Mini Symposium

Basin-wide collaboration in the agriculture and irrigation subsectors towards the development and food security in the Lower Mekong Basin.

Agriculture and Irrigation Programme

Mekong River Commission, Vientiane, 13-14 November, 2012

A synopsis of proceedings

River Commission

Mini Symposium

Basin-wide collaboration in the agriculture and irrigation sub sectors towards the development and food security in the Lower Mekong Basin.

Mekong River Commission, Vientiane, 13-14 November, 2012

A synopsis of proceedings

Introduction and summary

This short report is a synopsis of the presentations and resulting discussion from a two day symposium held at the Mekong River Commission (MRC), Vientiane, 13-14 November, 2012. The symposium was organised by the Agriculture and Irrigation Programme (AIP) of MRC which has a goal of achieving regionally balanced and sustainable agricultural development supported through integration of national agricultural planning processes with basin-wide perspectives. Representatives of the four Lower Mekong Basin (LMB) countries (Lao PDR, Thailand, Cambodia and Viet Nam) participated to discuss issues in regard to improving food security in the LMB.

The objective of the symposium was to identify knowledge gaps for the materialisation of the MRC's Strategic Priority "Expand and intensify irrigated agriculture for food security and poverty alleviation" by collectively reviewing the BDP2 (Basin Development Plan 2) outputs, which claim the feasibility of future irrigation development plans in terms of the basin water balance, as well as its process and lessons learnt. Special attention was paid to discussing the identified knowledge gaps, risks associated with them and the agreed follow up actions.

The symposium was opened by the AIP coordinator, Mr Prasong Jantakad and presentations were from national and international participants to open up discussion about the need for basin-wide collaboration to improve efficiency and effectiveness, data collection and calibration processes, modelling, irrigation, groundwater, water quality and agricultural development. Country representatives presented current and planned irrigation and agricultural development programmes in their own countries, placing emphasis on activities in the basin.

The symposium commenced with a presentation "setting the scene" of the LMB in the regional and world economies and discussed ways in which improving food security could be facilitated with basin wide collaboration. The following session was primarily related to irrigation and irrigation planning. Presentations by each of the countries on their irrigation development plans for the LMB were supplemented with "issues and questions", irrigation scenarios, modelling and calibration practices, irrigation planning processes, framework for ground water development and assessing water quality.

The second session was primarily related to agriculture and food security. The current status and plans for agricultural development in each country were presented. These presentations were followed by baseline trends for agricultural groundwater use, the effects of climate change on agriculture and crop models for rice production and agricultural development.

The third and final sessions of the symposium were for discussion about knowledge and capacity needs towards agricultural development and MRC's roles in basin-wide collaboration. Discussion was facilitated initially in groups and then via a panel. In the wrap up, the AIP coordinator presented the planned activities and timeline of the AIP programme.

An outline of the symposium programme is attached as Appendix 1 and the attendance list in Appendix 2.

Contents

Opening remarks

Mr. Prasong Jantakad, Programme Coordinator, Agriculture and Irrigation Programme (AIP), Mekong River Commission Secretariat, Phnom Penh, Cambodia

Your Excellency, Directors, Distinguished Guests, ladies and gentlemen, good morning!

It is my great pleasure to be given this opportunity to deliver the opening remarks for the mini-symposium on "the basin-wide collaboration in the agriculture and irrigation sub sectors towards the development and food security of the LMB", which is organised by the Agriculture and Irrigation Programme (AIP) of MRC Secretariat.

It was reported in the World Summit on Food Security 2009 that 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[1.] Although the Lower Mekong Basin countries have so far succeeded in securing staple food supply, to keep pace with growing populations and dietary changes, food production in the Greater Mekong Sub-region will need to increase by an estimated 25% over the next 15 years[2.]

Ladies and gentlemen,

To cope with this future food demand, MRC Member Countries have ambitious plans to further irrigation development to enhance agricultural production. Higher productivity can be expected in irrigated agriculture than in rain-fed cropping, and the proportion of arable land currently under irrigation is quite small, particularly in Cambodia and Lao PDR.

To facilitate actual irrigation development, the MRC has identified a long list of national and regional activities (BDP PIP) to follow up the BDP2 process. The activity list also includes developing climate change adaptation strategy, drought mitigation strategy, baseline indicators, and other supporting roles to be played by AIP. These activities were identified to complement the BDP2 analyses and to fill the knowledge gap the BDP2 still contained.

Ladies and gentlemen,

The AIP therefore has organised this mini-symposium which is aimed at identifying knowledge gaps to be urgently filled-in for the materialisation of the MRC's Strategic Priority of "expanding and intensifying irrigated agriculture for food security and poverty alleviation" and to draw the lessons learnt from BDP 2 process in the feasibility context of future irrigation development plans in terms of basin water balance.

[1]World Summit on Food Security 2009

[2]Johnston, R.et al. 2012.Managing water in rainfed agriculture in the Greater Mekong Subregion.Final Report. Colombo, Sri Lanka:IWMI; Stockholm, Sweden: Sida.

To wrap up my opening remarks, I would like to thank all the participants and to wish everyone a very successful meeting.

THANK YOU VERY MUCH AND HAVE A GOOD DAY!

Keynote speech

Need for basin-wide collaboration towards lasting food security in the Lower Mekong Basin. *Dr. Harry Nesbitt, Adjunct Professor, Faculty of Agriculture and Natural Sciences, University of Western Australia, Perth, Australia*

Abstract

The four riparian countries in the Lower Mekong Basin (LMB), Lao PDR, Thailand, Cambodia and Viet Nam all have economies growing at more than double the world's mean. The productivity and personal wealth of its farmers is also on the rise. Planned expansion of irrigation areas will enhance farm efficiency and profitability by providing the farmers with the means to reduce the risks of farming in rainfed environments. Agricultural mechanisation should lead to further production improvements, grain surpluses and animal production. All future projections for farming in the LMB appear to lead to improved food security in the LMB. However, there are clouds on the horizon in regard to fish productivity and diversity, and nutrient plus salt pollution of the waterways. There is also a strong possibility that development will lead to a widening wealth disparity between the haves and have nots with many of the benefits not going to the landless rural and urban poor. Improving overall food security for the residents of the LMB will require considerable planning and collaboration between the populations and Governments of each country. This can be achieved through bilateral and multilateral trade agreements and on labour flows plus education between countries. Collaboration between all nations will be necessary to reduce the adverse effects some infrastructure projects may have on the environment, particularly with regards to Mekong fisheries. Such agreements could be made through a strengthened Mekong River Commission.

