Mekong River Commission

Agriculture and Irrigation Programme (AIP)

Programme Document
2011-2015

11 November 2011

Glossary

AIP	:	Agriculture and Irrigation Programme of MRCS (2011-2015)
AIFP	:	Agriculture, Irrigation and Forestry Programme of MRCS (2001-2010)
ACIAR	:	Australian Council of International Agricultural Research
AEZ	:	Agro-ecological Zone
AFD	:	Agence Française de Développement
ASEAN	:	Association of Southeast Asian Nations
amsl	:	above mean sea level
AusAID	:	Australian Agency for International Development
BDP	:	Basin Development Plan
IWRM-BDS	:	Integrated Water Resources Management-based Basin Development Strategy
CNMC	:	Cambodia National Mekong Committee
CSIRO	:	Commonwealth Scientific and Industrial Research Organisation (Australia)
DOS	:	Development Opportunity Space
EIA	:	Environmental Impact Assessment
FAO	:	Food and Agriculture Organization of the United Nations
GDP	:	Gross Domestic Product
GMS	:	Greater Mekong Sub-region
IFPRI	:	International Food Policy Research Institute
IMT	:	Irrigation Management Transfer
IWMI	:	International Water Management Institute
IWRM	:	Integrated Water Resources Management
LCCS	:	Land Cover Classification System (of FAO)
LMB	:	Lower Mekong Basin
LNMC	:	Lao National Mekong Committee
MAF	:	Ministry of Agriculture and Forestry (Lao PDR)
MAFF	:	Ministry of Agriculture, Forestry and Fisheries (of Cambodia)
MARD	:	Ministry of Agriculture and Rural Development (of Vietnam)
MDG	:	Millennium Development Goal
MNRE	:	Ministry of Natural Resources and Environment (of Thailand)
MoAC	:	Ministry of Agriculture and Cooperatives (Thailand)
MONRE	:	Ministry of Natural Resources and Environment (of Viet Nam)
MOWRAM	:	Ministry of Water Resources and Meteorology (of Cambodia)
MRC	:	Mekong River Commission
MRCS	:	Mekong River Commission Secretariat
MPCC	:	Mekong Panel on Climate Change
Mw	:	Megawatt

NIAPP	:	National Institute for Agricultural Planning and Projection (Vietnam)
NGO	:	Non Governmental Organization
NMC	:	National Mekong Committee
NMCS	:	National Mekong Committee Secretariat
NPV	:	Net Present Value
OECD	:	Organisation for Economic Cooperation and Development
p.a.	:	per annum (per year).
PDIES	:	Procedures for Data and Information Exchange and Sharing
PIM	:	Participatory Irrigation Management
PNPCA	:	Procedures for Notification, Prior Consultation and Agreement
PMFM	:	Procedures for the Maintenance of Flows on the Mainstream
PPP	:	Public Private Partnerships
PWQ	:	Procedures for Water Quality
PWUM	:	Procedures for Water Use Monitoring
RBC	:	River Basin Committee
RBO	:	River Basin Organization
SIA	:	Social Impact Assessment
TbEIA	:	Transboundary Environmental Impact Assessment
TNMC	:	Thai National Mekong Committee
USGS	:	United States Geological Service
US$	:	United States dollar
VNMC	:	Viet Nam National Mekong Committee
WFP	:	World Food Programme
WREA	:	Water Resources and Environment Administration (of Lao PDR)
WUA	:	Water User Association

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Executive Summary

Agriculture provides livelihoods for more than 70% of the Mekong Basin's population, with 24% of the regional population considered to be below the poverty line. Agriculture is commonly the first point of intervention in raising living standards, improving livelihoods and mitigating poverty. There is considerable diversity in the character and extents of agricultural systems in different reaches of the basin, complemented by an extremely rich natural bio-diversity and aquatic resources.

Irrigation development will play an important role in increasing production to meet increased food demand in future. While the proportion of arable land that is irrigated is quite small, particularly in Cambodia and Lao PDR, its productivity is much higher than from rain-fed cropping. Yields in irrigated paddy in dry season and wet seasons are higher than those in rainfed paddy by 35-65 % and 20% respectively.

Although irrigation abstractions account for more than 70% of current basin water use, relatively little water is diverted for agriculture, typically less than 10% of the mean annual flow. However, analysis undertaken by Nesbitt and colleagues at MRC (2004) showed that water diverted for agriculture in the dry season can account for more than 45% of the seasonal flow that occurs in 10% of years and so careful analysis is required.

Agricultural development affects river basin management in two main ways: 1) through consumption of stream flow and groundwater by irrigated agriculture and; 2) through changes in hydrology arising from land use change for agricultural development. The drivers of agricultural development and resulting changes in land use are complex and varied. Agricultural planners are required to understand their context and socio-economic and political factors. Trends need to be analysed and understood for modeling and scenario assessment to reflect emerging and future realities.

The MRC Agriculture and Irrigation Programme (AIP) has been formulated to address land and water use issues in the agriculture sector to promote IWRM-based basin development in line with MRC's Strategic Plan 2011-2015 and the associated IWRM-based Basin Development Strategy (IWRM-BDS). IWRM-BDS identifies Development Opportunity Space in expansion and intensification of irrigated agriculture for food security and poverty alleviation. AIP will seek the DOS in both rain-fed and irrigated agriculture applying IWRM approaches paying special attention to poverty issues.

The principal focus of AIP 2011-2015 is on activities that contribute towards better regional planning and the integration of national and regional perspectives in agricultural development. Its secondary focus is to support activities that contribute to better regional outcomes in individual countries and to build analytical and planning capacity, with special emphasis on integrated approaches to land and water management. The third intention of the programme is to build agricultural capacity and institutional memory of agriculture within MRC Secretariat.

AIP 2011-2015 will be most closely aligned with monitoring and provision of data and evidence (with IKMP) and in the development and interpretation of agricultural components of basin development scenarios with BDP. It will make a special effort to: 1) incorporate agricultural plans and data from Member Countries into scenario analysis and; 2) interpret, explain and feedback scenario outputs in ways that are relevant and helpful to national planners. AIP will work closely with national planners to negotiate and adjust agricultural plans to improve regional outcomes where desirable.

AIP will also collaborate with other MRC programmes on specific matters of common interest that support better regional agricultural development and management. Expertise and capacities will be sought from and shared with other programmes where topics are cross cutting. These matters range from the adaptation to climate change in agriculture to the management and mitigation of drought and flood in agricultural areas, and the management of fisheries in the rivers where water is taken for irrigation as well as inside irrigated perimeters.

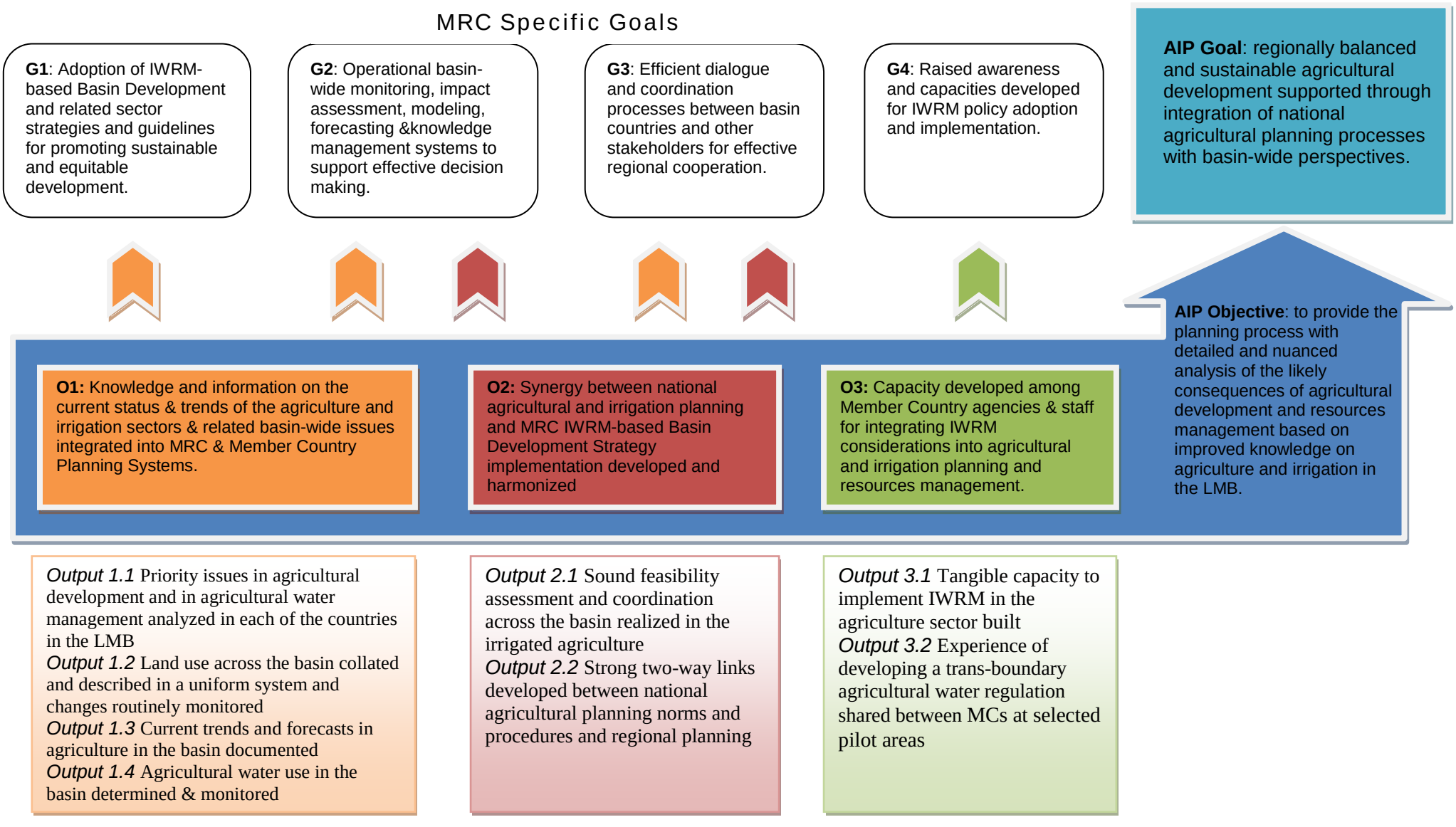
The proposed programme addresses four of MRC's specific goals, through three formal outcomes as follows:

1. Knowledge and information on the current status and trends of the agriculture and irrigation sectors and related basin-wide issues integrated into MRC and Member Country Planning Systems.
2. Synergy between national agricultural and irrigation planning and MRC Strategic Plan implementation developed.
3. Capacity developed among Member Country agencies and staff for integrating IWRM considerations into agricultural planning and management.

AIP seeks these outcomes by producing tangible outputs in agricultural land and water management as shown in the accompanying figure. Activities and tasks associated with these outputs are elaborated in the report.

The AIP 2011-2015 is managed and executed by MRCS through the AIP team of Operations Division (OPD). Its activities at the national level are implemented through relevant national agencies and institutes. Joint activities may also be undertaken with universities and donor agencies. To supervise the implementation, Steering Committee comprised of the senior officials of NMCs and line agencies in charge of agriculture and irrigation, OPD Director and AIP staff will be established. Programme Coordination Committee will also be organized for regular exchanges of information and facilitation of the programme implementation. MRC's common monitoring, reporting and evaluation framework is applied to AIP 2011-2015 with the performance indicators specifically designed for overall objective and three outcomes.

Budget for the AIP 2011-2015 is estimated at US$ 5.32 million for its five year implementation period. Funds of US$ 1.5 million for the initial 3 year activities relating to irrigation are financed by the Ministry of Agriculture, Forestry and Fisheries of Japan. Additional US$ 3.82 million require funding.



Linkages between AIP programme and MRC Strategy.

1 Background

The Agriculture and Irrigation Programme(AIP) was created from Agriculture, Irrigation and Forestry Programme (AIFP) separately from its watershed management component at the 16th Council Meeting (Nov 2009) in the course of the relocation process of MRC Secretariat. In the programme title are seen strong interests among Member Countries to give irrigation a more promintently represented status as a full MRC-programme. However, it is also logical to address both land and water use in the agriculture sector in an integrated framework to promote IWRM-based basin development.

Under such circumstances, a series of brainstorm meetings and consultations were held between MRC Secretariat and Member Countries, which was synthesized into a strategy paper: MRC's role in agriculture and agricultural water management. In March 2011, the Joint Committee took note of the progress in the formulation of the AIP Programme and instructed the Secretariat to formulate the AIP programme aligned with the MRC Strategic Plan 2011-2011.

Much of the thinking in developing the AIP 2011-2015 follows from the strategy paper. The strategy paper recommended two immediate actions to move towards the development of a more detailed work programme, which have yet to be undertaken:

1) *An institutional mapping exercise to identify key stakeholders and resources in agricultural planning and management in each country, and to understand in more detail their mandates and programmes.*
2) *Partnering with a selection of key stakeholders to complete a needs analysis for the agricultural sector in each country with particular focus on the strategic planning and regional coordination mandate of MRC.*

This document begins with a brief look at the issues and opportunities in agriculture and irrigation in the Mekong River Basin and summarises recent policy developments in each member country's agriculture and irrigation sectors. It then considers how AIP should align with MRC's new long-term strategy and the IWRM-based Basin Development Strategy (IWRM-BDS). AIP outcomes are linked to the goals of the MRC strategy and the outputs that contribute to them are defined and expanded into a set of supporting activities, which are detailed in Annex 3. The institutional arrangements for project management are presented and an indicative budget has been prepared. Background information on agriculture and irrigation in each member country is presented in Annex 1.

1.1 Issues in agriculture relevant to RBO

The broader issues and opportunities presented in this section are relevant to MRC's thinking and approach in developing a work programme, but are not necessarily subjects that fall within the regional, trans-boundary and strategic mandate of the organization.

1.1.1 Food security

The world's population is projected to reach 9.1 billion by the middle of this century, 34% higher than today. Income levels will be multiples of what they are now. In order to respond to the expected demand of this larger and richer population, food production must increase by about 70 % by 2050 (World Summit on Food Security 2009).

Although domestic food demand will increase in Cambodia and Laos, it is expected that the agriculture sector can meet the demand in the foreseeable medium term in a macro scale. However, problems in food security still occur at local levels due to flooding or poor road networks and post harvest infrastructure. Thailand is likely to continue to be a major rice exporter, but Vietnam is likely to require much of its current export surplus for domestic consumption.

One key factor limiting the aspirations of Laos and Cambodia to raise food production is the water resources, infrastructure and management capacity for dry season irrigation.

1.1.2 Poverty alleviation

The agricultural sector employs 60% of the region's labour but the average share of the GDP is only 14%. It means that the GDP per unit of labour in agriculture is only 10% of that in the other sectors. Increasing farmers' incomes is a key factor to reduce poverty, particularly in the rural areas. It requires not only improving the productivity of farming but other measures, which include:

- Securing the legal status of farmers to access resources (land, water);
- Providing and improving access to markets, credit services, crop insurance and better farming technology;
- Supplementing agricultural income with off-farm work; and
- Strengthening farmers organizations and developing new enterprises such as food processing, joint purchasing of seeds, fertilizers and other materials.

Through urbanization and industrialization, conditions and issues of poverty are changing rapidly. Knowledge and information on migration, landholding, vulnerable communities, and national poverty mitigation strategy are essential to basin planners and in development scenario analyses.

1.1.3 Crop Diversification

Crop diversification from rice paddy has been a topic among NMCs with manifold interests and concerns. Since many high value crops require less water than rice, considerable improvements in water productivity can result from crop diversification to other forms of cropping. However, rice is naturally adapted to anaerobic conditions that occur with water logging and poor drainage. Diversification implies further costs to farmers, as it requires improved drainage and construction of field irrigation channels in place of water distribution from Paddy to Paddy. On-farm water management is more demanding, and better water control (design, structures and management) is also required in place of simple continuous flow and proportional division of flows. If crop

diversification accompanies intensified use of fertilizer and chemicals, its impact on the quality of surface and groundwater body and aquatic ecosystems needs close look.

Diversification may also include the combination of agriculture and fisheries and further integration of livestock as well as a broadening of cropping patterns. Historically, capture fisheries have been so productive that there has been little need or interest in aquaculture in much of the LMB, but that is likely to change if current expectations of dam development are realised. AIFP's study on the multi-functionality of paddy fields showed that paddy fields and surrounding trenches play an important role in nurturing aquatic ecosystems and in supporting farmers' livelihoods. Paddy fields generate food for fish growth and in turn, the fish improve the diet or incomes of the farmers.

1.1.4 Irrigation Development

Most Member Countries have ambitious plans for irrigation development to enhance production. While the proportion of arable land that is irrigated is quite small, particularly in Cambodia and Lao PDR, its productivity is much higher than from rain-fed cropping. Yields in irrigated paddy in dry season and wet seasons are higher than those in rain-fed paddy by 35-65 % and 20% respectively with higher radiation during dry seasons. Water availability is a major constraint to develop dry season agriculture, and the projected increase in water discharge from upstream dams during the dry season may create opportunities for expansion of irrigation and dry season agriculture in the lower part of the Basin without aggravating low flow conditions.

Vietnam has extensively developed surface irrigation in the Mekong Delta and has recognized serious over-exploitation of groundwater in the central Highlands. As the downstream riparian it remains highly concerned about the effects of upstream development on dry-season water availability in the Mekong Delta. The development of irrigation results in the consumption (evapo-transpiration) of water by crops, which in turn depletes the source (surface water or groundwater).

Scenario analysis of the Basin Development Plan Phase 2 showed that dry season flows will increase 41% at Vientiane and 22% in Kratie (definite future scenario, without climate change), due to a number of hydropower developments on the main-stream and tributaries of the river. There is thus potential to develop more dry season irrigation to utilize the enhanced flow. However, careful analysis of the inter-annual variability is required, including consideration of climate change impacts.

1.1.5 Farmland conservation

Land concession in Laos and urbanization and encroaching of farmland in Cambodia are among the priority concerns related to basin hydrology. Changes in land use associated with agricultural development, plantation development or deforestation alter the hydrology of catchments, resulting in changes in the volume and timing of runoff as well as sedimentation and water quality. It is therefore important to be able to monitor land use and track actual changes at a regional scale. Considerable effort has been made to

map land cover, land use and land capability using GIS, traditional survey methods and more recently remote sensing, but yet covered the whole LMB.

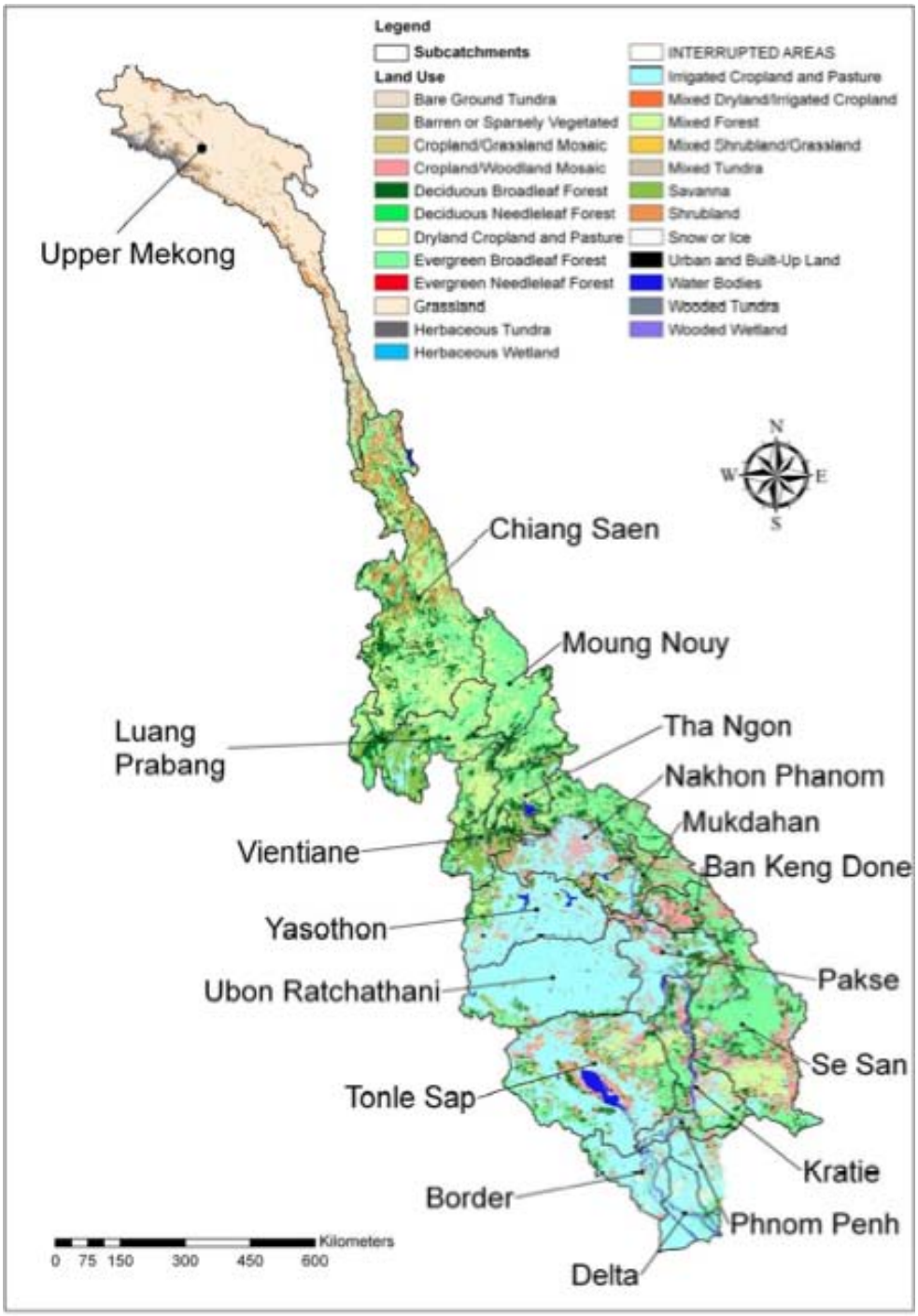


Figure 1 Land use in the Mekong Basin, (USGS, reported by CSIRO, 2009)

One challenge for mapping land cover and land use over the whole basin is that each country has a different system in place, and therefore there can be plenty of room for confusion over details. The available basin scale maps are coarse and are derived from remote sensing analysis and secondary statistics, such as the USGS map shown in Figure 1.

