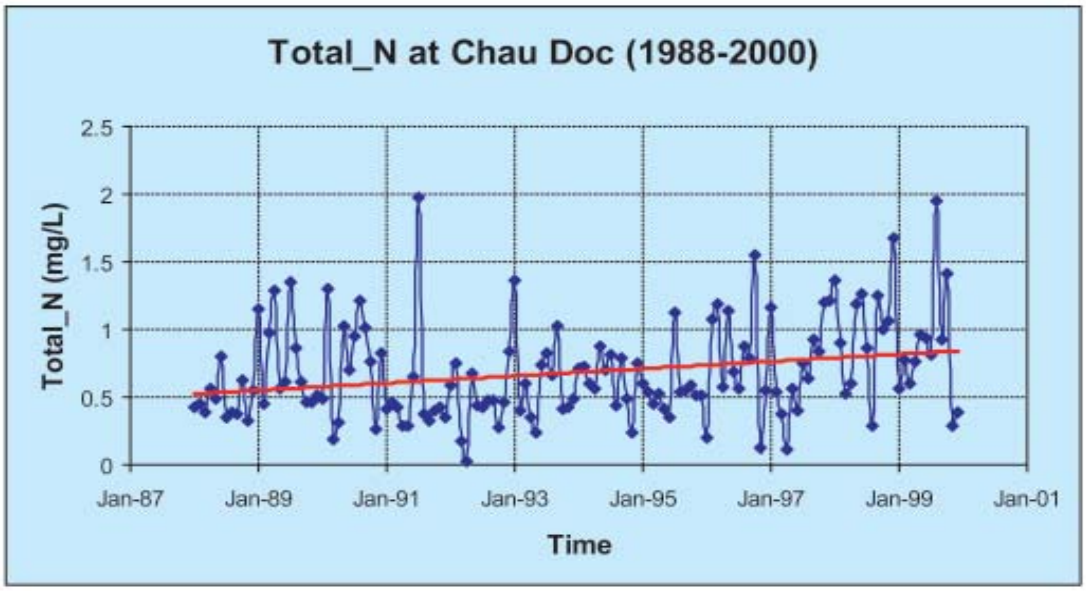


Concerns have been raised at various times about the rate at which the Tonle Sap Great Lake is filling with sediment. This concern arises from perceptions that forest clearing in the basin is leading to increased erosion rates, and thus to increased stream transport of sediment. Since 1992, when the records began, MRC data do not demonstrate an increase in sediment concentrations entering Tonle Sap Lake. A number of new studies of sedimentation in Tonle Sap Lake are underway or are planned, but the only available data [8] indicate that the lake is filling at a rate of about 0.1 mm a year and so would take more than a thousand years to fill, rather than decades.

In Northeast Thailand, there has been a conspicuous improvement in water quality, with nutrients, salinity and TSS all showing improvement. The reason is not obvious and will require further investigation. It is possible, but not likely, that this results from improved land management. A more likely possibility is that it results from the operation of increasing numbers of small-scale reservoirs (see Figure 9) which are increasing dry season flows and thus lowering concentrations of salt and nutrients at this time. Such reservoirs would also trap sediment, lowering TSS levels.

Within the delta region, the two conspicuous patterns in water quality are the decrease in conductivity and the increase in nutrients. The drop in salinity is probably due to a decrease in the intrusion of saline water from the sea, either through barriers or increased flushing with river water. The trend in nutrient level concentrations gives cause for concern. Levels of Total P at Chau Doc in Viet Nam, for example, are now approaching those usually associated with eutrophication and associated algal blooms in lakes (Figure13).[9] Flushing by the river may be sufficient to reduce the likelihood of severe algal blooms in mainstream sites, but should the water velocity be reduced by barriers to prevent saltwater intrusion, the problems could become far more severe.

Figure 13. Total Nitrogen concentrations in the Mekong River at Chau Doc, Viet Nam from 1988 to 2000 with the linear regression line fitted showing the significant ($p < 0.05$) increase over time.



Endnotes

[1] Hori 2000
[2] McMahon *et. al* 1982
[3] McMahon *et. al* 1982
[4] Hori 2000
[5] MRC 1997
[6] Institute of Hydrology 1988
[7] ICOLD 2002
[8] Jantunen 2003
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Biota of the Mekong Basin

4

The Mekong Basin occurs at the junction between several different biogeographical zones. The northern end of the tropical Malayan Peninsula meets the southeastern extension of the Himalayas and the southern edge of the northern temperate region of China. This results in a great variety of ecosystem types and the presence of a wide range of species,[1] although the actual species richness is probably lower overall than in the extremely biodiverse tropical forests of southern peninsular Malaysia and Indonesia.[2] The Mekong Basin constitutes a significant component of the Indo-Burma biodiversity hotspot, considered by Myers and co-authors[3] to be one of the eight major hotspots for biodiversity worldwide. This section will briefly outline knowledge of the biota, with an emphasis on the components associated with the river system.

1. Vegetation

Rundell[4] employed an ecological system of forest classification, dividing the forest first into montane and lowland types, and then by rainfall and tree assemblages.

The wet evergreen forests of mainland Southeast Asia are structurally similar to the better known Indo-Malaysian forest formations which occur south of about 6° North latitude, but they are less floristically rich. They share many genera with the more southern forests, but are distinct at the species level. Within the basin, this forest type occurs in the Cardamom and Elephant Mountains in Cambodia, and the Annamite Range in Viet Nam.

Mixed evergreen forest, Phnom Tbeng, Preah Vihear, Cambodia

Semi-evergreen or dry evergreen forest occurs in regions where mean annual rainfall is generally between 1,200 mm and 2,000 mm, and the dry season is 3-6 months. Characteristically, they contain mixed deciduous stands and/or deciduous dipterocarps. They are widespread across northern and central Thailand, extending through Lao PDR and Cambodia.

Mixed deciduous forest or monsoon forest extends from Burma through northern Thailand and Lao PDR, and is often characterised by the presence of teak

(*Tectona grandis*). Deciduous dipterocarp forest is the other major deciduous forest type. It is the most widespread forest type in mainland Southeast Asia, occurring mainly in areas with 1,000-1,500 mm annual rainfall and 5-7 months drought. All six deciduous members of the Dipterocarpaceae occur in this formation, which occurs in Thailand, Lao PDR, Cambodia and Viet Nam. Four dipterocarp species, *Shorea siamensis*, *S. obtusa*, *Dipterocarpus obtusifolius* and *D. tuberculatus* generally comprise the dominant species.

Under heavy human pressure, the lowland areas of deciduous dipterocarp forest may be converted to open savannah woodland. Under the influence of fire in particular, a few of the hardier tree species remain and other fire-adapted species, together with thorny shrubs and grasses, become more abundant. Such formations occur in parts of the Korat Plateau, northern Cambodia and drier areas in southern Viet Nam.

Freshwater swamp forests are rich in biodiversity and are nutrient rich spawning grounds for fish

Freshwater swamp forests occur in areas of seasonal inundation associated with coastal delta areas and inland wetlands. There are extensive areas associated with the Tonle Sap Great Lake. They are floristically and structurally distinctive from freshwater swamp forests elsewhere in the world. The dominant tree species is *Combretum trifoliatum,* which is generally low in stature and loses its leaves during inundation in the wet season.

Lower montane forests normally occur above 800-1,000 m altitude in northern Thailand and Lao PDR, and at lower elevations of 600-700 m in northern Viet Nam. They occur in regions with annual rainfall above 2,000 mm, and a mean temperature in the coldest month of below 15°C. This forest type is floristically distinct from the lowland forest, with families like the Dipterocarpaceae absent and families such as the Fagaceae, Magnoliaceae and Lauraceae being well represented. Epiphytes are also common in this forest type, including much of the orchid diversity of the region.

Montane conifer forests are common on drier montane sites with less than 2,000 mm annual rainfall at elevations of 800-1500 m. Two dominant conifer species, *Pinus kesiya* and *Keeteleria evelyniana,* are particularly widespread. The former through northern Thailand and into Lao PDR and Viet Nam, and the latter restricted to Lao PDR and Viet Nam. The Annamite Range in Viet Nam contains a rich assemblage of conifer species.

2. Vertebrate fauna

The vertebrate fauna of the Mekong Basin is difficult to quantify, partly because most inventories have been conducted on a country basis, partly because the inventories are clearly incomplete, and partly because the taxonomic studies on which such inventories depend are incomplete. MRC 1997 provided some estimates of the biota of the four lower basin countries that included 830 mammal species, 2,800 bird species, 1,500 fish species, 250 amphibians and 650 reptiles. However, these estimates should be treated as indicative only.

A number of the mammal species within the basin are considered rare. One terrestrial mammal closely associated with the river, the fishing cat (*Prionailurus viverrinus*), is considered globally near-threatened. Of three species of otter – the hairy-nosed otter (*Lutra sumatrana*), the smooth-coated otter (*Lutrogale perspicillata*) and the oriental small-clawed otter (*Aonyx cinerea*), the first two are considered by the World Conservation Union (IUCN) to be vulnerable to extinction, and the latter "near-threatened".[5] For all of these species, there is only anecdotal data on population numbers and distribution. For the Irrawaddy dolphin (*Orcaella brevirostris*), there is rather better data from population surveys.[6]

*The smooth-coated otter (*Lutrogale perspicillata*) is considered by the World Conservation Union (IUCN) to be vulnerable to extinction*

For birds within the basin, there is also an absence of quantitative data on population abundance and distribution. Dudgeon[7] has noted that a high proportion of the bird species in the region that are known to have declined in abundance, are riverine or wetland birds. For example, 24 of 35 species of bird identified as having declined seriously in Lao PDR over the past 50 years are wetland birds. The decline has been particularly noticeable in species that rely on sandbars and large rivers as breeding or feeding habitat. For example, the plain martin (*Riparia paludicola*), which has declined significantly in Lao PDR and Thailand, nests in burrows on sandbars, a habit probably shared with the now extinct white-eyed river martin (*Pseudochelidon sirintarae*).[8]

Wetland and riverine birds are declining in abundance, particularly those that rely on sandbars as breeding or feeding habitat

The largest of the reptiles in the basin are the two species of crocodiles. The largest wild populations of the Siamese crocodile (*Crocodylus siamensis*) are thought to occur in Cambodia, particularly in the Cardamom Mountains area. Some estuarine (*Crocodylus porosus*) crocodiles may still exist in the Mekong Delta, where a maximum number of 100 were estimated in 1994.[9]

A number of aquatic or semi aquatic turtles, snakes and lizards occur within the basin, and many are hunted for subsistence or sold for food or medicine in local markets

A number of aquatic or semi aquatic turtles, snakes and lizards occur within the basin, many of which are hunted for subsistence or sold for food or medicine in local markets. Of the lizards, the water

monitor (*Varanus salvator*), Bengal monitor (*V. bengalensis*), water dragon (*Physignathis* spp), Bocourt's water snake (*Enhydris bocouti*), puff-faced water snake (*Homolopsis buccata*), reticulated python (*Python reticulatus*) and the Tonle Sap water snake (*Enhydris longicauda*), are all consumed. Both snakes and many turtle species are also exported and a substantial illegal export trade exists. Among the turtles, the Asian box turtle (*Cuora ambioensis*) from the upland areas of Lao PDR, Viet Nam and Cambodia is now considered vulnerable due to hunting. Another box turtle, *Cuora galbinifrons*, is considered endangered and the formerly common *Cuora trifasciata*, appears to be rare. The big-headed turtle (*Platysternon megacephalum*) is considered endangered and the mangrove terrapin (*Batagur baska*) is now restricted to coastal mangroves, although it was once far more widespread.

Fish tracking equipment is used to monitor the migration patterns of some large endangered fish species

Data on amphibians within the basin are even more limited than data on reptiles. MRC (1997) lists 37 species of amphibians in Lao PDR, and it could be expected that all of those would probably have occurred in the Mekong Basin. The status of populations of amphibians cannot be adequately assessed in view of the lack of data. The larger frogs are eaten by humans, so their populations will have declined in areas where human populations have increased.

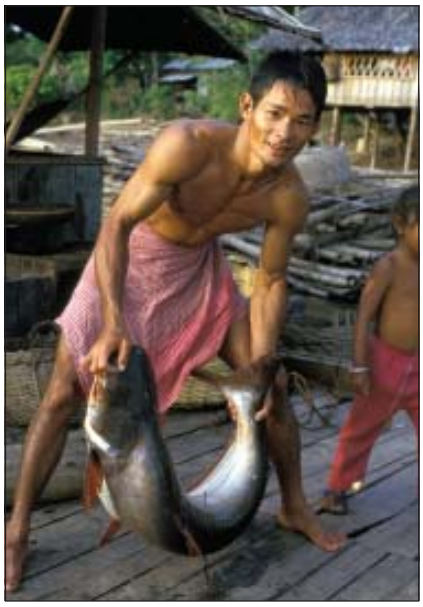
The fish fauna of the Mekong Basin is thought to be particularly diverse. Documenting the actual diversity is difficult for several reasons. There are many species which are essentially marine, but which may briefly enter the channels of the delta. Secondly, the fish fauna of the river are as yet incompletely known. A number of species have yet to be described and named, and some parts of the basin have yet to be surveyed. For the purposes of this section, we will count only species considered "true" freshwater species, and only those that have been described.

Kottelat[10] notes that there are about 700 described species documented from the Mekong Basin, and he records 481 species from Lao PDR. Rainboth[11] documents nearly 500 species from the Cambodian Mekong. The number of described fish species known from the Mekong Basin is large, but not remarkably so. The Zaire/Congo Basin in West Africa has 669 species[12] and the Amazon about 1200.[13] However, there are other large rivers that are far less rich, including the Nile in Africa with 320 species,[14] the Mississippi in North America with 241[15] and the Murray-Darling in Australia with only 28.[16]

The striking feature of the ichthyofauna of the Mekong is the great diversity of fish families. Rainboth[17] lists 65 families for the Cambodian section of the Mekong, and Kottelat[18] lists 50 for Lao PDR. In contrast, Géry[19] lists only 47 for the Amazon, so that at the family level, the Mekong appears to be one of the most diverse rivers. The fish fauna of the Mekong is dominated by the family Cyprinidae, with Rainboth[20] listing 54 cyprinid genera from the Cambodian Mekong, and Kottelat[21] listing 75 cyprinid genera and 193 species for Lao PDR, which is 40 percent of the total 481 fish species he documents from Lao PDR.

Two obvious changes have occurred in the fish fauna of the basin over recent times. One has been the introduction of a number of species either from other river basins in the region or from other regions. Kottelat[22] lists seven species of fish that have been introduced from other basins in the region, and 15 introduced from outside the region that are now established in the Mekong. Several

of the species from outside the region are species which are known to have become pest species when introduced elsewhere. These include Nile tilapia (*Oreochromis niloticus*) and mosquito fish (*Gambusia affinis*).



The catch of the giant, slow maturing fish species has declined drastically throughout the LMB

Secondly, and of greater concern, has been the apparent decline in large fish in the basin. A number of giant fish species, including the giant catfish (*Pangasianodon gigas*), *Pla Thepa* (*Pangasius sanitwongsei*), the thicklip barb (*Probarbus labeamajor*) and the giant barb (*Catlocarpio siamensis*), are now all rare and some are considered endangered within the river.[23] Foroese and Torres[24] concluded that worldwide, the proportion of threatened fish species increases significantly for fish species which grow to more than 100 cm in body length.

Several factors may contribute to a decline in large fish. Larger species that may require larger areas of habitat may be more susceptible to loss or disruption of their habitat than smaller species. This would be especially true if they migrate over longer distances than smaller species. Whether this is the case is not yet known. Secondly, larger fish species may be more susceptible to fishing pressure, either because larger fish are more easily caught, or because they live longer and take longer to mature. Typically fisheries deplete the larger fish species first, and then progressively focus on smaller-sized fish,[25] so the decline of the larger fish may be the first indicator of overfishing.

3. Invertebrates

Invertebrates, or animals without backbones, comprise most of the species of living things on earth and presumably also comprise most of the biodiversity of the Mekong Basin. The invertebrate fauna of the Basin is little known and poorly documented. What is apparent is that some groups of aquatic invertebrates, in particular, show high levels of species richness within the basin. This appears attributable to the geological origin and history of the basin.[26]

For example, within the molluscs (snails and mussels), the stenothyrid and pomatiopsid snails (gastropods) include over 120 species, with at least 111 endemic to the river.[27] This is the greatest known biodiversity of snails in any freshwater system in the world. A more diverse system previously occurred in Mobile Bay in the United States, but about a third of the species there has been lost due to pollution and flow regulation.[28]

The Mekong Basin is a "hot spot" for freshwater snail biodiversity

Most other groups of aquatic invertebrates are still poorly known. In the absence of information, little can be said about the fauna in general, but three important aspects of the fauna are discussed below.

Within the Mekong Basin, aquatic invertebrates are an important source of food. This is particularly true during the dry season when fish are less available. Invertebrates are probably particularly important during drought years, acting as an important factor in reducing food vulnerability. Campbell and Parnrong[29] documented 30 taxa of aquatic invertebrates which are consumed in Thailand, mostly in the northeast. Undoubtedly there are further taxa that will be added to the list in future. Only a single species of gastropod is listed, whereas anecdotal accounts identify at least four species as being consumed in Lao PDR.

Invertebrates, and particularly aquatic invertebrates, have often been used as indicators of the ecological health of rivers, lakes and wetlands. They are particularly suitable because they comprise a large proportion of the biodiversity, are almost ubiquitous and are relatively easily sampled and preserved. However, there have been relatively few attempts to use invertebrates as indicators in river systems as large as the Mekong.

In general, the invertebrate fauna in the lower mainstream seems to be depauperate (of low biomass and species richness).[30] This is probably because the riverbed consists largely of clay and shifting sand. In the tributaries and the delta, diversity and biomass are higher. In several areas, human impacts have been clearly demonstrated. Faunas below several dams differ from those elsewhere in the river system, indicating impacts of the dams. At some locations, invertebrates show the impacts of elevated salinity and nutrients.

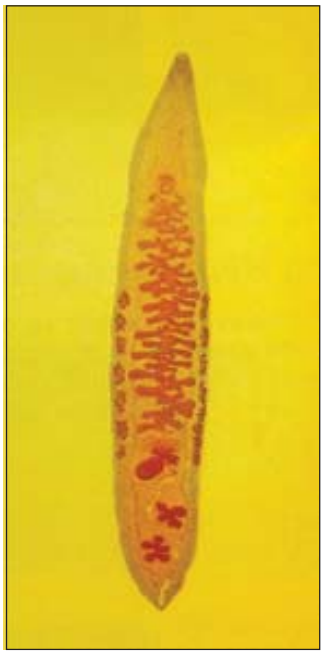
Finally, invertebrates play a key role in the transmission of several human parasites within the basin, and the parasites themselves are invertebrates. Two parasites which have attracted particular attention are schistosomaisis or bilharzia and liver fluke. Both are caused by platyhelminth worms that use snails as an intermediate host.