Notes from presentation

Data was presented illustrating that the economies in all four LMB countries are growing at two or more times the rate of the world on average. There is significant urban drift but agricultural productivity per household is improving. Such growth in the LMB itself will be further enhanced through an expansion in the area under irrigation, increasing crop yields, increasing animal numbers and the need for a larger labour force despite an expansion in the adoption of agricultural mechanisation. There are risks associated with an expanded and intensified agricultural area including an increase in the use of farm input, some of which may pollute the river system. There is a danger of inequitable distribution of wealth, particularly if the "wild food" sources from the natural ecosystems are damaged through drainage or other development. Conservation and improvement to food security at the rural level has a complex of interactions. There is a need to conserve community buffers, maintain or increase local and national Government support and improve regional collaboration. Recommendations for regional collaboration include:

- Opening up of trade in the LMB countries to ease distribution of goods and services and improve access to markets.
- Opening up the labour market for improved exchange of ideas and rural labour
- Promote use of water from cross border schemes
- Highways, bridges and other infrastructure to be planned on a regional basis
- Power across borders
- Regional education
- Inter-basin agricultural research and extension
- Inter-basin IPM, fertiliser and pesticide information support
- Food storage
- MRC has a particular advantage with planning for:
    - Equitable distribution of water resources
    - Equitable access to infrastructure, power, communications
    - IPM and other environmental networks
    - Research and extension networks

Discussion

Discussion ensuing from the presentation related to composition of the expected increase in yield and the magnitude of the increase plus why extra labour would be required in the future in view of the adoption of farm mechanisation. Increased yields were related to plant breeding for particular traits of resistance to pests, diseases of physiological problems such as salt, an improvement in agronomy practices and input. It was also noted that IRRI was researching into increasing yields with C4 rice.

Farm mechanisation is projected to reduce on-farm labour requirements by approximately 25%. However, this will be more than balanced by a projected expansion in the irrigated crop area by more than 2 million ha.

1. Session 1: Irrigation in basin planning

Session 1 facilitated presentations and discussion on irrigation in basin planning. The topic was introduced with a presentation on issues and questions in the irrigation sector. This was followed by national and regional presentations on country plans, trends in groundwater use for agriculture, climate change scenarios and crop modelling.

1.1 Issues and questions in the irrigation sector in the LMB.

Mr. Itaru Minami, Technical Advisor, Agriculture and Irrigation Programme, Mekong River Commission Secretariat, Phnom Penh, Cambodia

Abstract

Expansion of irrigated areas especially in the dry season is the biggest issue in irrigation development. The irrigation area has been gradually expanding for the last two decades mainly in Cambodia and Lao PDR. However, it is estimated that expansion of irrigation will slow down over the next period. It is commonly said that the increased dry season flow thanks to upstream hydro projects is the big opportunity of irrigation development. However, it is not clear to what extent the increased dry season flow in the

mainstream would facilitate the expansion of dry season irrigation. Where lesser rainfall is expected due to climate change and irrigation relies on local tributaries, irrigated agriculture would certainly face a more difficult future. Assessment of its feasibility and impacts must be an urgent task.

While major focus is given to expansion, management of existing schemes and infrastructure can also be a big issue. Though majority is gravity open channel systems, there are many special types of irrigation with which specific difficulties are associated.

The volume of water actually lost after the diversion is the most important figure for water resources planners to know. Data collected by AIP to identify system irrigation efficiency varied a lot. Work needs to be done to capture the cause of variation. Water productivity in AIP's pilot irrigation sites also varied significantly. More attention should be given to water productivity and the value of strategic water management inside irrigation schemes.

Crop diversification and adaptation of water-saving modern application methods are often regarded as the direction as part of agricultural intensification. Irrigated cash crop production has been tried not only by commercial estates but also by peasants and groups in many parts of the LMB. Especially, tube well irrigation attracts interests in some parts of the LMB. However, they have already caused significant decline in the groundwater table, which needs urgent attention.

According to an AIP's survey, 96 species of flora and fauna including 19 fish species were identified in paddy fields in a survey site in Northeast Thailand. The irrigation sector needs to work on cross sector collaboration towards achieving a holistic food strategy.

Notes from presentation

- Expansion of irrigated areas especially in the dry season is the biggest issue in irrigation development.
- Food production in the Great Mekong Sub-region is said to need a 25% increase by over the next 15 years.
- Expansion of supplementary irrigation is not enough to meet the 25% target.
- Innovation is needed if dry season irrigation must be the bearer of the necessary increased production.
- There is capacity to increase irrigation from tube wells.
- Systems need to be fish friendly.
- Water use efficiency and water productivity and crop diversity need to be studied further and improved.
- Capacity of IWRM and integrated land and water resources management are raised as remaining capacity needs by RID in Thailand.
- Capacity needs in Viet Nam vary from Management of sea water intrusion and groundwater management.
- Precise assessment of existing irrigation schemes is raised as capacity needs by MOWRAM of Cambodia.
- Operations, maintenance and management are raised as the priority capacity needs by DOI of Lao PDR.

- AIP would like to work with the LMB countries to develop basin wide priority areas and to revisit the BDP2 process, national plans and strategies, as well as latest developments in relevant sciences.

Discussion

Questions from the audience included a) whether production increases would come from efficiency or expansion of irrigation, b) the need for more research to study fish movement, c) technical developments to improve efficiency and, d) the effect that expanding dry season rice production would have on wetlands. In response to the question on efficiency or area expansion on production, the resulting consensus of opinion was that production increases would evolve from both an expansion in the area, intensification and agronomic improvements. The speaker responded that technical options for improved efficiency are many, but incentives and information are necessary to facilitate their broader use. One of these would be to seek methods for improving fish migration past dams, weirs and other river structures. Regulations will be required to prevent the over exploitation of wetlands.

1.2 Water resources and irrigation systems in Cambodia.

Dr. Teng Tara, Deputy Director of Technical Affairs and Director of Water Resources Management and Conservation Department, Ministry of Water Resources and Meteorology (MOWRAM), Phnom Penh, Cambodia

Presentation summary

Cambodia is approximately 181,000 km^2 in area; all but part of the south western side (14%) falls in the LMB. Most of the 14.5 million people live close to the Mekong River or associated areas. It is bordered by Thailand to the west, Lao PDR to the north and Viet Nam to the East. Rainfall across the nation averages 1000 – 1,400 mm per annum. The Mekong River runs from the north to the south with some flowing into the Tonle Sap Lake in the North West. The total irrigated area in 2011 was 947,000 ha but MOWRAM considers there to be potential water resources to increase the irrigated area to 1,667,300 ha. Only 7% of the water flow is currently utilised. There is little competition between water users. However, there are ten ministries or state organisations involved with the water industry, few of which interact and all having their own policies and agendas.

In 2008, MOWRAM counted 2,403 irrigation systems. 33 were considered to be large scale (>5000 ha), 955 medium (200-5000ha) and 1,415 small (<200ha). Sixty nine percent (69%) of these were not in operation due to a lack of O&M. MOWRAM has started to collect further data to monitor development of these schemes. Included in the database are the size and locations of dams, weirs and other structures.