In many countries, agricultural planners and researchers pay considerable attention to the definition of Agro-ecological Zones (AEZs) and define and understand the fit of different farming systems within them. There is little documented definition of AEZs in the LMB, But modeling studies often require some delineation of AEZs and their component farming systems.

1.1.6 Climate Change Adaptation

A recent study conducted by CSIRO on behalf of MRCS predicts that temperature and wet season rainfall would increase, but dry season rainfall would decreases in LMB. Since about 80% of agricultural area in the LMB is used for rainfed rice during the rainy season, higher temperature and increased rainfall in the wet season would potentially change its productivity, but it would also increase the flood risk, especially in the riparian zone, where much agriculture is located. On the other hand, decreases in dry season rainfall would intensify water stress in some areas, such as NE Thailand and Tonle Sap Great Lake, and would lead to a fall in irrigated rice production.

An analysis of flow regimes in the Mekong under different combinations of upstream development and climate change has been completed by IWMI using the BDP's modeling framework. The potential decrease in dry season flows, resulting from higher temperatures, higher evaporation rates and lower and more erratic dry season rainfall is compensated by the dry season release of water impounded in hydropower dams along the tributaries and upper reaches of the Lancang (in China). Climate change scenario combined with upstream development shows marginal increases in average dry season flows (around 10%).

The greatest threat to agriculture arising from climate change is sea level rise, which will substantially impact the productive area in the Mekong Delta, and exacerbate flooding in the wet season. Flood events will become more frequent and may threaten existing infrastructure.

Further analysis of climate change impacts on agricultural systems is required to combine analysis of flow impacts (with development) and direct impacts of more extreme and variable climate, particularly the frequency of drought and flood in different locations.

1.2 National and Regional Agricultural Development Plans

A strategic focus in all national agricultural development plans is emerging, although some are long term (to 2050 and beyond) and not necessarily explicit. Some consideration of these longer-term questions of what agriculture and the host economies will be like in 30-50 years would be instructive at many levels. As AIP engages more closely with national agricultural planners, the breadth and detail of the information introduced here will improve.

1.2.1 Cambodia

Agriculture Strategic Development Plan (2009-2013) is in place that responds to the governments "Rectangular Strategy" of development based on: 1) Enhancement of the agriculture sector; 2) Private sector development and employment; 3) Further rehabilitation and construction of physical infrastructure and: 4) Capacity Building and human resource development. This sector development plan is tied to the newly published National Strategic Development plan (2009-2013). The policy goals set for the agriculture and natural resources sector are:

1) Food security, productivity and diversification;
2) Market access for agricultural products;
3) Improving institutional capacity and legislative framework;
4) Fisheries reform; and
5) Forestry reform

Each policy now has an associated programme, and encompasses the following topics in the agriculture sector:

1) Provision of more and better quality support services in terms of: extension services, adaptive research and the release of effective technologies, coupled to new rural infrastructure development (roads, irrigation) and improving finance and investment to producers.
2) Increasing technical and outreach capacity of extension services, and systematically targeting different target groups of farmers and cooperatives. It is intended to deepen the connection to farmers by training existing village health workers in agricultural extension.
3) Acceleration of private investment in the sector to increase production and export, especially of agro-industrial crops.
4) Improve the connection between farmers and markets through both contract farming and improving the quality of agricultural products through both husbandry and processing. This will be coupled with the provision of better market information to farmers and traders.

Cambodia already has a coordinated Strategy for Agriculture and Water (SAW, 2007), developed by MAFF and MOWRAM, which strongly reinforces this approach, and enshrines basin-level analysis within the national agricultural planning process. The process of strategy development used in Cambodia aligns very well with MRC's efforts. There are five programmes under SAW:

1) Institutional capacity building and management support programme for agriculture and water;
2) Food security support programme;
3) Agriculture and agri-business (value chain) support programme;
4) Water resources, irrigation management and land programme; and
5) Agricultural and water research, education and extension programme.

The programme document and annexes for SAW contain a wealth of information including detailed tables that index past and current assistance in agricultural research and extension, irrigation investment and rural development projects. The Cambodia Investment Council oversees all national and foreign investment (aid and commercial) and maintains a database of existing and pipeline projects. Objectives are clearly defined to target 20% increases in agricultural output, beneficiary income, agri-business employment and area of cash crops. Exports are targeted to show a 30% increase in value, supported by a 25% increase in loans for agricultural production. It also targets a 10% reduction in food imports. The area of cropped land with access to irrigation must increase by 100,000 ha with an associated 20% reduction in the area affected by drought and flood. The central investment in this plan is around US$250 million for irrigation development and rehabilitation supported by many smaller programmes dealing with extension, research, market development and improved monitoring and appraisal of land capability, hydrology, meteorology and adaptation to climate change (total value US$ 501 million).

In 2011, MAFF has released an Action Plan to implement the NSDP goal of expanding paddy production and raising exports to around 6-8 Million tons per year.

1.2.2 Laos

The overall framework for agriculture sector development is provided in the National Socio-economic Development Strategy 2001-2010 (NSEDS) and the 6th National Socio-economic Development Plan 2006-2010 (NSEDP), both documents recognise the important contributions of irrigated agriculture. Whereas there is no comprehensive strategy for the agricultural sector as such, the Ministry of Agriculture and Forestry (MAF) updated its strategy for the irrigation sub-sector in 2010 and has recently developed Agriculture and Natural Resources Master Plan (2010-2015) and update the irrigation sector sub-strategy (2009) leading to an irrigated agriculture strategy in 2010. MAF, however, acknowledges that in future a more holistic sector strategy should establish effective linkages between research for technology development, extension of the introduction of technology and markets for both inputs and outputs. Target agricultural growth is 4.2% per annum from investment of 3% of GDP and it is estimated that a slightly higher 3.6% investment rate would yield growth of 5%.

The Development Goals foresee gradual modernization of lowland production systems, and conservation of upland ones with the following specific goals

1) Food security;
2) Modernized production incorporating pro-poor and green value chains;

3) Sustainable production patterns; and
4) Sustainable forest management.

Despite high rainfall across the country, the World Food Programme estimates 46% of rural population are vulnerable to droughts or perhaps more correctly short term dry periods in the rainy season and more systematic dry conditions in the hot dry season.

The Lao Irrigated Agriculture National Action Plan, 2010-2015 indicates that by 2015, wet paddy area will decline and total cropped area increase marginally (8%), with increases in the north, but a bigger decrease in the south. Commodity based irrigated agriculture in small plains. It plans big (proportionately) increases in dry season irrigated area in the north and central and more modest (25%) in south although actual areas are rather small. Focus will be on improving rice self-sufficiency. Irrigation will focus on small-scale development on ridges of mountains and hills, incorporating aquaculture and paddy, with livestock, vegetables and tuber production, and application of upland rice technology for production, through improvement of communal weirs and the development of small storages for dry season use (irrigation and livestock).

In the draft Irrigated Agriculture Sub sector Strategy prepared in 2009 with support from Agence Française de Développement (AFD), the primary goal was stated as "to achieve a substantial rise in commodity production, while maintaining food security. This will support industrial development, and create jobs and improve incomes in rural areas." The objective of the strategy is to create a more conducive environment for irrigated agriculture development. Under this strategy draft, public agencies will need to adopt a holistic perception of irrigated agriculture, an economic production or business activity undertaken by farming households and entrepreneurs governed by economic incentives. Such engineering activities as infrastructure development and management are said to be as a supporting component.

There are eight programmes listed in the Natural Resources Master Plan (2010):

1) Food production
2) Commodity production and farmer organizations
3) Sustainable production patterns, land allocation and rural development
4) Forestry development
5) Irrigated agriculture
6) Other agriculture and forestry infrastructure
7) Agriculture and forestry research and extension
8) Human resources development.

Diversification of farming is considered as integral to these goals. Capitalisation and intensification of lowland production systems will include the expansion of dry season irrigation, including larger Irrigated Agriculture Development Plans (IADPs), which are a unique mechanism through partnerships between private investors and interested farmers / farmer groups being facilitated by the government.

The Lao Extension Approach emphasizes watershed management, which promotes alternative adapted cropping systems in different upland areas: ricebean on maize; finger millet and pigeon pea; direct seeded aromatic rice on pigeon pea; soya on rice; and greater integration of livestock. Cultivation techniques such as contour strip planting are also being promoted. Upland and highland initiatives in north and south focused on meeting local food security needs, including diversification for better nutritional balance. A substantial area of Xieng Khouang high altitude plains is identified for commercial development.

1.2.3 Thailand

The Ministry of Agriculture and Cooperatives (MOAC) adopted the Sufficiency Economy approach, bestowed upon the Thai nation by His Majesty the King, as the guiding principle in its strategies to be implemented from 2012 to 2016. Its core strategy is to increase the productivity of small and medium-sized farms and to improve the standards of their output so that they can compete effectively in the international market. This policy is in line with Thailand's commitment towards the realization of the ASEAN Community by 2015.

In the agricultural development strategies, research on appropriate technology would be promoted, with which farmers could produce better agricultural products, so that they would be able to lead their lives on a sustainable basis. Since the Sufficiency Economy philosophy focuses on environmentally friendly cultivation, it would reduce the problem of chemical residues and help sustain and enhance the health of soil, plants, animals, and humans.

The 11th National Development Plan also adopts the Sufficiency Economy philosophy as the guiding principle for Thailand's development. It will be implemented in the 2012 fiscal year, which begins in October this year and will end in September 2016.

The Sufficiency Economy philosophy has three key principles: moderation; wisdom or insight; and the need for built-in resilience against the risks that arise from internal or external change. Farming based on this philosophy avoids the chemical-dependent monoculture that is often no longer profitable and places farmers at the mercy of market uncertainties.

Apart from the Sufficiency Economy concept, agricultural development in the next five-year national development plan will emphasize "green and cool agricultural economy," food and energy security, and agricultural extension in the form of cluster networks. It will also consist of four major strategies, which seek to improve the quality of life of farmers, enhance the capabilities of agricultural production, use agricultural resources more efficiently, and increase the efficiency of management in agriculture and cooperatives.

1.2.4 Vietnam

There is significant amount of planning information and data for the Mekong delta and for the upland sub-basins in Vietnam, coordinated by the National Institute for Projection and Planning (NIAPP – Southern) in Ho Chi Minh City. At the moment, it is likely that most documentation is written in Vietnamese language, but nevertheless it needs to be studied carefully.

The Agricultural Development Plan (2010-2020) emphasises further diversification and modernization in Vietnam's agriculture. This document is not yet available in English language. In the Mekong Delta, the major agricultural priorities related to raising income and living standards are:

- Crop diversification;
- Improving product quality; and
- Differentiated planning in sub-areas of the delta.

The role for MRC that is relevant to these three priorities lies in: 1) predicting and monitoring water demand; 2) understanding and predicting changes in water supply patterns and water levels and in providing a forum to safeguard them; and 3) monitoring and sustaining water quality at the head of the delta. It is noted that agricultural planners in the Mekong Delta cannot do their job effectively without good information on future water supply, especially since, by their estimate, inflows to the Delta have decreased by 36% over the last 30-40 years.

Farmers throughout the Mekong Delta are independently innovating many changes in production systems with significant adoption of various forms of inland and coastal aquaculture with fish and shrimp respectively. The landscape is becoming progressively more complex as hybrid fish rice systems are adapted to seasonal water availability and quality and the impacts of polder development to secure multiple crops of irrigated rice. It is becoming hard for the water managers to keep up with the pace of change, and sometimes conflicts ensue from the competing and different needs for volumes and qualities of water at different times of the year.

1.3 Work done by MRC programmes and AIFP in the past.

Previous work at MRC could be classified into two streams of effort: 1) Data collection and analysis (under IKMP and BDP); and 2) local pilot project activities, in irrigation and watershed management (under AIFP). The former is mostly focused on providing information needed in scenario analysis and evaluation of the Basin Development Plans, and has been conducted across a range of units within MRC. Project activities have generally been bilaterally funded and staffed, and have considered such aspects of land and water management as efficient and effective water use, and institutional aspects of catchment management.

Agriculture work has been undertaken as part of many other projects at MRC and so activities have not been confined to AIFP. Considerable work has been done by BDP,

including: updating and improving the Irrigation Database; investigating scenarios of basin development that include irrigation development in the scenarios; and publishing two technical annexes to the Basin Development Plan Scenarios Report on irrigation development (and its impact on downstream water availability) and water quality impacts of intensification (mostly in irrigation systems on the tributaries of the Mekong).

The Fisheries Programme has produced well-documented studies on rice-fish systems, their management, productivity and vulnerability and these should be used to inform irrigation development and structural flood mitigation and management work in the future.

Much of the project preparation work done for FMMP, especially for structural measures to mitigate floods, has a strong agricultural focus. The major benefit stream in the justification of the West Bassac Integrated Flood Risk Management Project in Cambodia is derived from rice production within polders and flood training works incorporated into the 300 million US$ proposal. The same is true for the smaller East Mekong Integrated Flood Risk Management Project. The forecasting work and capacity of Regional Flood Management and Mitigation Centre (RFMMC) has considerable potential for broader application in forecasting drought and flood, and could be used effectively in more vulnerable agriculture systems that have "low economic visibility" in comparison to urban and transport infrastructure.

The main projects conducted under AIFP in the past are summarised here, in a section abstracted from the Agriculture Strategy (2009)[1]. Although tangible outputs in such forms as technical papers and consultant reports have been published as the result of these projects, some issues seem to be remaining unaddressed as being described in the Agriculture Strategy.

1.3.1 Demonstration of Multi-functionality of Paddy Fields over the Mekong River Basin, 2002 - 2005

In order to achieve a "better understanding of multi-functionality of paddy fields in the Lower Mekong Basin", this project set its immediate objective as "to show visible examples of paddy fields' functions with quantified evaluation".

Major outputs include:

- Basin-wide data collection, including an irrigation database updated from 2001 data, land use map focused on paddy fields, and rice crop data including rice production, rice eco-system, cropping pattern, etc. Data is also stored in GIS;
- On-farm level data collection in eight experimental plots: it included basic information (land use, irrigation infrastructures, rice production, farmers'

[1] 1.3.4 Sustainable and Efficient Water Use in Irrigated Agriculture in Lower Mekong Basin is not covered by Agriculture Strategy. (2009)

activities, etc), and data related to water and climate (water inflow, water outflow, rainfall, evapo-transpiration, percolation and water quality);
- Analysis to estimate irrigation water use in the LMB;
- Analysis of multiple functions of paddy fields, considering four functions: i) flood mitigation; ii) soil conservation and erosion control; iii) nurturing of aquatic ecosystems, and; iv) livelihood analysis; and
- Consultants' reports that integrate all the major outputs.

1.3.2 Improvement of Irrigation Efficiency on the Paddy Fields in the Lower Mekong Basin, 2005-2008

The project objectives were as follows:

- To appraise irrigation efficiencies and irrigation systems based on modern concepts in selected irrigation schemes;
- To enhance capacity of all the stakeholders in using up-to-date concepts of irrigation efficiencies, water balance and modern tools and procedures for their assessment; and
- To produce guidelines for improving irrigation efficiency in paddy fields based on actual water use conditions in the member countries.

Major outputs included:

- Improved knowledge of irrigation modernization: through a four-day Rapid Appraisal Process training workshop and initial scheme assessment activities at four pilot sites with the collaboration and continuous support of FAO–RAP (Bangkok), sixteen engineers from Member Countries received training on irrigation modernization including water control methods, water balance, irrigation efficiency and productivity.
- Irrigation system performance assessment: through field work using the Rapid Appraisal Process (RAP), a primary data set of four pilot sites concerning water use and scheme management has been established in a uniform format. The analytical work were presented and distributed as an MRC technical report[2].
- Field observation and data collection by Member Countries: on-farm data regarding flows in canals, rainfall, evapo-transpiration, percolation, crop production, water distribution practice and management appraisal, etc. were collected through intensive field observation. These data have been collated as country reports and are useful for the pilot project staff and also as reference material for a wider audience.
- Guidance for efficient irrigation water use, arising from analysis and synthesis of the field data and experience. It covers some aspects of irrigation water management and system management in the LMB, but there are some basin level and strategic issues that still need to be addressed, as follows: 1) Strategic planning and management, and in particular financial and economic aspects of managing the irrigation sector; 2) Service orientation has become part of national irrigation policy in both Thailand and Vietnam, and 3) Niches in the irrigation

[2] The output of this activity was published in February 2010 as a Consultant's Report:"Guidance for Efficient Irrigation Water Use in the Lower Mekong River Basin."

sector, such as mountain irrigation, colmatage (Cambodia) and fish-agriculture system management.

1.3.3 Watershed Management Project, 2002-2011

This project intended to institutionalise watershed management planning in each of the Member Countries, through detailed development work in pilot areas. By 2009, the project has achieved the following outputs:

- A compilation of water related laws and regulations in the four LMB countries;
- Watershed Management Committees have been created in the project's six pilot watersheds
- Development of web-portal, www.Mekonginfo.org, the project's information and document repository, on natural and water resources management;
- Watershed Management Resource Kit, a capacity building aid is now available in draft form;
- Information and Learning Centers have been established in the project's six pilot watersheds;
- Plans of Action on critical watershed issues have been formulated in the project's six pilot watersheds.

1.3.4 Sustainable and Efficient Water Use in Irrigated Agriculture in Lower Mekong Basin, 2008 – 2011

A series of data collection, workshops, pilot field surveys and applied research were conducted focusing on water use efficiency and impacts of climate change on irrigated agriculture in the LMB.

- To identify issues and policy needs on WUE and drought management in the irrigated agricultural sector
- To build the capacity of line agencies for improving WUE and drought management
- To provide recommendations for future direction in irrigated agricultural sector, and
- To facilitate dialogue among member countries and partners about future directions

Four country reports about the result of pilot field surveys as well as a technical paper on climate change impacts on agriculture and irrigation in the LMB will be produced as the output.

1.3.5 Lessons learnt from the AIFP projects

As being described above, past activities and outputs of AIFP did not cover the broad sphere of agriculture. It comprised of projects relevant to either irrigation or watershed management. Agriculture and land use issues which affect the basin environment through cultivation, grazing and application of fertilizer and chemicals were not duly covered. To implement MRC's IWRM-based Basin Development Strategy, AIP should comprehend priority topics in agriculture and irrigation as a full-fledged programme.

Another lesson learnt from the past AIFP projects is a mismatch between the goal and methods in most activities. AIFP conducted only selective hands-on pilot activities in the past due to limited funding, but always held broad themes seeking comprehensive outputs. AIP in the coming years should cover the whole basin when the goal is to build comprehensive knowledge base. Spatial focus is desired if the topic is site-specific and target area is selected based on strategic importance. AIP should conduct hands-on projects when their benefits can be far-reaching and dissemination strategies are in place.

In addition to these lessons, the need for prior institutional mapping and synergy building for better quality of outputs and efficiency of implementation was recommended in the strategy paper, MRC's role in agriculture and agricultural water management:

1) An institutional mapping exercise to identify key stakeholders and resources in agricultural planning and management in each country, and to understand in more detail their mandates and programmes.

2) Partnering with a selection of key stakeholders to complete a needs analysis for the agricultural sector in each country with particular focus on the strategic planning and regional coordination mandate of MRC.

2 Context and Rationale

2.1 Regional Relevance

The MRC requires strong agricultural capability in order to fulfill its primary role of basin planning and negotiating harmonious development and management between member countries. Agriculture is important from two main planning perspectives: 1) Land use change, usually for agriculture, is a major driver of river basin hydrology and, elsewhere in the world, has had far greater effect on flow regimes than is anticipated from climate change. Although LMB is relatively underdeveloped (in Laos and Cambodia), the situation could change quickly and guiding and understanding that change task for a river basin management organization; 2) Irrigation development is the main abstractive and consumptive use in the basin - again relatively small at the moment, but likely to change because of its key role in poverty alleviation, food security and commercial agricultural development. The consequences of significant abstractions in one part of the basin clearly have downstream impacts, varying by year, season and location. Understanding, managing and planning around these consequences is a key function of a basin organisation. The potential to develop sustainable irrigation needs to be viewed from a basin perspective.

Past work has focused strongly on the improvement of water use efficiency in irrigation, and on better management through improving local management (PIM and WUAs). For the current plan period, these topics are therefore given lower priority.

2.2 Stakeholders and Target Beneficiaries

The primary stakeholders in agriculture development are those responsible for the development of national agriculture and irrigation sector plans in each country. This likely extends to their provincial and district sub-offices where project activities are undertaken that may have transboundary significance. NGOs and civil society organizations are closely involved with small-scale irrigation and other agricultural development on one hand, whilst also acting as champions for those impacted in different ways by large projects. The private sector has become very active in irrigation and agriculture development in all countries in the LMB, investing in concessions and contract production arrangements. Bilateral and multi-lateral donors play a big role in irrigation investment and increasingly in supporting the development of national sector development plans.

A preliminary list of likely stakeholders is presented in Annex 2. Some valuable stakeholders and potential partners will be added in the course of programme implementation.