Schistosomaisis is presently restricted mainly to the regions around Khone Island in southern Lao PDR and in northern Cambodia. The parasite completes part of its life cycle within the body of the small aquatic snail *Neotricula aperta*. The microsopic larval stage burrows out through the body wall of the snail into the water, and should it encounter the skin of a human, it burrows though the skin and moves through the blood vessels until it reaches the vicinity of the intestine.

In these blood vessels it matures and reproduces, laying spiny eggs that pass into the intestine and thence out with the faeces. Should the faeces be deposited into water, the eggs hatch and the hatched larvae seek out snails to continue their life cycle. Human infections are thought to occur mainly in the dry season, when water levels are low and snail numbers are higher. The snails feed on the algal layer that grows on the surface of rocks. Thus they need rocks in shallow water, because if the water is too deep, there is insufficient light to allow algal growth. During high flow periods, snail abundance is reduced, possibly because snails are washed away, and possibly because of reduced food due to greater water depth and higher turbidity.

Obviously, changes in the patterns of river flow could influence the populations of snails and thus the frequency of infection of the human population. Equally, improved sanitation could assist with reducing the infection cycle, as could treatment of infected individuals.

Liver fluke infection appears to be most common in Lao PDR, and the route of infection is through the consumption of uncooked or inadequately cooked fish. The most common liver fluke parasite, *Opisthorchis viverini*, completes part of its life cycle inside a snail of *Bithynia* sp., associated with vegetation in still or slowly flowing waters. Within the tissues of the snail, the larvae reproduce asexually before passing out through the body wall as a free-swimming cercaria larval stage. The cerciae burrow through the skin of a fish and then form a cyst in the muscle. Should the muscle be ingested by a human, the cyst hatches in the intestine and the fluke migrates up the host's bile duct to the liver, causing clinical disease. The eggs of the flukes pass out with the host's faeces, and if they enter water, they hatch as larvae that search out snails to continue the life cycle. Cooking fish properly kills the cysts, thus preventing infection. The infection is relatively easily treated, but reinfection readily occurs, because hosts cannot develop resistance.



A photo of the Opisthorchis liver fluke

Fish species associated with *Opisthorchis* cysts at Nam Ngum Reservoir include *Mystacoleucus* sp. (*pa langnam*), *Systomus orphoides* (*pa pok*), *Hampala dispar* (*pa sout*) and *Osteochilus haselti* (*pa eetai*). All are fish common in the reservoir and are both consumed locally and traded outside the immediate locality. Infections of *Opistorchis* are easily treated, but reinfection is common if treated individuals are re-exposed.

Endnotes

[1] e.g. Lekagul and Round 1991
[2] Rundell 1999
[3] Myers *et al*. 2000
[4] Rundell 1999
[5] Smith 2001
[6] Beasley and Somany 2002
[7] Dudgeon 2002
[8] Dudgeon 2002
[9] Cuc 1994
[10] Kottelat 2001
[11] Rainboth 1996
[12] Poll 1973
[13] Géry 1984
[14] Greenwood 1976
[15] Oberdorff *et al*. 1995
[16] McDowall 1996
[17] Rainboth 1996
[18] Kottelet 2001
[19] Géry 1984
[20] Rainboth 1996
[21] Kottelat 2001
[22] Kottelat 2001
[23] Mattson *et al*. 2002
[24] Foroese and Torres 1999
[25] Pauly *et al*. 1998
[26] Davis 1979
[27] Davis 1979; Hoagland and Davis 1979; Dudgeon 1999
[28] Groombridge and Jenkins 1998
[29] Campbell and Parnrong 2000
[30] Eriksson and Smith undated; Smith 1990

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Peoples of the Mekong 5

The peoples of the Lower Mekong Basin are extremely diverse and have much in common. They are diverse because they comprise more than 70 different ethnic groups. They speak different languages and dialects, have different histories, cultures and customs and they live under different political and economic systems. However, they also share much in common. Most of the basin's population live in rural areas, they are subsistence farmers who supplement what they grow with the fish they catch and the food and other materials they gather from forests and wetlands. Unfortunately, poverty is something many share as well. Nearly 40 percent of the people in Cambodia and Lao PDR, the two countries that lie mainly in the basin, have incomes below the poverty line. Poverty rates are also high in the parts of Thailand and Viet Nam that lie within the basin. At the turn of the 21st Century, with increasing development of the Mekong Basin's resources and rapidly changing circumstances, the peoples of the Lower Basin share hopes for prosperity as well as fears that development could make their lives even more precarious.

The majority of people in the LMB are subsistence farmers who supplement what they grow with the fish they catch and products harvested from wetlands and forests

Both in planning for development and in monitoring its impacts, decision-makers need accurate information about the status of populations that could be affected. Data on incomes, infant mortality, life expectancy, literacy, livelihoods, access to services such as education, transportation and health care and many others need to be considered with regard to development.

Approximately 80 percent of the basin's population live in rural areas

In the chapter that follows, data are provided that illustrate key aspects of human well-being and also that explore demographic and social trends that affect sustainable development of water and water-related resources in the LMB. Where appropriate, widely recognised measures of social and economic development have been used such as those tracked by UNDP in its Human Development Reports or recommended in the United Nations' Millennium Development Goals. Data have also been included in this chapter that match the particular circumstances within the basin.

Efforts have been made to find data that are comparable across the four countries and that can be compared in future editions of the State of the Basin Report. Although in some cases it has been possible to get data that match the area of each country that lies within the basin, for many topics, only national level data are available. For Cambodia and Lao PDR, the use of national data is not likely to be misleading because almost all of these countries lie within the basin; however for Thailand and Viet Nam, which have only 36 percent and 20 percent of their respective territory in the basin, national data is somewhat problematic. In future editions of the State of the Basin Report, MRC expects to have more data specific to the basin as a result of the data sharing agreement MRC signed in 2001.

1. Demographics in the Lower Mekong Basin

The Lower Mekong Basin is a rapidly growing, diverse region encompassing the four riparian countries and a multiplicity of ethnic and cultural traditions. Demographic trends will strongly influence the opportunities for sustainable development in the coming decades, including the spatial distribution, household characteristics, mobility and increase in the number of people living in the basin.

1.1 Where people live

The distribution of the 55 million people living in the LMB varies considerably. Cambodia and Lao PDR together comprise only about one-quarter of the basin's population, although 80 percent or more of each country's population lives within the basin. Thailand and Viet Nam contribute 43 and 31 percent respectively to the basin's population. However, the proportion of each country's population in the basin is small when compared to total population. In Thailand, the basin population is about 40 percent of the national population; in Viet Nam, 20 percent of the country's population lives in the Mekong Delta or the Central Highlands.

Table 1. Population of the Lower Mekong Basin (LMB)

	Population LMB (est.)	% LMB Population	% National Population
Cambodia	9,800,000	17.9	80.4
Lao PDR	4,905,000	17.9	93.9
Thailand	23,130,000	42.2	37.5
Viet Nam	16,920,000	30.9	21.8
	54,755,000		

Note: The data for Cambodia are based on the 1998 Census. The data for other countries are for 2000, based on preliminary census results (Thailand) or government estimates. However, the data for Thailand count people based on registered residence. In the case of the Northeast, a large proportion of the registered population may actually be living outside the region, e.g., in Bangkok.

Sources: NIS 1998; NSC/UNDP 2002; NSO 2002a; UNDP-Viet Nam 2002

Development in the basin is increasingly being planned based on the principal sub-national regions. In general, geographic conditions, population density and economic and cultural characteristics all vary among these sub-regions. The most populous regions are the Northeast Region of Thailand that represents about 40 percent of the basin population, and the Mekong Delta that represents about 25 percent.[1] The Tonle Sap and Plains Regions of Cambodia each represent 5-10 percent of the basin population.[2]

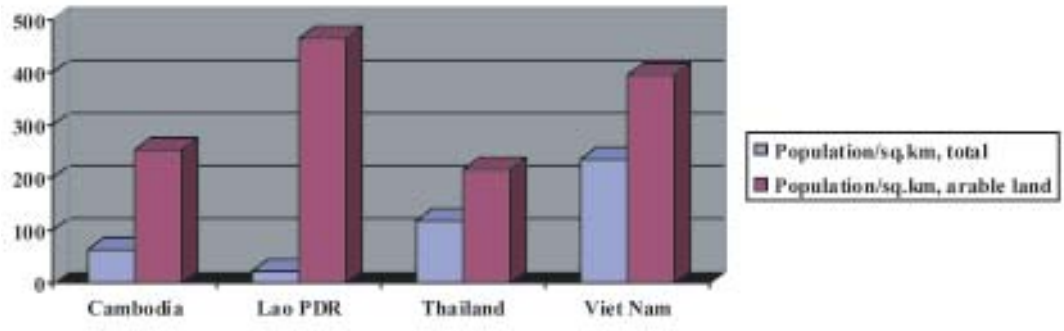
Rural and urban areas. The population of the LMB is predominately rural. Approximately 80 percent of the population live in rural areas and rely on natural resources for their livelihoods. The urban population is largely concentrated in the capitals of Cambodia and Lao PDR, Phnom Penh and Vientiane. In addition, there are a number of secondary urban centres, including provincial towns. These secondary centres, particularly in the Mekong corridor, are growing rapidly.

The overall population density of the LMB is low at 87 people per km^2. It is lowest in Lao PDR, with the population relatively evenly distributed across the country. Elsewhere, there are significant variations across the basin, within and between countries. Aside from the city of Phnom Penh, the Mekong Delta in Viet Nam is the most densely settled region. In Cambodia, the density is higher in the Plains than in other national sub-regions, in part due to expanding development outside the small, densely settled territory of Phnom Penh Municipality.

An estimated 25 percent of the basin's population lives in the Mekong Delta

While overall densities are low, when rural density is measured in terms of arable land, the picture changes markedly. The low ratio of arable land to population, particularly in Lao PDR and Viet Nam, results in net rural densities in the LMB that will have increasing significance for sustainable rural development as population grows in these countries

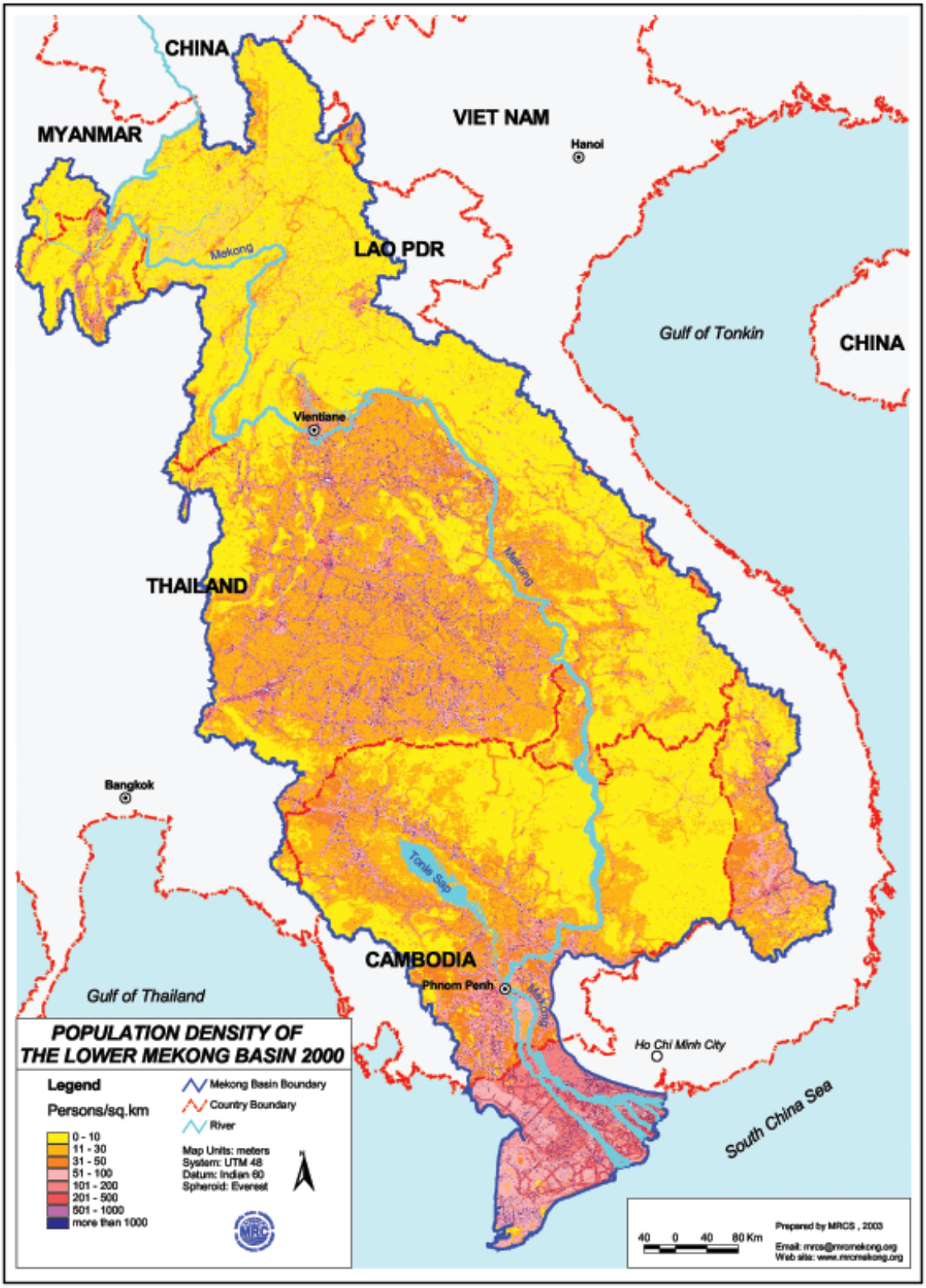
Figure 1. Population density in the Lower Mekong Basin, 1995-2000



Notes: The ratio of population to arable land has been calculated at the country level for Cambodia and Lao PDR; it has been estimated for the portions of Thailand and Viet Nam in the LMB, based on data for farmland in these regions.

Sources: NIS 1998; NSC/UNDP 2002; NSO 2002b; UNDP-Viet Nam 2002; EEPSEA 2002.

Figure 2. Population density in the Lower Mekong Basin



1.2 Ethnic diversity in the Mekong Region

The Mekong Region is characterised by a rich diversity of ethnic cultures, particularly in the upland areas of Lao PDR, Cambodia and Viet Nam. The history of Southeast Asia, including the Mekong Basin, is one of waves of different ethnic groups moving into the area from South Asia and from China, and bringing with them their traditions and religious beliefs. Today's national boundaries divide the same ethnic peoples into several countries.[3] The Hmong, Mien and Khmu, for example, live in Lao PDR, Thailand and Viet Nam. The Cham are found in both Cambodia and Viet Nam. Nearly one million ethnic Khmer live in the more remote parts of the Mekong Delta in Viet Nam.

The Khmer, the Tai Lao and the Kinh are, respectively, the dominant ethnic groups in Cambodia, Lao PDR and Viet Nam. The Khmer constitute 90 percent of the population of Cambodia. Hill tribes, or Khmer Loeu, as they are collectively known, are concentrated in the mountainous regions of northeast Cambodia. They include the Jarai, Kreung, Brou, Kuay, Mnong, Stieng and the Tampuan.[4] While only about one percent of the total population, hill tribes account for the majority of the population in the provinces of Rattanakiri and Mondulkiri.[5]

There are more than 70 different ethnic groups in the LMB, each with its own language and culture

In 1995, the national census in Lao PDR distinguished 47 main ethnic groups and a total of 149 sub-groups.[a] The dominant ethnic group is the Tai Lao, also known as ethnic Lao, who make up 35 percent of the national population.[6] Other groups referred to as ethnic minorities, comprise half the population in the Central and Southern Regions, and about 85 percent in the north.[7]

Ethnicity in Lao PDR is generally categorised by ethno-linguistic family, as well as by patterns of geographic distribution and lifestyle.[8] The ethnic Lao, along with other members of the Tai linguistic family, such as the Phutai and the Lue, account for about 60 percent of the population.[9] They are commonly known as *Lao Loum*, or lowland Lao, as they tend to live near the Mekong and in other river valleys where they practice sedentary rainfed and/or irrigated paddy cultivation of glutinous rice.

The Khmu and other Mon-Khmer ethnic groups of the Austro-Asiatic family represent about 30 percent of the Lao population.[10] These groups were the first inhabitants of Lao PDR. Because they settled on slopes and in valleys at altitudes of 300-900 m, they are known as the *Lao Theung* (midland Lao). They are distributed throughout the country, where their traditional production systems combine swidden (shifting) cultivation of glutinous rice and other crops on forested highlands with mostly rainfed paddy cultivation in valleys.

In Lao PDR, the Hmong make up 80 percent of the Miao-Yao family that constitutes slightly more than 5 percent of the national population.[11] The ethnic groups of the Sino-Tibetan family comprise under 5 percent of the population.[12] Together, groups of these families are known as *Lao Soung* (highland Lao). Located primarily in the north of Lao PDR, they practice swidden cultivation, growing rainfed non-glutinous rice, corn and other vegetables during the rainy season and, often, opium poppy during the dry season.

[a] Chazée 1999; it should be noted that some studies have identified as many as 200 ethnic groups and sub-groups in Lao PDR.

In Viet Nam, over 50 ethnic groups are referred to as hill tribes and constitute about 14 percent of the national population.[13] They are concentrated in the mountainous regions of the northern and Central Highlands. The hill tribes of the Central Highlands such as the Ba-Na, Gie-Tieng, Ra Giai, Xo-Dang and E-De, represent less than 3 percent of the national population.[14] In Kon Tum Province, ethnic minorities account for over 50 percent of the population. However, recent government policies such as the establishment of New Economic Zones have resulted in the in-migration of the ethnic majority Kinh to the Central Highlands, where they now account for 66 percent of the regional population.[15]

In Thailand, hill tribes live primarily in the Northern Region and constitute 6 percent of the national population

In Thailand, hill tribes constitute only six percent of the national population and are located primarily in the Northern Region.[16] The principal groups include the Karen, Akha and Hmong.