Policies and laws have been developed by the Government to ensure water resources are managed in a sustainable manner. MOWRAM has developed a strategic plan to analyse water use in the basin, continue to rehabilitate and construct irrigations systems and alleviate flooding.

Approximately 328 farmer water user communities (FWUCs) have been established to involve farmers in water management. Of these, 114 groups were registered with MOWRAM. However it is considered that the FWUCs have low capacity and are under-resourced. Government support to the FWUCs and MOWRAM would resolve many of the problems of underutilisation of existing irrigations schemes and increase the area under irrigation.

Discussion

Discussion from this presentation revolved around irrigation construction costs and groundwater. The cost of constructing schemes was estimated to be above $2,000 per ha for project constructed schemes and $500-$1,000 per ha for Government schemes. These were considered to be variable dependent on conditions. Groundwater responsibilities are not those of MOWRAM. However, a need was identified for these resources to be defined and for planned development schemes to be compiled.

1.3 Irrigation development in Lao PDR.

Mr. Khammai Vongsathien, Director of Irrigation Development and Drainage Division, Department of Irrigation, Ministry of Agriculture and Forestry, Vientiane, Lao PDR

Presentation summary

Lao PDR is 360,800 km^2 in area, most of which falls in the LMB. Sixty seven percent of its population of 6.5 million live in the rural areas and are involved in agriculture. The population growth rate is approximately 1.5% per annum but 32% of the rural population lives below the poverty line. Expanding the irrigation area will improve food security in these areas. The Mekong River runs the length of the country, some of which follows the border with Thailand. The average rainfall in Lao PDR is 1900mm per annum but ranges from 1500 mm to 3,000 mm per annum. Much of this water flows into the Mekong River and there is considerable potential for irrigation development in the country.

The Department of Irrigation (DOI) within the Ministry of Agriculture (MAF) was established to increase rural incomes and stabilise rice availability by expanding irrigated areas for both wet season and dry season production and to improve the operation and maintenance of existing irrigation systems. The Irrigation systems have primarily been developed in areas where rain-fed paddy production was previously practiced.

Dry season irrigation schemes increased from 50,000 ha in 1997 to 120,000 in 2007. There are plans to increase the total wet season irrigation area to 450,000 ha by 2020. Management of the irrigation systems is encouraged through Water User Groups (WUGs) and farmers on some schemes are charged 200 kg of paddy per ha for gravity fed water, 150 kg for electricity pumped water and 100 kg per ha for diesel engine pumped water.

The DOI is currently developing a national development plan for irrigation. It will clarify irrigation development objectives, define possible irrigation co-management options and clarify infrastructure ownership under each management option.

Discussion

Interest was shown from the audience on the method of charging farmers for water. This was explained to be through the WUGs who were being encouraged to take responsibility for O&M of the irrigations systems.

1.4 Irrigation development plan for NE Thailand.

Dr. Chawee Wongprasittaporn, Senior Civil Engineer, Royal Irrigation Department, Thailand

Presentation summary

NE Thailand is approximately 166,000 km^2 in area and is situated with Lao PDR to the North and East. Part of the South of NE Thailand borders Cambodia. Approximately one third of the Thai population (77 million) live in the NE on incomes lower than average for the nation. The Mekong River flows in from the north western side of NE Thailand and travels along the northern border before turning South. NE Thailand is predominantly on the Korat Plateau, an uplifted saucer shaped plain, tipping to the South East. The flat region often floods from local rainfall. Two major river systems are found in the NE. These are the Mun and Chi Rivers. There is a slight rain shadow near the range of mountains to the east. As a consequence annual rainfall patterns increase from 1,200 mm/pa in the West to 1,500 mm/pa in the East. About 12% of this water is currently collected and utilised. Dry spells in the wet season often reduce yields during flowering and many of the irrigation schemes in the region are for supplementary wet season irrigation. Yields remain low at approximately 1.9t/a in rainfed areas and 2.7t/ha when irrigated. Farm size is large to compensate for low yields and most farms are highly mechanised. Improving the reliability of water reaching the farm at critical times would greatly raise yields and improve food security.

Large, medium and small irrigation schemes currently cover 14% of the area. There are plans to increase the coverage area to 25% within the next 30-50 years. 2,741 projects are in the planning stage, which would benefit 330,000 million ha. One large scheme in its planning stage is to pipe water from the Loei River in the NW of the NE of Thailand and canal or pipe it to the centre of the NE and exit in the SE.

Soil suitability and land use maps have been developed for the NE and these are being used to plan for the construction of dams and cropping patterns. Of concern in the lower lying central area is the predominance of saline soils.

Discussion

The existence of saline soils was of concern to some members of the audience and the question was raised in the suitability of irrigating these areas. It was explained that Jasmine rice is predominant in the NE of Thailand and recent research has indicated that the aroma of Jasmine rice may be related to sodium uptake from the saline soils. The MAF wishes to maintain the high quality of rice harvested from the NE and practices will be introduced to ensure no land is lost from salinisation. Because Jasmine rice is photoperiod sensitive, irrigation may be limited to the wet season in these areas, thereby not affecting salt levels.

1.5 Water resources development irrigation plan for Sub Area 7V, Viet Nam.

Ms. Dang Thi Kim Nhung, Chief of Planning, Division for Central and Central Highlands, Ministry of Agriculture and Rural Development, Institute of Water Resources Planning, Hanoi, Viet Nam

Presentation summary

An overview of Sub-area 7V was presented to the audience. Included in the overview were the sub-area's location (Viet Nam Central Highlands), population (5.2 million), area (55,000km^2), catchments (Sesan and Srepok Rivers) and climate (wet season May-Nov, dry season Dec-April). Development plans were also presented showing the increase in proposed irrigated areas for the catchments over a 10 year period. There was enough water in each river to irrigate the planned expanded area. To expand the area, the number of required structures were calculated and reported. In conclusion it was stated that:

- To ensure food security and poverty reduction, it is necessary to repair, upgrade and construct irrigation structures to satisfy an expanded irrigated demand for agriculture, especially in view of the fact that climate change is predicted to have a negative effect on agricultural production.
- To maintain or improve food security in the area it is necessary to have policies in place to give priority for structures to be built to assist ethnic minorities.
- Improved irrigation methods and strengthened management are needed to ensure the areas' water use remains sustainable.

Discussion

The MARD was complimented for the fact that it has a policy of targeting ethnic minorities and the underprivileged. It was explained that the national Government has a policy of targeting ethnic minorities but these policies may need some strengthening for irrigation structures to be constructed for them. Additional discussion emanated from the construction of structures and the need to carefully define the requirements for each classification.