2.3 Relationship to the MRC Strategic Plan

2.3.1 AIP to support other programmes in the achievement of the Basin Development Strategy

AIP's work will relate to the core functions for river basin management, expressed in the MRC Strategic Plan 2011-2015 and consolidated in the Basin Development Strategy, with the following components:

1. Data acquisition, exchange and monitoring;
2. Analysis, modeling and assessment;
3. Planning support;
4. Forecasting, warning and emergency response;
5. Implementing MRC procedures;
6. Promoting dialogue and communication; and
7. Reporting and dissemination.

Projects that implement development activity on the ground are not envisaged under the MRC Strategic Plan and therefore none will be implemented under AIP. At present, AIP is not in a position to develop a credible capacity building programme in the near term, as its internal capacity (number of staff and broader knowledge about agriculture in the basin) is currently limited. Capacity development in relation to the outputs and activities presented below will be conducted towards the end of the plan period, or with the help of third parties.

The goals in the MRC Strategy to which AIP most closely aligned are summarised below:

Goal 1 – Application of IWRM-based basin development and related sector strategies and guidelines.

Outcome 1.1 The IWRM-based Basin Development Strategy is applied in planning and decision-making on Mekong water and related sector development in the LMB countries through an institutionalised basin development planning process.

Outcome 1.2 The required management plans, sector strategies, guidance and guidelines are developed to support the implementation of sector-specific elements of the IWRM-based Basin Development Strategy in relation to the mainstream and significant tributary systems.

Outcome 1.3 Sector and cross-sector strategies and plans incorporate climate change adaptation planning and implementation at various levels and in priority locations throughout the Lower Mekong Basin (LMB)

Outcome 1.4 National, sub-basin and basin planning and management systems incorporate economic, environmental and social implications of on-going and proposed developments in the Basin and considerations of sustainability and equitable development.

Goal 2 – Operational systems for basin-wide monitoring, impact assessments, modeling, forecasting and knowledge management to support effective decision-making.

Outcome 2.1, (with IKMP) Information and data on the full range of water and related resources parameters are systematically monitored and used in basin and sub-basin planning and management, and the state and developments in the basin are reported.

Outcome 2.2 (under BDP) MRC analysis, modeling and assessment tools are effectively used at appropriate levels of planning, decision-making and operational management.

Outcome 2.4 (under BDP) Key water and water-use parameters, trans-boundary impacts and other sustainability issues of water utilization and management, and threats to livelihoods posed by climate change and other emerging environmental issues are researched, analysed and assessed for national and regional responses.

Goal 3 – Efficient dialogue and coordination processes between basin countries and other stakeholders for effective regional cooperation

Outcome 3.2 Enhanced dialogue and co-ordination between MRC, Government agencies, civil society organizations and the private sector in basin planning and management and decision-making on Mekong water-related resources.

2.4 Linkages to the IWRM-based Basin Development Strategy and other MRC programmes

2.4.1 Realising the Development Opportunity Space (DOS) in line with Strategic

Priority

The MRC IWRM-based Basin Development Strategy (IWRM-BDS) presents the concept of Development Opportunity Space as an intermediate step in the filtering process that moves from considering the full range of development possibilities to a portfolio of projects that achieves the shared vision, within the prevailing regulatory requirements at national and regional levels. DOS is certainly a priority issue, but requires close scrutiny to be preferred, equitable and balanced options for development projects and trajectories in each country that result in the optimum benefit for the whole basin.

The IWRM-BDS also identifies Strategic Priorities that provide direction and support to optimise development opportunities and minimise associated risks as well as to ensure that developments proceed within the established national and regional regulatory framework. The Strategic Priorities guide and support project preparation, appraisal/approval and implementation, improve implementation of agreed MRC Procedures, minimize impacts and provide good practice guidelines.

As expansion of irrigated agriculture is identified as DOS, producing and sharing information, knowledge and assessment of development options on irrigated agriculture or their alternatives is a key mandate of MRCS. To facilitate the sound project identification for irrigation development, the IWRM-BDS adopts "Expand and intensify irrigated agriculture for food security and poverty alleviation" as the relevant Strategic Priority.

Therefore, AIP will focus on two main themes:

1) Status and issues of agricultural and irrigation development; and
2) Land and water use planning at basin level resulting in the harmonization of national agricultural plans with the Basin Strategy.

The following sections outline the tasks that fall into the potential mandate of AIP with clear linkage with other MRC programmes identified in the course of preliminary consultations held in July 2011. AIP has a mandate with strong thematic relevance with other programmes as follows.

2.4.2 Better monitoring and modeling - IKMP

- Mapping and/or monitoring of land cover, land use, land use change, land classification (additional importance to Cambodia, Laos)
- Inventory of current irrigation and agriculture development projects by country (within LMB boundaries)
- Better classification of irrigation schemes, improvement of database (broadening content to other water management systems, increasing detail, improving usability and offering more output for modeling)
- Incorporation of existing and future land use change scenarios into the SWAT component of DSF hence into BDP scenarios.
- Calculation and monitoring of agricultural water use –

- Contribution to Procedures for Water Use Monitoring
- Development of evapo-transpiration maps (methodology required)
- Preliminary quantification of agricultural use of groundwater and of pumped irrigation systems

2.4.3 Improved scenarios and impact analyses – BDP

- Incorporation of basic information on agricultural land and water use (such as detailed soil map, Agro-Ecological Zones, and irrigation coverage) and the outcome of studies on relevant specific issues to the Basin Development Strategy;
- Impact analyses of upstream development, climate change and irrigation development on dry season flows and frequency of droughts and (perhaps more importantly) floods with a focus on:
  - The pattern of dry season flows over a period of 30 years or more at key points along the Mekong. The soil fertility implications of sediment loss on riparian farming systems.

AIP can contribute to the improved BDP scenario analyses providing with the knowledge, information and national plans on land and water use in the agricultural sector. AIP should also help national planners interpret the BDP scenarios from the perspectives of agricultural and irrigation development.

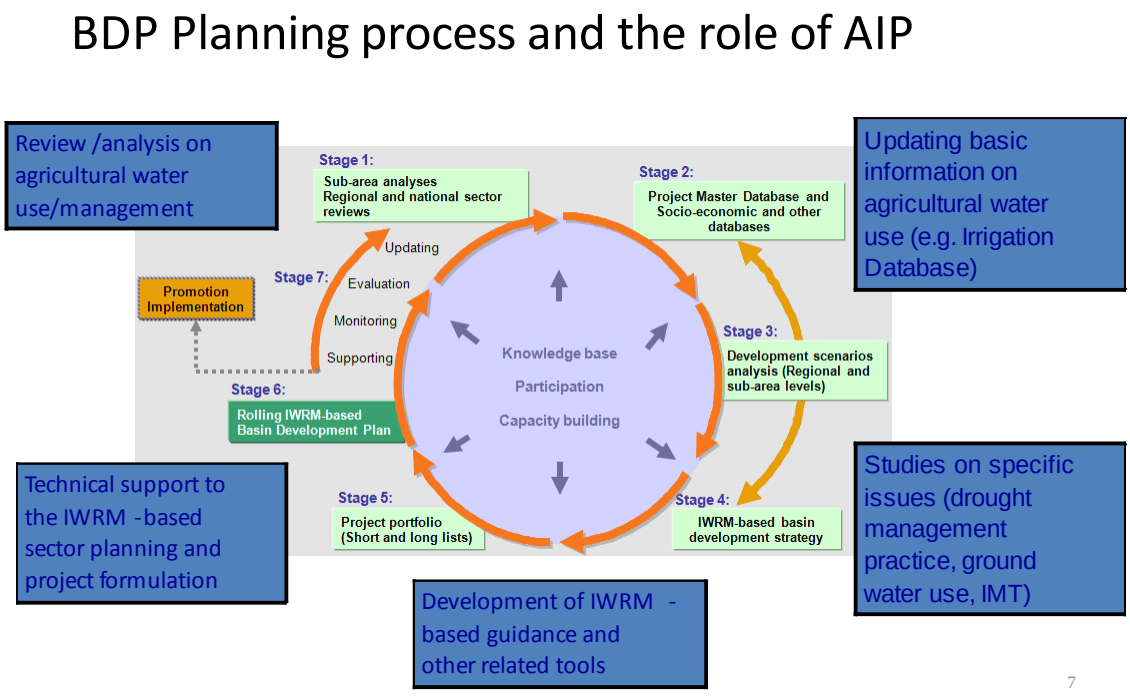


Figure 2. AIP inputs to the Basin Development Strategy

2.4.4 Addressing cross cutting issues - FP, EP, CCAI

- Studies on fish friendly agriculture and irrigation development and management, with reference to the following systems:
    - Flood plain capture fisheries
    - Rice-fish systems
    - Small scale weirs in upper catchments and their impact on fish migration with further work on improving design and operation to maintain fish passage.
- Studies on the needs for agro-chemical management in intensified systems to maintain capture fisheries benefits
- Studies on the potential for compensatory aquaculture development within irrigation systems in relation to loss of capture fisheries in and adjacent to the main stem and tributaries of the river
- Impact assessment of polder development for intensified agriculture
- Impact analyses of climate change on agricultural production and production systems: the significantly greater likelihood of floods and droughts due to climate change requires a strong focus on adaptation planning to complement pilot adaptation projects being conducted across the basin by CCAI.
- Studies on the relationship between crop intensification and non-point-source pollutants.

2.4.5 Collaboration on common agricultural interests – FMMP, DMP, ISH

- Exercise to apply the results of flood prediction and monitoring to agriculture planning – notably in the preparation of weather forecasts, drought and flood prediction and flood and drought monitoring.
- Activities related to agricultural policy and planning in DMP.
- Data collection for irrigation potential assessment in terms of using flows downstream of hydropower units for dry season irrigation.

2.5 Regional and National Priorities

Member Countries wish to develop and manage food production systems that: mitigate poverty and improve the livelihoods and nutrition of the poor; achieve national food security; and generate export earnings. The precise needs of each country reflect different contexts and different intensities the current use of natural resources. The regional perspective is enshrined in MRC's vision and supporting mission

- An economically prosperous, socially just and environmentally sound Mekong River Basin.
    - *To promote and coordinate sustainable management and development of water and related resources for the countries' mutual benefit and the people's well-being.*

National representatives in the brainstorming workshop in Vientiane (9-11 December 2008) identified the following possible roles for AIP:

- To assist countries to develop Basin Development Plan (BDP)[3] outputs and findings into concrete plans for inclusion in national social economic and financing plans and investment schedules;
- To facilitate the funding of the implementation pipeline, in cooperation with development partners;
- To provide technical assistance on agricultural and natural resources management strategies and programmes within Member Countries; and
- To assist and facilitate with the preparation and development of transboundary agricultural development and management projects, that increase experience and understanding of transboundary and basin level management issues.

More specific themes and activities suggested by NMCs and line agency stakeholders in preliminary consultations in October 2010 and in the national reviews of the draft Programme document in September 2011 includes the following items.

a. Groundwater use and water use efficiency
b. Crop diversification
c. Land use mapping, capability and soil classification
d. Marketing
e. Contract and concession agriculture
f. Public Private Partnerships in irrigation
g. Externalities of export oriented agricultural development especially with respect to basin hydrology and sedimentation
h. Analytical work on current situation, needs and priorities for agricultural sector
i. Changing flow regime under agricultural and hydropower development and climate change
j. Impacts of land use change on flows
k. Sea level rise
l. Integration of land and water management in the Mekong Delta and application of IWRM based approaches
m. Institutional mapping to identify the niche of MRC AIP
n. Long term regional analysis of agriculture development

These diverse themes and activities presented by MCs with mixed perspectives on whether the focus be broadened to agriculture more generally or more narrowly on water management require careful selection from the perspectives of MRC's core functions.

[3] The BDP programme is central to the MRC's role of guiding development and managing the river basin in a sustainable manner. The BDP assembles scenarios of development across all sectors (hydropower, fisheries, flood mitigation and management, agriculture, navigation etc), based on national programmes and plans. It uses a sophisticated modelling framework to analyse the hydrological and economic consequences of different scenarios, accounting for up-stream-downstream impacts of development, and impact of developments on one sector on those of another. Land-use change due to agriculture, and irrigation development, are two key factors affecting and affected by the hydrology of the river. In order to achieve a balanced, sustainable and equitable development of natural resources across the whole basin, the trade-offs between different development options need to be 1) understood; 2) valued and 3) adjusted for optimal outcomes for all parties.

2.6 Cross Cutting Issues

In addition to the thematic priorities, the following cross-cutting issues are duly recognized in the course of national consultations:

- Poverty alleviation: The distribution of rural communities and types of production systems that are vulnerable to changes in hydro-meteorologic environment should be considered by basin planners to understand likely risks to the rural poor and communities that are not beneficiaries of planned developments. Food security and poverty alleviation are the ultimate goal in the DOS of irrigated agriculture in the IWRM-BDS.
- Gender issues: In collaboration with MC governments, MRC needs to promote gender mainstreaming at all levels of activities. Various occasions that require gender consideration are foreseen related to policy analyses and planning exercises as well as field surveys. Close collaboration with Gender Mainstreaming Project of ICBP are required.

3 Programme Design

3.1 Programme Goal, Objective and Outcomes

Goal: regionally balanced and sustainable agricultural development supported through integration of national agricultural planning processes with basin-wide perspectives.

Objective: to provide the planning process with detailed and nuanced analysis of the likely consequences of agricultural development and resources management based on improved knowledge on agriculture and irrigation in the LMB.

The following outcomes are suggested for AIP.

1. **Knowledge and information on the current status and trends of the agriculture and irrigation sectors and related basin-wide issues integrated into MRC and Member Country Planning Systems**, with priority given to better dissemination of existing but underutilized knowledge.
2. **Synergy between national agricultural and irrigation planning and MRC IWRM-based Basin Development Strategy implementation developed and harmonized –** introduction of IWRM-based agricultural sector planning in Member Countries and more focus on pro-poor development in the implementation of MRC's Strategic Plan.
3. **Capacity developed among Member Country agencies and staff for integrating IWRM considerations into agricultural and irrigation planning and resources management**.

The term agriculture and irrigation encompasses all activities in rainfed and irrigated cropping, livestock production and rangeland management. In the regional consultations, MC's stressed that IWRM approaches to agriculture and irrigation should focus on the integration of land and water management and understand the socio-economic drivers that precipitate choices and practices in better land and water management.

The outcomes and supporting outputs are summarised in Figure 3, which shows how they contribute to MRC's strategic goals. The outputs are elaborated in more detail in the following section, with a brief justification and the details of associated activities and tasks are listed in Annex 3. Implementation plans will be developed and costed when the Programme Document has been formally approved by MRC Council.

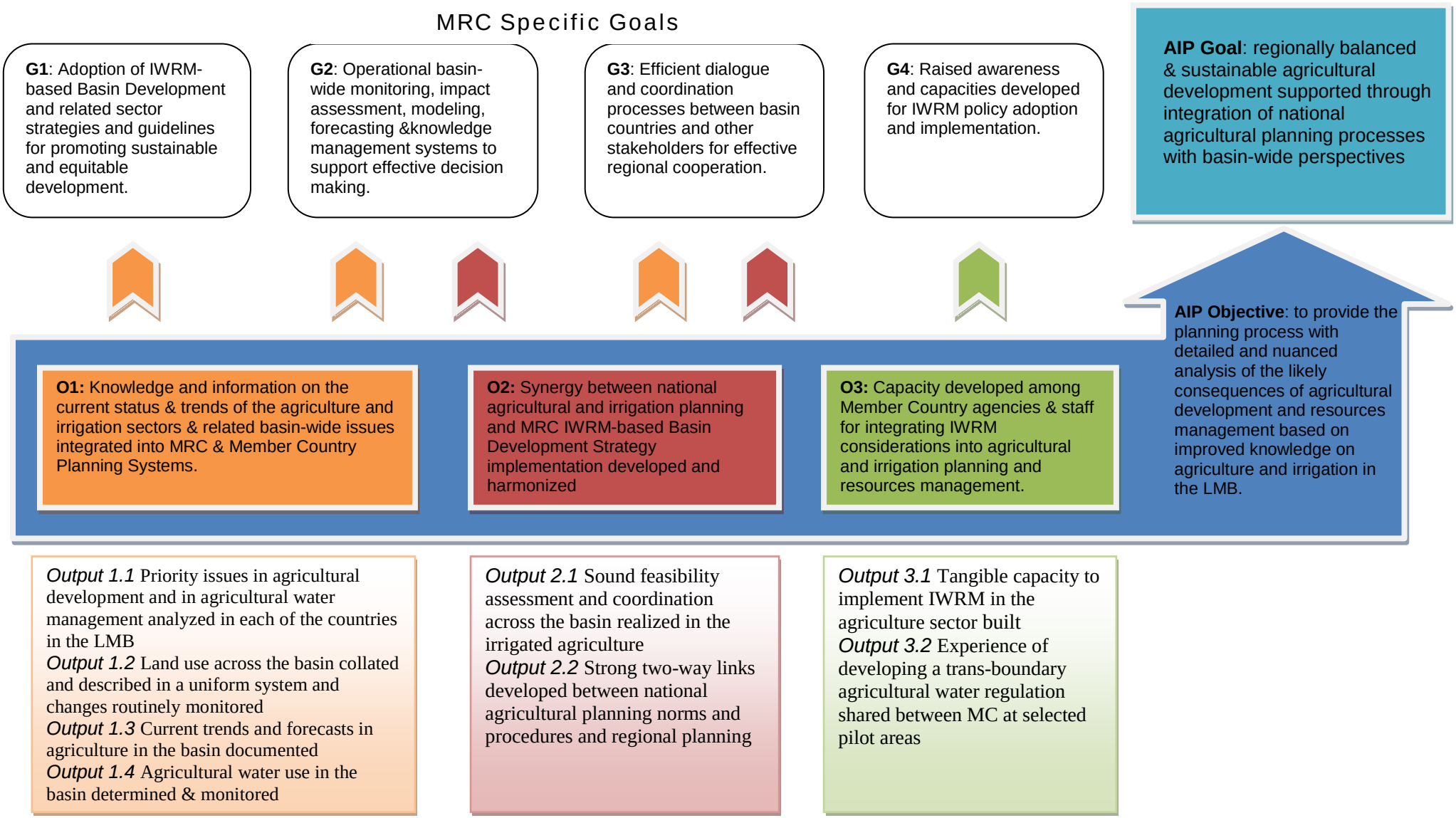


Figure 3 Linkages between AIP programme and MRC Strategy.

3.2 Outputs and Activities

Outputs and activities are selected on the basis of their basin-wide impacts. Some of the following items may have limited spatial relevance, or trans-boundary impacts with direct benefits being shared only by two or three MCs. Others may be implemented in a limited number of MCs depending on their diverse conditions; however, they still have long term or indirect benefits to all four MCs.
To help readers better understand the spatial focus of each output, country focus is noted in Annex 3 where its activities have prospects of implementation in a limited number of MCs.

Outcome 1
Knowledge and information on the current status and trends of the agriculture and irrigation sectors and related basin-wide issues integrated into MRC and Member Country Planning Systems, with priority given to better dissemination of existing but underutilized knowledge.

Output 1.1	Priority issues in agricultural development and in agricultural water management analyzed in each of the countries in the LMB

Background
Detailed country-by-country consultation is essential for the initial stage of programme implementation. Identification and selection of key collaborators in each of the member countries will be done as the basis for effective and efficient programme implementation.

Activities
- Complete institutional mapping to identify and select key collaborators in each of the member countries.
- Organise detailed country by country consultation with agricultural planning agencies and water management agencies, and selected NGOs and Civil Society Organisations.

Output 1.2	Land use across the basin collated and described in a uniform system and changes routinely monitored

Background
Land use change can impact the hydrology of the river and change downstream water availability and flooding patterns, especially in extreme years (wet or dry). Scenario modeling so far undertaken by the BDP assumes no land use change over the simulation periods, but this needs to be looked at in detail in relation to 1) planned change and 2) actual change that may be quite different from planned development. Also, soil suitability is a key-limiting factor to the development of new irrigation systems in most of LMB.

To strengthen the knowledge base on agriculture, soil mapping, agro-ecological zoning, land cover, land use, and land capability mapping will be undertaken on a unified regional basis (based on FAO LCCS).

Activities

- Conduct mapping of agro-ecological zones and farming systems in each member country.
- In collaboration with IKMP, develop land use mapping in the LMB.
- In collaboration with IKMP and FMMP, conduct soil mapping in selected locations - for irrigation suitability, including other factors such as flood extent and frequency; demographic trends

Output 1.3 Current trends and forecasts in agriculture in the basin documented

Background

Agriculture is very dynamic in Vietnam and is undergoing relatively rapid change in Laos and Cambodia through contract and concession farming, as well as under national agricultural plans with bilateral and multilateral assistance. Through urbanization and industrialization (particularly in Vietnam and Thailand), conditions and issues of rural poverty are also changing rapidly. Given all these factors plus climate change in the future, long-term food security and its necessary conditions remain the key concerns of all MCs.

To encompass accurate information in the programme implementation, policy surveys and dialogues with relevant national authorities will be held regularly on rural and agricultural development and situations of the rural poor. The soundness of long-term plans and projection on food security will be assessed, too.

Activities

- Analyse and update country agricultural sector plans on a regular basis.
- Identify trends of rural poverty and develop poverty conscious irrigation and agricultural water management strategy through the analyses of socio-economic data relating to rural poverty and vulnerable communities.
- Compile the long-term plans and projection of food security in MCs and assess their soundness.

Output 1.4 Agricultural water use in the basin determined and monitored

Background

Surface water use in the agriculture sector can be sought in MRC's Irrigation Database, which needs updating and would benefit from being more user-friendly. Groundwater use in the farming sector, on the other hand, is not regulated or monitored in a broad range of LMB except in part of Thailand and the Vietnamese Mekong Delta. An

assessment of agricultural groundwater use is essential to learn the needs for regulatory measures. Water use may also have impacts on high water hydrology (and river morphology and fish migration) because of intake facilities and their operations. Information on irrigation weirs in tributaries and upper catchments are so far partially shared and analyzed.