As will be discussed in some detail throughout this chapter, ethnic minorities throughout the LMB have lower levels of social and economic well-being when compared with the dominant groups in each country. Government policies frequently target ethnic minorities for improved education, health and economic conditions. This is particularly the case in Lao PDR and Viet Nam. While this is essential, there is also significant debate about government strategies that lead to greater assimilation of ethnic minorities.[b]

1.3 Individual and household characteristics of people in the LMB

Households constitute the basic social and economic unit throughout the LMB. The ratio of men and women, fertility rates, age-related dependencies and household formation patterns influence how households function and their reliance on natural resources.

Ratio of men to women (M/F ratio). Women outnumber men in the populations of Cambodia, Lao PDR and Viet Nam. Armed conflicts in these countries over the past 50 years resulted in the deaths of more men. The ratio of men to women in Cambodia (0.93) is still the lowest in the LMB, due to the more recent end of civil strife. In 1998, the M/F ratio among Cambodians aged 20 years and older was 82.3 men to 100 women; among the elderly it was only 71.8 men to 100 women.[17] In Lao PDR and Viet Nam, the ratio of men to women is becoming more equal, as has always been the case in Thailand.

Due to decades of armed conflict in Cambodia, Lao PDR and Viet Nam, women significantly outnumber men

Traditionally, men have been more likely to migrate out of rural areas to find work in cities. This often results in higher proportions of women in rural populations, as in Lao PDR and the Mekong Delta. However, elsewhere in the basin other economic forces have different impacts.

[b] See, for example, Dennis 1997a-d; Roy, n.d.

In the Central Highlands, due to recent in-migrations of lowlanders, men actually outnumber women. Also, younger women are increasingly attracted from rural areas to urban jobs in the growing garment industry and in the service sector.

Fertility rate. Women in the Mekong Region have traditionally given birth to large numbers of children. Large families have been important to provide labour and to ensure the care of elderly family members. Women have had frequent pregnancies, partly in response to the high death rates of infants and young children. Total fertility rates (TFR)[c] remain high in Cambodia and Lao PDR, with women in both countries averaging 5.1 children. These rates, however, represent major declines from, respectively 5.9 and 6.4 in 1993,[18] and reflect changes that are occurring as a result of birth spacing programmes and greater access to health care.

In Thailand and Viet Nam, fertility rates have dropped dramatically to near or below the replacement level of 2.1 children per family. The most important reason for this change is higher education levels for women in these countries. Other contributing factors include government programmes that encourage smaller families and increasing economic opportunities for women outside the agricultural sector.

Overall women head about one quarter of households in the Lower Mekong Basin

In rural areas of the LMB, fertility rates tend to be higher than in urban areas. In Cambodia, TFR is 5.5 in rural areas, compared with 4.4 in urban areas.[19] In rural areas of northern Lao PDR, TFR exceeds 6.0 in some provinces.[20] Higher fertility rates in rural areas are associated with lower literacy rates and levels of educational attainment among rural women. Ethnic minority women and women working in the agricultural sector also tend to have higher than average fertility rates.[21]

Age structure and dependency. The population of the LMB is very young. This is due primarily to high fertility rates, including a baby boom in Cambodia in the 1980s. More than half the population of Cambodia and Lao PDR is estimated to be below the age of 15 years.[22] This produces a high age dependency ratio (ADR[d]) because each working adult must support other household members who are too young (or too old) to work. In Thailand, for every three people of working age, there is one dependent youth whom they support.[23] In Viet Nam, the ratio is one youth for every two working-age people.[24] In Cambodia and Lao PDR, the age dependency ratios are well above the 1999 average of 0.6 for the East Asia and Pacific Region.[25]

Between 1999-2015, the number of elderly people in the LMB is expected to grow at rates of 2-3 percent per year

[c] Total fertility rate is a measure of the number of children born to women of childbearing age.

[d] The age dependency ratio (ADR) is generally defined as the ratio of youth (0-15 years) and elderly (65 years and older) to the number of people of working age (15-65 years).

The dependency ratios will tend to decline as young people become adults and, in general, have fewer children than their parents. This transition has begun in Thailand and Viet Nam. At the same time, people are living longer, signalling major changes in the overall age structure in future. In the period 1999-2015, the number of elderly in the LMB is expected to grow at annual rates of 2-3 percent, while growth rates for the 0-15 year age group will be less than one percent or negative.[26] In Viet Nam, the elderly dependency ratio doubled to 0.15 in the three-year period from 1997 to 2000.[27] As the number of elderly increase, age dependency ratios will tend to rise again, with more elderly depending on working age adults for support.

Household formation. The average household size in Cambodia and Lao PDR is five or six persons, reflecting a common feature in rural, subsistence households in the LMB. In Thailand, the average household size has dropped from six to four persons due to declining fertility rates. A similar transition is occurring in Viet Nam, aided by government policies to encourage small families. At the same time, the number of households is increasing. For example, between 1993 and 1997 there was an increase of about 20 percent in the number of households in Cambodia.[28]

Overall, women head about one-quarter of the households in the LMB. In rural areas, female household heads tend to be widows who lost their husbands in war, or married women whose husbands are away working as migrant labourers. In rural areas of northern Lao PDR, among older household heads, as many as 60-70 percent are women.[29]

In Cambodia, Lao PDR and Viet Nam, the rate of female-headed households in urban areas is twice that for rural areas.[30] Rural women raising families alone are more likely to lose their land due to conflict or poverty, which forces them to move to urban areas in search of work. In Viet Nam, where women's education levels are generally higher than in the other countries, female household heads may be attracted to urban areas where they can find better work opportunities.

Table 2. Individual and household characteristics

			Age dependency			Aver.	%
	M/F ratio	Fertility rate	Total	Youth	Elderly	HH size	Female head
Cambodia	93.0	5.1	0.88	0.82	0.06	5.2	25
Lao PDR	97.7	5.1	0.87	0.80	0.07	6.0	15
Thailand	100.0	1.7	0.42	0.33	0.09	4.1	24
Viet Nam	97.6	2.4	0.64	0.49	0.15	4.5	32

Sources: ADB 2002; NIS 1998; NSC/UNDP 2002; NSO 2002a, UNDP-Viet Nam 2002; WB 2002b

1.4 People's movements in the basin

People living in the LMB have moved frequently and for diverse reasons. Conflict and instability in the past 50 years have caused many people in Lao PDR, Viet Nam and Cambodia to leave their homes. When they were able, many returned voluntarily or as part of government resettlement programmes. In upland areas, traditional swidden cultivation has involved the regular movements of entire villages. Government policies influence people's movements, moving people out of highland areas as part of programmer to stop shifting cultivation (as in Lao PDR) or into highland areas to meet government objectives for increased agricultural production (as in Viet Nam).

The search for employment is a principal cause of migration. Seasonal and semi-permanent migration to urban areas provides important income for households in rural areas. In Northeast Thailand, the population is declining as people move to urban areas in search of work.[31] Based on evidence from Thailand and Viet Nam, economic migrants tend to be the young and better-educated people.[32] Also, increasing numbers of women are moving to cities to work in low-skill manufacturing and service jobs.

Seasonal migration to urban areas provides important income for rural households

Several different types of migration appear to be taking place at the same time, as suggested by national level data from Cambodia and Thailand. The largest movements are between rural areas. People relocate from densely populated rural areas to more remote ones to seek new economic opportunities. This may be voluntary, as in northeast Cambodia, or it may be part of a government scheme such as Viet Nam's resettlement of lowland farmers to the Central Highlands in order to increase production of coffee and other commercial crops.

As economies develop in the LMB, urban centres will attract more people because jobs are more numerous, they often pay better and urban areas have better services. In the LMB, these movements – seasonal and long-term – occur within countries and across borders. Many people who migrate from rural to urban areas relocate to secondary urban centres and to the areas immediately surrounding urban centres, rather than to major cities themselves.

Migration patterns in the LMB include strong two-way rural-urban linkages. People who move to urban centres maintain strong social and economic links with their rural communities. They return periodically and, more importantly, they regularly send money home. These remittances are an important source of income for many rural households and for rural economies as a whole. Moreover, in times of economic difficulty, such as the recent financial crisis in Southeast Asia, many people working in urban areas return to their rural homes, where extended family networks can support them.

Table 3. Migration patterns (%), Thailand and Cambodia

	Thailand (1997)		**Cambodia**
	Female	**Male**	(1998)
Urban-Urban	7.6	6.9	14.5
Rural-Urban	15.2	12.0	19.2
Rural-Rural	40.5	38.6	58.2
Urban-Rural	34.8	39.1	8.1

Sources: Huguet *et al.* 2000; NSO 1998

1.5 Population dynamics and growth

The rapid population growth that characterises the LMB is likely to continue for the next 20-30 years, particularly in Cambodia, Lao PDR and Viet Nam. Declining fertility rates will tend to slow population growth in Viet Nam and Thailand and, to a lesser extent, in the other countries. However, each country has a large pool of young people who will start their own families. This and increased longevity mean that overall population growth will remain high. The projected annual growth rates of 2-2.5 percent for Cambodia and Lao PDR will result in a 50-55 percent increase in the population over the next 20 years. The populations of Thailand and Viet Nam will grow more slowly, but they will still increase by 20-30 percent.

By 2025, it is projected that half the population in the Asian and Pacific Region will live in urban centres.[33] While urban growth rates will not be as high in the LMB, the relationship between rural and urban areas will change significantly. The rates of growth in urban areas will greatly exceed national growth rates, reflecting government policies to promote increased industrialisation and economic growth. By 2020, up to one-third of the population in the LMB will be located in urban areas.

The trends in urbanisation will increase the importance of the relationship between urban centres and the immediately surrounding (or peri-urban) areas. In major centres such as Phnom Penh, new arrivals tend to settle on the outskirts of the city, converting semi-rural areas to urban areas. This often results in the loss of valuable agricultural land, increased costs to provide services such as water and sanitation, and, in floodplains, to increased risks and costs associated with flooding. Increased migration from rural areas to small and medium-sized urban centres will cause them to grow and expand also, but will help to relieve the pressures on bigger cities.

Although fertility rates are falling in the LMB, the population is expected grow from 55 million today to 90 million by 2020

Table 4. Projected population growth, LMB

	Population 2000 (million)	Aver. annual growth 2000-2020 (%) Rural	Urban	Total	Projected population 2020 (million)	%Urban population 2000	% Urban population 2025
Cambodia	13.1	1.2	6.2	2.3	20.5	16	26
Lao PDR	5.3	1.8	7.3	2.6	8.1	24	36
Thailand	62.8	0	3.7	1.0	75.1	22	33
Viet Nam	78.1	0.8	3.9	1.4	100.2	20	28

Source: WRI 2002

2. Social development in the Mekong Region

Social development is commonly measured by people's health status, literacy rates and educational achievement, as well as their access to safe water, sanitation and electricity. These indicators measure the well-being of people living in the basin and their capacities to lead full and productive lives. The level of social development varies widely among the riparian countries in the Lower Mekong Basin, and is often considerably lower than other regions in Asia. There are, however, some positive trends towards improvement in general and, particularly, in closing the gap between the opportunities for both men and women.

2.1 Indices of human development

The Human Development Index (HDI) is a composite index developed by UNDP to measure average achievements in social and economic development using indicators for longevity, knowledge and standard of living.[e] The Gender Development Index (GDI) measures women's achievement using the same indicators as the HDI. The relationship between the HDI and GDI for each country measures the relative status of women's opportunities. The closer the values of the HDI and GDI, the greater the degree of gender equality.

All countries in the LMB are presently classified as "medium human development" countries, with HDI values between 0.500-0.799. Over the 1990s, the HDI improved steadily in all LMB countries. However, the 1999-2001 levels in Cambodia, Lao PDR and Viet Nam remain below the 1990 level in Thailand (0.713). The HDI for Thailand and Viet Nam are above the average of 0.660 for middle-income countries. Cambodia and Lao PDR are low-income countries with HDI values below the average of 0.610 for developing countries in East Asia and the Pacific.

There is wide variation among sub-national regions within countries in the LMB. In Thailand in 1999, the HDI for the Northeast Region, cited in the national human development report was 0.655 compared with a national value of 0.880.[f] In general, the HDI for urban areas such as Vientiane (0.665) is significantly higher than the national average. Only the Central Region (0.539) of Lao PDR has an HDI above the national average, due primarily to the proximity of prosperous rural areas to Vientiane.

In Thailand and the Mekong Delta, there are relatively high levels of gender equality, although Thai data are not specifically for the basin. This equality is based primarily on higher life expectancy for women in general, and more equal levels of achievement in literacy and education. Elsewhere, greater systemic differences remain between the opportunities for men and women. This is particularly true in rural areas of Cambodia, the Northern Region of Lao PDR and the Central Highlands of Viet Nam. Throughout the LMB, women's income levels continue to be substantially lower than those of men.

For females, opportunities for a better life are closely linked to continuing their education beyond primary school

Table 5. Development indices, 1999-2001

	HDI	GDI
Cambodia	**0.541**	**0.534**
Urban		0.601
Rural		0.496
Lao PDR	**0.535**	**0.530**
Vientiane	0.665	0.650
Northern	0.531	0.490
Central	0.539	0.550
Southern	0.519	0.520
Thailand	**0.757**	**0.755**
Viet Nam	**0.696**	**0.680**
Mekong Delta	0.669	0.668
Central Highlands	0.604	0.599

Sources: NSC/UNDP 2002; UNDP 2002; UNDP 2000; UNDP-Viet Nam 2002

[e] HDI uses international data to measure life expectancy at birth, adult literacy rate, combined school enrolment ratios and adjusted per capita income (PPP $US). The highest possible value is 1.000; the higher the HDI value, the greater the level of human development. (UNDP, 2002).

[f] UNDP 1999. N.B. These national indices for Thailand were developed using government sources of data, rather than UN agency data that are used for the international UNDP HDI. The national indices are valid for inter-provincial comparisons within Thailand.

2.2 People's health

Life expectancy and the health of children and women are important measures of quality of life, and have a significant impact on economic productivity and output. Progress in improving health conditions is a good indicator that the benefits of economic development are reaching more than just the small percentage of affluent people. Diseases such as malaria and, increasingly, HIV/AIDS, need to be monitored. They have consequences for public health and for the success of development in the region.

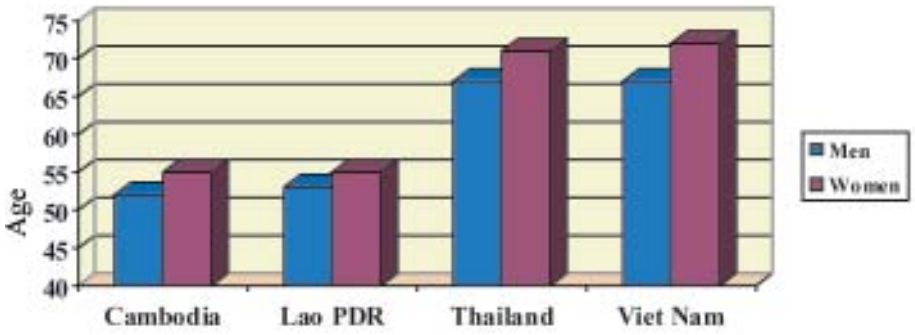
Life Expectancy. Life expectancy at birth is lowest in the LMB in Cambodia and Lao PDR, where the average rates are 54 years. These rates are significantly below the average of 69 years for developing countries in East Asia and the Pacific.[34] They reflect, among other factors, poorer health conditions. In Thailand and Viet Nam, life expectancy of approximately 69 years corresponds to the regional average.

There are significant differences in life expectancy throughout the LMB, between men and women, and between urban and remote regions. In general, women tend to live 4-6 years longer than men. Residents of urban centres also tend to live longer, for example, life expectancy in Vientiane Municipality (63 years in 1995) was nearly twice the rate of Sekong Province (35 years).[35]

Overall, life expectancy is increasing in the LMB. In Lao PDR, people now live 7-9 years longer than they did in 1995. In Cambodia, it is estimated that people are living five years longer than they did in 1990. The governments of Lao PDR and Viet Nam have targeted further improvements in life expectancy by 2010. In Lao PDR, the objective is to raise average life expectancy to 67 years. In Viet Nam, the target for 2010 is 71 years.

Life expectancy in Cambodia and Lao PDR is 54 years, while in Thailand and Viet Nam it is 69 years

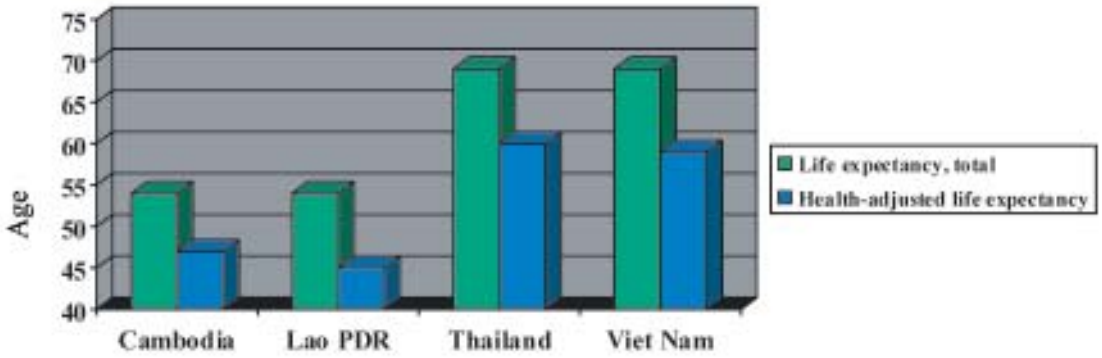
Figure 3. Life expectancy at birth (years), 2000



Source: WB 2002a

Health-adjusted life expectancy (HALE) is a new statistic introduced by the World Health Organisation in 2001[36]. It is based on data for life expectancy at birth, adjusted, however, to take into account the effective time spent in poor health during a lifetime. In the LMB, substantially lower HALE rates indicate that poor health seriously compromises the expectations for healthy, productive years for a majority of the population. The causes are diverse and may include injury or disability due to landmines or unexploded ordinance, particularly in Cambodia and Lao PDR; endemic and chronic diseases that are common in the region; and the combined effects of strenuous physical labour, inadequate nutrition levels and lack of access to health services.