1.6 Irrigation sector review and scenarios for irrigation development.

Dr. Thanapon Piman, Postdoctoral Fellow in Water Resources, University of Canterbury, New Zealand

Abstract

Irrigation sector review was carried out by the Basin Development Plan Programme (BDP), MRC in 2009 to assess present status and trend of irrigation development in the riparian countries of the Lower Mekong Basin (LMB) including Cambodia, Lao PDR, Thailand and Viet Nam. The assessment results were used for formulation and assessment of

basin-wide development scenarios which provided a basis for discussion and negotiation among the riparian countries on mutually beneficial levels of water resources development and their associated levels of transboundary environmental and social impacts.

The irrigation sector forms the largest water user in the basin. The total potential irrigation area was estimated by 10 million ha. The current irrigation area in the LMB is about 4.0 million ha. Present dry season irrigated area is 1.2 million ha, which is about 30% of the wet season irrigated area. The Viet Nam Delta has a largest irrigated area (1.7 million ha) followed by NE Thailand (1.4 million ha), Cambodia (0.5 million ha) and Lao PDR (0.2 million ha). Rice is the main crop in the four countries with yield that vary from 2-6 tons/ha. The fully-irrigated rice crops in flooded area of the Viet Nam Delta give the highest yields. Major non-rice crops are sugarcane, corn, cassava and fruit. Since 1990 the irrigation area has gradually expanded with rate 4-5% per annum and most suitable sites have already been taken up for development, particularly in Viet Nam and Thailand.

Irrigation development scenarios in the LMB have been defined to assess the different levels of possible development of irrigation based on existing information in the irrigation database which provides information on the present, planned and potential irrigation areas for each irrigation scheme as well as consultation with the riparian countries. Nevertheless, there are ambitious plans from the Lower Mekong countries to increase overall basin irrigation areas from 4.0 to 5.3 million ha (32%) in the next 20 years, with dry season irrigation being increased by 42% from 1.2 to 1.7 million ha. However, irrigation expansion is still potentially limited by the availability of suitable soils, physical conditions, high seasonal variation of rainfall, low flows in the dry season, and investment and maintenance costs. Thus, there is also a high need to consolidate the existing irrigation to increase efficiencies and productivity.

Notes from the presentation

An irrigation sector review in the LMB was carried out by the Basin Development Plan Programme, Phase 2 (BDP2) in 2009 to:

- Assess current status of irrigation development
- Update inventory of existing, planned and potential irrigation projects
- Identify of the key opportunities, constraints and issues for sustainable irrigation development
- Outline national institute frameworks and policies
- Support formulation and assessment of basin-wide development scenarios in the LMB

A process was developed to fulfil the study including desk studies, consultation, data collection and field trips. The key outputs were:

- Updated irrigation database for the LMB-2009
- Irrigation sector review reports at regional and national levels
- Scenario formulation for irrigation development over next 50 years

From these results it was possible to formulate irrigation development scenarios for the next 50 years. Included in the plans are a 20 year plan, long term development plan and a very high development scenario.

The study also assisted to develop regional strategic priorities for:

- Maintenance of a register of ongoing and planned water resources development for irrigation for both monitoring and promotion of development
- Development of guidelines that will help project developers and agricultural (water) managers improve rice-field fisheries and reduce agrochemical runoff
- The identification of long-term flood management options for the Mekong Delta to respond to growing pressures from land development, climate change, and upstream development plan

Discussion

Availability of the data to the general public was discussed. Some of the data is available online while the remaining data is available to Member Countries and general public on request. It was explained that the database is large and defined requirements would be necessary. It was also mentioned by other participants that many countries are happy to share data that may be used to predict changes in water flows. For example, China happily shares information on schedules for water release from its dams.

One presented graph showing a predicted increase in dry season flows and reduced wet season flows was discussed. An explanation was given on the retention of flood water from the wet season in large dams to be released during the dry season for hydro-electricity generation.

Symposium participants were also interested in the irrigation scenarios including the cropping patterns. Will there be sufficient water for these scenarios? It was stated that there will be sufficient water for all irrigation scenarios and all cropping patterns. There were difficulties in generating some data for some countries, Cambodia in particular. It, like most countries, does not have strategic plans reaching out past 10 years. For this reason the number of potential projects in the 20 year scenario is small.

1.7 Modelling and calibration practices in the BDP2.

Ms. Ornanong Vonnarart, Modeller, Information and Knowledge Management Programme, Mekong River Commission Secretariat, Phnom Penh, Cambodia

Abstract

MRC DSF (MRC Toolbox) is used to assist in developing rules for water sharing among the four riparian countries in the Mekong River Basin and to support decision-making for basin planning and management through assessment of the environment and socio-economic impact of development options.

A package of simulation models in MRC DSF enables the prediction of impacts of changes in conditions within the basin on the river system. The SWAT developed by the United States Department of Agriculture has been set-up to generate sub-basin runoff from rainfall and climate data. The Soil Water Assessment Tool or SWAT models provide input to a series of basin simulation models that are based on the Integrated Quantity and Quality Model (IQQM) software originally developed for the Murray - Darling Basin in Australia. The simulation model route catchment flows through the river system, making allowance for control structures such as Dams and irrigation abstractions. A hydrodynamic model, based on

iSIS software developed by HR Wallingford and Halcrow, is used to simulate the river system downstream part of the basin including Great Lake and Delta.

The IQQM irrigated crop demand model (one component in IQQM model) can respond to additional needs of the Mekong River System in term of Irrigation Development Assessment that can allow the simulation of multiple rice crops and estimate the area of irrigated crops that could have been sustainably grown under a particular flow regime.

The Baseline Model that had been approved by the 5th TCG, Jan 2006, Do Son, Viet Nam was adopted for BDP2. This Baseline Model has more details about the SWAT model upstream of Kratie to Lao-China border and area around Great Lake. The IQQM was setup on 01 Jan 1985-31 Dec 2000 with Irrigation, Population and Dam/structure base on year 2000, including 12 dam in NE of Thailand. ISIS model improvement in year 2007 incorporated more nodes in the plain of reed in Viet Nam and canal in the delta, as well as improved water demands.

A database of existing and planned irrigation projects throughout the LMB has been prepared for scenario analysis including population growth, Mainstream and Tributary dam data (characteristic, operating rule, etc) and the simulated result.

Notes from the presentation

The MRC developed a Decision Support Framework (MRC Toolbox) to:

- Determine availability of water resources in the Mekong Basin.
- Predict how the river system will behave under different future development scenarios.
- Assess what impacts are likely to occur.
- Undertake these analyses in a manner that is transparent and acceptable to all.

Three models were used to generate the data. These were SWAT (Hydrological model), IQQM (Basin simulation model) and ISIS (Hydrodynamic model). Part of the IQQM is able to simulate irrigated crop water demand with multiple crops and estimated the area of irrigated crops that can be sustainably grown under particular flow regimes.