Updating and upgrading of irrigation database and rapid survey of groundwater use and irrigation weirs will be conducted as the first step to comprehend agricultural water use in the LMB.

Activities

- Improve the irrigation database: locations, extents, cropping patterns, actual water use; cost-benefit; land and water productivity.
- Conduct a rapid appraisal of agricultural groundwater use in four Member Countries
- Conduct a rapid assessment of existing irrigation weirs in terms of fish friendliness in collaboration with FP, river morphology and high water hydrology in the upper catchment of tributaries.

Outcome 2

Synergy between national agricultural and irrigation planning and MRC IWRM-based Basin Development Strategy implementation developed and harmonized– introduction of IWRM-based agricultural sector planning in Member Countries and more focus on pro-poor development in the implementation of MRC's Strategic Plan.

Output 2.1 Sound feasibility assessment and coordination across the basin realized in the irrigated agriculture.

Background

Ambitious irrigation development is seen in the long term BDP scenarios in Cambodia, Laos, and Thailand. Because irrigation can make huge impact on regional economy and society, MRC has determined to "expand and intensify irrigated agriculture for food security and poverty alleviation" in its Basin Development Strategy. Irrigation development, however, requires big investment and complex technical solutions based on sound knowledge and comprehensive information, where "synergy" is most demanded.

The feasibility of irrigation project portfolios, implication of BDP scenarios for irrigation development, and soundness of the practices in irrigation development will be assessed in such aspects as water-use efficiency and resilience against climate change for quality improvement, mutual trust, and public reputation. A preparatory work for water-use monitoring will also be done for more precise water use management in the future.

Activities

- Prepare and analyse inventory of irrigation projects under development and proposed over the coming plan period.
- Interpret the BDP scenario outputs on the risks and potential for irrigation

development under the changing climate and environment.

- Assess the needs and impacts of technical harmonization in irrigation planning, designing, quality controlling and performance evaluation.
- Develop a proposal for bulk water monitoring in the irrigation subsector in the basin.

Output 2.2 Strong two-way links developed between national agricultural planning norms and procedures and regional planning.

Background
MRC has developed Decision Support Framework, Tool Kit, and the BDP process to help national planners adopt IWRM-based development strategies. MRC has also developed versatile capacity for forecasting and planning in terms of flood management and mitigation. If those tools and services are adapted for national agricultural development planning and extension services, MRC's specific goals can be accomplished with tangible outputs in the agriculture sector.

BDP scenarios, i.e. basin hydrology, erosion and sedimentation, aquatic ecosystem, etc., will be reassessed based on the current agricultural land-use map and national agricultural development plans. The benefit and measures to utilize MRC's capacity for short and long term flood forecasting in national agricultural extension services will be explored, too.

Activities

- Incorporate improved land use maps in BDP scenarios.
- Develop agricultural land-and-water-use components of future BDP scenarios with national agricultural and irrigation planners, based on present use and current and future policies.
- Explore the feasibility of developing seasonal forecasting services for farming utilizing flood management capacity of MRC.

Outcome 3
Capacity developed among Member Country agencies and staff for integrating IWRM considerations into agricultural and irrigation planning and resources management

Output 3.1 Tangible capacity to implement IWRM in the agriculture sector built

Background
Integrated planning and management of land and water resources requires a fleet of various professionals, institutionalized knowhow, and the core persons with strong skills in information management and good analytical capacity to understand the drivers of the

current situation and desired changes. In the course of building the knowledge base on agriculture and irrigation inside MRCS, activities for capacity building and dissemination will need to focus more on the "needs assessment." This must be justifiable given the prospect of diverse stages and needs in capacity development among MCs.

To make tangible progress in adopting IWRM in the agricultural sector, training on land-use mapping will be conducted during this programme term. Capacity needs will be closely analyzed in the area of agricultural planning and irrigation development, and a more broad survey will be held for cross cutting issues related to capture fisheries, aquaculture, local river transport and groundwater quality.

Activities

- Undertake a capacity needs assessment with reference to integrated planning and management of agriculture, water and environment and develop capacity building plan tailored to each MC.
- Compile and analyse national regulations, guidelines and extension policies in the agriculture sector to facilitate the implementation of IWRM-BDS by minimizing negative externalities in water quality, capture fisheries and aquaculture development, and local river transport.
- Conduct training on land use mapping and land suitability.

Output 3.2 Experience of developing a trans-boundary agricultural water regulation shared between MCs at selected pilot areas.

Background

Groundwater use is not regulated or monitored in many of the LMB. Where the same aquifer is supposed to be shared by two MCs, effective aquifer management can be done only through the collaboration of two MCs.

At the border area in Mekong Delta, earlier polder development and salinity management schemes in Vietnam may have exacerbated floods in Cambodia. On the other hand, similar polder development and other forms of water resources development in Cambodia may become a threat to existing salinity management schemes in Vietnam though it is desired by Cambodia to replicate the development model of Vietnam.

Given the aforesaid trans-boundary topics, groundwater-use survey in selected trans-boundary areas will be conducted to draw a road map for effective aquifer management, and area-specific modeling exercises will be done by two MCs to learn the agreeable development opportunities.

Activities

- Develop a road map and assess the necessary capacity for the management of three trans-boundary aquifers: 1) between Laos and Cambodia 2) between Cambodia and

Thailand 3) between Cambodia and Vietnam, based on a joint survey of current groundwater use, development plans and institutional arrangements.

- Develop a pilot project for trans-boundary agricultural water use at the Mekong Delta border area between Cambodia and Vietnam.

3.3 Risks and Assumptions

Risks in AIP's new programme stem principally from the availability of funding. Other risks can also be found in the following:

- Regional issues and MRC's roles are not intuitive in the agricultural sector and for national agricultural planners except in Vietnam where it is considered very important.
- Additional country staff will likely be needed to work on specific aspects of data collection, synthesis and monitoring for both agriculture and irrigation topics (one in each country).
- Programme funding will have to be split between existing Japanese funding focused on irrigation and other funds (to be sought) on broader agricultural activities including land use monitoring, work on crop diversification and so on.

The assumptions made in the preparation of the work programme include:

- Lower Mekong countries have a good scientific understanding of their agricultural systems with varying levels of mapping and detailed data on their characteristics and performance.
- There is an agreed need for agricultural expertise within MRCS.
- Basic science and research on the dynamics of agricultural systems is not required, but better classification, description and databasing are likely required for Cambodia and Laos.
- Major regional negotiations on harmonizing regional and national development plans will be overseen and represented by MRCS, with AIP (and other programmes) feeding and shaping inputs, information, suggestions and options.

4 Implementation and Management

4.1 Implementation Strategy

The AIP needs to have a core capacity within MRCS, but where possible, relies on national partners, agencies and consultants to provide up-to-date information and conduct specific studies. The core capacity includes a good understanding of irrigation and agriculture science, of national agricultural context and plans and of planning processes. It will provide institutional memory and continuity over the years. By acquiring such a core capacity, AIP will play the expected roles of MRC: regional coordination, guidance, technical assistance, regional synthesis and capacity building. AIP 2011-2015 is therefore comprised of various activities that aim to build its technical foundation. On the other hand, AIP also adheres to a longer term strategy to shift to a steady mode of operations taking into account the road map for transition towards the implementation of the MRC core functions and increased Member Country contributions. In AIP 2011-

2015 is a small capacity building portfolio that is manageable during its own capacity building stage.

Under the Mekong Agreement, the MRCS and AIP will collate up-to-date data, GIS and other background information from national partners at minimal cost. A considerable amount of work in collating data has been undertaken by IKMP, and various analytical tools have been developed. AIP 2011-2015 places its basis on the existing capacity of IKMP, BDP, FMMP and other programmes.

To form a strong tie between AIP and national agencies, particularly planners, substantial efforts will be devoted to establishing a higher level, day-to-day engagement with national planners in addition to regular, yet less frequent, formal meetings. At an early stage of the programme implementation, the AIP team will also negotiate with coordinators in NMCs on specific work plans to develop effective and efficient collaboration with competent national line agencies and institutes. Networking with development partners for information exchange also plays a key role in achieving the programme goals efficiently.

4.2 Institutional Arrangements

The AIP 2011-2015 is managed and executed by MRCS through the AIP team of Operations Division (OPD), which provides regional coordination, technical, scientific and managerial advice and capacity development, and regional synthesis and reporting. Its activities at the national level are implemented through relevant agencies and institutes in such areas as agriculture, land use, irrigation and water resources management. Joint activities may also be undertaken with universities and donor agencies. Implementation of the work programme is coordinated and facilitated by the four NMCs.

In order to give necessary directions to the AIP team, a Steering Committee (SC) comprised of the senior officials of NMCs and line agencies in charge of agriculture and irrigation, OPD Director and AIP staff will be established. The tasks of SC will be, among others, to provide strategic guidance on the direction of the programme in line with the overall MRC Strategic Plan 2011-2015; to advise the AIP to ensure the quality of outputs; to review the overall progress of the programme to achieve its goal and objectives, and to advise to the Joint Committee if required. A ToR for the Steering Committee is attached in Annex 6.

Programme Coordination Committee (PCC) will also be organized for regular exchanges of information and facilitation of the programme implementation. PCC will be comprised of NMC coordinator, working level staff member of relevant line agencies, and AIP staff. Up to two participants from line agencies will be selected by the NMC coordinator of each MC depending on the topic of PCC.

The OPD Director has overall management responsibility for the implementation of AIP 2011-2015. Co-ordination with other divisions and sections of the Secretariat is ensured

through internal MRC coordination mechanisms. In implementing the core river basin management functions, AIP closely coordinates its activities with BDP, IKMP, EP, FMMP, FP, DMP, ISH, NAP and ICBP. The AIP Coordinator supervises and manages the day-to-day operations of AIP 2011-2015. Technical Advisor supports the AIP Coordinator technically and scientifically.

Within the NMCs, AIP Coordinators' roles are very important. The work plan for AIP Coordinators in NMCs will be negotiated towards the facilitation of the following functions:

- Provision of necessary inputs into programme activities;
- Inter-agency coordination and facilitation for programme implementation;
- Engagement with national organizations and individual experts;
- Monitoring of programme progress on national level, and facilitation of necessary actions for efficient implementation;
- Preparation of reports to national governments and Joint Committee;
- Effective communication with government policy and decision-making authorities.

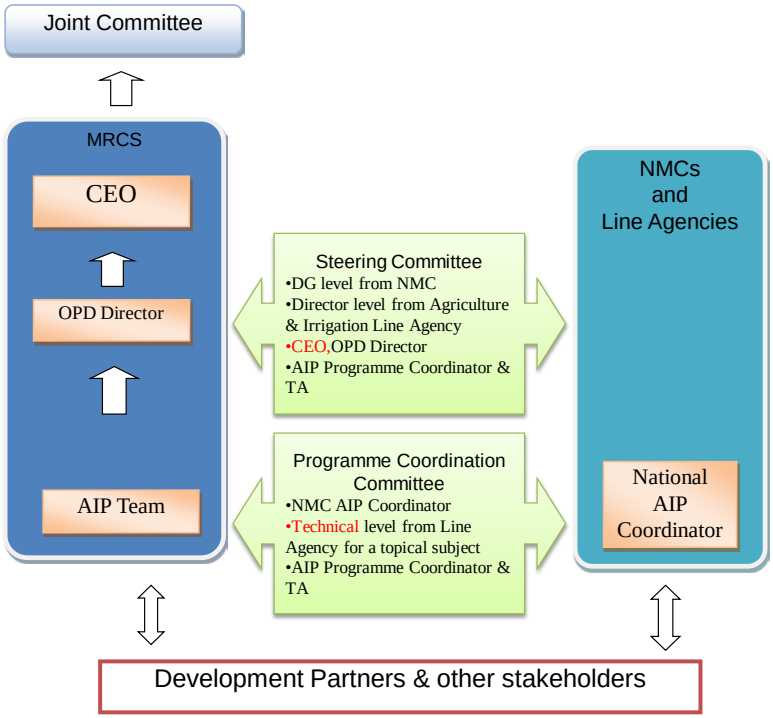


Figure 4. Accountability and coordination

4.3 Work programme, staffing and budget

The work programme will be overseen and executed by four full time staff members in MRCS, the four agricultural programme co-coordinators in the NMCs and selective use of consultants. Where possible and effective, local consultants will be used. The funds secured from the Japanese Ministry of Agriculture, Forestry and Fisheries supports three years work specifically on the irrigation component of AIP's work programme (see Annex 4), but funding needs to be sought as soon as possible for the remaining components, under the leadership of ICCS and the new CEO.

In the course of programme implementation, cross funding across programmes will be sourced from:

- M-IWRMP for groundwater;
- CCAI for drought management and strategy development for adaptation to climate change;
- BDP for IWRM strategy support;
- ICBP for capacity building

4.4 Monitoring, Reporting and Evaluation

The MRC is currently developing a new common monitoring, reporting and evaluation framework, which will incorporate the elements presented in Table 2.

Table 2 Reporting schedule for AIP

	Timing/cycle	Reporting and Evaluation level	Recipient	Notes
Quarterly Activity Report	4 times a year	Report on Activities	Countries	
Six-monthly Output Report	July	Report on Outputs	Development Partners	Steering Committee
Annual Outcome Report	January	Report on outcomes	Development Partners	Steering Committee
Program Completion Report	Within 6months of programme completion	Achievement of goal and individual outcomes. Lessons learned.	Development Partners and countries	

AIP will basically follow the MRC's common M&E framework. A preliminary set of indicators and data to establish the achievement of outcomes is give in Table 3.

Table 3. Summary design of the AIP 2011-2015 with objective, outcomes and indicators.

Objective	Indicator	Source of Data
Programme Objective		
To provide the planning process with detailed and nuanced analysis of the likely consequences of agricultural development and resources management based on improved knowledge on agriculture and irrigation in the LMB.	• National plans and strategies in MCs detailed and nuanced with food security and poverty issues appropriately reflecting the knowledge and information on agriculture and irrigation provided by AIP	• MC national policy papers, plans, and strategies on agriculture and irrigation
Outcomes		
Outcome 1: **Knowledge and information on the current status and trends of the agriculture and irrigation sectors and related basin-wide issues integrated into MRC and Member Country Planning Systems**, with priority given to better dissemination of existing but underutilized knowledge.	1.1 Priority issues in agricultural development are fully integrated and mainstreamed into national planning system	• Progress reports on the implementation of AIP • Programme evaluation report of AIP
	1.2 Latest national priorities and plans of MCs are appropriately incorporated into BDP scenarios.	• BDP scenarios and their base maps
	1.3 Land use change in LMB is monitored and documented systematically	• Assessment report of land use change across the basin
	1.4 Agricultural water use in the basin monitored	• Water accounts
Outcome 2: **Synergy between national agricultural and irrigation planning and MRC IWRM-based Basin Development Strategy implementation developed and harmonized –** introduction of IWRM-based a in Member Countries and more focus on pro-poor development in the implementation of MRC's Strategic Plan.	2.1 Priority technical knowledge in the agriculture and irrigation sector being shared between MRCS and national and regional line agencies.	• Annual sector reports of MC line agencies
	2.2 Formal and informal frameworks of data and information sharing in the agriculture and irrigation sector established and maintained day-to-day basis.	• Records of communication, material exchanges and meetings
Outcome 3: **Capacity developed among Member Country agencies and staff for integrating IWRM considerations into agricultural and irrigation planning and resources management**.	3.1 Issues and topics relating to IWRM in agriculture and water management planning being covered by the programme	• Progress reports of AIP
	3.2 Progress in the implementation of trans-boundary agricultural water regulation	• Report of joint study on trans-boundary agricultural water regulation shared
	3.3 Evidence of increased planning skill for agriculture and irrigation and related resources management. Pilot integrated planning projects established and effective	• Annual sector reports of MC line agencies • Ex post performance appraisal at end of plan period.

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Annex 1 Agriculture in the Lower Mekong Basin.

This annex provides a brief summary of the agricultural context of the Mekong basin and of agriculture within each member country. It provides further details of the predominant farming systems and current trends in agricultural development.

A1.1 General Background.

Agriculture provides livelihoods for more than 70% of the Mekong Basin's population, with 24% of the regional population considered to be below the poverty line (Table A1). Agriculture is commonly the first point of intervention in raising living standards, improving livelihoods and mitigating poverty. Although population growth rates are still high in Cambodia and Lao PDR (>1.68%), significant, and varied demographic changes are taking place and more are expected in terms of migration away from rural areas. For example, the area planted in the dry season in NE Thailand is limited by the availability of labour.

Significant areas of the basin, notably in Laos and Cambodia remain forested. Forest area in Cambodia declined from 70% in the 1980s to 58% at present. In contrast, most of the forest in the NE of Thailand was cleared in the 1960s and 70s and little remains and there are many initiatives to reforest selected areas.

The agricultural contribution to GDP has in general been declining in all countries (Figure A1) – but has rallied or "stabilised" recently in Cambodia at around 29% in 2010, having dropped rapidly from around 34% in 2001.

Table A1 Agriculture and the national economy in the LMB

2004-2006	Cambodia	Lao PDR	Thailand	Vietnam	Average
GDP (million US$)	5836	2362	157817	44835	
Share of national GDP	31.7	44.8	10.8	21.1	13.9
Population (,000)	13957	5666	63004	85025	
Growth rate (%)	1.7	1.6	0.7	1.4	1.2
Urban population growth rate (%)	3	1.8	0.8	1.7	1.5
Poverty incidence (%)	35	33	13.6	28.9	23.8
Malnourishment (% of population)	25	19	17	13	15.7
Work force (,000)	7474	2952	38579	45536	
% of workforce in agriculture	68.1	75.6	52.5	65.3	60.6

Source: FAO Food Security Statistics by Country

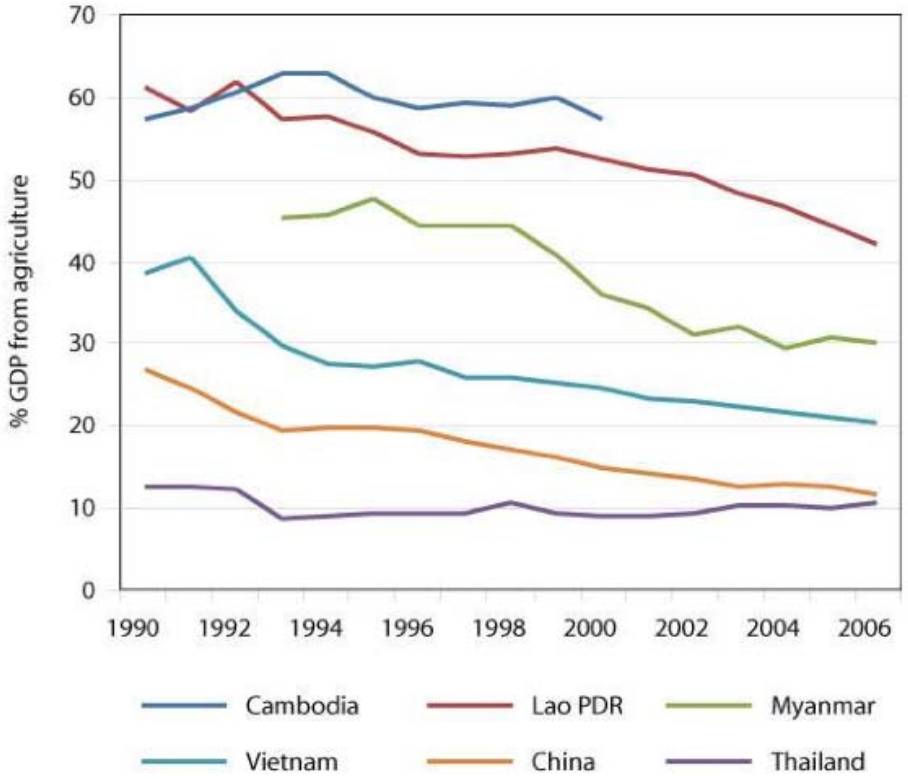


Figure A1 The proportion of GDP contributed by the agriculture sector in GMS countries (source: Johnstone et al, 2009, from World Bank Data)

The natural flow regimes of the Mekong River and its tributaries result in high water levels during and after the monsoon and low levels in the dry season which accounts for less than 10% of mean annual flow (MAF). Throughout NE Thailand and Lao PDR, some form of water storage is required to allow irrigation in the dry season and dry season irrigation areas are substantially smaller than wet season ones. However, in the Mekong Delta (Vietnam), rice may be cropped up to 7 times in 2 years within areas protected from floods (polders) and the area irrigated in the dry season is similar to that in the rainy season.

Soils in the basin are generally poor and acrisols dominate the potentially cultivable areas of NE Thailand, parts of Laos and in Cambodia (totaling about 12 Million ha). These soils typically have low nutrient status and extensive areas are acidic when not water logged, imposing limits to crop cultivation and suitability. There is considerable diversity in the character and extents of agricultural systems in different reaches of the basin, complemented by an extremely rich natural bio-diversity and aquatic resources.

Rainfed cropping is the dominant form of cultivation in NE Thailand, Laos and Cambodia, principally one rice crop per year, due to high rainfall although areas are limited by extensive flooding and water logging of riparian soils. The area of irrigation in

the Mekong Delta is by far the largest in the LMB, and accounts for more than 60% of the total. Although irrigation abstractions account for more than 70% of current basin water use, relatively little water is diverted for agriculture, typically less than 10% of the mean annual flow. However, analysis undertaken by Nesbitt and colleagues at MRC (2004) showed that water diverted for agriculture in the dry season can account for more than 45% of the seasonal flow that occurs in 10% of years and so careful analysis is required.