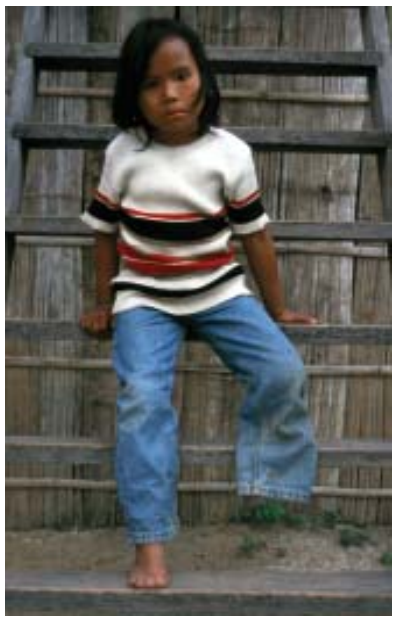
Figure 4. Health-adjusted life expectancy, 2000



Sources: WB 2002a; WHO 2001

Children's health. Health conditions for children in the LMB, particularly in Cambodia and Lao PDR, have been among the poorest in the world. The mortality rate of infants (IMR[g]) and under-five children (U5MR[h]) are related to a number of factors, including low birth weights and diseases such as malaria, diarrhoea and dysentery. In the recent past, civil strife and the remoteness of large portions of the region meant that many people did not have adequate access to health services. As recently as 1997 in Lao PDR, one-quarter of children born in poor households died before reaching the age of five years.[37]

The efforts of governments and international and other organisations to implement effective programmes to reduce the IMR and U5MR are showing results. In the decade from 1990-2000, the IMR in Cambodia dropped from 122 per 1,000 births to 88. In Lao PDR, it declined from 108 to 92. Nonetheless, these rates remain significantly higher than the average IMR of 34 deaths per 1,000 live births[38] for developing countries in Asia and the Pacific. There are also large discrepancies between the IMR rate in urban and rural areas. For example, in the mid-1990s, the IMR in Vientiane Municipality was 72 deaths per 1,000 live births, compared with the much higher rate of 138 in nearby Xaysomboon Special Region.[39]



The presence of landmines and unexploded ordnance is a continuing problem in Cambodia, Lao PDR and Viet Nam

[g] Infant mortality rate (IMR) is the number of infants who die before the age of one year per 1,000 live births.
[h] Under-five mortality rate (U5MR) is the number of children who die between the ages of one year and five years, per 1,000 live births.

While U5MR decreased 1-3 percent per annum in Lao PDR, Thailand and Viet Nam in the 1990s, the reverse was true in Cambodia.[40] Between 1994 and 1998, the U5MR in Cambodia increased from 115 to 125 deaths per 1,000 live births, although the rate is considered to be stabilising or, at least, increasing at a slower rate.[41] Despite declines in Lao PDR, U5MR rates in both countries remain much higher than the average for developing countries in Asia and the Pacific of 44 deaths per 1,000 live births.[42] The U5MR in urban areas is also much lower than in rural areas.[43] Malnutrition is associated with half of all under-five deaths,[44] and high rates of child malnutrition in Cambodia and Lao PDR continue to limit improvements in the U5MR.[i]

In general, the health conditions in Thailand exceed regional averages. Nonetheless, IMR in the North and Northeast Regions tends to be twice the rate in Bangkok.[45] In Viet Nam, despite much lower levels of economic development, there was a decline of over 20 percent in IMR and U5MR during the 1990s, to levels close to or just below regional averages. The IMR and U5MR in the Mekong Delta are similar to the national rates in Viet Nam; however, the rates are twice as high in the Central Highlands.[j] Malnutrition in Viet Nam declined from 45 percent of children under 5 years in 1994, to about 33 percent in 2000.[46] Malnutrition rates in ethnic minority areas such as the Central Highlands remain above 40 percent.[47]

The Millennium Development Goals (MDG) set targets for 2015 of reducing U5MR by two-thirds and child malnutrition by 50 percent. The Government of Viet Nam's targets for 2010 for children's health include IMR and U5MR of, respectively, 25 and 32 deaths per 1,000 live births and malnutrition rates of 20 percent.[48]

The gender gap in years of education is greatest for ethnic minorities

Table 7. Children's health conditions, 1998-2000 (most recent year)

	IMR (per 1000 births)	U5MR (per 1000 births)	Child Malnutrition (% under 5)
Cambodia	88	125	46
Lao PDR	92	125	40
Thailand	28	33	19
Viet Nam	27	34	33

Sources: ADB 2002; WB 2002b

Reproductive health. Maternal mortality rates (MMR[k]) in Cambodia and Lao PDR are among the highest in Asia, and constitute a major constraint to overall social and economic development. The MMR in these countries is 4-5 times higher than in Viet Nam, and 10-12 times higher than in Thailand. High MMR can be attributed to poor access to and utilisation of maternal health services, low-quality health facilities and insufficient use of birth-spacing strategies. Women often die in childbirth because they have been unable to obtain adequate pre-natal care or because they give birth without the assistance of a trained attendant.

[i] Child malnutrition is defined as the proportion of children under 5 who are underweight for their age.
[j] For example, IMR in the Central Highlands in 1998 was 64.4 deaths per 1,000 live births. UNDP-Viet Nam 2001b; WB 2002e
[k] Maternal mortality rate (MMR) is the number of women who die in childbirth per 100,000 live births.

In Thailand, declines in the fertility rate, combined with government programmes to promote safe motherhood practices, have led to a dramatic drop in the MMR, from about 200 women per 100,000 live births in 1990, to 44 in 1996. The principal causes of maternal deaths in Thailand are complications during labour and delivery.[49] In Viet Nam, improvements in reproductive health services halved the MMR between 1990 and 2000, although the rate in the Central Highlands remains extremely high at 418 deaths per 100,000 live births.[50]

Throughout the basin, MMR tends to be higher in rural areas and in areas with large ethnic minority populations. Significant progress has been made to reduce the MMR in areas where it is very high. For example, in the Northern Region of Lao PDR, the MMR dropped by more than 100 percent between 1995 and 2000 (from over 1,100 to 520 deaths per 100,000 live births).[51] In Cambodia, the rate has dropped from an estimated 1990 rate of 900 deaths per 100,000 live births to a level under 500.[52] Continued improvement in MMR will come as rural and ethnic women achieve higher education levels, have greater access to health services and as governments promote birth spacing programmes.

Maternal morality rates in Cambodia and Lao PDR are among the highest in Asia

The Millennium Development Goals targets include a reduction of 75 percent in MMR by 2015. In Viet Nam, the 2010 target is 70 deaths per 100,000 live births.[53] In Cambodia, the Five-Year Action Plan anticipates that with the introduction of a Safe Motherhood Programme, the MMR can be reduced to 250 deaths per 100,000 live births by 2015.[54]

Table 8. Reproductive health, 1998-2000 (most recent year)

	Maternal mortality (per 100,000 live births)
Cambodia	473
Lao PDR	530
Thailand	44
Viet Nam	100

Sources: Ministry of Health, Thailand 1998; UNDP 2002; UNDP-Viet Nam 2001c; UNFPA 2001

Malaria and HIV/AIDS. There is widespread endemic tropical disease in the LMB, much of which is related to contaminated water. Malaria is the leading public health problem throughout the LMB, particularly in Cambodia and Lao PDR. In some provinces of northeast Cambodia, the incidence rates range from 2,000-3,000 people per 100,000 people.[55] Malaria-endemic areas of Viet Nam include the Central Highlands and southern provinces, where morbidity and mortality rates are, respectively, 50 and 150 percent above national averages.[56] The high incidence in remote areas of the LMB is related to unsafe water supplies, inadequate sanitation and the lack of sufficient, accessible health services.

Table 9. Incidence of malaria and HIV/AIDS

	Malaria incidence, 1997 (per 100,000 people)	**HIV/AIDS prevalence, 1999** (% 15-49 years)
Cambodia	1,096	3.20
Lao PDR	1,076	0.05
Thailand	163	2.15
Viet Nam	86	0.22

Sources: UNAIDS 2000; UNDP 2002; UNDP-Cambodia 2001

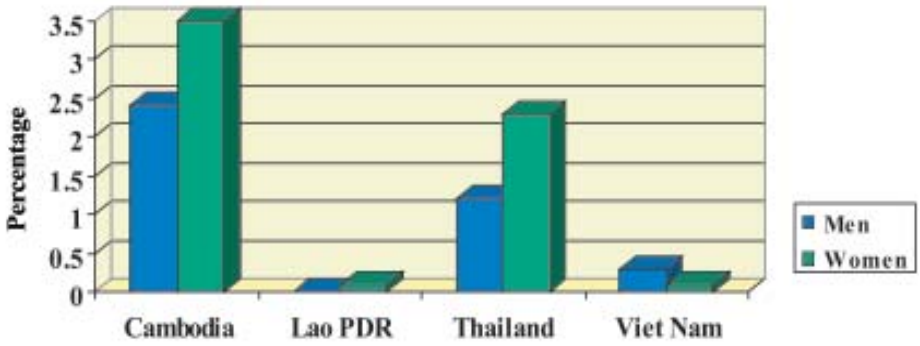
The presence of HIV/AIDS in the countries of the LMB has been documented since the early 1990s. It is recognised as an emerging public health problem of serious proportions and, if not controlled, a potential constraint on economic development in the region. Throughout the region, sexual contact is a major factor in the transmission of the HIV virus. In Viet Nam, injecting drug use is also a major cause of HIV/AIDS, accounting for 65 percent of cases.[57] Vulnerability to HIV/AIDS is closely associated with population movements in the LMB.[58]

The incidence of HIV/AIDS varies significantly. Cambodia has had the highest rate in the LMB and the highest rate of increase in HIV/AIDS in Southeast Asia.[59] Most of the affected people live in Phnom Penh, the Plains Region and provinces close to Thailand. Data suggest that the situation may be stabilising in Cambodia, with a drop in the incidence of HIV/AIDS from four percent in 1997 to 2.8 percent in 2000.[60]

In recent years, Thailand has implemented successful measures to control and significantly reduce the incidence of HIV/AIDS.[61] Nonetheless, infection rates are particularly high in the North Region.[62] The incidence in Lao PDR and Viet Nam is much lower, but it has increased rapidly over the 1990s (for example, 7 percent per annum in Viet Nam).[63] The MDG target is to halt and reverse the spread of HIV/AIDS by 2015.

Women in the LMB are particularly vulnerable to the growing presence of HIV/AIDS in the region. Trafficking in women and young girls for sexual purposes increases their exposure to HIV. Women in the general population and their unborn children are also at risk due to the high degree of mobility among men within the region. In Cambodia and Thailand, young women (15-24 years) have HIV/AIDS prevalence rates significantly higher than men in the same age group. Available data indicate that in Lao PDR, half of the people infected with HIV are women.[64] Women constitute approximately 20 percent of people living with AIDS in Viet Nam.[65]

Figure 5. HIV/AIDS prevalence, 15-24 years (%), 2000



Source: WB 2002a

2.3 Literacy and educational achievement

Improving the levels of literacy and educational achievement is essential for economic and social development in the LMB. Economic growth and development require a skilled work force, including both men and women. Higher literacy and education levels among women are closely associated with lower fertility rates, as well as improvements to their own health and the health of their children.

Literacy rates. Approximately 95 percent of the population in Thailand and Viet Nam over the age of 15 years is literate, compared with 1990 rates in these countries which were, respectively, 89 and 87 percent.[66] Equally important, women have literacy rates as high or, in the case of young women in Viet Nam, higher than men of the same age. However, in Viet Nam, adult literacy rates remain significantly lower in rural areas, achieving levels of only 83 percent in the Central Highlands and 88 percent in the Mekong Delta.[67] Women in these areas are much more likely than men to be illiterate.[68] Whereas 5 percent of men in the Mekong Delta and the Central Highlands are illiterate, the proportions of illiterate women are respectively 10.5 and 13.4 percent.

Literacy rates are lowest for older women and ethnic minorities

Adult literacy has increased in Cambodia[l] and Lao PDR during the 1990s, although the rates remain below the average of 85 percent for developing countries in Asia and the Pacific.[69] Moreover, there remain significant discrepancies between men and women living in urban and rural areas. The differences are even more pronounced among ethnic minority women. In the Cambodian provinces of Rattanakiri and Mondulkiri, women have literacy rates that are less than half the average for rural women.[70] While ethnic Lao women have literacy rates higher than the national average for women in Lao PDR, ethnic minority women have rates that range from 10-30 percent.[71]

Table 10. Adult and youth literacy (%), 2000

	Adult literacy 15 years and older		Youth literacy 15-24 years	
	Male	**Female**	**Male**	**Female**
Cambodia	80	57	83	75
Lao PDR	64	33	83	58
Thailand	97	94	99	98
Viet Nam	96	91	96	97

Source: WB 2002a

In Cambodia and Lao PDR, the literacy rates among young women aged 15-24 years are much higher than among adult females. However, a much smaller proportion of young women in those two countries are literate, compared with Thailand and Viet Nam.

School enrolment and educational achievement. Throughout the LMB, the net primary enrolment rate (NER)[m] has increased in recent years for both boys and girls. Nearly as many girls as boys attend primary school in Thailand and Viet Nam. In Cambodia and Lao PDR, however, the percentages of girls enrolled in school remain lower than for boys. Parents are more reluctant to send their daughters to school because of the important role they play in domestic and household economic activities. Families also prefer to educate sons for cultural reasons and because it is considered safer to send boys to schools located some distance from villages. However, only about half of all enrolled students complete the primary level.

[l] A UNICEF study suggests that literacy rates are significantly lower than reported by other sources. This study (reported by Chunn and Prasertsri, 2000) actually tested people's ability to read and found that only 37 percent of the population was literate. The proportion of literate women (29 percent) was significantly lower compared to men (48 percent).

[m] Net primary enrolment rate (NER) is defined as the number of children of primary school age enrolled in primary school as a percentage of all children of primary school age.

In Cambodia, NER is above 80 percent throughout the country, except in the Plateau/Mountain Region, particularly in provinces with large ethnic minority populations.[72] In the provinces of Rattanakiri and Mondulkiri, the NER is less than 50 percent.[73] In Lao PDR, NER in urban areas is 89 percent, compared with 63 percent in rural areas.[74] However, ethnic minority areas have significantly lower NER. In 1992, the NER for ethnic Lao was about 80 percent, while it was less than 15 percent for some ethnic minority groups.[75]

In Cambodia and Lao PDR only about half of all enrolled students complete the primary level of schooling

The Millennium Development Goals target 2015 for universal access to primary education, and that will likely be achieved in Viet Nam and in urban areas in the basin. Nonetheless, regional differences persist in Viet Nam. Net primary enrolment in the Mekong Delta is 90 percent, compared with a national rate of 95 percent.[76] In the Central Highlands, the rate is lower.[77] At the national level, only 68 percent of school children complete primary education, indicating high dropout rates.[78]

Table 11. Net primary enrolment (%), 1999-2000 (most recent year)

	Total	Male	Female	Completion rate
Cambodia	83.8		80.7	49
Lao PDR	77.3	80	72	55
Viet Nam	94.8	94	92	68
Thailand		78	76	

Note: Information on NER reflects readily available data.
Sources: EMIS-UNICEF 2002; NSC/UNDP 2002; UNDP-Viet Nam 2001c; WB 2002a; WB 2001b; WB 2002c

An important MDG target for gender equality is the elimination of disparities in male and female net secondary enrolment rates (NSR). For women, opportunities to improve their social and economic conditions are closely linked to continuing their education beyond the primary school. Overall in the basin, NSR are only 40-50 percent of primary enrolment rates. In Cambodia and Lao PDR, young women account for only 30-40 percent of secondary students.[79] In Cambodia, net secondary enrolment is the lowest in Southeast Asia.[80]

The net secondary enrolment is lower in rural areas than in urban areas, and for young women compared with young men. In Viet Nam, the gender gap has disappeared among urban secondary students, but in rural areas only 20 percent of young women attend lower secondary schools, compared with 32 percent of young men.[81] A gender gap is also particularly evident in ethnic minority areas. Combined primary and secondary net enrolment rates for ethnic minority children in Viet Nam are 76 percent of rates for ethnic majority Kinh children.[82]

In Thailand and Viet Nam, both boys and girls attend school for an average of 10 to 11 years. In Cambodia and Lao PDR, however, the average for years of schooling is much lower (for boys it is only nine years and for girls only seven years).[83]

Table 12. Net secondary enrolment (%), 1999-2000 (most recent year)

	Secondary	Lower secondary	Upper secondary
Cambodia	-	16.6	7.7
Lao PDR	-	48.3	22.5
Viet Nam	-	46.9	27.3
Thailand	55		

Note: In Thailand, data are reported for overall secondary enrolment. In the other countries, there are lower and upper secondary levels.
Sources: EMIS-UNICEF 2002; NSC/UNDP 2002; UNDP-Viet Nam 2001c; WB 2002a; WB 2001b

2.4 Access to water, sanitation and electricity[n]

Access to improved sources of water and adequate sanitation enhances the living conditions of people, particularly their health. Electricity also contributes to improved living conditions, as well as to opportunities for income-generation activities.

The access to improved or safe water supplies varies widely across the LMB.[o] Less than 40 percent of the population in Cambodia and Lao PDR has access to safe water, and less than 30 percent in rural areas. In urban areas, the presence of piped water supplies increases the availability of safe water. In Cambodia, however, during the dry season, the number of households with access to safe water declines in both urban and rural areas, compared with the rainy season.[84]

In Thailand and Viet Nam, access to safe water supplies is generally more widespread, in both urban and rural areas. In the Mekong Delta, however, fewer than half the households have access to safe water.[85] The Millennium Development Goals target a reduction by half in the proportion of people without access to safe water by 2015.

In Thailand and Viet Nam the majority have access to safe drinking water, but in Cambodia and Lao PDR, the rate is below 40 percent

Adequate sanitation usually means the availability of a latrine in or near the house, or a flush toilet. As with water, the situation varies across the LMB. Most households in Thailand and urban households in Viet Nam have adequate sanitation. In rural areas of Lao PDR and Cambodia, less than 25 percent of households have adequate sanitation. In Cambodia, in richer rural villages, 79 percent of households have adequate sanitation, but this is so for only 10 percent of households in poorer villages.[86]

[n] See also Chapter 12 on domestic water and sanitation for further detail on this subject.
[o] Safe water is defined by UNICEF, the source of the principal data for this section, as one of the following: household connection, public standpipe, protected dug well, protected spring or rainwater collection, with a minimum quantity of 20 litres/person/day within one hour of people's residences (UNICEF 2002b).