Generated data and simulations resulted in predicting the total area that could be irrigated, the amount of water required for various cropping systems and the amount of domestic supply required under different development scenarios.

Discussion

Some symposium participants appear surprised at the depth of study during the BDP2 planning process and enquired after the completeness of the model and access to data. As with earlier presentations on the BDP2, data were collected from all countries and the analyses are available to the public.

1.8 Establishing capacity of river basin water resources development and management in Pursat river basin of Cambodia as a model case.

Mr. Masahiko Hiraiwa, JICA Advisor to Ministry of Water Resources and Meteorology, Phnom Penh, Cambodia.

Abstract

From the viewpoint of achieving sustainable agriculture and increasing agricultural productivities, and of getting effects of agricultural investment exactly, it is important for the government to utilise limited water resources properly and fairly in a river basin.

Therefore the government of Cambodia enforced the Water Resources Management Law in 2007 and has been discussing legalisation of sub-decrees on River Basin Water Resources Management, Water Licensing, Water Quality and Farmer Water Users Community (FWUC) under this Law. However, it will take more time to enforce these decrees. And recently water resources development and irrigation projects have been actively implemented according to social and economic development in rural areas. Therefore it is urgent for the government to establish a mechanism for the substantial coordination of river basin water resources.

I would like to introduce capacity development for river basin water resources development and management in Technical Services Centre of the Ministry of Water Resources and Meteorology (MOWRAM) and a programme started in 2012 as a model case for establishing such a coordination mechanism in Prusat river basin located in western region of Tonle Sap Lake of Cambodia.

The objective of the programme is to enhance capacity of officers of MOWRAM for planning, coordinating and implementing river basin water resources development and management. As expected outputs, officers of MOWRAM understand concept and methodology, and become able to formulate, examine and coordinate river basin water resources development plans and management plans. An institutional framework will be established for water resources development and management.

Notes from the presentation

The Japan International Cooperation Agency is assisting MOWRAM to:

- develop its capacity to manage water resources through strengthening the strategy, policy and legal framework for integrated water resources management (IWRM);
- improve coordination and cooperation with other ministries and agencies as well as among MOWRAM at the river basin level; and
- strengthen MOWRAM's technical and human resources capacity to promote IWRM.

A new development plan should respect existing water use activities and plans while keeping river maintenance flows which are necessary for conserving the river environment. If several projects are planned at the same time, a river basin wide master plan for water resources development should be formulated.

The Pursat River Basin was used as a pilot study to demonstrate these principles. The Pursat River Basin is located at the west side of Tonle Sap Lake with about 5,000km^2 of catchment area. It is a high potential basin with good rainfall and approximately 60,000 ha of irrigable fertile land. There are plans to develop a hydro-electricity dam on the site but there are few plans for allocating water. A good model will achieve well-ordered water allocation in this river basin. It is envisaged that this plan will assist establish a framework for operating and managing irrigation systems harmonised with water users in other river basins. A river basin water development and management plan will be established with good coordination bodies and water licensing. This will be done at a) the central level to monitor and coordinate implementation of this programme, b) the Provincial level to study and coordinate setting up a water resources coordination framework in the Pursat river basin and

c) at a river basin level to implement the technical study, make materials and explain to the committees.

Discussion

Discussion among the participants suggested that simulation for water use could be included in the IQQM simulation model. BDP2 did not focus on the water balance in the sub-sub basin level but the information developed from the Pursat River Basin could be used in future simulations. It would be necessary to conduct some case study training at this level and some adjustments to the model may be required.

1.9 A framework for deriving the groundwater irrigation potential at the basin scale accounting for human and environmental requirements

Dr. Paul Pavelic. International Water Management Institute, Vientiane, Lao PDR.

Abstract

The trajectory of future groundwater use for all productivity-related sectors over much of the LMB is expected to increase with growing recognition that groundwater offers a powerful adaptation measure for coping with climate variability and as technologies for drilling and equipping wells become cheaper and more widely accessible. Expansion of groundwater irrigation for example, offers an attractive option to smallholder and commercial farmers to overcome unreliable wet-season rainfall and enhance dry-season production. Agriculture is universally the largest user of groundwater, and any proliferation in development of this kind can lead to over-exploitation of the resource in terms of falling water levels, deteriorating water quality and land subsidence — as evidenced in various regions of the world. Sustainable management of groundwater, as a goal, is underpinned by the need to develop strategies that effectively balance supply and demand constraints.

In keeping with the paucity of data in many regions, this paper presents a simple, generic groundwater-balance-based methodology that involves a set of type-curves to assist with decision-making on the scope for developing sustainable groundwater irrigation supplies, and to help understand how cropping choices influence the potential area extent of irrigation at a variety of spatial scales. Guidance to avoid over-exploitation of the resource is also provided. The methodology is applied to some case studies to reveal the scope of the potential for further groundwater development for irrigation whilst allowing provisions for other sectoral uses, including basic human needs and the environment.

Notes from the presentation

World-wide use of groundwater for irrigation is on the increase but remains low in the Mekong Basin at 9% of the total irrigated area for Thailand, 1% for Viet Nam and less than 1% for Lao PDR and Cambodia. Development of a catchment area requires good planning to determine how much the catchment can sustain and whether sensitive wetlands need to be considered. The technical challenge is how to define sustainable levels of development for groundwater irrigation, specifically allowing for other sectorial uses in cases where very little is known about the groundwater resources. This can be done using simple guiding principles including a) simplicity due to data/knowledge constraints, b) adaptive management - start small, monitor impacts and learn as you go and c) Operate within the groundwater budget. The basic principles are to include in the calculations, requirements for human consumption,

irrigation, industry, livestock and the environment. Recharge is the key sustainability indicator.

Two models were demonstrated showing one having sustainable amounts of water being drawn from the aquifer with the second suffering from a reduction in water table indicating that this system is not sustainable. It is a challenge to find sufficient data in the LMB to test the sustainability model.

Discussion

Discussion on the sustainability of the model related to the amount of water required for the environment and the period of time one needs to monitor the system before adapting the model. It was explained that sustainability of groundwater systems differ and that the amount of water required for the environment needs to be calculated on a case by case basis. Controlling abstractions from non-sustainable systems can only be done by regulation and should be avoided if it is possible to set the limits of the system prior to the water table dropping too far. It was mentioned that there are aquifers along the Mekong River in Cambodia where the water table follows the river height. This is a unique system but recharge remains the "key sustainability indicator" and overuse can reduce water tables in the short term.

The modellers were questioned on whether they had models which could measure groundwater use. SWAT was deemed to be suitable to model inflow, but not for extraction. Sophisticated model adaptations need to be used to measure water use and quality.