Although dominated by wet season rice, there is considerable variety in cropping systems in the LMB as shown in Figures A2 and A3 and in Table A2.

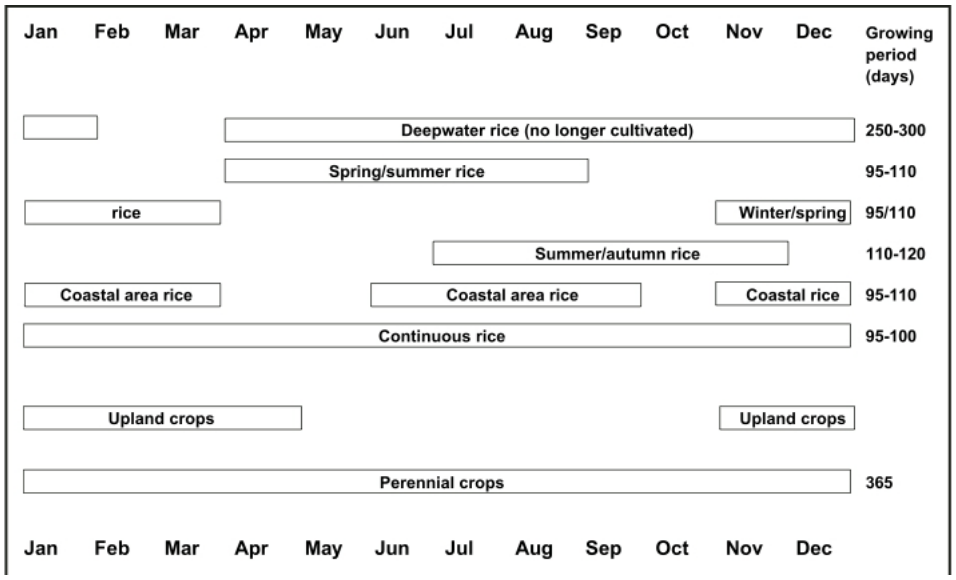


Figure A2 Generalised cropping pattern for Mekong Delta (predominantly irrigated)
Source: Nesbitt et al. 2004

Table A2 Harvested areas of crops in the LMB. Source: Mainuddin et al, 2008.

Crop	1995	1996	1997	1998	1999	2000	2001	2002	2003
Main rainfed rice	63.9	63.8	63.3	63.9	64.6	64.1	64.0	64.7	64.6
Irrigated rice	8.3	7.6	8.0	7.6	7.4	7.2	6.8	6.4	6.3
Upland/flood-prone rice	9.3	10.0	10.4	11.0	11.4	11.9	11.9	11.7	11.1
Maize	4.7	5.0	5.2	5.4	4.7	4.8	4.8	5.0	5.0
Cassava	6.7	6.5	6.1	5.1	5.2	5.4	4.9	4.5	4.7
Sugarcane	3.2	3.3	3.3	3.3	3.3	3.0	3.6	3.7	4.0
Other upland crops	3.9	3.8	3.7	3.6	3.5	3.5	4.0	4.1	4.3
Total rice	81.5	81.4	81.7	82.6	83.3	83.2	82.7	82.7	82.0
Total upland crops	18.5	18.6	18.3	17.4	16.7	16.8	17.3	17.3	18.0

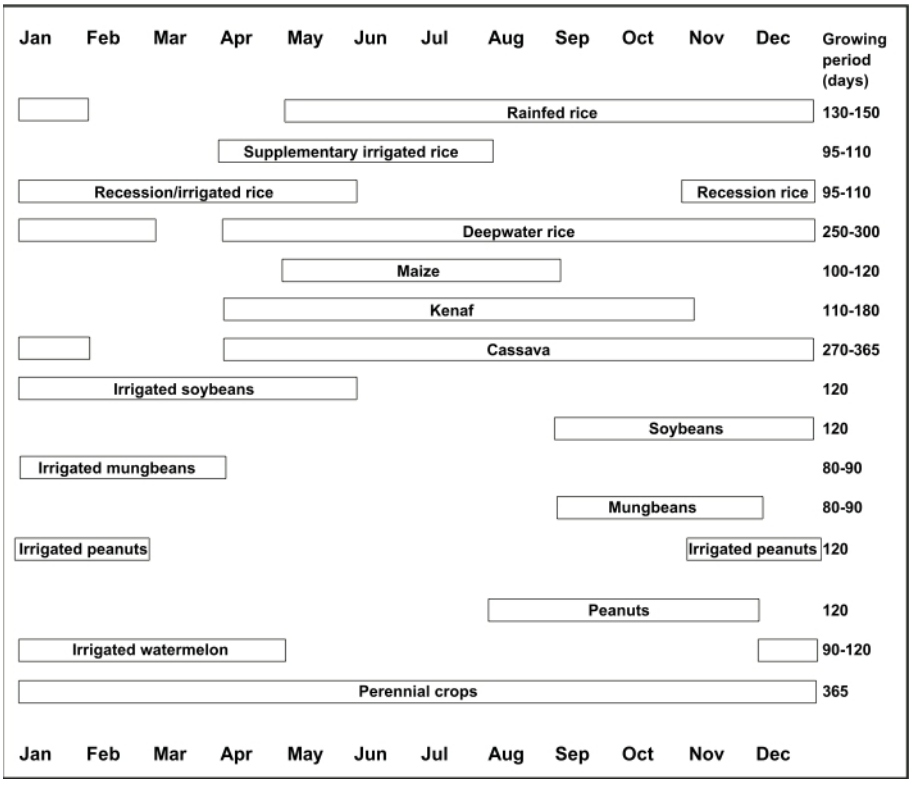


Figure A3 Generalised crop pattern for Laos, Cambodia and NE Thailand
Source: Nesbitt et al. 2004

Groundwater is extensive but not greatly used and the potential for sustainable use is uncertain in many places. It may be limited where potential problems of Arsenic contamination exist, which have been clearly identified in the Mekong Delta and Cambodia. Groundwater in NE Thailand is predominantly saline and in the Mekong Delta, salinity and drainage from acid sulphate soils restrict the usability of shallow aquifer. In general, national policies do not encourage groundwater use for agriculture, but farmers increasingly use it in the dry season in some parts of the basin.

In general, agricultural productivity is low in the Thai, Lao and Cambodian parts of the basin, although agriculture is extensively developed (mainly for rice), and relatively well diversified and intensive in the Mekong Delta, with significant areas of fruit trees and a substitution of rice by aquaculture. The variability in rice yields shown in Figure A4 illustrates this pattern of agricultural productivity across the basin. Diversification in enterprises has been plagued by extreme price volatility, exemplified in catfish aquaculture in the upper Mekong Delta, where it initially expanded as a very profitable alternative to rice cultivation. Coastal shrimp culture has experienced similar unpredictability, although overall it has been spectacularly profitable.

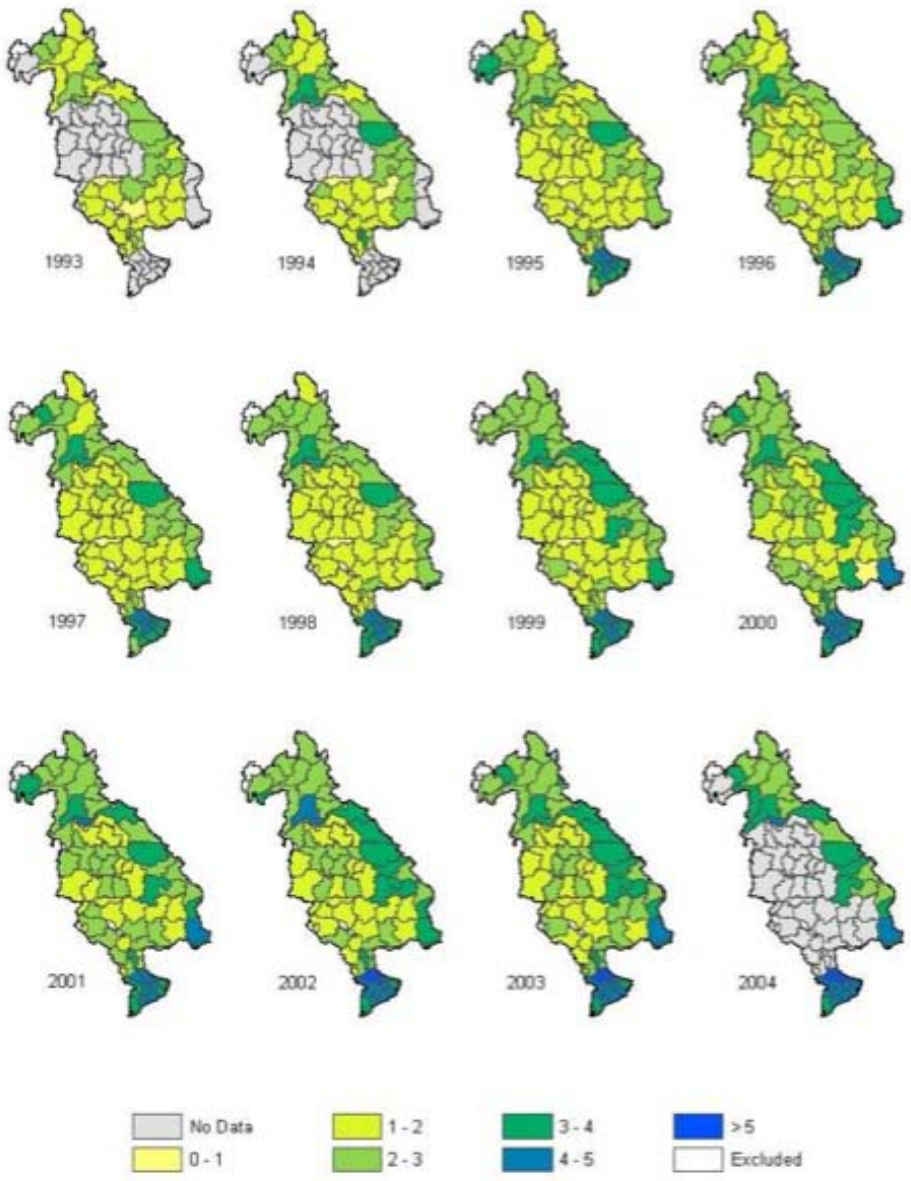


Figure A4 Variability in average per ha yields of rainfed rice across the LMB (CSIRO, 2009)

Irrigation development will play an important role in increasing production to meet increased food demand in future. While the proportion of arable land that is irrigated is quite small (Figure A5, with water use in irrigation as a proxy for area), particularly in Cambodia and Lao PDR, its productivity is much higher than from rainfed cropping. The area of rice irrigated in Cambodia, Lao PDR and Thailand is less than 7% of the annual contributes about 10% of production. Yields in irrigated paddy in dry season and wet seasons are higher than those in rainfed paddy by 35-65 % and 20% respectively.

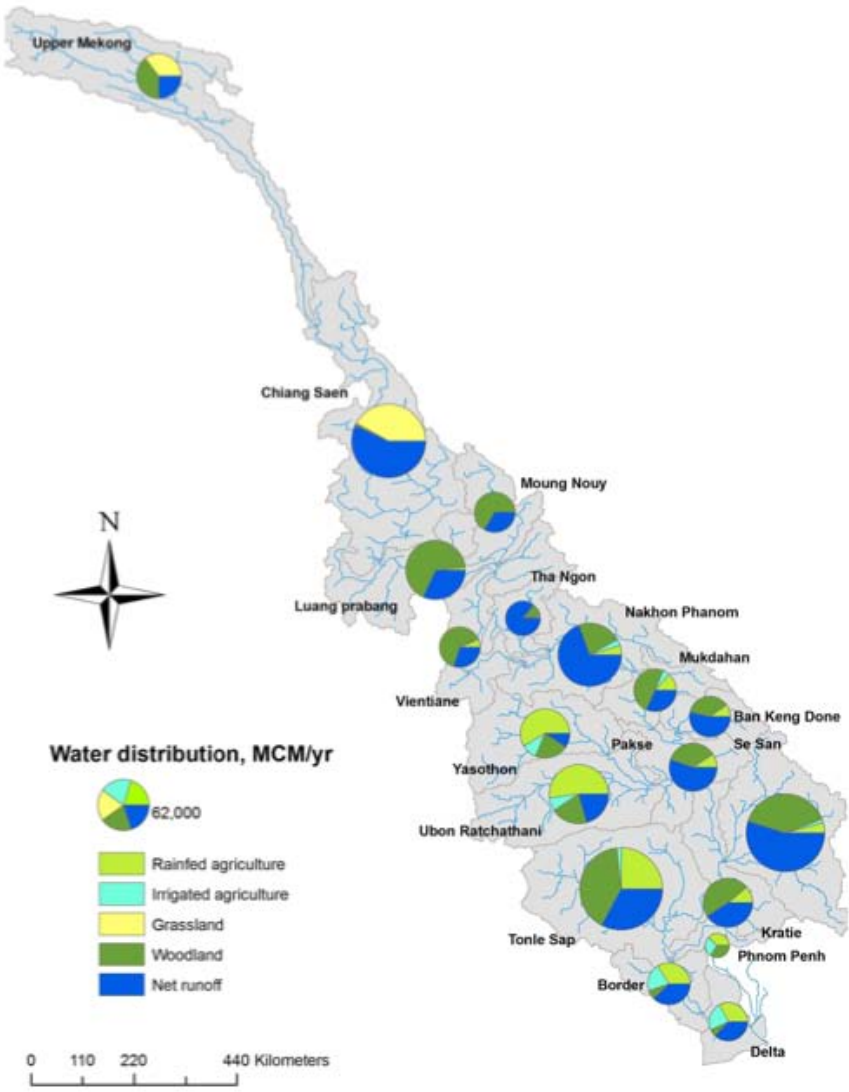


Figure A5 Estimated water use by agriculture and natural land use (CSIRO, 2009)

A recent report on fisheries in rice paddies (MRC, 2008) observed that land tenure is not formalised or secure in practice for many, if not most, farmers and natural resource users in Lao PDR and Cambodia. This is thought to limit investment to develop or intensify production. Capture fisheries in traditional rice systems (flood plain and "upland") remain important sources of food but typically suffer if intensification involves the application of pesticides and even inorganic fertilizers. Rice yields in flood prone and water logged river plains tend to be lower than in the "upland" soils, which may sit only a few meters higher in elevation. If a secure source of water is available, these units tend to be the most productive, but recurrent short dry periods in the wet season may reduce yield. Typically farmers may own two or more types of land, which is a form of adaptation strategy to the near simultaneous occurrence of flood and "drought".

Thailand and Vietnam are the two leading rice exporters in the world. Cambodia and more recently Lao PDR have planned significant expansion in rice area to become significant players in the export market. The recent rise in global rice prices has strengthened this position, but longer term patterns of rice growing and productivity will be directly determined by the evolution of world prices and, to an extent, by developments and reforms in rice markets in each country.

Throughout the basin there is evidence of a rising tide of commercial agriculture in addition to traditional, small-scale subsistence cultivation. Until the re-emergence of a "global food crisis" in 2007, in the wake of rising commodity prices, livelihood strategies and export earnings have been the complementary ends of the agricultural policy agenda in the region. The revival of a food security agenda and of concerns about the likely impacts of global climate change have re-ignited interest in larger interventions in public and private irrigation and agricultural development. The recent parliamentary approval of the proposed water grid in Thailand and similar proposals for large-scale irrigation development in Cambodia are obvious examples of intended large-scale water engineering. Food security interests are also likely to drive "private sector" investment in contract farming and both corporate and foreign direct investment into irrigation development, with strong interest in both Lao PDR and Cambodia.

Recent rates of deforestation have been alarming, averaging 0.5% per year over a period of four years, attributed to logging and slash and burn agriculture in the upper catchments, commercial concession plantations and mining developments, especially in Lao PDR and Cambodia.

Changing land use has a great impact on the hydrology of a basin, and the most sensitive and vulnerable production systems in the basin are:

- Forests in the upper catchments;
- Rainfed farming systems, which are vulnerable to nutrient depletion, poor management practices and are likely to be especially sensitive to climate change impacts in the future.
- Agricultural and fisheries systems associated with flooding around the Ton Le Sap; and
- The Mekong Delta, where year-round maintenance of water levels is essential to the management of saline and acid-sulphate soils, and to control saline intrusion from the sea.

A 1.2 Agriculture and key farming systems by country

A1.2.1 Cambodia

The pace of economic growth in Cambodia has been rapid, averaging 10%/year from 2004 to 2008, mostly from tourism, garments and construction. Agriculture and fisheries production has risen in terms of physical output, year on year since 2004, although as

proportion of national GDP it has been roughly static at 29% over the same period. The harvested area of rice has risen from 2.2 to 2.6 million ha over the same period and total rice production has nearly doubled to 8.25m tones in 2010. The export surplus is thought to be around 3.7m tonnes in 2010, marketed through a variety for formal and informal trade channels across the borders with Vietnam and Thailand. The area of maize has nearly tripled to 169,000 ha since 2001, and yield increased from 2.81 tons/ha to 3.75 tons/ha (EIC data, 2009). Most production is consumed within Cambodia, but there is informal trade with Thailand and Vietnam. The areas of the other three "priority crops" (cassava, mung bean and soya bean) have more than doubled, although remain modest. The area of rubber is expanding rapidly across estates, private concessions and small-holder plantations, in total up 39% from 2009 to 2010, although production has yet to increase noticeably.

Table A3 Land use in Cambodia in 2004 (MAFF)

Category	Area (m ha)	% share
Forest not under concession	4.7	26.1
Protected areas / forests	3.3	18.3
Forestry concessions	3.1	17.2
Cultivated land	2.7	15
Agricultural concessions	0.8	4.4
Scrubland and non-wooded land	1.7	9.4
Fishing Concessions	0.5	2.8
Towns, infrastructure	1.1	6.1
Land mine contaminated areas	0.1	0.6
Total land	18.2	100

Forest covers about 58% of the country and there are plans to restore a further 10-12 % of the land that has been degraded since the 1980s. About 2.7m ha of land is now under cultivation, of a potential estimated at 3.7m ha. A further 6.4m ha of forest and scrub could be converted to agriculture or agro-industrial production (MAFF). 90% of cultivated land lies in the flood plains of Mekong and Ton Le Sap (Figures A6 and A7), with 80% rice production occurring in the wet season (July to October). The remaining 20% of rice produced in the dry season is mostly under irrigation, although irrigation is functional on only 7% of arable land. There are widely differing figures for the extent of irrigation in Cambodia and Yem notes that there 2,430 schemes in the country, nominally covering 1.06m ha. 333,000 ha are irrigated in Tonle Sap district, where only 195 of 590 systems are working. 20% of rural population is landless but much land remains unused and water availability is stated to be the major limiting factor by 84% of surveyed farmers (Lim 2006).

1m ha of ELCs (Economic Land Concessions) have been granted, which represents a sizeable fraction of available land and is a large proportion of current cultivated area. Many concessions have not taken up and there is a fear of speculation, but since the terms

of a lease typically include “use it or lose it” clauses, many may be revoked. Social land concessions to small holders are modest, totaling not more than 100,000 ha.

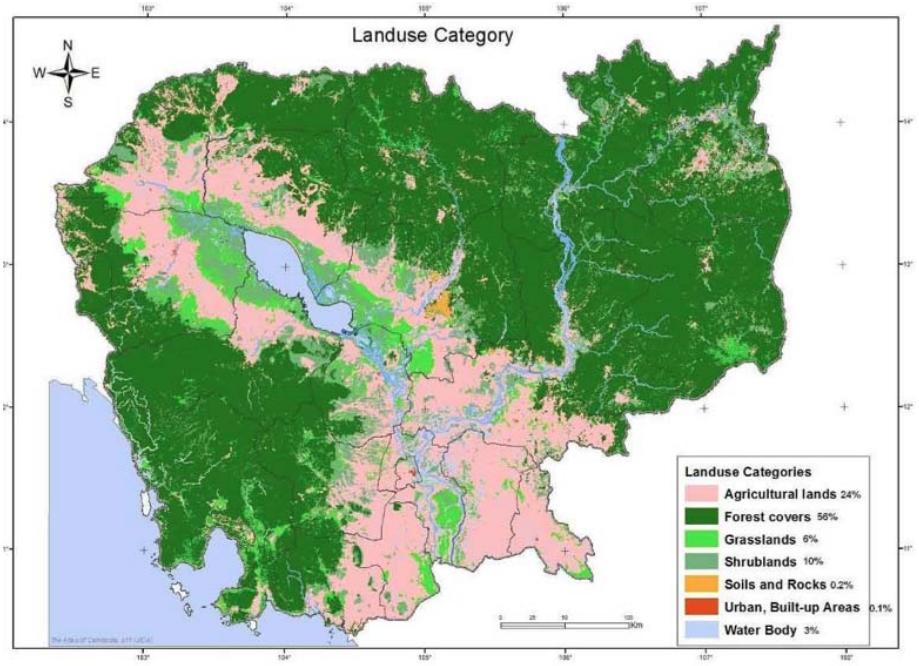


Figure A6 Land use in Cambodia (SCW, 2006)

The most extensive areas of problem soils for agricultural development in Cambodia are Red and Yellow Podsols. Alluvial soils are generally good, but risk flooding as they lie adjacent to river and are often already developed in one form or another.

Cultivation along the margins of the Ton Le Sap and in the Cambodian flood plain has many similarities with the Mekong Delta prior to extensive settlement and development (Figure A6). The dominant production system is a single rain-season crop of rice, with the first sowing usually between March – May, typically using 120 day varieties. A single crop is normally only possible along the rivers, due to flooding and water logging in the flood season. There are a number of different forms of rice cultivation are practiced as shown in Figure A7, including floating rice in deep water areas. A traditional system of un-gated diversion canals, known as colmatage, is used to divert flood and river water into tiers of rice fields, that allow rice to be grown on recession water and residual moisture under more controlled conditions at the end of the flood season, typically around November, allowing the crop to mature in conditions of high sunlight (January-February) and attain higher average yields than under rainfed conditions.