Table 13. Access to improved water supply and sanitation, 2000

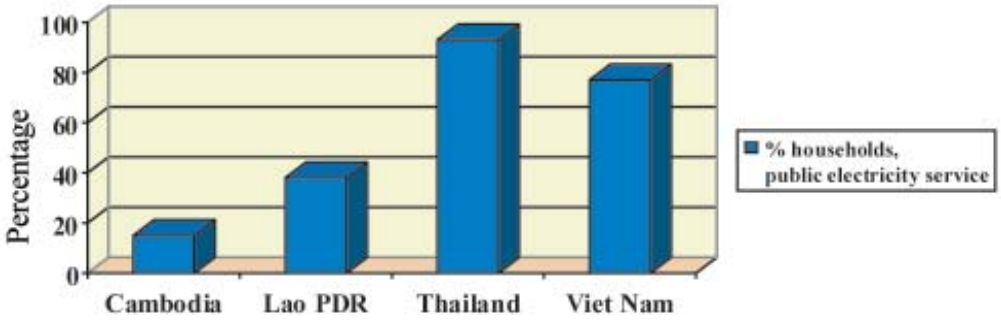
	Improved Water Supply			Sanitation		
	Total	Urban	Rural	Total	Urban	Rural
Cambodia	30	54	26	17	56	10
Lao PDR	37	61	29	30	67	19
Thailand	84	95	81	96	96	96
Viet Nam	77	95	72	47	82	38

Source: UNICEF 2002b

Electricity is available in most parts of Thailand and more than 90 percent of households have service. Per capita consumption in Thailand is very high (1,360 kWh). In Viet Nam, more than 75 percent of the population has electricity, although the rate in rural areas is significantly lower. In the Mekong Delta and Central Highlands, the proportion of households without electricity is 45-50 percent.[87] Viet Nam's per capita consumption (203 kWh) is less than half the average for low-income countries (448 kWh).[88]

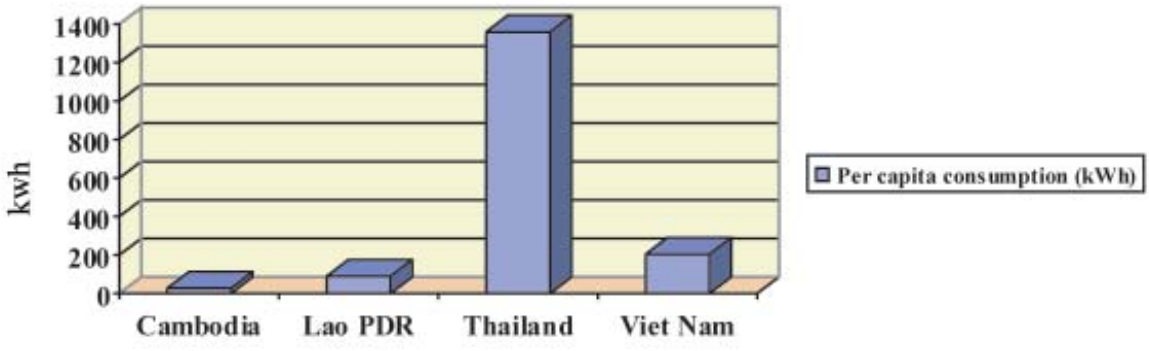
In Cambodia and Lao PDR, the proportion of households with access to public electricity service is, respectively, 15 and 38 percent. In Lao PDR, this varies from 91 percent in urban areas, to 19 percent in rural areas. Where households do have electricity, they use, on average, only 10-30 percent of per capita electricity consumption in Viet Nam. Some households without public electricity service use generators to produce electricity for lighting, and batteries to operate radios and TVs. In many provincial and district towns, diesel-generated public electricity service may be limited to a few hours a day.

Figure 6. Access to electricity, % households, 1997-2000 (most recent year)



Sources: EEPSEA 2002; Ministry of Planning 1998b; NIS 1998; NSC 2001; NSC/UNDP 2002; NSO 2002a; UNDP-Viet Nam 2002

Figure 7. Electricity consumption per capita (kWh), 1997-2000



Sources: EEPSEA 2002; Ministry of Planning 1998b; NIS 1998; NSC 2001; NSC/UNDP 2002;

3. Livelihoods, income and poverty in the Mekong Region

The majority of people living in the basin rely on agriculture for their livelihoods. Rice is the main crop of most rural households, with 80-90 percent of farming households growing it as their principal crop. In recent years, the economies of Cambodia, Lao PDR and Viet Nam have begun a shift towards market-oriented production and trade liberalisation.[p] They are progressively becoming more industrialised, as happened in Thailand 20-30 years ago. These changes are important factors affecting livelihoods, incomes and poverty levels of people living in the region.

3.1 Rural livelihoods

Throughout the basin, rural households grow rice and other food crops primarily for household consumption. In lowland areas, farmers are sedentary, while in upland areas, farmers engage in shifting cultivation. In the LMB, most of the rice crop is rain-fed, usually grown as a single crop during the rainy season. Dry season rice production is limited to the estimated 7-10 percent of cultivated land that is irrigated.[q] Generally, due to low use of agricultural inputs (improved seed, fertilisers, pesticides etc.), high reliance on human and animal labour and unpredictable rains, floods and droughts, overall productivity is low and rice yields vary considerably from year to year. When sale of small surpluses of rice is possible, profits barely cover production costs. An exception, however, as discussed below, is the Mekong Delta, where modernisation of production has made Viet Nam the world's second largest producer of rice.

Subsistence farmers also grow a variety of vegetables and other food crops, primarily during the dry season. Governments are encouraging small-scale farmers to grow a greater variety of annual and perennial cash crops. For example, in the upland regions of the Korat Plateau in Thailand, there has been a dramatic growth in cash crops such as corn and cassava since the 1950s, when the government created incentive programs and constructed roads that provided access to markets.[89]

In many rural areas, raising livestock is an important source of household income, for example, accounting for more than half of farmers' income in Lao PDR.[90] Large animals such as buffalo are valuable as draft animals and as a form of savings. Thus, overall, lack of ownership of animals is strongly related to poverty.

[p] See also, Chapter 6 on macro-economics
[q] See also, Chapter 8 on agriculture (irrigation)

The harvesting of non-timber forest products (NTFP) contributes significantly to the incomes of many subsistence households in the LMB. In Lao PDR, NTFP accounts for up to 40 percent of total household income.[91] In Cambodia, over 80 percent of households in the Tonle Sap Region harvest products such as food, fuel and building materials from flooded forests.[92] Unsustainable harvesting of NTFP is a growing problem in the LMB. It results from deforestation, greater reliance on NTFP by poor households and increased market demand for some types of NTFP.

In the Mekong Delta and the Central Highlands in Viet Nam, agricultural production has changed dramatically from traditional to modern systems through the intensification and commercialisation of agricultural activities. In the delta, approximately 60 percent of agricultural land is irrigated.[r] Land holdings have been consolidated and large-scale irrigation systems support two to three rice crops a year, most of which is intended for sale and export. Coffee, tea and tobacco, which are grown in the Central Highlands and other regions outside the basin, are important agricultural exports.

An estimated 70-90 percent of the animal protein rural households consume in the LMB comes from fisheries and aquaculture, which are also important economic activities in Cambodia, Thailand and Viet Nam. In Cambodia, 40 percent of the total population depend on the Tonle Sap Lake and its floodplain for their livelihoods.

Subsistence farmers grow a variety of vegetables, primarily in the dry season

The majority of rural households in the basin rely increasingly on a combination of farm and non-farm activities (including migration). In addition to subsistence agriculture, fishing and foraging from forests and wetlands, they engage in a variety of other jobs and home businesses. This diversification of livelihood strategies helps rural households to meet their basic needs, generate cash income and reduce their economic vulnerability.

For example, 35 percent of workers in Cambodia (more men than women) hold multiple jobs.[93] In the dry season, men of all ages and, increasingly, young women, leave rural villages to work in urban areas. In some rural households, some or all members work part- or full-time in non-agricultural activities. In Cambodia, rice farming is the main source of livelihoods, although 26 percent of households earn their primary income from other sources.[94] In Viet Nam, there was a 31 percent increase in non-farm incomes between 1993 and 1998.[95]

Women's roles in rural livelihoods. Rural women share equally with men all aspects of rural livelihoods in the LMB. In many areas, during the wars and civil conflicts of recent years, women took over the traditional roles of men in the farming systems. They continue to assume the primary responsibility for agricultural production in households where men are absent, in addition to their roles managing the household and caring for children, the elderly and the sick.

Women raise and sell pigs, chickens and ducks for household income

In the division of labour in rice production, men are generally responsible for the heavy work such as clearing land, ploughing and harrowing, making bunds,

[r] See also, Chapter 8 on agriculture (irrigation)

preparing seedbeds and fertilising. Women participate in these tasks and also perform the lighter, but time-consuming work of transplanting and weeding. Everyone works together during the harvest, threshing and transporting the rice.

In the dry season, women grow vegetables and other food crops for household consumption and for sale. They share with men the responsibilities for livestock, particularly caring for, managing and selling smaller animals such as pigs, chickens and ducks. Women are also often responsible for collecting water and firewood for household use, and for foraging for NTFP for household consumption and sale. While men are primarily responsible for catching fish, women contribute 75 percent of the labour associated with inland fisheries in the LMB. This includes cleaning and drying of fish, and value-added activities such as making fish sauce and marketing. Women also fish in small streams and rivers to provide for household consumption needs.

Women play a central role in the generation of cash income for the household. They are responsible for selling surplus rice, vegetables, NFTP and livestock. They sell fresh fish in local markets, as well as process and sell fermented fish and fish sauce. Women's handicrafts are a major source of household income. Women generally manage household money, although men and women share in the decisions on expenditures.

Men usually manage irrigation systems, including channelling water to the fields and maintaining structures and canals. Women take on the field tasks of watching water levels and opening and closing bunds to drain or replenish fields. It is generally the money earned from women's activities that is used to pay for irrigation investments and water fees.[96] However, women are rarely represented in water user groups.

In a similar manner, agricultural extension services and other training target men in rural areas. Due to cultural traditions and their lower levels of education, women are thought to be unable to understand or use technology. They therefore have fewer opportunities to receive training to improve their skills as farmers. They also have more difficulty obtaining credit.

Overall, during the course of a day, women generally work longer hours than men, with less time during the day to rest. Frequently women are doing two jobs at once, such as cooking and feeding the animals. As a consequence, rural women have little time to participate actively in community affairs.

Because of their household responsibilities, women generally work much longer hours than men

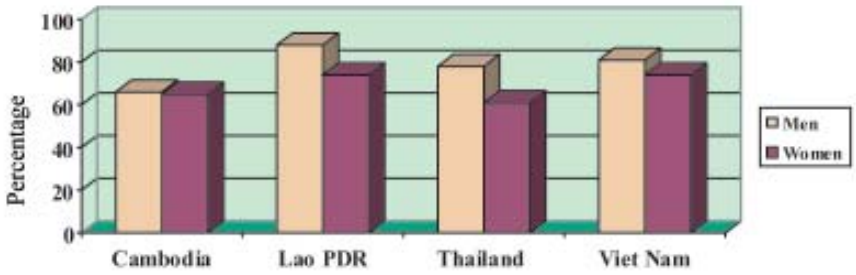
3.2 Employment and incomes

Most adults and many young people living in the basin are economically active.[s] Between 65 and 85 percent of the labour force in Cambodia, Lao PDR and Viet Nam are employed in the agricultural sector. In Lao PDR, 74 percent of economically-active persons in rural areas are engaged in subsistence agriculture.[97] Even in Thailand, where agriculture accounts for less than 10 percent of GDP, agricultural workers make up nearly 70 percent of the labour force in the Northeast Region.[98]

[s] The participation rates reflect national definitions of the labour force or the economically active population in each of the LMB countries. As these definitions vary, the figures are not completely comparable.

Across the LMB, women have labour force participation rates that are much higher than the average of 51 percent for East Asia and the Pacific.[99] In general, subsistence agricultural production depends on the full participation of all adult household members. The participation rates among young women under the age of about 25 years are often higher than for men of the same age.[100] However, the rate drops rapidly as women get older.

Figure 8. Labour force participation (% economically active population), 2000-2001



Sources: ADB 2002; ADB 2001c; NSC 1997; Alpha Research Co. 2000; UNDP 2002; UNDP-Viet Nam 2002

Women account for 50-70 percent of the agriculture labour force. In Viet Nam, they represent 68 percent of the workers in the aquaculture sector.[101] In addition, women are frequently self-employed in a wide range of businesses in the formal sector and, particularly, in the informal sector. In Cambodia and Lao PDR, 90-95 percent of women are involved in market trading and running small businesses, as well as operating their own farms or working as unpaid family labour.[102] Women make up a large part of the labour force in the service sector, particularly among women who migrate to urban areas. They are also increasingly present in the industrial sector. For example, 90-95 percent of workers in the garment industries in the LMB are women.

Unemployment and underemployment. Although data are scarce, very few people in rural areas are unemployed. In urban areas, unemployment is much higher. During the financial crisis of 1997, unskilled workers in urban areas were among the first to be laid off in Thailand.[103] This caused many people to look for work in the informal sector, or to return home to their families in rural areas.[104]

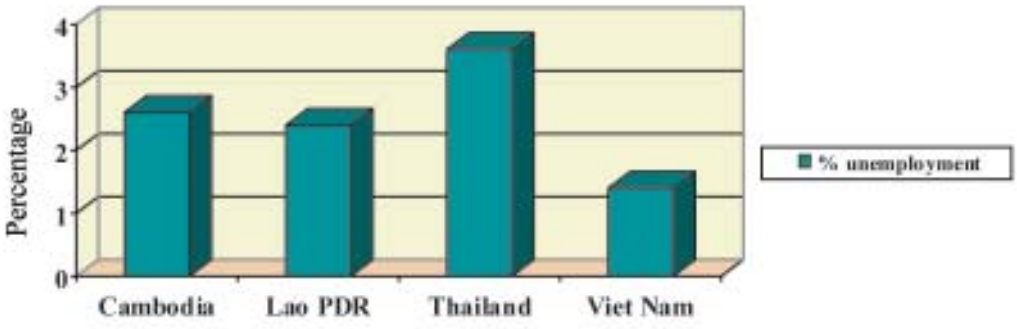
Women generate household income by selling fish, fish sauce, vegetables, non-timber forest products and handicrafts

Table 14. Employment/sector (%), 1997-2000

	Agriculture			Industry			Services		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Cambodia	78	71	79	4			18	4	20
Lao PDR	85		90						
Thailand	55	55	56	13	13	11	32	32	33
Viet Nam	67			13			20		

Note: Information reflects available data for most recent year. Agriculture includes forestry and fisheries.
Sources: ESCAP 2002; GSO 2000a; Huguet *et al.* 2000; Ministry of Planning, Cambodia 2000; NSO 2000a

Figure 9. Unemployment (% economically active population), 2000-2001



Sources: ADB 2002; ADB 2001c; NSC 1997; Alpha Research Co. 2000; UNDP 2002; UNDP-Viet Nam 2002

Underemployment is a significant, but not well-documented problem. In the LMB, it is more common in rural than in urban areas.[t] In Viet Nam, widespread underemployment occurs in the agricultural sector, where people work an average of 21 hours per week.[105] Underemployment in the Mekong Delta is similar to national rates (25 percent), while it is lower (18.1 percent) in the Central Highlands.[106]

Income. Household incomes vary widely across the basin. For Thailand and Viet Nam, the LMB has provided the natural resources that have spurred economic development within each country, but has not received the benefits. As a consequence, there is a significant and widening gap between incomes within the basin and parts of respective countries that lie outside the basin, and among LMB countries themselves.[107] Incomes[u] in Thailand are three times higher than those in Viet Nam and more than four times greater than those in Cambodia and Lao PDR.

There are also significant differences within countries, between regions and in urban and rural areas. Since the financial crisis in 1997, the North and Northeast Regions of Thailand have experienced significant unemployment and the return of workers who have lost their jobs in urban areas.[108] Urban incomes in Viet Nam are nearly four times higher than rural incomes. In Cambodia and Lao PDR, urban incomes are approximately twice the national average.[109]

Incomes in the Mekong Delta and the Central Highlands are, respectively, 20 and 40 percent below the national average.[110] Income levels remain low in Viet Nam, despite strong economic growth during the 1990s. This is due to very high population densities.[111] As a consequence, there is less arable land per capita compared with other LMB countries. As well, benefits from foreign investment and exchange earnings need to be spread over a much larger population.

In general, women tend to work at low-paying, more menial jobs. As a consequence, their overall income levels average 60-75 percent of men's incomes. Data available for Cambodia and Lao PDR suggest that non-agricultural wage levels for women are about 80 percent of those of men, except in urban areas where women's income more nearly equal men's.[112] In Thailand, women working in the public sector tend to have income levels nearly equal to men, but they earn only about 75 percent of men's wages in private sector, non-agricultural jobs.[113] In Viet Nam, women's wages overall are 72 percent of men's, but only 62 percent of men's in the agriculture sector.[114]

[t] Underemployment refers to people who do not work during part of the year or who are unable to work regularly for more than 35 hours per week (Ministry of Planning, 2000)

[u] Incomes expressed as PPP$ GDP per capita. Purchasing power parity (PPP$) rates of exchange take account of price differences in different countries, allowing more accurate comparison of income levels.