There was also discussion on the artificial recharge of aquifers through the redirection of water from other sources. This is being done in NE Thailand. There are trade-offs to this and there needs to be a prior good understanding of the system and good planning.

1.10 Assessment of water quality and implications for agricultural development.

Mr. Kongmeng Ly, Water Quality Specialist, Environment Programme, Mekong River Commission Secretariat, Vientiane, Lao PDR.

Abstract

The MRC's 2010 State of Basin report characterises water quality throughout the LMB as generally good. In the Mekong mainstream and tributaries, water quality mostly continues to meet requirements for protection of aquatic life, human impact, and agricultural use, with no restrictions on usage. Some degradation of water quality is however evident related to urban and industrial development and agricultural production. Higher nitrogen and phosphorus concentrations in water are being measured in areas of the LMB subject to intensive agriculture and human population pressures, especially downstream of major cities such as Vientiane and Phnom Penh, in northeast Thailand, and in the Mekong Delta.

This presentation provides the most recent update on MRC's water quality monitoring results for the LMB, based on the Multi-Media Monitoring and Assessment survey carried out in 2011 and the routine water quality monitoring from 2011. The survey covers measurement of a long list of parameters in water, sediments, biota and fauna from 28 locations, whereas the routine monitoring covers traditional physic-chemical parameters in the water phase from 48 locations.

The only MRC quality requirement for water for agricultural use in the Mekong is related to electrical conductivity and the monitoring results indicate that the Mekong river water is still suited for agricultural use in all monitored locations. Only limited impact from agriculture on water quality was found in the monitoring. In some places elevated levels of nutrients may indicate impact from fertilizer use, especially in the delta. Pesticides, originating mainly from agricultural activities, were also monitored and found to be of little concern for human health and aquatic life.

Notes from the presentation

The MRC water quality monitoring network (WQMN) routinely monitored water quality across 48 monitoring stations in 2012. Monitoring is carried out based on agreed terms of reference for the monitoring according to number of measured parameters and methods. Data is then stored in an agreed format and reported to MRCS and national members.

Special diagnostic studies are also conducted to provide baseline measure and to detect changes in quality especially regarding toxic chemicals. These are measured against MRC water quality indices developed and adopted in 2006. Conclusions from the studies indicated that:

- The Mekong River water quality was suitable for all types of agriculture, with EC levels < 70 mS/m in 2011
- Despite seventeen (17) stations being rated as either "impacted" or "severely impacted" by human activities in 2011, almost all stations are rated as "excellent" for the protection of aquatic life
- Dissolved heavy metals and organic pollutants were low, with the exception of cyanide and phenol at a few stations
- Elevated concentration of Pb and Hg in sediment observed at most stations
- Concentration of metals and organic micro pollutants in all fish group were low and did not exceed available guidelines for human consumption

Discussion

It was observed that each riparian Member Country in the LMB has its own guidelines but the results of these surveys were provided to all countries for their own comparisons and conclusions.

2. Agriculture for food and poverty

2.1 Agricultural production development in the Mekong River Delta Region, Viet Nam.

Mr. Pham Huy Hoang, Sub Institute for Agricultural Planning and Projection, Ho Ch Minh City, Viet Nam

Presentation summary

The Mekong River Delta Region (MRDR) is approximately 4 million ha in area of which 2.96 million ha is agriculturally productive. Although the delta accounts for only 12% of the country area as a whole it is around 32% of the nation's agricultural land. Despite the fact that 40% of the delta is on acid sulphate soils, and many part of the delta floods often, it provides sufficient agricultural produce to fill 40% of the GDP originating from the agricultural sector, supplies half of the nations rice production and 55% of the fish outputs.

Rice is the main crop on the delta, occupying between 90% and 95% of some areas. This crop occupied 1.9 million ha in 2010 and has increased in intensity to much of the land growing two or three crops in one year. Other more economically viable crops have replaced rice in recent years with other annual crops growing from 92,000 ha in 1980 to 145,000 in 2010. Perennial tree crops have increased in area over the same period from 192,000 ha to 536,000 ha. Aquaculture is a growth industry increasing in area from 6,400 ha in 1980 to more than 500,000 ha in 2010. The Government has issued policies to encourage farmers to convert to other crops to substitute imported raw materials. Animal production, aquaculture and fruit tree cultivation are projected to expand considerably in the future.

Discussion

A clarification was made regarding an increase in the area to higher value crops and fish. This was for higher economic return. There will also be a direction towards improving quality in addition to quantity. There was also a question relating to the possibility of soil deterioration as a result of fish cultivation. To temper this occurrence, fish farms are encouraged to be constructed on the poorer, less productive soils.

The Government has also undertaken to protect the delta against climate change in increasing saline intrusion.

2.2 National agricultural development plans. Thailand.

Ms. Sutara Yindeerod, Senior Professional Level, Land Development Department (LDD), Bangkok, Thailand.

Presentation summary

The total area of Thailand is 51.31 million ha consisting of, agricultural land 20.95 million ha; forest 16.78 million ha, urban and rural area 13.35 million ha and mangrove forest 0.23 million ha. Over the past 40 years the increase of 7 million ha in agricultural area has mainly been cultivated with trees indicating the nation has reached maturity in agricultural development. Rice production has increased significantly during this period (by 10 million ton) from increased yields and cropping intensity.

Planning for agricultural development is from the National Economic and Social Development Plan (NESDP) and administered through the Ministry of Agriculture and Cooperatives (MOAC). The plan is to:

- increase the productivity of small and medium-sized farms
- improve the standards of output for compete effectively in the international market.

- agricultural development in the next five-year national development plan will emphasise "green and cool agricultural economy," food and energy security, and agricultural extension in the form of cluster networks.

The MOAC vision is to "To provide agriculturists with good quality of life, people with safe food for consumption, with their generation of income for the land". Part of the ministry's strategy is to increase agricultural production. For Thailand, 32 crops are being targeted. For the northeast, target crops are cassava, para-rubber, sugarcane, paddy, maize and soybean.

Land use planning is employed as a tool to identify areas suitable for each crop.

Discussion

Part of the land use planning system involves socio-economic surveys. These were described as being for the assistance of poor farmers in some instances. The stated rice production increases were due to a number of factors. These included the use of higher yielding varieties, improve water resources and the employment of improved agronomic practices. Questions on whether the MOAC had yield targets for crops were answered with the proposal that yield intensity would increase by 30% in the 5 year policy but these changed from year to year depending on available water, especially in the NE. Recent reductions in dry season yields have been due to a lack of water from the 1 in 30 year drought. Labour reductions have resulted from the adoption of farm mechanisation.