There are few rivers and ponds in the NW of the country, although 2 rice crops are possible under rainfall in Battambang and Pailin. Irrigation allows reliable dry season

cropping, but irrigation remains far from reliable in Cambodia and is a constant focus of interest.

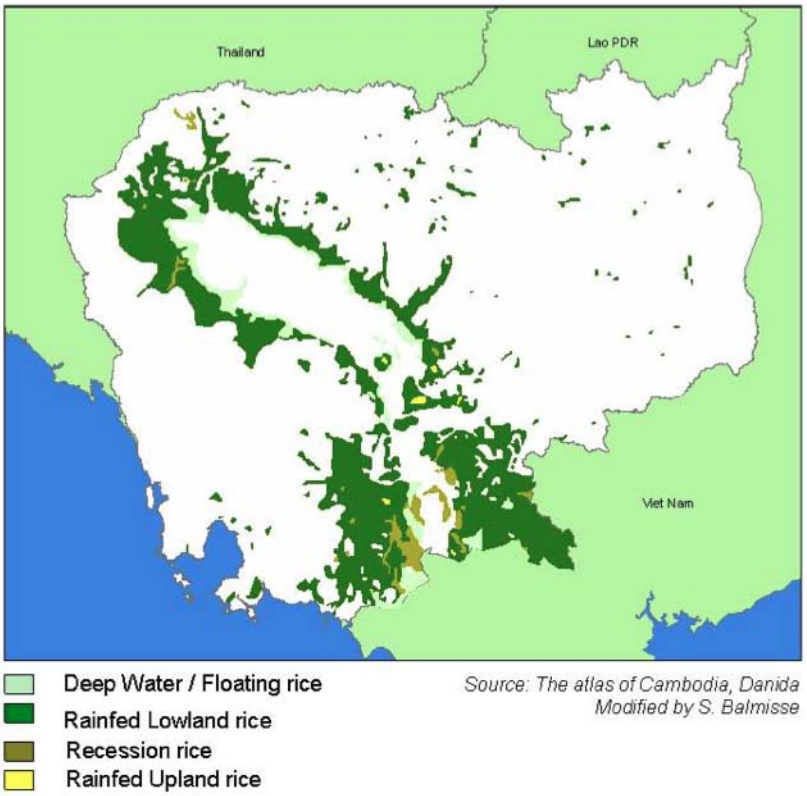


Figure A7 Rice production systems in Cambodia (Danida, 2004)

A1.2.2 Laos

Although the annual average growth rate in agricultural production is 4.3%, it only accounts for 0.9% of the annual growth in Laos' GDP (7%) and is small compared to the growth from hydropower provision (3.3%). At the same time, agriculture and forestry continue to be cornerstones of the economy and account for 47% of GDP and 80% of employment.

Hills and steep terrain cover 2/3 of the country and the government has targeted an end to shifting cultivation through development of a settled agriculture that has typically involved land clearance without conserving forest, wild life corridors or stabilising slopes.

80% of the farm population is composed of subsistence farmers and women account for 54% of agricultural workforce although their activities are largely not accounted for. Average farm size is less than 2 ha and rice accounts for 85% of total crop production and 39% of agricultural GDP. However, most upland production is consumed on-farm and about 110,000 tonnes of rice (5% of production) is commercially marketed. At a

regional level, all crop yields are increasing, except for coffee: maize 8% pa; vegetables 2.7% p.a. and rice 2.3% p.a.

Nationally, rice production has risen dramatically from 1.3 million tonnes (1993) to 2.7 million tonnes in 2007, due among other things to better irrigation performance arising from Irrigation Management Transfer. National market surplus is about 10% of this and is planned to increase.

The average size of smallholder farms is reported to have increased by factor of 5 with advent of contract cropping (maize) from 1995 to 2005 and poverty incidence maps provide evidence of decreasing poverty due to commercial agriculture. Smallholder cash cropping has caused considerable deforestation, erosion and chemical pollution at a local watershed scale, even if it is mostly not reflected in river water quality monitored by MRC.

1.5 million hectares of land have been approved for concessions, mostly in sloping areas, although actual development is more modest at around 500,000 ha. Commercial rubber plantations have already reduced the competitiveness and incomes of small holders.

Forestry remains the dominant land cover in Laos and there are two main farming systems:

1) Lowland Mekong Plain rainfed and or irrigated
2) Upland slash and burn.

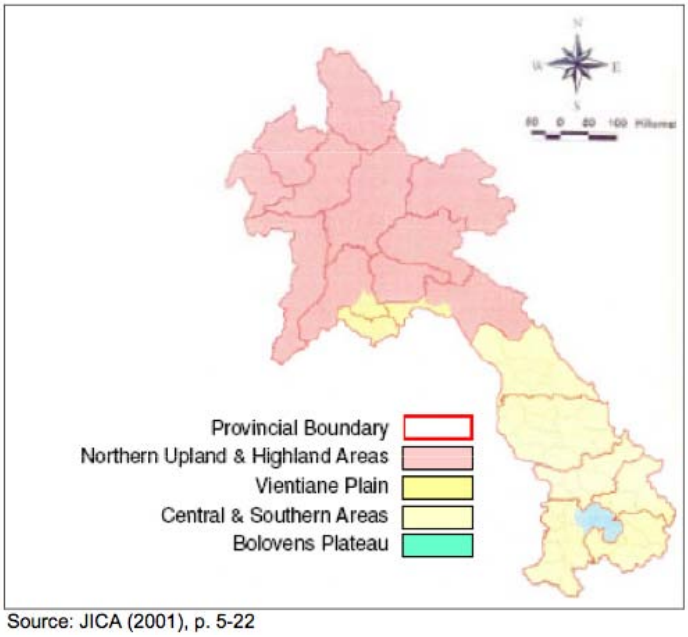
Rice is the main crop and accounts for 72% of cropped area, with traditional aromatic and sticky varieties in the upland and improved ones in the lowland. An amazing 3000 rice varieties have been identified in Laos, mostly indigenous cultivars, which represent an immense and valuable gene pool. There are also significant numbers of tea varieties including wild ones with demand in China.

A third but smaller farming system is dominated by horticulture and coffee on the Bolovens plateau. There is significant micro-diversity of farming systems in the country across 6 major agro-ecological zones in the country, which are crudely characterized as follows:

1) Vientiane Plain – 300,000 people.
2) Mekong Corridor – the most densely populated part of Laos at 100-200m amsl; 1.5 million people.
3) Central Southern Highlands – 200-500 m amsl, with poor agricultural potential due acid soils.
4) Northern Highlands – 1500-2500m amsl; high erosion risk with well suited soils for farming and animal husbandry; shifting cultivation and rubber; low population density and a medium to high incidence of poverty.

5) Northern Lowlands – 500-1500m amsl; 1500-2000mm of annual rainfall; natural forest has largely been removed by shifting cultivation; rapid expansion of cash crops (maize) and livestock.
6) Bolovens Plateau – 500-1500m amsl; 2500-3000mm of rain fall; natural for tree crops, coffee and cardamom; recent and contested expansion of medium to large-scale concessions; 60,000 people with a low incidence of poverty.

A simplified mapping of these areas is given in Figure A8.



Source: JICA (2001), p. 5-22

Figure A8 Agricultural development zones in Laos (JICA, 2001)

A1.2.3 Thailand

The NE of Thailand represents 1/3 of area of the country and contains 17 million people across 17 provinces covering a total of 170,000 km^2. It is hilly at higher altitudes and upland and lowland landforms are defined in the plain based on slight differences in elevation (typically 1-2 m). The Korat Plateau lies at 100-200m amsl and contains undulating land and shallow soil, which is underlain by naturally saline rock except for the Karst outcrop in Loei.

NE Thailand experiences a South West Monsoon climate with an average of 1300-1400mm rainfall per year and 90% falls between May and October. There is a rain shadow in west, where average annual precipitation falls to 1100mm. The highest rainfall occurs in the north-east (1800mm). Generally, rainfall is erratic and unpredictable both during the rainy season and between years.

Average farm size is 4.3 ha, ranging from 2.8 to 5.8 ha. 80% of the cultivated area is rainfed on loamy sands or sandy loams with low fertility and poor moisture retention

capacity. These soils contain weathered limestones and so the small clay fraction is composed of kaolinites with low cation exchange capacity (CEC) and hence they have low natural fertility. There are about 8 million ha of acrisols in the region. Deforestation occurred on a large scale for agricultural development in 1960s resulting in "high" rates of erosion – 25 to 33t/yr in traditional systems, equivalent to about 2mm/yr, which if unchecked results in top-soil depletion.

Two big rivers, Sri-Songkhram (North) and Chi Mun (South), drain into the Mekong, but contribute almost nothing to river flow. There has been extensive development of small-scale irrigation infrastructure (weirs, dams, farm ponds) to the point that flow from the three main rivers into the Mekong has all but ceased. Irrigated area was 600,000 ha in 1986 or about 7% of cultivated land. At present it has grown to more than 1.6 million ha, now mostly supplied by small dams and farm ponds, which collect all available runoff. Two zones have been more formally developed: 1) from large reservoirs and; 2) by direct pumping from rivers with 2.1 and 1.9 million rai respectively (336,000 ha and 304,000 ha) supporting less than 20% of farm population.

As a result of the uncertainty in farming and the difficulty of finishing a crop in the dry season, and with limited dry season water availability, people have always been very mobile and migrate far and wide, as far as Singapore as construction workers in the 1980s.

In 1986, Iain Craig noted that attempts to define agro-ecological zones on basis of rainfall, soils and socio-economic status had largely been disregarded in Thailand because: 1) of considerable variability within one zone (or even village); 2) of not accounting for topography, which determines soil hydrology and nutrient status but is subtly varied in many cases. He defined hill, mini-watershed, flood plain, non-floodplain and irrigated farming systems, distributed with respect to rivers and rainfall (Figure A9).

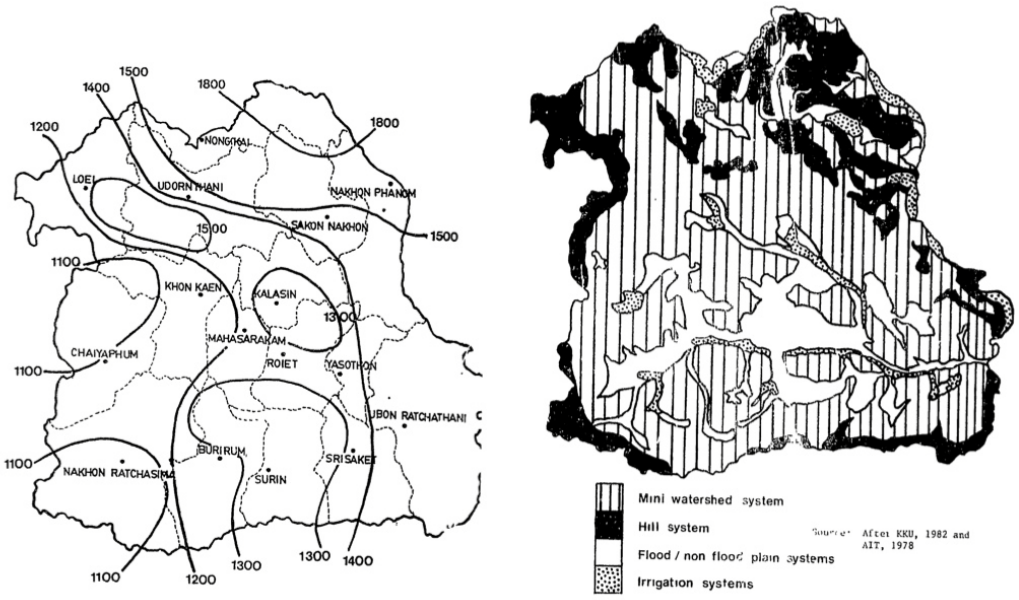


Figure A9 a) Rainfall iso-hiyets and (b) farming systems in NE Thailand c. 1985 (Craig and Pisone, 1986)

Historically, 80% of the area is sown to rice, with mixes of other enterprises including livestock, dry footed crops and even silk. Craig observed that Isan farmers are highly skilled and well adapted, some of the best in Asia. Strategies to cope with variable rainfall include staggered planting dates, soil moisture conservation practices and crop type selection, and most farms have a mix of 2-3 land types. Farmers plant photoperiod sensitive rices to allow variation in planting dates, whilst allowing all plantings to be harvested before the flood season. They store rice for seed and consumption over a number of years (which is generally unusual) and use minimal inputs in flood prone areas.

Lower paddy land is planted to longer season rice varieties but is subject to flooding. Middle land is probably the most productive and is sown to medium duration rice varieties, sometimes with a legume or another dry season residual moisture crop (short duration). Rice on upper lands may only be successfully planted and harvested 3-4 times in 10 years and there are therefore substantial weed problems on these lands. Hill soils tend to be more naturally fertile than river plain ones and give reasonable yields of maize, upland rice and so on. Problems here are sheet and gully erosion, poor water retention and remoteness from markets.

Cassava was the largest cash earner in the form of animal feed exports to Europe and development of the industry was supported by the construction of processing mills.

In more recent literature, there is frequent reference to low yields, which are assumed to be due to poor husbandry and which are therefore thought to offer good potential for improvement. Craig would disagree for he noted that breeding should target yield stability rather than increasing it. Existing cropping has already denuded soil fertility and

further intensification would exaggerate this. He suggested that better water control (weirs, leveling, use of shallow groundwater) are much more important in stabilizing and raising yields than moving to higher rates of inputs.

More recent writing (Nesbitt, Johnstone and Soleing (MRC), 2004) indicates that many of Craig's observations remain fundamentally true, and for the foreseeable future, agriculture in the North-east of Thailand will consist of:

- wet season rainfed and irrigated rice in the most productive lower paddy fields;
- dry season rice on good soils in some irrigation schemes that have sufficient water;
- sugarcane production in the higher rainfall areas, on good soils and on some irrigation schemes within transport range of sugar mills;
- maize production on good soils in higher rainfall areas, for example, in Loie;
- intensive fruit and vegetable production under irrigation;
- extensive cattle production on areas formerly planted with cassava and other rainfed crops;
- intensive cattle, pigs and poultry feeding enterprises; and
- tree crops such as rubber, cashew, mango, eucalypts, bamboo, neem, and teak in areas formerly used for cassava and other rainfed crops

The rural economy has been bolstered by farmers' preference to plant traditional aromatic and sticky rice varieties that command a price premium whilst being well adapted to conditions in NE Thailand. Rubber plantations have been promoted but have further encroached on forest area

Irrigation schemes will make more economically efficient use of water in the dry season if higher value crops are introduced.

A1.2.4 Vietnam

The two areas of Vietnam that lie within the Mekong River Basin, the Mekong Delta and part of the Central Highlands, have very different agricultural and topographic characteristics.

Mekong Delta

The Mekong Delta has fast become the most important agricultural region for the country, contributing more than 50% of staple food crops and 60% of fish production, equivalent to 27% of the national GDP. Besides rapid agricultural growth, the industrial sector has recently also expanded rapidly, particularly in agro-processing and manufacturing.

The population is 18 million (about 22% of the whole population of the country) resulting in a high population density of about 434 persons/km^2 in 2005. The region has been settled by three major ethnic groups, Vietnamese, Khmer and Chinese, and a small

number of Cham people. About 10.9 million people are engaged in work and about 80% of the population lives in rural areas (CSO, 2005).

The total area of the delta is 3.96 million ha, of which 3.21 million ha is cultivated as follows: 1.85 million ha for rice; 0.22 million ha for fruit trees; 0.22 million ha for annual industrial crops; 0.63 million ha for aquaculture; and 0.39 million ha for forestry. The delta produces about 19.23 million tons of rice per year (accounting for 54% of total national production), with an average yield 5.03 t/ha. 90% of total national rice exports originate from the delta.

About 2 million ha are irrigated, although a lot of irrigation is not “formal” gravity supply but is characterized by water level control in dual-purpose drainage and supply channels. Small pumps abound and there is some debate on the attribution of water use between shallow groundwater and connected surface water. Development of the Mekong Delta began with navigation canals and wetland conversion by farmer pioneers with later state involvement in agriculture. An extensive network of canals has been constructed in the last 300 years and now incorporates 7,000 km of main canals, 4,000 km of secondary canals, and more than 20,000 km of protection dykes to prevent early floods (MARD, 2003).

Humans have attempted to settle and cultivate the natural wetlands of the Mekong Delta over the last 300 years, but development has accelerated quickly since 1975. Long-planned water control infrastructure has been built with the intention of expanding the area served reliably by fresh water from the Hau and Tien rivers. This enables progressive intensification of rice cultivation from one wet season per year to as many as seven crops in two years.

The delta is criss-crossed by a dense network of canals, which both supply and drain water and have been the principle means of transport in the past. Vietnamese in the Mekong live by or on the water, and road networks and infrastructure to an extent bypass much of rural life in the Mekong. Large canals, such as Quan Lo Phung Hiep in Bac Lieu and Ca Mau, were originally built as ship canals with direct connection to the sea. Conditions in the Mekong Delta are complex. It experiences flooding and sedimentation from the Mekong River, highly seasonal rainfall, and salinity intrusion from the surrounding sea.

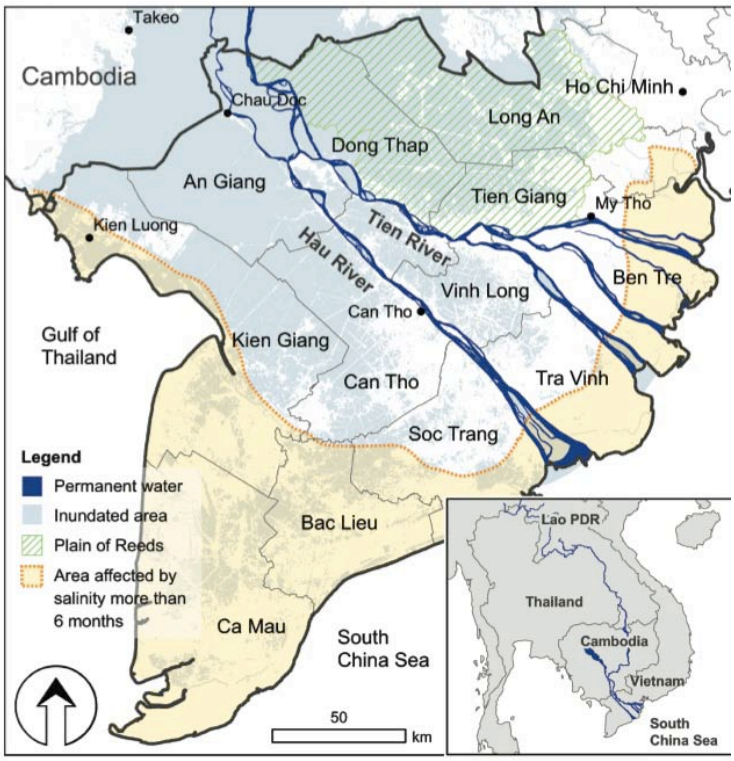


Figure A10 Location map of the Mekong Delta, showing the distribution of fresh and saline water, and provincial boundaries. *Source: Kakonen, 2008. Mekong Delta at a cross roads: more control or adaptation.*

Each year (July to November) there is extensive flooding from the Cambodian border, southwards along the rivers. In the dry season, there is an extensive freshwater zone along and between the Hau and Bassac Rivers, where early settlement and rice cultivation took hold. Since rainfall in the dry season (December to May) is typically less than 15% of the annual total, freshwater is required to irrigate crops. Upstream diversions reduce flows further downstream in the nine branches of the Cuu Long.

Salt water can penetrate far inland through rivers at high tide, and also along man-made canals (Figure A10). The tidal range in the West Sea is slightly less than one meter, whereas it is around four meters in the East Sea. The tidal regimes have different periods, which result in varying patterns of saltwater penetration into the delta. There have been extensive problems with saline and acid-sulphate soils (marine soils) and saline intrusion (at high tide and in storms). About 2.1 million hectares of the delta's coastal zone are affected by salinity intrusion during the dry season (from December to May). Soils with high iron sulphide content cover another 1.6 million hectares (40%) of the Mekong Delta.

Significant areas of the Western Mekong are underlain by acid-sulphate soils, which present little problem if inundated or saturated by saline water. Saline water has three times the buffering capacity of freshwater. If potentially acid-sulphate soils are exposed

to air, they ripen and liberate large quantities of acid into solution lowering pH to less than 3.5 in streams as well as in the parent soils. Acid-sulphate soils are generally overlain by river sediments that may be up to several meters thick. Digging canals and excavating embankments may expose acid-sulphate soils that then generate acid runoff. Typically, acidic flushes are generated by the first rain events in the wet season, mostly from exposed dry acid soils. Where it is possible to maintain flooded conditions, even with fresh water, potentially acid-sulphate soils can be used for rice production.

Previous attempts to develop areas with acid-sulphate soils by drainage and leaching have resulted in years of toxic acidification (Plain of Reeds and Long Xuyen quadrangle) before reclamation, assisted by large applications of lime, is complete. Vietnamese scientists have progressively mapped acid-sulphate soils, saline intrusion, freshwater zones and developed computer software (such as VRSAP) to model the hydrodynamics and salt transport of natural and man-made waterways in the delta. Although salinity can be well modeled and monitored, it is much harder to simulate the behaviour of acidification in soils and waterways.