Some caution should be taken in using GDP per capita income data as they may understate living standards. Large numbers of people in the LMB are not part of the market economy. Data for 1996, nonetheless, indicate that wages in Thailand are five times the rates in Cambodia and Lao PDR, and 2.5 times greater than in Viet Nam.[115]

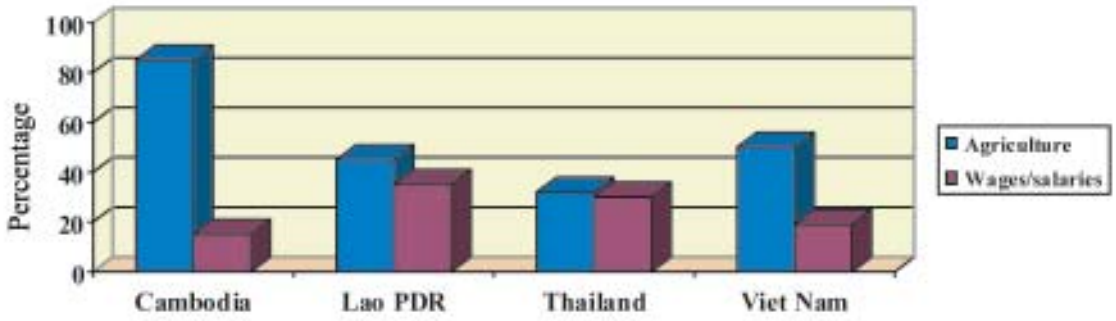
Table 15. Income levels, 1999-2000 (most recent year)

	GDP/ capita 2000(PPP$)	GDP/capita, 1999(PPP$) Total	Male	Female	GNI/capita, 2000 ($, Atlas method)
Cambodia	1,440	1,361	1,541	1,190	260
Lao PDR	1,540	1,471	1,774	1,169	290
Thailand	6,320	6,132	7,660	4,634	2,000
Viet Nam	2,000	1,860	2,170	1,552	390

Sources: ADB 2001c; ADB 2000b; WB 2002b

The growth of the rural non-farm sector is reflected in changes in sources of income. In Lao PDR, while most household income still comes from agriculture, wages and profits from home businesses now account for more than one-third of incomes. People who are paid employees and who are self-employed each represent as much as 10 percent of the labour force.[116] Self-employment is also an important source of income in Cambodia.[117] In Northeast Thailand, nearly one-third of employed persons are government or private sector employees.[118] Remittances from household members who have found work in urban areas are another common source of rural income. In Thailand, for example, 20-25 percent of household income is derived from remittances.[119]

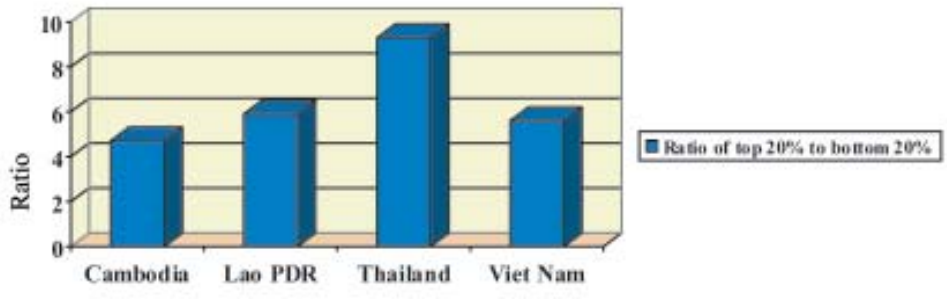
Figure 10. Sources of income (%), 1999-2000 (most recent year)



Sources: ADB 2000b; NSC 1999; NSO 2002a

In the LMB, there are wide disparities between the incomes of the rich and poor, within and between countries. In Thailand, incomes are distributed more unequally among rich and poor households than in most middle class countries. In low-income countries like Cambodia and Lao PDR, the difference between the rich and poor is much less, but income inequality is rapidly increasing. In Viet Nam, while the relationship of rich to poor in the Mekong Delta (7.8) is similar to the national situation, in the Central Highlands there is a greater difference (10.4).[120]

Figure 11. Income disparities, 2000



Source: ADB 2002

3.3 Dimensions of poverty in the LMB

Poverty is widespread and pervasive throughout the Lower Mekong Basin. Poverty is multi-dimensional – poor people lack a wide range of livelihood assets and opportunities as well as income. Poverty reduction is a priority in the socio-economic development policies of all the countries in the LMB, making the reporting of data on all dimensions of poverty an important objective.

Incidence of poverty. Towards 40 percent of the populations of Cambodia, Lao PDR and Viet Nam live below the poverty line.[v] In the Northeast Region of Thailand, 19 percent of the population is below the poverty line;[121] this accounts for 62 percent of poverty in Thailand.[122] Between 1993 and 1998, economic growth in Viet Nam and Lao PDR contributed to significant reductions in poverty levels. In 2000, continued growth in Viet Nam was estimated to have lowered poverty levels to about 32 percent.[w] However, in Cambodia, despite economic growth, poverty declined only marginally between 1994 and 1999.[123] In Thailand, since 1997, the regional financial crisis has contributed to an increase in the poverty rate from 11.4 percent to 15.9 percent.

Employment creation is crucial. In Cambodia alone, an estimated 200,000 young people enter the labour market each year

Throughout the LMB, the average poor household's income falls below the poverty line by a relatively small percentage. This poverty gap[x] is, in general, less than 10 percent and the majority of the poor are clustered near the poverty line. This means that positive economic growth and other policy changes can readily contribute to raising the incomes of poor households above the poverty line. At the same time, many households are not far above the poverty line and could fall below due to economic slowdowns, natural disasters and

[v] The international consumption-based poverty line is defined as the level of resources (income and/or own-production) required to ensure a daily per capita 2,100-calorie food basket plus a small allowance for non-food expenditure. Measuring poverty in terms of consumption rather than income is considered to be more reliable and to reflect more accurately the levels of need of poor households.

[w] In 2001, the Government of Viet Nam introduced a new poverty line based on per capita income: VND 80,000 per month for island and rural mountain areas; VND 100,000 per month for rural plain areas; VND 150,000 per month for urban areas (Socialist Republic of Viet Nam 2001). Using the new national poverty line, the estimated poverty level at the end of 2001 is 16 percent (ADB 2002).

[x] Poverty gap measures the depth of poverty, that is, the average distance people are below the poverty line, as a percentage of the poverty line.

other adverse changes. In some regions of the LMB, such as the Central Highlands and the Northern Region of Lao PDR, the poverty gap is between 15-20 percent, indicating more deeply entrenched poverty in those regions.[124]

While poverty levels have declined throughout much of the LMB, there is increasing inequality in the distribution of income between the rich and the poor, and between urban and rural areas in most countries. In Viet Nam, 96 percent of the increase in inequality can be attributed to a widening gap between urban and rural poverty.[125] That is, the substantial declines in poverty have been due primarily to economic growth in urban areas, rather than a more equitable distribution of wealth.

Table 16. Poverty incidence in the LMB, 1993-1999 (most recent dates)

	Headcount (%)		Poverty gap	Gini coefficient[y]	
	1993-96	1997-99		1992-94	1997-99
Cambodia	39	35.9	6.5		0.340
Lao PDR	45.0	38.6	10.3		0.357
Thailand	11.4	15.9	4.3	0.511	0.531
Viet Nam	58.1	37.4	10.0	0.330	0.350

Sources: ADB 2001b; Ministry of Planning, Cambodia 1999b; SPC 2000; Glewwe *et al.* 2000; WB 2001a

Spatial distribution of poverty. Over 90 percent of poor households live in rural villages. The rate of rural poverty is 10-35 percent higher than the national averages. Seventy percent and more of poor households are headed by persons whose main source of income is in the agricultural sector.[126] However, even in rural areas, the incidence of poverty varies significantly between richer and poorer villages, depending on access to productive land, roads, markets and social services. In Cambodia, for example, 70 percent of the population of the poorest villages is below the poverty line, while only 4 percent of people in the richest villages are poor.[127]

Over 35 percent of the populations of Cambodia, Lao PDR and Viet Nam live below the poverty line

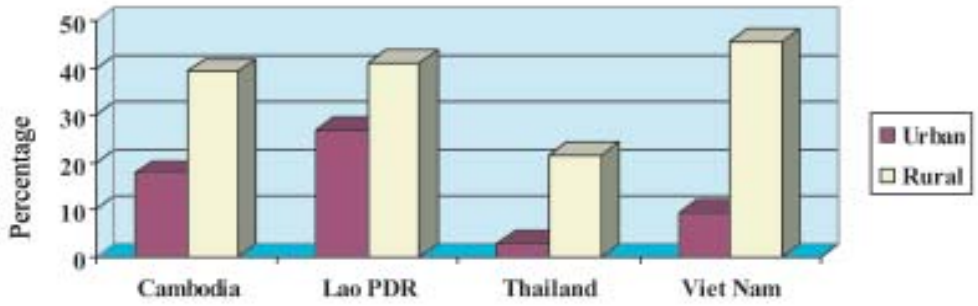
There is also a significant variation in poverty levels among sub-national regions. Poverty levels in the Tonle Sap (37.8 percent), the Northern Region (52.5 percent) and the Central Highlands (52.2 percent) are the highest in, respectively, Cambodia, Lao PDR and Viet Nam. In Thailand, the North and Northeast Regions account for nearly 75 percent of all poverty in the country.[128]

Poverty levels are very high and deeply entrenched in the remote rural areas where ethnic minority groups live. In upland areas of Lao PDR, for example, poverty levels are as high as 75-90 percent.[129] In Viet Nam, poverty among ethnic minorities exceeds 70 percent compared with a national rate of 37 percent, and accounts for nearly 30 percent of all poor people[130]. The incidence of poverty

[y] The Gini Coefficient measures the degree of inequality in the distribution of incomes. The higher the Gini Coefficient, the greater the inequality in the distribution of incomes.

among ethnic minorities in the Central Highlands is 90 percent[131]. Moreover, while poverty dropped dramatically in most of Viet Nam in the 1990s, it declined only one percentage point among ethnic minorities in the Central Highlands during the same period.[132]

Figure 12. Spatial distribution of poverty in LMB (%), 1997-1999 (most recent year)



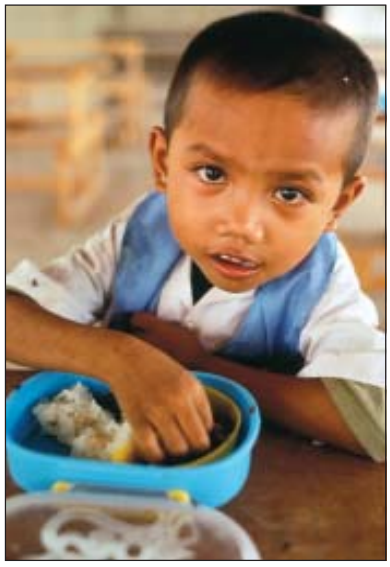
Sources: Glewwe *et al.* 2000; NIS 1998; SPC 2000; UNDP 2002; UNDP-Viet Nam 2001c; WB 2001a

Food security and food poverty. Overall, the countries in the LMB produce adequate amounts of rice to feed their populations. In Thailand and Viet Nam, the average daily per capita calorie supply in 1999 was, respectively, 2,411 and 2,564 kilocalories, well above the recommended daily minimum of 2,100 kilocalories.[133] In Viet Nam, in particular, per capita food production increased by 25 percent during the 1990s.[134] As a consequence, the percentage of undernourished people declined in both these countries.[135]

Nutrition levels in Cambodia (2,000 kilocalories/person/day) and Lao PDR (2,150 kilocalories/person/day) are equivalent to or below the recommended daily average.[136] This is reflected in the fact that both countries have only recently achieved national food sufficiency. Bad weather, natural disasters and other factors that affect annual yields can easily threaten food security.

Overall, nutrition levels in the LMB range from 75-95 percent of average levels in Asia.[137] Throughout the region, rice is the main component of rural diets. In Thailand and Viet Nam, animal protein constituted less than ten percent of per capita calorie intake; in Cambodia and Lao PDR, the ratio was less than five percent.[138]

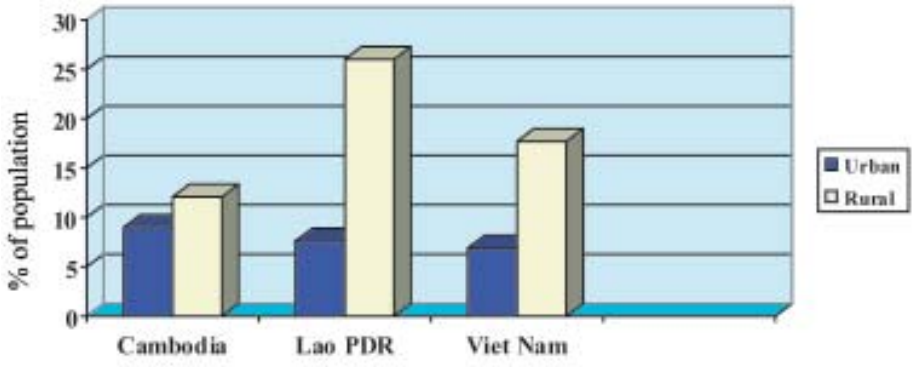
Many regions throughout the LMB experience regular food shortages. In Cambodia, half the provinces may have annual rice shortages and the provinces of Kandal, Kampong Cham and Kampong Speu experience perennial food deficits.[139] In Lao PDR, food shortages can last on average six to seven months per year, with longer periods for ethnic minority groups.[140] Shortages are particularly acute in the period between planting and harvesting of the rainy season rice crop. The per capita calorie deficit during these periods can be large, representing as much as 10 percent of the minimum daily requirement.[141] The predominance of rice in rural diets is a major factor in malnutrition, particularly for young children.[142]



Half of all under five child mortality in Cambodia and Lao PDR is associated with malnutrition

The incidence of food poverty reflects the problems of food security in the LMB.[z] In Cambodia, Lao PDR and Viet Nam, 10-20 percent of the total population and 12-25 percent of the rural population are below the food poverty level. In Phnom Penh and urban areas in Lao PDR and Viet Nam, the incidence of food poverty is much lower, although in other towns in Cambodia the incidence is greater than the national rate. In urban areas, food security depends on the availability of income to purchase food. In Vientiane Municipality, for example, the daily dietary intake still averages only 70-80 percent of the recommended requirement.[143]

Figure 13. Food poverty incidence in Cambodia, Lao PDR and Viet Nam (%), 1993-1999 (most recent year)



Sources: Ministry of Planning, Cambodia 1999b; SPC 2000; NIS 1998; GSO 1999

Other dimensions of poverty. Other dimensions of poverty have been qualitatively documented in the growing number of participatory poverty assessments and other studies carried out in the LMB. Although there are fewer quantitative data, these issues are important dimensions for understanding rural poverty in the region.

Land. Lack of access to productive land and insecure land tenure are frequently identified as key issues of poverty.[144] Some data for Cambodia and Lao PDR indicate that while most households have access to land, the average agricultural landholding is very small.[145] In Cambodia, farmers have only about one hectare per household, and households headed by females have only about half an hectare. In comparison, in the 1960s in Cambodia, the average landholding was 2.2 hectares, with 84 percent of households farming one to five hectares.[146]

In Lao PDR, where 93 percent of rural households have access to land, holdings average about 1.6 hectares.[147] However, the average number of separate parcels per household is about two, with the result that individual parcels average about 0.75 ha.[148] In Viet Nam, the average landholding in the Mekong Delta is 1.2 ha, compared with a national average of 0.2 ha.[149] Throughout the country, fragmentation of landholdings into several unconnected parcels has reduced the efficiency of agricultural labour and capital.

Governments in the LMB are working to establish systems for registering land titles, but they cannot keep up with demand. This is particularly a problem in Cambodia and Lao PDR. In 1989, following the end of the Khmer Rouge regime, the Royal Government of Cambodia re-privatised land and redistributed small parcels to rural households. Today, however, only about 10 percent of households have been granted ownership certificates and many have only temporary certificates.[150]

[z] Food poverty is defined as adequate resources (income and/or own-production) to ensure a daily per capita food intake of 2,100-calories.

In many rural areas in Cambodia and Lao PDR, traditional land use systems support the needs of subsistence agriculture. They include land reserves to permit fields to recover after several years of cultivation, as well as forests, lakes and rivers that are designated as common property resources. These common property resources provide a range of non-timber forest products (NTFP) such as firewood, wild vegetables and herbs, medicinal herbs, wildlife and materials for construction and handicrafts, as well as fish. Fish and food from the forests are essential during periods of rice shortages. In Cambodia, however, the Land Law of 1992 does not clearly identify common lands.[151] This makes it more difficult to ensure access to these resources.

Lack of access to productive land and insecure tenure are key issues in the LMB

Rapidly growing rural populations and other pressures on rural agricultural land are resulting in a growing incidence of landlessness, as has been widely studied in Cambodia.[152] In Lao PDR, government policies to encourage upland communities to settle in one place and cease shifting agriculture, have increased pressure on the amount, quality and location of agricultural land. Forest concessions and large-scale holdings for commercial plantations and agriculture have the same effect in both Cambodia and Lao PDR. In Viet Nam, the relocation of communities and the growing concentration of land holdings to support large-scale production and tree plantations, has exerted pressure on land availability in rural areas. Poverty is both a cause and a result of these processes, with households forced to sell land to meet vital expenses. In Cambodia, the high cost of meeting medical expenses when family members fall ill, has been identified as a principal cause of farm households selling their land and becoming landless.[153] Recent studies estimate that more than 20 percent of rural households in Cambodia are landless, with the highest rates in Battambang, Kampong Cham, Kampong Chhang and Kandal Provinces.[154]

Agricultural productivity. Subsistence agriculture in the LMB is characterised by low inputs and low productivity. In Cambodia, much of the agricultural infrastructure, such as irrigation systems, was destroyed during the period of conflict and instability, and has yet to be rebuilt. In upland areas of Lao PDR, the terrain limits the potential for irrigated rice cultivation. Households in these areas use little if any fertilisers or pesticides. All labour is provided by humans or draft animals. As a consequence, yields are low, contributing to the incidence of food shortages each year.

Agricultural productivity is low in upland areas because farmers lack access to irrigation, inputs and markets for their produce

Moreover, there is a severe shortage of agricultural extension services and well-trained personnel in rural areas to assist farmers in adopting technologies and practices that could enhance productivity. In Cambodia, for example, only 4 percent

of the poorer rural villages have an agricultural extension worker.[155] Most rural households do not have access to formal credit facilities, and instead rely on family members and other informal systems that provide cash and in-kind assistance. If those are not available, they must borrow from moneylenders, who charge high interest rates. As a result, farmers are unable to invest in improved seeds, infrastructure or techniques to enhance their production. The low rate of electrification in rural villages and households in Cambodia and Lao PDR, further limits opportunities for agricultural processing and other income-generating activities.

In many areas of the basin people have to travel long distances to get medical treatment

Transport and marketing systems. The road network in rural areas of Cambodia and Lao PDR is limited, is generally in poor condition and throughout the rainy season much of the network is impassable. In Lao PDR, one-third of villages and approximately 20 percent of the population are not accessible by truck throughout the year; another 30 percent of villages and households are accessible only during the dry season.[156] Moreover, the market systems are incomplete in both countries. In Cambodia, only 14 percent of poor rural villages have a market.[157] In Lao PDR, no rice is marketed in about half the rural villages in the country.[158] The risk of poverty is greater in these regions where farmers do not have adequate opportunities to sell agricultural products, nor to engage in the formal and informal businesses or the wage labour that is usually found in market towns.