2.3 National agricultural development plans. Lao PDR.

Mr. Khamsay Phothideth, Chief of Planning Division, Department of Planning, Ministry of Agriculture and Forestry, Vientiane, Lao PDR

Presentation summary

Lao PDR has an agricultural area of approximately 958,000 ha which is about 4.33% of the total land area. The cropping index is 1.17 although food production has been increasing between 3% and 4% per year. Rice production stands at 400-500kg/person/year and fish production is at 40-50kg/person/year. In 2010 national production stood at 2.7 million tonnes but the Department of Agriculture (DOA) within the Ministry of Agriculture and Fisheries (MAF) predicts that this will increase to 4.2 million tonnes by 2015 and 6.0 million tonnes by 2020. This will be achieved by an increase in the 170,000 ha of irrigation by about 30% per annum. Wet season rice and dry season rice yields currently at 4.5 and 5.5 t/ha respectively will also increase.

The MAF has goals to improve:

- Food availability
- Food accessibility
- Food safety and nutrition
- Food production stability

2.4 Agricultural plan towards development and food security. Cambodia.

Mr. Mak Soeun, Director of Department of Agricultural Extension, Ministry of Agriculture, Forestry and Fisheries, Phnom Penh, Cambodia

Presentation summary

The Cambodian MAFF acknowledges that world food production will need to increase by 1.2 billion tonnes by 2050 to feed the increased population. The agriculture sector is the "Key to feeding the world" and the MAFF has joined global food security initiatives to achieve this goal.

The MAFF has a programme to improve food security, reduce poverty, improve economic growth and sustain natural resources through agriculture, livestock, rubber, forestry and fisheries. In 2011, agriculture's share of total GDP was 28.4% and growth was at 3.3%. 54% of agricultural production was from crops and remainder fisheries, forestry, and livestock.

Rice production has more than doubled over the past 10 years and cash crop production, livestock and rubber are also on the increase. The Government's vision is that by 2015, Cambodia will have a surplus of more than 4 million tonnes of paddy and more than 1 million tonnes of rice and be a major player in the international rice market. It will do this by a) enhancing rice productivity, b) improving paddy collection and processing, c) facilitating rice marketing and export. Priority programmes for agricultural development include:

- 1. Enhancing Agricultural Productivity and Diversification;
- 2. Increase Market Access for Agricultural Products;
- 3. Strengthening Institutional, Legislative Framework and Human Resource Development (HRD);
- 4. Sustainable Fisheries Resources Management and
- 5. Sustainable Forestry Resource Management

It is recognised that the MAFF needs to strengthen its institutional framework and capacity building to achieve these goals.

Discussion

It was explained by other members of the Cambodian delegation that a land use law was being developed to ensure proper land reform and land use. This law will also cover fisheries management which are mainly private aquaculture ventures.

Food security issues will develop in the Tonle Sap region should the fisheries industry be disrupted by developments on the Mekong River and agricultural development along the lake shores. Use of good agricultural practices should reduce the use of agricultural pesticides. The MAFF encourages the use of rice intensification using IPM practices. The overall goal is to improve protein production through ecological intensification. There is also a need to think regionally to reduce the adverse effects of development.

2.5 Baseline and trends of agricultural groundwater use in the LMB.

Dr. Hiromasa Hamada, Consultant

Abstract

Assessment of the basin-wide development scenario by the Mekong River Commission (MRC) didn't mention groundwater development. Subjects related to hydrological impact were river flow, sediment transport and water quality in surface water. The reasons that groundwater was not mentioned are: (1) There is much surface water for irrigation; and (2) Information for agricultural groundwater use is limited including successful groundwater irrigation projects.

The contents of this presentation are (1) recharge and discharge area (unit of consideration for groundwater development), (2) evaluation of sustainability of an existing groundwater irrigation project in northeast Thailand and (3) groundwater use in Mekong Delta.

In the selected site in northeast Thailand, the calculated safe yield of groundwater (about 1500 m^3/day) is larger than the current use (about 500 m^3/day). The results of socio-economic survey are as follows: (1) Roles of water users' group are clear; (2) After participating, farmers get enough water for cultivation in a timely manner; and (3) Farmers usually get benefits using groundwater. However, crop price fluctuates indicating that farmers cannot get benefits when the price is low. Groundwater development for agriculture requires not only groundwater survey but also socio-economic survey in order to realise sustainable participatory irrigation management.

In Mekong Delta, groundwater levels declined by 1.83-4.56 m in comparison with 10 years ago though estimated inflow to aquifers is larger than that of outflow including usage of groundwater. Groundwater sustainability is defined as groundwater use without causing unacceptable consequences. It is necessary to clarify unacceptable consequences in Mekong Delta.

Notes from the presentation

Information on groundwater use is not uniform across the LMB. Little data is available on groundwater availability in Cambodia and Lao PDR. The Thailand Department of Groundwater Resources (DGR) has a good database on the hydrological cycle, groundwater basins maps etc on its website as does the National Centre for Water Resources Planning in Viet Nam. There are some projects for agricultural use in NE Thailand and it is known that approximately 23 million m^3/day is drawn from the aquifers in the Mekong Delta. It is reported that groundwater levels in Mekong Delta and some areas in Central highland are declining.

There are many advantages to using groundwater compared with transporting to the field from an external source. The water source is often close at hand and accessible 24 hours a day, quality can be good, and does not evaporate until pumped. However only small quantities are available at one time, some sources are of low quality water and it may not be easy to find.

Sustainability of the water source requires prior evaluation and there needs to be participatory irrigation management. Two cases were compared. At one site in NE Thailand, there was good modelling and evaluation beforehand. The safe yield was calculated to be 1,500 m^3 per day and the current use remained at 500 m^3 per day leaving some scope for expansion in the future. In this case the farmers were involved in the aquifer development and paid for an extra well in collaboration with the Government. Farmers pay the water users group for the electricity to pump the water.

In the Mekong Delta, groundwater is used mainly for domestic use. The hydraulic conductivity of the aquifers is well understood but unregulated overuse has resulted in aquifer levels dropping between 1.83 and 4.56 meters in 10 years. In conclusion it was stated that groundwater development for agriculture requires not only groundwater surveys but also socio-economic surveys and that groundwater sustainability is defined as the use of ground water in a manner that can be maintained for an indefinite time without causing unacceptable consequences.

Discussion

In NE Thailand the RID and DGR collaborate to encourage recharge of the aquifers. There is insufficient water for full irrigation but is often used to supplement surface irrigation water. It is also possible to irrigate small areas of vegetables and upland crops.

1.11 Climate change scenarios and their implications for agricultural development.

Mr. Itaru Minami, Chief Technical Advisor, Agriculture and Irrigation Programme, Mekong River Commission, Phnom Penh, Cambodia

Abstract

The task given to the agriculture sector is to feed the increasing global population from current seven billion to a projected nine to ten billion by 2050 while adapting to climate change and reducing greenhouse gas emissions. It is observed that every 1^0 increase in night temperatures leads to a 10% yield drop in rice.