Sluice gates have been constructed to control saline intrusion and polders have been built to establish freshwater areas for intensive rice production (supporting up to 7 crops in 2 years). Although land holdings are larger than elsewhere in Vietnam, it has become progressively harder to make good profits from rice production. This has stimulated extensive diversification to improve incomes and maintain food self-sufficiency. There has been widespread aquaculture development with coastal shrimp production and fresh-water fish or brackish water species further inland. Production systems are becoming increasingly tailored to (changing) water conditions (freshwater, brackish, saltwater) and the main challenge for state agencies seems to be in coordinating water control and matching it to the needs of evolving farming systems.

Policies and infrastructure investments of the government have encouraged intensification of rice and aquaculture in the upper and mid-delta, resulting in reduced water availability downstream. Intensive rice farming with two or three crops a year, in the upper and mid parts of the delta, is the major water user in the dry season and may account for 50% of mean flow of the Mekong within Vietnam between December and May. Thus there is a tension between further rice intensification in the upper part of the delta, and the consequences of saline intrusion and lower water availability for coastal production systems further downstream. Water scarcity for irrigation is estimated to affect nearly 1.5 million hectares of cultivable land in the dry season and local groundwater table falls by 2 - 3 m in some places during the dry season when river flows fall below 2,500 m^3/s.

The evolution of agriculture has focused on rice: the expansion of rice areas into previously saline or weakly acid-sulphate soil areas. Mangroves were cleared along the coast to allow rice production; and wetlands, scrub and Melaluca forests have been cleared in the interior parts of the delta. High-intensity rice production areas have been created by ring-diking, which supplies fresh water and limits the ingress of saline water

through sluices placed along rivers or estuaries (O Mon-Xa No, Quan Lo Phung Hiep, Mang Thit and others).

Hydraulic control has sometimes resulted in unforeseen consequences. Farmers in the Mekong are famously dynamic and market aware, but they are also highly responsive to changes in the production environment. There is thus a dynamic variety of production systems based on multiple cropping of irrigated rice in protected areas (inside the ring-dike), down to single crops in the most flood prone areas. Adaptations to salinity (absolute or seasonal) involve different combinations of rice, capture fisheries, mixed rice-fish systems, and a variety of intensive aquaculture systems in both family farming and commercial sectors. The concept of water management zoning has become embedded in the development of the Mekong, but other sectors (notably agriculture and aquaculture) have somewhat different conceptions of the boundaries of production systems.

Broad descriptions of production systems or water management zones are useful, but the underlying complexity is constantly evolving and needs to be better incorporated into management procedures, and in the long term into infrastructure development, operations and maintenance.

Central Highlands (Tay Nguyen).

Tay Nguyen still has many primitive forests, which are protected in a number of national parks. Although thought of as a plateau at 500-600m above sea level, the area is composed of a series of connected plateaus and valleys. Soils are derived from basalt and are fertile, so that high value permanent crops such as coffee, rubber, cashew, cacao and pepper are widely grown. Coffee has become the major cash and export crop for the region, based in Dak Lak Province.

The region has a relatively low population density and a higher proportion of ethnic minorities (~40%) than in other parts of the country. The poverty rate is higher for ethnic minorities, who typically cultivate annual crops on steeper slopes with poorer soils. Shifting cultivation is also still commonly practiced in some areas.

There has been a crisis of over-abstraction of groundwater to meet the irrigation needs of coffee growers, which emerged in the late 1990s. However, agronomic research has indicated that coffee is usually over-irrigated and halving water applications would increase output by 1-5t/ha and also reduce variable costs by about 10% (ACIAR, 2005). However, the goal of reducing groundwater overdraft seems unlikely to be realized at present.

Annex 2 Preliminary list of organisations to be included in institution analysis

National Mekong Committees
MRC Programmes (BDP, IKMP, FP, EP, CCAI, FMMP, DMP)

Regional
GMS (agriculture)
ASEAN (agriculture policy)

Thailand
Ministry of Agriculture and Cooperatives (MoAC) - Economics and planning departments
Department of Water Resources (within MONRE)
Ministry of Natural Resources and Environment (MONRE)
Royal Irrigation Department (RID)
Land Development Department (LDD)

Cambodia
Ministry of Water Resources and Meteorology (MOWRAM) and provincial and district branches
Ministry of Finance - Aid coordination and project/investment database.
Ministry of Agriculture, Forestry and Fisheries (MAFF) - Planning Department
Technical Working Group on Water and Agriculture (TWGAW)
Ministry of Rural Development

Vietnam
Ministry of Agriculture and Rural Development (MARD), plus provincial and district branches - PARDs and DARDs
National Institute for Agriculture Planning and Projections (NIAPP -Southern)
Mekong Research Centre, Can Tho University
Southern Institute for Water Resources Research
Southern Institute for Water Resources Planning

Laos
Ministry of Agriculture and Forestry (MAF)
Department of Water Resources (DWR)
Centre for Survey and Design (irrigation)
Aid Coordination Unit of MAF
National Agriculture and Forest Research Institute (NAFRI)
Land Authority
Forestry Information Centre (MAF)

Donors
Asian Development Bank (Laos, Cambodia, Vietnam) – Delegated projects in each country and non-delegated projects managed from Manila.
World Bank (Laos, Cambodia, Vietnam)
Agence Francaise de Développement (Cambodia, Laos)
JICA, MAFF (Japan)

Research and technical support
FAO
IWMI
IRRI
Can Tho University

NGOs
M-Power
WWF
IUCN
SEI (Bangkok)
International Rivers

Annex 3 Programme Activities

Outcome 1
Knowledge and information on the current status and trends of the agriculture and irrigation sectors and related basin-wide issues integrated into MRC and Member Country Planning Systems, with priority given to better dissemination of existing but underutilized knowledge.

Output 1.1	Priority issues in agricultural development and in agricultural water management analyzed in each of the countries in the LMB

Activity 1.1.1 Complete institutional mapping to identify and select key collaborators in each of the member countries.

Tentative task list

- ✓ Draw up preliminary list of all agencies working in agriculture and irrigation in each country, including national agencies at central, provincial and district level; bilateral and multilateral donors; NGOs and other civil society organizations working at a strategic or planning level.
- ✓ Make a brief summary of the activities and note where they have regional implications.
- ✓ Prepare briefing papers with a plan of major collaboration works for country consultations.

Activity 1.1.2 Organise detailed country by country consultation with agricultural planning agencies and water management agencies, and selected NGOs and Civil Society Organisations.

Tentative task list

- ✓ Organise a meeting with selected stakeholders (1.1.1) from each MC, and identify specific agricultural development policies, actions and projects that have regional context.
- ✓ Produce a summary report that clarifies the key tasks of AIP, its stakeholder base and collaborative partnerships.
- ✓ Identify a list of guiding principles and strategic priorities in each activity

Output 1.2	Land use across the basin collated and described in a uniform system and changes routinely monitored

Activity 1.2.1 Conduct mapping of agro-ecological zones and farming systems in each member country.

Tentative task list and country focus

- ✓ Collate all agro-climatic data for each MC in GIS form – temperature, evaporation, radiation, precipitation, rainfall anomalies and patterns.
- ✓ Review existing agro-ecological zoning in each country.
- ✓ Review agro-meteorological data availability and recommend improvements for the agromet-data network in the basin, with special reference to Lao PDR and Cambodia.
- ✓ Collate all data on farming systems in each country, and map using GIS.
- ✓ Use GIS to determine characteristic agro-ecological zones for each MC through spatial analysis.
- ✓ Review the history and experience of land consolidation in each MC and suggest approaches that would help Cambodia and Laos consolidate land ownership in ways that improve farmers' livelihoods and ease of farming.

Activity 1.2.2 In collaboration with IKMP, develop land use mapping in the LMB.

Tentative task list and country focus

- ✓ Do the followings take into account that IKMP has a land cover map for 2000 and is updating a 2007 map with current groundtruth to produce a basin map for 2010
- ✓ Scanning, digitization, ortho-rectification and tiling of available aerial photography as a high-resolution base map for the region.
    - o Create an inventory of aerial photography by scale, coverage and date for the LMB
    - o Select the most appropriate (most recent complete coverage) data set and obtain from each MC.
- ✓ Create hi-resolution Digital elevation model (DEM) for each country (if IKMP DEMs are not adequate)
    - o Obtain SRTM-30m data for each country, if no hi-resolution DEM already exists
- ✓ Develop preliminary land cover and land use maps.
    - o Use segmentation analysis (in software like *eCognition*) of medium resolution remote sensing data (such as Landsat 5TM) to define target areas for ground truth.
    - o Ground truth campaign to verify land use at selected locations – farming systems information as well as crop currently in the field.
- ✓ Definition of land cover using FAO Land Cover Classification System (LCCS) or an alternative but "standardized" system, based on remote sensed imagery, and national GIS and statistics.
- ✓ Development of a land-data base in GIS for Laos and Cambodia.
- ✓ Harmonised versions of land use GIS for Vietnam and Thailand.
- ✓ Development of Land capability classification tool for Laos and Cambodia.

Activity 1.2.3 In collaboration with IKMP and FMMP, conduct soil mapping in selected locations - for irrigation suitability, including other factors such as flood extent and frequency; demographic trends

Tentative task list and country focus

- ✓ Review existing soil classifications, maps, data for MCs, especially Laos and Cambodia.
  - o Local products
  - o FAO and international coarse scale products
- ✓ Develop a priority listing of locations for soil survey based on farming systems and existing (coarse) soil maps. Focus on areas where irrigation development is likely
- ✓ Review current remote sensing approaches to soil classification.
- ✓ Assess feasibility and cost of undertaking soil classification using remote sensing techniques, identify and select research partners.
- ✓ Conduct pilot soil survey to develop and test classification techniques.
- ✓ Develop and market proposal for larger area mapping (national scale) based on pilot study findings, with particular reference to Cambodia.

Output 1.3 Current trends and forecasts in agriculture and irrigation in the basin documented

Activity 1.3.1 Analyse and update country agricultural sector plans on a regular basis.

Tentative task list

- ✓ Trend analysis - crop type and area, use of inputs (inorganic and organic fertilizer, pesticides, herbicides) crop patterns, production, productivity, cost benefit, externalities, labour and migration (land holding size).
- ✓ Additional focus on economic and environmental performance, flood/drought vulnerability

Activity 1.3.2 Identify trends of rural poverty and develop poverty conscious irrigation and agricultural water management strategy through the analyses of socio-economic data relating to rural poverty and vulnerable communities.

Tentative task list

- Review and analyse national primary and secondary socio-economic data on agricultural production, trends, patterns and contributions to livelihoods.
- In collaboration with national agencies, conduct livelihood analysis (and survey where needed) to identify the livelihood trends and distribution of vulnerable rural communities and their long term risks.
- Identify also where irrigation or other forms of agricultural water management can play a key role in minimizing poverty and improving livelihoods.
- Draw up a poverty-focused irrigation development plan for MCs.

Activity 1.3.3 Compile the long-term plans and projection of food security in MCs and assess their soundness.

Output 1.4 Agricultural water use in the basin determined and monitored

Activity 1.4.1 Improve the irrigation database: locations, extents, cropping patterns, actual water use; cost-benefit; land and water productivity.

Tentative task list

- ✓ Analyse and present the structure, contents, data gaps and other problems of MRC's irrigation DB
- ✓ Prepare a manual and detailed metadata to improve its interface.
- ✓ Analyse its link with IWRM-BDS/DSF and the potentials and benefit of improvement
- ✓ Survey the needs and possible users of MCs related to irrigation DB
- ✓ Analyse the ways to establish the sustainable mechanism to maintain the DB
- ✓ Propose and discuss the priorities and strategy of improving the DB with MCs
- ✓ Develop a work plan, assess detailed budget, and prepare contracts/agreement
- ✓ Incorporate additional data from national databases
- ✓ Incorporate additional data into database, based on questionnaire surveys, for example: water supply (annual, seasonal) and inflow rates; estimated net water use; estimated return flows; cropped areas and production; agricultural performance; system status; total operational costs; total production value.

Activity 1.4.2 Conduct a rapid appraisal of agricultural groundwater use in four Member Countries

Tentative task list (The following tasks are all optional depending on the area to be surveyed.)

- ✓ Conduct informal diagnostic surveys of agricultural groundwater use (IWMI-Tushaar Shah style) to determine the location (with geographic coordinate systems), the extent, costs, benefits and typical characteristics of available groundwater, to complement groundwater monitoring undertaken by IKMP (with assistance from USGS).
- ✓ Determine current and projected use of groundwater and likely trends in water levels and water quality from limited monitoring data.
- ✓ Assess the data requirements to develop and calibrate coarse and more detailed groundwater models.
- ✓ Review the regulations governing groundwater use in each country and analysis their strengths, weaknesses and practicality.
- ✓ Review the literature and information on groundwater recharge
- ✓ Possibly conduct targeted pilot studies on groundwater recharge
- ✓ Possibly conduct (with national agencies) a programme to characterize and map the extents of the main aquifer(s), through drilling, radio-tracing, and seismological techniques.
- ✓ Make recommendations on groundwater zoning, licensing and compliance.

Activity 1.4.3 Conduct rapid assessment of existing irrigation weirs in terms of fish friendliness in collaboration with FP, river morphology and high water hydrology in upper catchment and tributaries.

Tentative task list and country focus.

- ✓ Conduct rapid diagnostic surveys of irrigation weirs and their fish ladders (if existed) in tributaries in Cambodia and Laos to determine the value of the river segment for capture fisheries and the weir's impacts on fish migration, as well as river morphology and high-water hydrology where desirable.
  - o Quantify the abstraction of water in such systems and determine any impacts on local capture fisheries downstream, at critical times of the year.
- ✓ Review techniques successfully used to all migratory fish to traverse traditional weirs.
- ✓ Draw up and cost a plan for modification of traditional and small scale structures in the upper reaches of tributaries.
- ✓ Synthesize the result into a irrigation database
- ✓ Investigate the opportunities and experiences with aquaculture development within these irrigation systems.

Outcome 2

Synergy between national agricultural and irrigation planning and MRC IWRM-based Basin Development Strategy implementation developed and harmonized – introduction of IWRM-based agricultural sector planning in Member Countries and more focus on pro-poor development in the implementation MRC's Strategic Plan.

Output 2.1 Sound feasibility assessment and coordination across the basin realized in the irrigated agriculture.

Activity 2.1.1 Prepare and analyse inventory of irrigation projects under development and proposed over the coming plan period.

Tentative task list

- ✓ Update the inventory of existing and proposed irrigation development projects on an annual basis, using Irrigation Database and updated development planning information.
- ✓ Estimate current and projected water use.
- ✓ Assess the feasibility and possible externalities of irrigation development on the basis of:
  - o Climate factors (rainfall, evapo-transpiration, and temperature)
  - o Water-use efficiency (conveyance, distribution, and application)
  - o Water source (groundwater, river water, locally captured and stored water)

- Socio economic drivers (poverty incidence, potential for poverty alleviation, population growth and density, urban growth and rural out-migration, markets and infrastructure)
- Soil suitability
- Flood and drought risk (with and without climate change)
- Impact on capture fisheries

Activity 2.1.2 Interpret the BDP scenario outputs on the risks and potential for irrigation development under the changing climate and environment.

Tentative task list and country focus

- ✓ Interpret modeled assumptions in terms of
  - Crop choice, plant physiology, and irrigation efficiency in the IQQM algorithm and parameters
  - Methods and impact of validation and calibration in setting agricultural parameters
- ✓ Interpret scenarios at existing and planned irrigation schemes in terms of
  - Water levels at the irrigation headworks
  - Rainfall and ET in planned irrigation schemes
  - Impact of estimated intake at colmatage systems on water regime in the delta
- ✓ Identify and interpret low and high water scenarios in ten year return periods in terms of impact of rainfall and ET changes in climate change scenarios on irrigation plans and current rainfed crop zones schemes
- ✓ Analyse hotspots of water shortage imposed by upstream development in different reaches of the River Mekong and on key tributaries.
- ✓ Analyse the frequency and risk of low flows entering the Vietnamese Mekong Delta, and estimate the economic and social consequence

Activity 2.1.3 Assess the needs and impacts of technical harmonization in irrigation planning, designing, quality controlling and performance evaluation.

Tentative task list

- ✓ Identify key areas where MC irrigation agency management feels capacity building needs exist
- ✓ Identify resource people/ collaborating institution to investigate technical problems in the identified areas
- ✓ Identify key steps, skills, and knowledge to secure the feasibility of irrigation planning, the quality of project implementation, and the efficiency of scheme operations
- ✓ Investigate past and current problems in water efficiency and feasibility in selected typical irrigation projects (both new and rehabilitation) in each MC
- ✓ Identify their root causes in planning, designing, quality controlling and performance evaluation
- ✓ Investigate current practices to check if desirable standards, regulation, and training are in place in selected past and on-going irrigation projects of different entities and financiers

- ✓ Assess the aggregated impact of difference or lack of methods on water regime
- ✓ Publish the result of the aforesaid surveys and assessment for public relations at the consent of MCs
- ✓ Propose a guideline for consistent irrigation project management

Activity 2.1.4 Develop a proposal for bulk water monitoring in the irrigation subsector in the basin.

Tentative task list

- ✓ Develop a typology of irrigation systems based on the Irrigation Database.
- ✓ Review the collection and accuracy of flow measurements in selected irrigation systems.
- ✓ Estimate, using ET maps, the depletion of water resources, and determine the extent of return flows from irrigation.
- ✓ Determine what routine monitoring of inflows is required, how it is best done, and who by.
- ✓ Propose a process for data collation and analysis and preferably incorporate this information into the Irrigation database.
- ✓ Estimate the costs of basin wide monitoring of bulk allocations.
- ✓ Propose a bulk allocation framework for agricultural projects in the basin.
- ✓ Outline procedures to monitor, analyse and audit bulk allocations at national level and provide appropriate training.

Output 2.2 Strong two-way links developed between agricultural planning norms and procedures and regional planning.

Activity 2.2.1 Incorporate improved land use maps in BDP scenarios.

Tentative task list

- ✓ Review and summarise trends in actual land-use
- ✓ Review and update irrigation development plans
- ✓ (With IKMP/BDP) better link land use change to DSF model inputs in SWAT model components.

Activity 2.2.2 Develop agricultural land-and-water-use components of future BDP scenarios with national agricultural and irrigation planners, based on present use and current and future policies.

Tentative task list

- ✓ Review current agricultural policy and the balance or irrigated and rainfed agriculture and plans for future development.
- ✓ Determine trends in land use change (observed) and foreseen in development plans.

- ✓ Develop additional scenarios of land use change in conjunction with Climate Change and other development options and conduct simulations with the DSF.
  - o Estimate future water use with and without climate change, for likely cropping patterns and cropping intensities.
- ✓ Explain impacts of land use change and irrigation development on dry season flows in conjunction with other scenarios, to national agricultural planners and work with them to refine plans to minimize downstream impacts and optimize local benefits.
- o Make explicit links between national policies and project portfolios and any important regional outcomes.

Activity 2.2.3 Explore the feasibility of developing seasonal forecasting services for farming utilizing flood management capacity of MRC.

Tentative task list

- ✓ Review seasonal forecasting tools in use for agriculture around the world – such as "Rainman" in Australia.
- ✓ Review data requirements for a typical forecasting tool, and match to real time data availability from FMMP.
- ✓ Undertake a feasibility study for the development of a seasonal forecasting tool for agriculture in different reaches of the Lower Mekong Basin.
- ✓ Review the flood zoning and flood hazard work undertaken by FMMP with particular reference to farming systems, crop choice and existing adaptive practices.
- ✓ Assess the potential for medium range flood forecasting and assess its utility in modifying farmers planting decisions.
- ✓ Work with FMMP to adapt flood forecasting information for seasonal use to assist farmers with planting decisions (dates, crop types, fallowing).
- ✓ Pilot work to demonstrate the utility of flood forecasting and improved adaptive practices in the flood plain of LMB.

Outcome 3
Capacity developed among Member Country agencies and staff for integrating IWRM considerations into agricultural and irrigation planning and resources management

Output 3.1 Tangible capacity to implement IWRM in the agriculture sector built

Activity 3.1.1 Undertake a capacity needs assessment with reference to integrated planning and management of agriculture, water and environment and develop capacity building plan tailored to each MC.

Activity 3.1.2 Compile and analyse national regulations, guidelines and extension policies in the agriculture sector to facilitate the implementation of IWRM-BDS by minimizing

negative externalities in water quality, capture fisheries and aquaculture development, and local river transport.

Tentative task list

- ✓ Identify technical and institutional topics in the agriculture sector that could have impact on the basin environment in terms of sedimentation, fish migration, water quality, and groundwater quality.
- ✓ Compile each MC's regulations, technical guidelines, extension policies related to the identified topics to find out priority issues for realizing IWRM-based development in MC's institution and technical norms.
- ✓ Propose model guidelines on the identified topics and quantify the potential benefit of their introduction.
- ✓ In collaboration with BDP, M-IWRM and ICBP, develop a capacity building module for IWRM-based planning comprised of the findings in the aforesaid analysis.

Activity 3.1.3 Conduct training on land use mapping and land suitability

Tentative task list and country focus

- ✓ Comprehensive training in land use, land cover and land capability assessment for Member Countries, possibly undertaken by regional experts.
- ✓ Training for groundtruth procedures –
  - o Planning (using segmentation analysis of aerial photographs and recent Landsat scale imagery).
  - o Field techniques
  - o Agricultural crops and farming systems identification

Output 3.2 Experience of developing a trans-boundary agricultural water regulation shared between MCs at selected pilot areas.

Activity 3.2.1 Develop a road map and assess the necessary capacity for the management of two trans-boundary aquifers: 1) between Laos and Cambodia 2) between Cambodia and Thailand 3) between Cambodia and Vietnam, based on a joint study on agricultural water accounting measures, development plans and institutional arrangements.