Education and health services. The incidence of poverty is closely linked with the level of social development and access to social services. Most rural villages in Lao PDR have a primary school, although the poor quality of many of these facilities, as well as the lack of trained teachers and adequate learning materials, compromise the quality of the education.[159] In Cambodia, 46 percent of poor rural villages have a primary school, but only 5.4 percent have a lower secondary school.[160] Net enrolment rates in these poor villages are 44 percent at the primary level and 4 percent at the secondary level.[161] In addition, only 16 percent of poor rural villages in Cambodia have a clinic.[162]

The Millennium Development Goals endorsed by all countries in the LMB call for reducing by 50 percent the proportion of people living in poverty by 2015. In Cambodia, the government has set a target of 31 percent for 2005.[163] The Government of Viet Nam is aiming for a poverty rate of 6-10 percent in 2010.[164]

4. Conclusions

Demographic and socio-economic factors – population growth; economic growth, industrialisation and regional economic integration; urbanisation and urban-rural linkages; income growth, inequality and poverty; and, human resource development – are key driving forces affecting sustainable use and development of water and related natural resources in the LMB. This section briefly summarises some aspects of these driving forces, the relations between them and trends that should be monitored. In general, data suggest significant variations in socio-economic conditions throughout the LMB that will influence policy objectives and resource-use decisions.

Population growth. In the short term – that is, over the next 2-3 decades – the population of the LMB will continue to grow rapidly. Population growth – increased numbers and densities of people – that exceeds the capacity of the natural resources of the basin can undermine environmental management and sustainable development of the water resources, land capacities and the rich biodiversity of the LMB. The two poorest countries, Cambodia and Lao PDR, will, at present rates of growth, nearly double their populations in the next twenty years. This will place significant pressures on rural livelihoods, as well as on the use and management of natural resources for economic development in these countries.

The prospects in Thailand and Viet Nam are somewhat more optimistic in the short term. Fertility rates in these countries have declined to or near replacement levels. While the large number of young people have started or will soon start their own families, they will likely have fewer children than their parents. Overall, the rate of population growth will slow in these countries, with the populations increasing 20-30 percent over the next twenty years. However, this transition to more moderate population growth will take longer in rural areas of the LMB where extended families with many children have supported traditional agricultural livelihoods.

For the next two to three decades, the population of the LMB will continue to grow rapidly

Eventually, the rate of population growth in all four countries will decline. In Cambodia, Lao PDR and elsewhere in rural areas of the basin, increased education and health services for women will be a primary cause of lower fertility rates. The development of agriculture beyond subsistence farming to include a diversified range of cash crops, as well as the expansion of non-farm economic activities in rural areas, will contribute to higher household incomes. These changes interact with other factors to result in slower population growth.

The overall population density of the LMB is low at 87 people km^2, but much of the land is not arable

Population growth impacts on the sustainable development of natural resources in several ways. The simple increase in the numbers of people places higher demands on the availability and use of water, land, energy and other resources. As mentioned, increased numbers and densities risk exceeding the natural carrying capacity of resources, as well as the present institutional capacities to manage them. Population growth interacts with other driving forces such as economic growth and urbanisation. Changes in the age structure of the population along with increased economic growth and higher incomes lead to changes in labour productivity and consumption patterns. These factors also contribute to population migration patterns, including increased urbanisation.

Economic growth, industrialisation and regional economic integration. Economic growth is the central development objective of the LMB governments and is closely linked with strategies for industrialisation and integration of riparian economies at the regional and international levels. Diversification of agriculture to higher value crops and export-oriented production are essential to ensure food security in the region and to generate revenues. However, economic growth is and will be led by industrialisation. Thailand and Viet Nam are focusing on rural industrial development in the LMB such as agro-processing, construction materials and other resource-based industries, and similar initiatives will occur in Cambodia and Lao PDR. Tourism is another growth sector that has great potential for development in the LMB.

Paid employees and the self-employed represent only 10 percent of the labour force

Continued economic growth in the LMB will meet growing needs for job creation and non-farm employment, and will reduce poverty through increased incomes. It will lead to closer economic ties among riparian countries through increased trade, investment and market interconnection within the region. At the same time, economic growth must be closely monitored to balance demands on water and other natural resources among competing agricultural, industrial and other uses in different parts of the basin. Industrial expansion in the LMB will be a significant driver of more intensive use of natural resources, and issues of environmental quality will become more important.

Urbanisation and urban-rural linkages. Within the next twenty years, approximately one-third of the LMB population will be living in urban regions. Urban centres are primarily located in the lowlands of the Mekong and its principal tributaries. Rapid urban growth will occur not only in the major cities of Phnom Penh and Vientiane, but also in numerous secondary centres along the rivers. The concentration of industries in cities and their peri-urban regions, and the higher incomes of many urban residents will increase demand for water and other services. The expansion of densely populated areas will lead to the conversion of valuable agricultural land to urban uses. Unplanned development of lowland urban areas will increase the risks associated with frequent flooding.

The expansion of densely populated areas is leading to the loss of valuable agriculture land

Although the majority of the basin population will continue to live in rural areas, the social and economic linkages will become stronger between urban and rural areas. Cities attract people seeking work, including migrants from rural areas and commuters from the outskirts of urban areas. Urban enterprises rely on demand from rural customers, while access to urban markets and services is essential for rural farmers. The interactions linking cities and rural areas are most intense in the areas immediately surrounding cities. These areas are characterised by changes in land use and farming systems, changing patterns of labour force participation, social change and changing demands for infrastructure. These changes, in turn, place new and increased pressures on water and other resources, including the capacity of natural resource systems to absorb urban-generated wastes.

Another aspect of urban-rural linkages in the LMB involves the return migration of people from urban centres back to rural areas. This occurred following the regional financial crisis of the late 1990s, and may continue as a consequence of government policies for structural adjustment and economic reform. Workers in the urban formal sectors who lose their jobs may return to their home communities, where the costs of living are lower. This population increase in rural areas may exert additional demands on land, water and other resources. At the same time, these returnees often bring with them knowledge and experience with technological and socio-cultural innovations that may facilitate more efficient and sustainable development and management of natural resources.

More than half the population of Cambodia and Lao PDR is below the age of 15

Income growth, inequality and poverty. Economic growth and opportunities for better-paying, non-farm employment will lead to higher incomes, in rural as well as urban areas. Rising incomes will lead to consumption patterns that are increasingly modelled on those of more industrialised countries. Income growth, therefore, will create additional demands for water, energy and other ecosystem services. It will also emphasise the importance of environmental quality.

Rising incomes in the LMB have and will continue to contribute to reducing poverty. However, income growth in the basin has also been accompanied by deepening income inequality. The benefits of recent economic growth in the region have been concentrated in the urban areas, while rural poverty remains high. There is a growing realisation that expanded rice cultivation, including the use of more water for irrigation, cannot increase incomes enough to reduce rural poverty. Governments and donors are now targeting strategies that promote the creation of rural employment outside the traditional agricultural sector. Priorities in resource allocation including water will, therefore, focus increasingly on non-agricultural uses.

Human resource development. The development of human resources in the LMB – through better education, training and employment opportunities – is a key factor in the sustainable use of the basin's resources. The "baby boom" of young adults now joining the workforce will result in serious unemployment in the coming years unless more jobs are created. The agriculture sector cannot provide livelihoods for all these young people. Moreover, many young adults – men and women – will be better educated and could participate in higher-skilled work if they have equitable opportunities to improve their capabilities.

End Notes

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[4] Dennis 1997a; Ringler 1999; Roy n.d.
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[6] Chazée 1999
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[116] NSC 1999
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Macroeconomic trends in the Lower Mekong Basin 6

In the last ten years, the economies of the four countries that share the Lower Mekong Basin have undergone considerable change. Not only have industrial and service sectors grown as agricultural sectors have declined; in Cambodia, Lao PDR and Viet Nam, economies have been changing from allowing and even promoting free enterprise.

The rate of economic development has also changed. In the 1980s and first half of the 1990s, Thailand had one of the fastest growing economies in history. In 1991, Cambodia signed the Paris Peace Accords, which ended decades of war and isolation, and within a few years had growth rates of over 5 percent. In the mid-1990s, the economies in Viet Nam and Lao PDR also began to grow rapidly, with annual growth of 7 percent or more per year.[1]

In the 1980s and first half of the 1990s, the Southeast Asia region has had one of the fastest growing economies in history

The last five years however has seen a dramatic fall in economic growth in all four LMB countries. The unprecedented growth of the early and mid-1990s stalled dramatically in 1997-1998 after the Asian Financial Crisis began in Thailand. As will be discussed later in this chapter, the crisis was felt the most dramatically in Thailand, where it began, but the other three LMB countries were also affected, as were countries all over Asia.[2]

Economic growth in urban areas of LMB countries has done little to improve the lives of rural people

In the chapter that follows, data are presented on the contradictions in the economies of the LMB. On the one hand, LMB countries have considerable undeveloped hydro, mineral, and in some cases, timber resources, as well as tourism potential. At the same time, they face considerable obstacles to development that have kept them among the poorest countries in Asia and the world.

This chapter describes the economic situation in each of the four riparian countries, focuses on the general level of development and looks at how different sectors' contribute to GDP. It concludes with a discussion of major macroeconomic trends that are likely to develop over the coming decade.
As is the case in other chapters in this report, data on the national economies of Cambodia and Lao PDR can be considered representative for each country's territory within the basin. Cambodia has 86 percent of its territory within the basin, while Lao PDR lies almost entirely within the basin (97 percent). The situation is somewhat different for Thailand and Viet Nam. Only some 36 percent of Thailand and about 20 percent of Viet Nam are included in the LMB. About 40 percent of Thailand's population, but only 20 percent of Viet Nam's, live in the LMB. Ideally a description of the economic situation in the Thai and Vietnamese parts of the LMB should include data only for these specific regions. However, the data available for both countries are mainly national data. Although this is a drawback to some extent, it is important to keep in mind that economic development in the basin areas of Thailand and Viet Nam is strongly influenced by economic development in the country as a whole. National economic trends and policies in Thailand and Viet Nam have strong influences on development on each country's territory within the basin. Thus the use of national economic data is relevant. It is also important to remember that economies are influenced by economic trends in the region and in the rest of the world. This is especially important as countries develop beyond the level of subsistence and engage in trade and international commitments.

The Mekong's fishery is one of the most productive fresh water fisheries in the world

1. Economic overview of the four riparian countries

1.1 Differences in levels of development

There are major differences between the levels of economic development in the four countries that share the LMB. Thailand is by far the richest and most developed country. In recent years, Viet Nam has made a significant move forwards in industrialising, yet the level of poverty is still high. Cambodia and Lao PDR are amongst the poorest countries in Southeast Asia. The livelihoods of the majority of people in both Cambodia and Lao PDR are still largely based on subsistence production derived from farming, fishing and foraging in wetlands and forests. The methods of production are little developed, making these people particularly vulnerable to natural disasters and adverse impacts that could arise from upstream development projects.

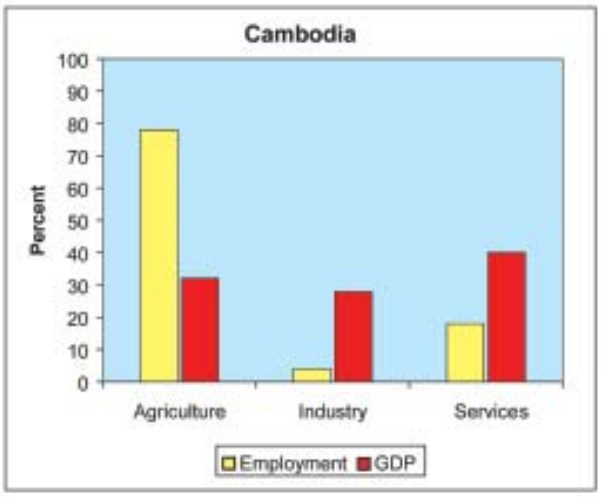
The livelihoods of the majority of people in Cambodia and Lao PDR are still based on subsistence farming, fishing and foraging

1.2 Cambodia

Cambodia is a very poor country with per capita GDP at just $240 in 1993 constant prices,[3] equivalent to some $1440 in purchasing power parity.[4]* Even with annual GDP growth rates at around 5 percent per year, as seen in 2000 and 2001,[5] due to a rapidly increasing population (2.3 percent per year) poverty is decreasing at a very slow rate.[6] It is estimated that 36 percent of Cambodians live below the poverty line.[7]

As stated previously, most Cambodians' livelihoods come from farming, fishing and foraging in wetlands and forests. Nearly 80 percent of the labour force is engaged in agriculture, but this sector only generates about 30 percent of the country's GDP,[8] as shown in Figure 1. The four percent of the labour force who work in industry generate more than almost 30 percent of the GDP.

Figure 1. Sector share of employment and GDP, Cambodia



Note: Employment information reflects available data for most recent years 1997-2000. Agriculture includes foresty and fisheries.

Source for employment: ESCAP. 2002.

Sources for GDP: ADB. 2002. Asian Development Outlook 2002. ADB. 2001. Country Strategy Programs. IMF. 2002. Selected Issues and Statistical Appendix.

In Cambodia tourism has become an increasingly important source of income

The service sector generates the largest portion of GNP, namely 40 percent, and employs some 18 percent of the labour force. The service sector includes a variety of businesses, from small street vendors and restaurants to supermarkets and large-scale hotels. Tourism has become an increasingly important income earner for Cambodia.[9]

Industry has taken the lead in annual growth figures over the last five years. In 2000, the annual increase in industrial production was almost 29 percent. In the same period, the growth in agriculture was in general low, and even negative in 2000, because Cambodia was hit by severe flooding.[10] The average rice yield of 1.4 tonnes per hectare is amongst the lowest in Asia. Cambodia's inland fish catch, on the other hand, seems to be the most productive in the region, with an estimated 400,000 tonnes caught annually.

As agricultural productivity is much lower than productivity in the industrial sector, and as industries are mainly situated in urban areas, incomes tend to be higher in the cities. According to World Bank figures published in 2002,[11] per capita

* Purchasing power parity (PPP) takes account of price differences in different countries, allowing a more accurate comparison of income levels.

incomes are 3-4 times larger in urban Phnom Penh than in rural Cambodia, thus making poverty largely a rural phenomenon. Ninety percent of the poor live in rural areas, and the highest poverty rate is found among households where agriculture is the primary source of income.

In order to move Cambodia out of the ranks of the least developed countries by 2020, the National Assembly adopted the Second Socio-economic Development Plan (SEDP-II), with a strong focus on poverty reduction.[12] The government plans to follow a growth strategy aiming at increasing productivity in agriculture, as well as levels of industrialisation.

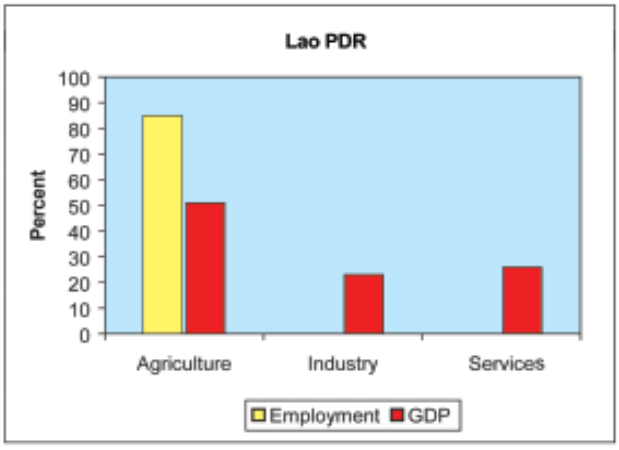
The Cambodian labour force is growing fast as a result of the post-conflict baby boom. Around 200,000 persons are entering the labour market annually and real wages for unskilled workers in Phnom Penh are falling.[13] Increasing the level of industrialisation is expected to help create new job opportunities and thereby increase earnings.

1.3 Lao PDR

In 2000, GDP per capita in Lao PDR was estimated at $330 [14] (in 1990 prices), which is equivalent to about $1540 in purchasing power parity.[15] Real GDP growth in Lao PDR has been higher and more stable than that of Cambodia; over 7 percent in 1999 and nearly 6 percent in 2000.[16] However, population growth of more than 2 percent[17] partly offsets the impact of economic growth on per capita incomes. It is estimated that 39 percent of the Laotian population is living in poverty.[18]

In the LMB, agriculture's share of GDP has declined relative to the manufacturing and service sectors

Figure 2. Sector share of employment and GDP, Lao PDR



Note: Employment information reflects available data for most recent years 1997-2000. Agriculture includes foresty and fisheries. Data on employment not available for industry and services.

Source for employment: ESCAP. 2002.

Sources for GDP: ADB. 2002. Asian Development Outlook 2002. ADB. 2001. Country Strategy Programs. IMF. 2002. Selected Issues and Statistical Appendix.

As is the case with Cambodia, Lao PDR's economy is at a low level of development, with agricultural production accounting for over half of GDP[19] (see Figure 2). An estimated 85 percent of the workforce is employed in agriculture.[20] Industry and services each account for roughly a quarter of GDP.[21] The economy of Lao PDR is largely based on the natural resources within the country and therefore depends on a sustainable environment to generate future growth.

Agriculture led the economy's recovery from the regional financial crisis of 1997-98. The overall growth rate of agriculture has gone up to about 5 percent per year, from a more typical 2-3 percent per year.[22] Industry and energy production led growth in 2000, and

In Lao PDR, hydro power projects on the Mekong's tributaries are an important source of government revenue

again in 2001, industry remained the fastest growing sector, with construction and garment production playing lead roles.[23] The country's textile production is not as large as Cambodia's, but is still significant at nearly $80 million in 2000. Energy production and services, particularly tourism, are increasingly important to the Laotian economy.

Lao PDR is characterised by heavy economic dependence on Thailand. Much of the county's identifiable economic activity is confined to the Mekong Corridor, the flat lowland area along the Mekong, bordering Thailand, where development has concentrated in otherwise-mountainous Lao PDR. It is estimated that the value of imports and exports, formal and informal, equal about the same amount as annual GDP. The Laotian economy was therefore adversely affected by the 1997 Asian financial crisis and the devaluation of the Thai Baht. Today, the Laotian economy is being dollarised, though not to the same extent as the economy of Cambodia. Inflation was reported at 7.8 percent in 2001. This represents a significant reduction from the very high inflation rates of 1998 and 1999, and is one of the lowest rates of inflation since the economy reopened to the outside world in 1986.[24]

Poverty reduction through increased economic growth is the overarching objective of Lao PDR's 'Fifth Five-year Socio-economic Development Plan (2001-2005)'. Like Cambodia, Lao PDR wants to move out of the 'least developed country' category by 2020. Reforming the financial sector, improving systems of revenue generation and government expenditure and reforming state-owned enterprises are priorities for the economy.[25] Future economic growth will have to be built upon improved productivity in agriculture, thereby releasing labour resources to work in more productive sectors of the economy.

1.4 Viet Nam

With per capita GDP at $370[26] (1999 prices), which is equivalent to about $2000 in purchasing power parity,[27] Viet Nam is not quite as poor as Lao PDR and Cambodia. The country experienced a period of very fast growth during the 1990s, with aggregate growth rates around 9 percent per year. Growth slowed down by the end of the decade, when both the Asian Financial Crisis and severe drought hit in 1998. However by the beginning of 2000, growth rates were once more on the way up.[28] The Vietnamese population is growing at around 1.5 percent per year. In 1999, an estimated 17 percent of the population lived in poverty, according to the government's definition of poverty, and 32 percent were poor, according to the World Bank's definition.[29]

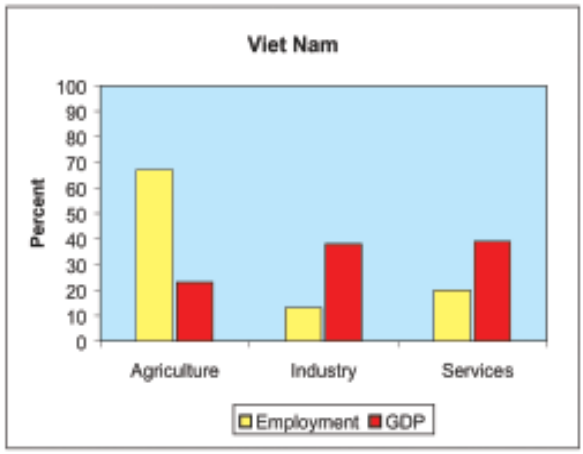
Viet Nam is the world's second largest exporter of rice, after Thailand

The strong growth was driven by rapid industrialisation. In 1988, agriculture accounted for 40 percent of GDP. Ten years later, in 1998, agriculture's share of the economy had dropped to some 25.7 percent, and by 2000, was even lower at 24.3 percent (see Figure 3).

Even though the industrial sector increased dramatically, in 1999, nearly 70 percent of the Vietnamese population were still employed in agriculture.[30]

Agricultural production is dominated by rice, which accounts for half of agricultural production. Production methods have been intensified and rice yields are now among the highest in the region. Vietnamese farmers have also begun to diversify into other agricultural products. Perennial cash crops such as rubber, coffee, tea and fruit are grown in significant amounts.[31]

Figure 3. Sector share of employment and GDP, Viet Nam



Note: Employment information reflects available data for most recent years 1997-2000. Agriculture includes foresty and fisheries.
Source for employment: ESCAP. 2002.
Sources for GDP: ADB. 2002. Asian Development Outlook 2002. ADB. 2001. Country Strategy Programs. IMF. 2002. Selected Issues and Statistical Appendix.IMF. 2002. Selected Issues and Statistical Appendix..

Expansion in the industrial sector in the early 1990s was largely due to growth in manufacturing.[32] In the late 1990s, heavy industry, including mining, oil production and construction, became the most important drivers of growth. The country now has major oil and gas earnings. The service sector also increased strongly in the 1990s, providing large numbers of new jobs. During the crisis in 1998, the service sector stagnated and unemployment began to rise.[33]

Although industrialisation has increased in Viet Nam, it is not evenly distributed across the country. People living in the LMB region of the country, which comprises the Central Highlands, the Mekong Delta and a small area in the northwest of the country, are still heavily dependent upon agriculture for their living. Agriculture comprises around 70 percent of GDP in the Central Highlands, even though rice yields are well below the national average. Likewise, manufacturing production in the Central Region is generally very underdeveloped.

In the Mekong Delta, agricultural production accounts for about 55 percent of the regional GDP. Industrial output is about 9 percent of the country's total. It seems that although Viet Nam is, on average, more industrialised than Lao PDR and Cambodia, the people in the LMB areas have similar living conditions to Laotians and Cambodians. In general, these populations depend on agriculture for their livelihoods and, as such, are vulnerable to flooding and drought.

The government of Viet Nam pursues a policy of continued industrialisation and structural reforms described in 'Social and Economic Development Strategy, 2001 –2010'. Poverty alleviation is a main target, and the goal is to reduce poverty levels to less than 10 percent of the population by 2005, as measured by Vietnamese standards.[34]

Structural steel being loaded at Can Tho Port in the Viet Nam Delta

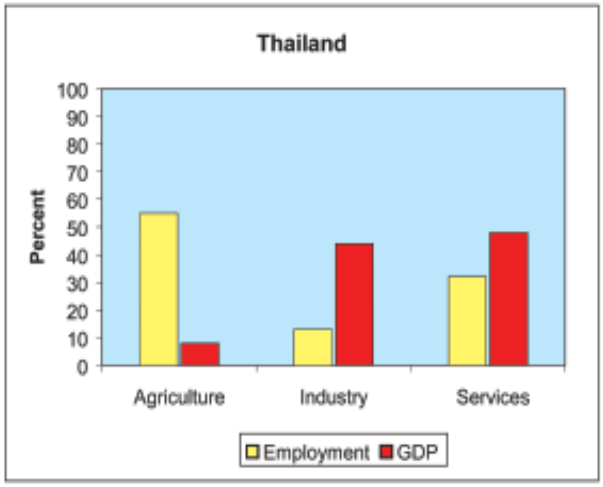
Viet Nam is moving towards a more open, market-oriented economy. Yet state-owned enterprises (SOEs) are still dominating in more capital-intensive industries such as oil and gas, and internal economic reforms designed to improve the business environment are still slow in coming.[35] Without these reforms, it will be difficult for the country to return to the growth rates of the 1990s.

LMB countries, particularly Cambodia and Viet Nam, suffer significant losses in high flood years

1.5 Thailand

Thailand's economy is qualitatively and quantitatively different from those of Cambodia, Lao PDR and Viet Nam. Per capita GDP is around $2000 (at 2001 prices),[36] equivalent to about $6300 in purchasing power parity.[37] Annual growth has recovered from the 1997 financial crisis and has stayed above 4 percent since 1999.[38] Population growth is merely 0.9 percent. The proportion of the population living in poverty is about 15 percent. Poverty has increased since the financial crisis; in 1996, the poverty percentage was down to 11 percent.[39] Even though average incomes are still below pre-crisis levels, Thailand's economy has definitely moved into another league when compared with those of fellow countries in the LMB.

Figure 4. Sector share of employment and GDP, Thailand



Note: Employment information reflects available data for most recent years 1997-2000. Agriculture includes foresty and fisheries.

Source for employment: ESCAP. 2002.

Sources for GDP: ADB. 2002. Asian Development Outlook 2002. ADB. 2001. Country Strategy Programs. IMF. 2002. Selected Issues and Statistical Appendix.IMF. 2002. Selected Issues and Statistical Appendix.

The higher level of economic development is reflected in agriculture's low share of GDP. According to ADB data from 2002, less than 10 percent of Thailand's GDP is generated by agricultural production (see Figure 4). The industry and service sectors each contribute around 45 percent of GDP.[40] Agriculture employs around 50 percent of the labour force, industry employs nearly 15 percent and the service sector more than 30 percent.

Thailand is one of the world's major producers of agricultural and agro-industrial products, and the country is sometimes referred to as a 'newly agro-industrialised' country. The country's first wave of sustained economic growth in the 1980s was largely due to success in agricultural and agri-industrial production. Today, Thailand is the world's rice trade centre and, as an example, the world's largest exporter of canned pineapple.

The Thai areas of the LMB differ from the country as a whole. These areas comprise the whole of the Northeast Region and some of the Northern Region. These areas have been relatively neglected in development terms, and the government is now promoting development in these regions in order to spread development more evenly across the country.[41] Agriculture's share of GDP in these regions is still well over that for the country as a whole but average rice yields are well below those on the central plains.

Poverty alleviation is an important issue in the Northeast, with estimates showing that average per capita incomes in 1999 were around $630. This is one third of per capita incomes in Bangkok. Traditionally, the Northeast has been Thailand's poorest region, with 19 percent of the population living in poverty.[42] In Thailand, poverty is largely a rural phenomenon which has been exacerbated by urban-rural migration and the decline in rural wages that followed the financial crisis in 1997.[43]

Despite the Northeast's relatively poor status in national terms, the Thai parts of the LMB remain by far the most developed areas of the LMB. The region has very good physical infrastructure, with all-weather roads, bridges and storage facilities. Local and national companies have made large investments in the region, making agricultural and agro-industrial production more productive. Dairying is widespread and milk production is increasing. Poultry and shrimp farms are found throughout the region. In addition, a variety of manufacturing industries, including textiles, light assembly and rubber processing have been established.

Thailand's 'Ninth National Economic and Social Development Plan (2002-2006)' incorporates a number of objectives aimed at bringing the country more balanced and sustainable development than was the case in the past. With emphases on good governance, strong social foundations and improvements in natural resource and environmental management, the development plan addresses targets at a higher economic level than is the case with the development plans of Cambodia, Lao PDR and Viet Nam. Nevertheless, the Thai government also addresses poverty alleviation in its strategy. The target is to reduce poverty to less than 10 percent by 2006,[44] and regional planning for the Northeast is now strongly oriented around poverty reduction. New initiatives are centred on developing opportunities in agriculture and agro-industry.

1.6 Common economic characteristics of the LMB

The overall economic situation in the four countries sharing the LMB are very different. Cambodia and Lao PDR are both latecomers to development and industrialisation, and the two countries still heavily rely on official development assistance. In Cambodia, the external contribution to the economy was around 13 percent of GDP in 2001.[45] Viet Nam has achieved impressive progress during the last decade, with fast industrial growth. However, the country still has high levels of poverty in many areas, which include the LMB. Thailand is by far the most developed country in the LMB and overall is in a completely different economic category than the other three countries.

In Cambodia, growth in manufacturing and exports has largely been a result of the garment industry

Looking at the specific regions of the LMB, the economy is overwhelmingly natural resource-based and perhaps three-quarters of the basin's population still depend directly

upon agriculture, fisheries and foraging for their livelihoods. Agricultural production in each of the four riparian countries is large enough overall to meet the consumption needs of the population.

With the exception of the North and Northeast Regions of Thailand, industrial development in the LMB is very limited in scale and restricted in scope primarily to natural resource processing and agro-industrial activities. Only a small part of industrial activities in the LMB involve actual manufacturing, and these are largely the garment factories.

For the LMB as a whole, economic diversification, increased industrialisation and higher productivity will be necessary if people are to obtain higher standards of living.

2. Economic development and trends

The countries in the LMB all see economic growth as necessary to overcome poverty. In order to accelerate economic growth in the four countries, economic integration is being promoted along with a market economy and private sector development. Formal cooperation and economic integration is being promoted in the LMB through international initiatives such as the Association of Southeast Asian Nations (ASEAN) and the Asian Development Bank's Greater Mekong Sub Region Programme (GMS).

Integration is supported by increased investment in physical infrastructure linking the countries together. As discussed in more detail in Chapter 14 on cooperation, in support of ADB's GMS Programme, ADB is loaning money to LMB countries to upgrade and build new roads and improve navigation and airports in order to link major cities in the LMB with each other and with coastal ports. These links will also include Myanmar and the rapidly industrialising province of Yunnan in southern China. Along these major roads, which will run from north to south and east to west and greatly improve the movement of people, raw materials and finished products between countries, ADB/GMS is promoting the development of economic corridors.

With loans from ADB, governments are building a network of roads that will link major cities and ports in all six Mekong Basin countries

The East-West Economic Corridor, which includes Northeast Thailand, central Lao PDR and central Viet Nam, will centre on upgrades of Route 9 in Lao PDR. The proposed Southern Economic Corridor will link Bangkok, Phnom Penh, Ho Chi Minh City and the port of Vung Tau.

Countries are also developing cooperation initiatives between themselves. The Thai-Cambodian Master Plan for the Border Area 2002-2012 involves seven Thai and seven Cambodian provinces, with multiple border crossing points.

2.1 Trade and diversification

Formal recorded trade between countries in the whole Greater Mekong Subregion is growing significantly. As an example, the combined value of exports and imports between Thailand and Lao PDR has grown by an average of 33 percent per year during the last decade. The growth in formal trade is taking place despite significant official barriers to transactions between the four LMB countries.

Informal trade and short-term migration between LMB countries are also growing. The LMB is generally characterised as having fairly porous borders that allow significant amounts of goods, raw materials and labour to move from one LMB country to another. It seems that informal trade flows respond more rapidly to shortages or higher prices in one country. Labour migration is a response to differences in wages from one country to another.

The goods, which are traded between LMB countries both formally and informally, reflect differences in levels of development. The less developed countries of Cambodia and Lao PDR mainly export raw materials and agricultural products such as wood, gum, rubber, live animals and fish to Thailand and Viet Nam. Low-skilled labour also moves out of the poorer countries to seek employment in Thailand. Processed or manufactured goods move from the more developed to the less developed countries. These products include cement, construction steel and sawn timber from Viet Nam and vehicles, machinery, fuels, fertiliser and pharmaceuticals from Thailand.

Goods are traded between LMB countries on an informal as well as a formal basis

Because of their proximity to large industrial production centres in Thailand, Viet Nam and Yunnan in China, it will likely be difficult for Lao PDR and Cambodia to expand their own manufacturing sectors. The markets of the two smaller countries (some 5 million people in Lao PDR and 13 million people in Cambodia) are small relative to the more than 60 million people who are consumers in Thailand and nearly 80 million in Viet Nam. This means that producers of processed or manufactured goods in Lao PDR and Cambodia will find it difficult to compete with larger producers in neighbouring countries that benefit from economies of scale because they have a much larger internal market. Unfortunately the tendency is for goods from Thailand and Viet Nam to cross both legally and illegally into the smaller neighbouring countries and thereby undermine their attempts to diversify production and add value by setting up manufacturing and processing industries.

It thus seems that economic growth in Cambodia and Lao PDR in the short-to-medium term will come mainly from increasing agricultural output as the sector becomes more productive. For Cambodia, the sources of potential growth are likely to be agriculture, natural resources, light industry and tourism.[46] For Lao PDR, the same sectors have potential, and the country also has potential to earn revenue from the production of electricity from hydropower. Viet Nam will continue its industrialisation process, but to some extent focus on internal markets. Thailand is on the threshold of entering a yet higher level of economic development. This will involve replacing

current production, which is based primarily on relatively cheap labour and abundant natural resources, with production that is more technologically advanced and requires more highly skilled human resources.[47] For both Thailand and Viet Nam, the driving forces behind their economic development are located in parts of the country that lie outside the LMB.

2.2 Investing in the future

In order to achieve economic growth, it will be necessary for the countries in the LMB to provide a stable macroeconomic framework that will encourage investments. Increasing labour productivity, either though improvements in agricultural production or though increasing employment and production in the industry and service sectors, can only be achieved if investment in better production facilities, upgrading of labour skills and the like is made.

Because the people of the LMB are poor, the levels of aggregate savings are generally low. The regions of the LMB are thus looking for foreign direct investment (FDI) as a source of capital. With the exception of Thailand, the overall investment climates are not especially positive. The nationally-defined investment regimes across the LMB vary considerably, but they all share the characteristics of high transaction costs, uncertain land and property rights, and in the case of Cambodia, a poor legal framework.[48] As a result, the LMB is generally not viewed particularly favourably by investors from outside the region. For the less developed countries of Cambodia and Lao PDR, the situation is further worsened by the fact that the countries within the LMB (again with the exception of Thailand) compete against each other in attracting foreign investors.

Cambodia and Lao PDR may find it increasingly hard to compete with the much larger economies of Viet Nam, Thailand and China

The LMB countries have all experienced a decline in FDI since 1997. Most of the FDI was previously coming from crisis-affected countries such as Japan and Thailand itself. The scale of contraction can be seen in the fact that by 1999, FDI approvals in Lao PDR and Viet Nam had fallen to about 10 percent of their 1996 levels. Likewise, Cambodia's boom years from rapidly-growing investments in the textile industry are likely over, and there too, FDI has fallen over the last few years. New FDI projects in 2001 dropped by about 50 percent compared to 2000.[49]

3. Conclusion

Four major trends in macroeconomic activity seem likely to appear in the LMB in the coming decade: increasing agricultural specialisation and commercialisation, increasing non-resource based industrial developments, increasing urbanisation and increasing subregional integration.

As the LMB primarily gains its income from agriculture, reforming this sector is of vital importance in order to achieve growth and prosperity. Through producing a variety of cash crops for marketing, incomes in the poorer areas of the basin could improve significantly, and at least move beyond their current subsistence level. The more developed areas will also see improvements in the quality of goods produced. The most developed areas will increase the use of technology and findings from scientific research in agricultural production.

To further boost overall productivity and income, the LMB countries will seek to develop more manufacturing-oriented industries. The less developed areas will try to diversify their production and thereby end their dependency on the garment sector. The more developed countries will try to spread their industry geographically. The latter will have direct effects for the LMB, especially in Thailand.

Industrial development will tend to concentrate in and around urban areas and thereby attract an increasing part of the populations to the cities. Population growth in itself will also be a driving force in the urbanisation process. Some people will move to urban areas within the LMB, while others will be attracted by cities outside the basin.

Increased commercial production in both agriculture and industry will, together with the increasing income levels generated, increase trade and be a driving force behind increasing *de facto* subregional integration. Furthermore, the countries in the LMB have also formally committed themselves to a path of increased subregional integration.

The four trends in macroeconomic activity will have major impacts on the environment and use of resources within the Mekong basin. Different areas and regions will compete with each other for use of the basin's resources, especially as economic development will come in different areas at a different pace and through different sectors, depending on the economic climate in each country. Careful planning and cooperation, assisted by the increasing formal integration between the countries, can help optimise the use of resources in the LMB.

Endnotes

[1] ADB 2002a
[2] ADB 2002a
[3] ADB 2001b
[4] WB 2002c
[5] ADB 2002a
[6] WB 2002b
[7] ADB 2002a
[8] ADB 2002a
[9] ADB 2001b
[10] ADB 2001b
[11] WB 2002a
[12] WB 2002a
[13] CDRI 2002.
[14] ADB 2001a
[15] WB 2002c
[16] ADB 2002a
[17] WB 2002b
[18] ADB 2002a
[19] ADB 2002a
[20] ADB 2002a
[21] ADB 2002a
[22] ADB 2001a
[23] ADB 2002a
[24] ADB 2002a
[25] ADB 2002a
[26] ADB 2000b
[27] WB 2002c
[28] ADB 2000b
[29] ADB 2002a
[30] ADB 2000b
[31] ADB 2000b
[32] ADB 2000b
[33] ADB 2000b
[34] ADB 2000b
[35] ADB 2000b
[36] ADB 2000a
[37] WB 2002c
[38] ADB 2000a
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