Tentative task list

- ✓ Compilation of the existing geological information on the region including the distribution of aquifers, their hydraulic and storage properties, groundwater levels, recharge rates, discharge, and groundwater quality.
- ✓ Compilation of the existing data and information on groundwater use and monitoring, as well as development plans and current institutional arrangements.
- ✓ Negotiation of management goals, objectives and presumptions.

- ✓ Case studies of trans-boundary water-use agreements and regulations and their implementation, as well as lessons learned from the past negotiations to draft a joint regulation on surface water resources utilization.
- ✓ Action planning of data collection, groundwater flow modeling, agreement drafting, and regulation implementation.
- ✓ Assessment of needed capacity and finance.

Activity 3.2.2 Develop a pilot project for trans-boundary agricultural water use at the Mekong Delta border area between Cambodia and Vietnam.

Tentative task list

- ✓ Compile the existing geological information including the hydraulic properties of the aquifer and its salin/fresh water balance.
- ✓ Compile the existing data and information on the groundwater use and monitoring in Cambodia, as well as the proposed development plans.
- ✓ Compile the information about the current water management structures and its operation modes
- ✓ Conduct rapid survey of groundwater use if there is no existing information
- ✓ Propose and negotiate management goals, principles and presumptions
- ✓ Develop decision support tools that specifically target the MD area utilizing MRC's tool kits
- ✓ Conduct feasibility studies and comparative scenario analyses of the development plans proposed by Cambodia and Vietnam using the developed tools
- ✓ Propose and negotiate a pilot project plan for trans-boundary agricultural water use

Annex 4 Indicative Work Plan

Indicative work plan AIP 2011 - 2015

	Activities	2011				2012				2013				2014				2015				Note
1 **Integration of knowledge and information on the current status and trends of the agriculture sector and related basin-wide issues into MRC and Member Country Planning Systems**																						
1.1 *Synergy & priority*																						
1.1.1	institutional mapping																					JFP
1.1.2	country consultation																					JFP
1.2 *Basin map*																						
1.2.1	mapping of agro-ecological zones																					
1.2.2	land use mapping																					
1.2.3	soil mapping																					
1.3 *Overview of agriculture*																						
1.3.1	country sector plans																					JFP
1.3.2	trends of rural poverty																					
1.3.3	Long term food security assessment																					
1.4 *Agricultural water use*																						
1.4.1	Irrigation database																					JFP
1.4.2	Rapid survey on agro-groundwater use																					
1.4.3	irrigation weirs																					
2 **Development of synergy and harmony between national agricultural & irrigation planning and MRC IWRM-based BDS implementation**																						
2.1 *irrigation feasibility*																						
2.1.1	inventory of irrigation																					JFP

	project																						
2.1.2	interpret the BDP scenario outputs																						JFP
2.1.3	harmonization in irrigation																						JFP
2.1.4	bulk water monitoring																						
2.2 *agricultural planning*																							
2.2.1	improved land use maps in BDP																						
2.2.2	future BDP scenarios																						
2.2.3	seasonal forecasting services																						
3 **Capacity developed among Member Country agencies and staff for integrating IWRM considerations into agricultural & irrigation planning and resources management**																							
3.1 *capacity for IWRM*																							
3.1.1	Undertake capacity needs assessment																						
3.1.2	Compile regulation, guidelines and extension policies																						
3.1.3	training on land use mapping																						
3.2 *trans-boundary exercise*																							
3.2.1	Roadmap for trans-border aquifer management																						
3.2.2	Pilot for trans-boundary water use at C-V border																						

= JFP

= Non-JFP

Annex 5 Cost Estimate

Summary budget table covering five year implementation period 2011-2015

BL	Description	Budget required in USD
11-00-00	Inter- Expert/Consultants	243,000.00
12-00-00	International Staff (MRCS)	486,000.00
13-00-00	Support Staff	40,800.00
15-00-00	Official Travel	573,600.00
16-00-00	Programme review	30,000.00
17-00-00	Riparian Experts / Consultants	1,102,500.00
18-00-00	Riparian Professional Staff (MRCS)	427,200.00
21-00-00	Sub-contracts	634,375.00
30-00-00	Training and workshop	425,940.00
41-00-00	Expendable Equipments	45,000.00
42-00-00	Non-Expendable Equipment	45,000.00
43-00-00	Construction/civil work (For 3 pilot sites)	15,500.00
51-00-00	Operation and Maintenance of Equipment	10,000.00
52-00-00	Reporting Cost	8,100.00
53-00-00	Miscellaneous (5 %)	228,121.00
	Sub-Total	4,790,536.00
70-00-00	MRC management and administration fee (11 %)	526,959.00
	Grand TOTAL	**5,317,495.00**

GRAND TOTAL	**5,317,495**
Committed fund from JPF	**1,500,000**
Funding Gap	**3,817,495**

Annex 6 Terms of Reference of the Steering Committee for Agriculture and Irrigation Programme (SC-AIP)

Objectives of the Steering Committee (SC-AIP)

The objective of the SC is to supervise the implementation of the AIP Programme and guide the works and activities to an appropriate direction for achieving the goal and objectives of AIP Programme.

Tasks of the SC-AIP

1. To provide strategic guidance on the direction of the AIP in line with the overall MRC strategic plan 2011-2015 and Member Countries related plans in agriculture and irrigation.
2. To endorse annual work plan/Programme implementation plan.
3. To advise the AIP for ensuring the quality of outputs and timely, effective and efficient implementation of the Programme.
4. To review the overall progress of the Programme, provide guidance and recommend necessary adjustments for achieving the Programme goal and objectives.
5. To advise for addressing the issues arising from the implementation of Programme work plan and activities.
6. To provide a platform dealing with policy related issues, to recommend and advise to the JC if required.

Composition of the SC-AIP

- The SC-AIP will consist of respective representatives of four Member Countries including NMCs and line agencies, and the MRCS as below.
  1. Two or three members from each of Member Countries.
     - One member will be a representative at the level of Deputy Secretary/Director General of the NMC.
     - One or two members will be nominated by national line agencies responsible for agriculture and irrigation, at the level of Director or Deputy Director of the Department.
  2. CEO of MRCS and Director of Operations Division (OPD)
  3. Development partner representatives
  4. Programme Coordinator of AIP serves as the secretary of the Committee.
  5. National AIP Coordinators and Technical Advisor attached to AIP shall be invited as observers.

Meetings of SC-AIP

- The SC-AIP meeting will be held on a regular basis, at least once per year.

- The SC-AIP meeting will be chaired by a representative of the respective host country and co-chaired by the CEO of MRCS.
- A country chairing the meeting may nominate one more participant to attend the meeting.
- The SC-AIP meeting will be convened by the MRCS in consultation with member countries.
- Minutes of the meeting will be prepared by the MRCS. In the minutes, date and venue of the next meeting will be indicated.
- Costs for organization and participation of the SC-AIP members and observers in the meeting will be covered by AIP budget.

Review, revision and amendment of the ToR

The SC may review, revise or amend the ToR as necessary and submit to the JC for approval.

Annex 7 Terms of Reference of the Programme Coordination Committee for Agriculture and Irrigation Programme (PCC-AIP)

1 Background

The Agriculture and Irrigation Programme(AIP) was created from Agriculture, Irrigation and Forestry Programme (AIFP) separately from its watershed management component at the 16th Council (Nov 2009) to address land and water use in the agriculture sector in an integrated framework to promote IWRM-based basin development.

The goal and objective of AIP are as follows:

Goal: "Regionally balanced and sustainable agricultural development supported through integration of national agricultural planning processes with basin-wide perspectives"

Objective: "To provide national planners with detailed and nuanced analyses of the likely consequences of agricultural development and resources management based on improved knowledge on agriculture and irrigation in the LMB"

MRC's basin development planning cycle recently adopted by Member Countries includes rolling steps of scenario analysis, IWRM-based Basin Development Strategy and Project Portfolio. AIP's work will facilitate these steps focusing on MRC's core functions for river basin management, which are expressed in the MRC Strategic Plan 2011-2015 and consolidated in the Basin Development Strategy. Data acquisition, monitoring, assessment, planning support and capacity development in terms of agricultural land and water use constitute the major part of AIP's work plan.

To achieve the goal and objective stated above, AIP requires regional coordination and regular consultation with line agencies of Member Countries (MCs) at working level for its programme implementation. This Terms of Reference (ToR) is therefore developed to guide AIP in coordination, implementation and monitoring of the programme.

2 Objectives

The objectives of the PCC-AIP is to ensure effective management and proper coordination of activities in implementation, monitoring and reporting of the Programme.

3 Functions and Responsibilities of the PCC-AIP are:

3.1 To facilitate the coordination of activities between NMCs, AIP team of the MRC Secretariat (MRCS), and other MRC Programmes for effective and successful of programme implementation so that they arrive at optimal synergy;

3.2 To facilitate the preparation of the programme work plans (annual and five year work plans) and their modification of activities and budget for submission to AIP Steering Committee;

3.3 To review the biannual, annual and completion reports for submission to the Steering Committee; and

3.4 To seek advice from the Steering Committee on the matters relevant to MRC's policies and AIP's strategic direction.

4 Composition

The AIP - PCC consists of two members from each MC at the technical level, in which one must be the national AIP coordinator; and three members from the MRCS, in which one must be the AIP Coordinator.

5 Meetings

5.1 The PCC-AIP meetings shall be chaired by OPD Director.

5.2 The PCC-AIP meetings shall be convened biannually (every 6 months) in between Steering Committee meeting at either OSP or OSV in principle.

5.3 The AIP Coordinator can call for specific meeting(s) when necessary or upon legitimate request from national AIP coordinators.

5.4 Additional members may be invited from other programmes of MRCS on an ad hoc basis when the AIP Coordinator deems it necessary.

5.5 Meeting records including the review of activities, conclusions and recommendations will be prepared after each meeting and distributed to all participants.

6 Decisions and Reporting

The PCC-AIP meetings will make decisions by consensus. Any pending issue shall be submitted to AIP Steering Committee for instruction and decision.

7 Modification of the Terms of Reference for PCC-AIP

PCC-AIP and NMCs may recommend modifications to this ToR. Any modifications to this ToR shall be sought AIP Steering Committee's approval.

ANNEX 8 : Detail Budget AIP 2011 - 2015

Programme Name : Agriculture and Irrigation Programme
Organization : Mekong River Commission
Relevant Value Used : US Dollars
Contribution :

	Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
Outcome 1 : Knowledge and information on the current status and trends of the agriculture and irrigation sectors						
Reporting and publication lump sum	600	600	600	600	600	3,000
Output 1.1 Priority issues in agricultural development and in agricultural water management analyzed in each of the countries in the LMB						
Activity 1.1.1 Complete institutional mapping in each of the member countries						
National organizations/line agencies						
For institutional mapping ; 4 countries (9 m)	27,000	13,500				40,500
Official travel and perdiem						
Coordination and meeting with national line agencies (4) ; 4 countries x 3,200	12,800	12,800				25,600
Activity 1.1.2 Organize country by country consultation						
Official travel and perdiem						
National consultation meeting (4); 6,000 x 4	24,000					24,000
Regional meeting (1); 14,000 x 1	14,000					14,000
Conduct regional programme start up workshop : 1 x 14,000	20,000					20,000

Output 1.2 Land use map across the basin						
Activity 1.2.1 Conduct mapping of agro-ecological zones						
National organizations/line agencies						
For collection of data & review on agro- climate (4) ; 4 countries (12m)		40,500	13,500			54,000
International consultant (1) ; 900 x 60 days		54,000				54,000
Official travel and perdiem						
On the job training on data collection & analysis (4); 4 countries		18,740				18,740
Training material (4); 1,500 x 4		6,000				6,000
Activity 1.2.2 In collaboration with IKMP, improve land use mapping in the basin						
National organizations/line agencies						
For land use mapping (4); 4 countries (33 m)		13,500	54,000	54,000	40,500	162,000
International consultant (1); 900 x 30 days x 2 yrs			27,000	27,000		54,000
Official travel and perdiem						
Coordination and meeting with line agencies (4); 2,000 x 4			8,000	8,000		16,000
Activity 1.2.3 In collaboration with IKMP, conduct soil mapping in selected locations						
National organizations/line agencies						
For soil mapping (4) ; 4 countries (33 m)		13,500	54,000	54,000	40,500	162,000
International consultant (1) ; 900 x 30 days			27,000			27,000

Official travel and perdiem						
On the-job Training on soil mapping (1); 1 training 4 countries			30,000			30,000
Training material (4); 2,000 x 4			8,000	8,000		16,000
Coordination and meeting with line agencies (4); 4 countries x 3,200			12,800	12,800	12,800	38,400
Output 1.3 Current trends and forecasts in agriculture and irrigation in the basin						
Activity 1.3.1 Analyse and update country sector plans on a regular basis.						
National organizations/line agencies						
For reviewing sector plan (4); 4 countries (8 m)	18,000	18,000	18,000	18,000	18,000	90,000
Official travel and perdiem						
Coordination and Meeting of line agencies (4) ; 4 countries	12,800	12,800	12,800	12,800	12,800	64,000
Activity 1.3.2 Identify trends of rural poverty						
National organizations/line agencies						
For trend of rural poverty analysis (4) ; 4 countries (8 m)		13,500	13,500	13,500	13,500	54,000
Official travel and perdiem						
Coordination and meeting with line agencies (4); 4 countries		6,400	6,400	6,400	6,400	25,600
Activity 1.3.3 Compile the long-term plans and projection of food security in MCs and assess their soundness. ;						
National organizations/line agencies						
For compilation and assessment of food security ; 4 countries x 3,375		13,500	13,500	13,500	13,500	54,000

Official travel and perdiem						
For coordination and meeting with line agencies ; 4 countries		6,400	6,400	6,400	6,400	25,600
Output 1.4 Agricultural water use in the basin						
Activity 1.4.1 Improve the irrigation database						
National AIP Coordinators NMCs (4) ; 4 countries x 1	27,000	54,000	54,000	54,000	54,000	243,000
Official travel and perdiem						
Coordination and meeting & on the job training on database (4); 4 countries	19,200	19,200	19,200	19,200	19,200	96,000
Training material (4); 1,500 x 4		6,000	6,000			12,000
Activity 1.4.2 Conduct rapid appraisal of agricultural groundwater use						
Contracted national organization						
For rapid appraisal (4) ; 4 countries (21 m)		27,000	54,000	54,000	27,000	162,000
one international consultant : 900 x 80 days		36,000	36,000			72,000
Official travel and perdiem						
Coordination and meeting with line agencies (4); 4 countries		6,400	6,400	6,400	3,200	22,400
Activity 1.4.3 Conduct rapid assessment of existing irrigation weirs						
National organizations/line agencies						
For assessment of existing irrigation weirs (1); Lao PDR (21 m)			13,500	10,125		23,625
Official travel and perdiem						
Coordination and meeting with line agencies (4); 4 countries			6,400	6,400	3,200	16,000

	175,400	392,340	501,000	385,125	271,600	1,725,465
Miscellaneous 5 %	8770	19617	25050	19256.25	13580	86,273.25
Sub-Total -Output	**184,170**	**411,957**	**526,050**	**404,381**	**285,180**	**1,811,738**
Outcome 2: Synergy between national agricultural planning and MRC Strategic Plan implementation developed and harmonized						
Reporting and publication lump sum	300	600	600	600	600	2,700
Output 2.1 Sound feasibility assessment and coordination across the basin realized in agriculture sector and irrigation planning						
Activity 2.1.1 Prepare and analyse inventory of irrigation projects						
National organizations/line agencies						
For inventory of irrigation (4); 4 countries x 3,375 (12 m)	13,500	13,500	13,500	13,500	13,500	67,500
Official travel and perdiem						
Meeting and coordination with line agencies (4); 4 countries x 3,200	12,800	12,800	12,800	12,800	12,800	64,000
Activity 2.1.2 Interpret the BDP scenario outputs						
National organizations/line agencies						
For interpretation of BDP scenario (4); 4 countries (21 m)		40,500	40,500			81,000
Official travel and perdiem						
Meeting and coordination with line agencies (4); 4 countries x 3,200	12,800	12,800	12,800			38,400
Activity 2.1.3 Assess the needs and impacts of technical harmonization in irrigation						

National organizations/line agencies						
For technical harmonization of irrigation (4); in 4 countries (24m)		54,000	27,000			81,000
Official travel and perdiem						
Meeting and coordination with line agencies (4); in 4 countries		12,800				12,800
Activity 2.1.4 Develop a proposal for bulk water monitoring						
National organizations/line agencies						
For bulk water monitoring (4); 4 countries (36 m)			40,500	54,000	27,000	121,500
Official travel and perdiem						
On the job training for line agencies (4); 4 countries			14,400	14,400	14,400	43,200
Training material (4); 1,000 x 4			4,000	4,000	4,000	12,000
Output 2.2 Strong two-way links developed between agricultural planning						
Activity 2.2.1 Incorporate improved land use maps in BDP scenarios.						
National organizations/line agencies						
For improving land use map (4) ; in 4 countries (27 m)			27,000	54,000	27,000	108,000
Official travel and perdiem						
Meeting and coordination with line agencies (4); 4 countries x 3,200			12,800	12,800	12,800	38,400
Activity 2.2.2 Develop agricultural land-and-water-use components of future BDP						
National organizations/line agencies						

For developing future BDP scenario (4); in 4 countries (27 m)		13,500	54,000	27,000		94,500
Official travel and perdiem						
Meeting and coordination with line agencies (4); in 4 countries		12,800	12,800			25,600
Activity 2.2.3 Explore the feasibility of developing seasonal forecasting services						
National organizations/line agencies						
For developing seasonal forecasting (4); in 4 countries (18 m)		54,000	27,000			81,000
Official travel and perdiem						
On the job training (4); in 4 countries		14,000	14,000			28,000
	39400	241,300	313,700	193,100	112,100	899,600
Miscellaneous 5 %	1,970	12,065	15,685	9,655	5,605	44,980
Sub- Total -Output	**41370**	**253,365**	**329,385**	**202,755**	**117,705**	**944,580**
Outcome 3 : Capacity developed among Member Country agencies and staff for integrating IWRM						
Reporting and publication lump sum		600	600	600	600	2,400
Output 3.1 Tangible capacity to implement IWRM in the agriculture sector						
Activity 3.1.1 Undertake a capacity needs assessment						
National organizations/line agencies						
Sub-contracted for capacity need assessment (4); 3,000 x 4		12,000				12,000

Activity 3.1.2 Compile and analyse national regulations, guidelines and extension policies						
National organizations/line agencies						
For compilation & analysis of regulations (4); in 4 countries (36 m)			40,500	40,500	40,500	121,500
Official travel and perdiem						
Meeting and coordination with line agencies (4); 4 countries			12,800	12,800	12,800	38,400
Activity 3.1.3 Conduct training on land use mapping and land suitability						
Conduct national training on land use mapping (4); 4 countries x 1,600			51,200	51,200		102,400
Cost for trainer fee : 900 x 20 days			18,000	18,000		36,000
Training material (4); 2,000 x 4			8,000	8,000		16,000
Output 3.2 Experience of developing a trans-boundary agricultural water regulation						
Activity 3.2.1 Conduct joint study , assess necessary capacity for the management of two trans-boundary aquifers						
Procurement :						
Equipment for piloting trans-boundary study on groundwater monitoring (3 sites) : 3 x 8,500			25,500			25,500
National organizations/line agencies						
For joint study on trans-boundary ; 3 sites (36)			27,000	54,000	27,000	108,000
Official travel and perdiem						
coordination and monitoring ; for 3 sites			12,800	12,800	12,800	38,400
Conduct joint national workshop (2) ;			12,800	12,800	12,800	

						38,400
Conduct regional workshop (1); 700 x 20 persons					14,000	14,000
Activity 3.2.2 Develop a pilot project for trans-boundary agricultural water use at the Mekong Delta border area						
National organizations/line agencies						
For implement pilot project for trans-boundary ; 1 site (2 countries) 24 m		15,200	30,350	15,200		60,750
Official travel and perdiem						
For coordination and meeting with line agencies ; 2 countries		3,200	12,800	3,200		19,200
		31,000	252,350	229,100	120,500	632,950
Miscellaneous 5 %		1,550.00	12,617.50	11,455.00	6,025.00	31,648
Sub-Total -Output		**32,550**	**264,968**	**240,555**	**126,525**	**664,598**
Programme management						
Programme Coordinator (1) : 4,000 x 12	24,000	48,000	48,000	48,000	48,000	216,000
Programme Officer (2) : 2,200 x 12		52,800	52,800	52,800	52,800	211,200
Support staff (1) : 680 x 1 x 12	8,160	8,160	8,160	8,160	8,160	40,800
Technical Advisor (1) : 9,000 x 12	54,000	108,000	108,000	108,000	108,000	486,000
Programme evaluation (+ Annual consultation)		15,000	15,000			30,000
Conduct programme steering committee (2 times/year); 14,400 x 2		28,800	28,800	28,800	28,800	115,200
Conduct programme coordination meeting (2 times/year); 14,400 x 2		28,800	28,800	28,800	28,800	115,200
Procurement						

Expendable equipment	5,000	10,000	10,000	10,000	10,000	45,000
Non expandable	5,000	10,000	10,000	10,000	10,000	45,000
	96,160	309,560	309,560	294,560	294,560	1,304,400
Miscellaneous 5 %	4,808	15,478	15,478	14,728	14,728	65,220
Sub-Total -Output	**100,968**	**325,038**	**325,038**	**309,288**	**309,288**	**1,369,620**
TOTAL	**326,508**	**1,022,910**	**1,445,441**	**1,156,979**	**838,698**	**4,790,536**
MRC management and ministration 11 %	35,915.88	112,520.10	158,998.46	127,267.72	92,256.78	526,958.93
GRAND TOTAL	**362,424**	**1,135,430**	**1,604,439**	**1,284,247**	**930,955**	**5,317,495**