Yield losses in rice could be between 10% and 15%. Elevated CO^2 (540–958 ppm) would reduce the protein concentration as well. Furthermore, a common denominator is crops may not be able to grow where they had been grown for many generations. On the other hand, agricultural CH_4 and N_2O emissions have globally increased by nearly 17% from 1990 to 2005.

About the adaptation measures, better use of seasonal climate forecasting, greater deployment of water conservation technologies and diversification of on-farm activities, development and adoption of different varieties more suited to emerging climatic conditions, improved management of pests and diseases, etc. are regarded as no-regret strategies. As mitigation measures, improved crop and grazing land management, restoration of organic soils that are drained for crop production, restoration of degraded lands, improved water and rice management, improved livestock and manure management, and agro-forestry are recognised. Though these are also applicable to the LMB, tailored analyses are demanded.

To understand the climate change impacts on rice farming in the LMB more in detail, AIP attempted (1) stochastic analyses of rainfall and evapo-transpiration in LMB under the climate change scenario, (2) simulation of water allocation to the irrigation sector under the CC and BDP-20yr plan scenario, and (3) time series simulation of soil moisture and on-farm water storage at several LMB locations under the climate change scenario. These attempts show that not only the rainfed rice but also irrigated rice would face difficultly through increased irrigation demand and declining water in reservoirs and tributaries together with higher pumping costs. Improved O&M strategy would be required to maintain current irrigation area under climate change.

Notes from presentation

Climate change will bring increasing climate variation in the short term and a shift of mean climate conditions in the long term.

- Changes in average rainfall are small, but annual deviation becomes larger, which causes water shortage in reservoirs and tributaries more often.

- ET will increase in both average and 90% cumulative probability, which raises irrigation demand.
- Higher irrigation demand will increase operation costs in such irrigation systems that depend on pumps.
- The irrigation systems that depend on tributaries and reservoirs may face shortage in water resources due to higher irrigation demand and occasionally lesser available water in the river/reservoirs.
- Planting of rain-fed rice may have to start late, and reduce the yield of fragrant rice varieties.
- Longer dry spells during the wet season will raise the risk of drought damage in rain-fed rice

Discussion

It was suggested by a participant that a system of land management is necessary to mitigate the effects of climate change and that this system needs to be implemented across the basin.

2.6 Crop models for regional prediction of rice production.

Dr. Tao Li, Scientist, Crop Modeller, International Rice Research Institute (IRRI), Los Baños, Philippines

Abstract

To enhance food security, alleviate poverty and adapt and mitigate the effects of climate change in rice production, effective tools are essential for the prediction of rice production and evaluation on the effects of innovated technologies and varieties on rice production. Crop models have been proved as efficient tools to help the improvement of rice production in almost all aspects. Recent study showed that ensemble modelling approach with multiple models can significantly improve the accuracy and confidence of the prediction of rice production to be consistent with measurements. However, some models were not fully functional to key cropping practices such as the management of water and/or fertiliser, or were not suitable for regional prediction. ORYZA2000 is an ecophysiological rice model, and has been approved as a reasonable tool to explore the effects of water and nitrogen fertiliser management on rice production and to predict rice production. Similar to many other crop models, ORYZA2000 also has weaknesses, but continuous development will extend its capability to serve wide range of end-users in various purposes. In summary, crop models are capable for prediction of rice production from field to global scales in which accuracy of prediction depends on the quantity and quality of necessary information on soil, weather and cropping practices.

Notes from presentation

- Single model has advantages and disadvantages, and only works well within the assumption scope of model;
- Ensemble model predictions is the best for high accurate rice production prediction at current stage, especially for regional without detail rice varieties;

- ORYZA2000 has strong capability on simulating effects of water, nitrogen, and climate on rice growth and yield;
- However, well calibration and validation are necessary for ORYZA2000 as well as other models to provide confidential predictions.

Discussion

Some delegates at the mini symposium had not used ORYZA2000 but had experience with the FAO charts used by agronomists. The FAO and ORYZA2000 approaches are different. The FAO system ignores genotype and management while the ORYZA2000 includes complex interactions from 91 genotypes. Using ORYZA2000 it is difficult to generate graphs for a particular environment. There are two sites in Thailand trialling the model.

Crop modelling and water stress are useful for predicting the effects of climate change. ORYZA2000 can be used at different water levels. Inclusion of "real time" management will be useful for predicting water use and irrigation requirements.

3. Group discussion. Knowledge and capacity needs towards agricultural development and MRC's role in basin-wide collaboration.

Section three of the symposium gave the opportunity for the delegates to discuss knowledge gaps within the national programmes and the potential for AIP to work constructively with the programmes to resolve any outstanding issues. Four country groups were formed. MRC staff and other resource people joined these groups to assist and facilitate the discussion.

Each group discussed the following three issues taking into account the earlier presentations.

- What are the urgent knowledge gaps in the agriculture and irrigation sector to fill in to make basin development scenarios more realistic, reliable, and informative?
- What data/information and capacity are necessary to implement sub-basin level IWRM in agriculture and irrigation developments?
- What are the necessary knowledge to link the long-term goal of food production with current agriculture and irrigation planning?

Each group individually reported urgent national actions to fill in the knowledge and capacity gaps, as well as AIP's roles to support these national actions. The presentations were summarised as follows:

Lao PDR

1. *Urgent knowledge gaps in the agriculture and irrigation sectors to make basin development basin scenarios more realistic, reliable, and informative.*

Irrigation

- Operation maintenance of existing facilities
- Capacity building for local staff and farmers
- Collecting the existing irrigation project

Agriculture

- High quality treatments
- Input supply and management
- Indicator for marketing potentials
- Sharing information on agriculture and irrigation planning

2. *Data/information and capacity are necessary to implement sub-basin level IWRM in agriculture and irrigation development*

Irrigation

- Strengthening local staff and central government
- Strengthening Farmer WUG
- Expanding irrigated area
- Improve irrigation canal system.
- Improving on IMT

Agriculture

- Monitoring and Evaluation needs
- Data information on the flood and drought
- Statistic of the agricultural production from local authorities

3. *Knowledge gaps link to the long-term goal of food production with current agriculture and irrigation planning*

Irrigation

- Expanding irrigated area
- Sufficient water supplying
- Flood and drought mitigation and management
- Monitoring and evaluation on the implementation

Agriculture

- Monitoring and evaluation
- Improve seeds quality
- Promotion on agricultural activities to farmers
- Agriculture practicing on climate change adaptation

Cambodia

1. *Urgent knowledge gaps in the agriculture and irrigation sectors to make basin development basin scenarios more realistic, reliable, and informative.*

- Knowledge gap on assessment analysis and use of water balance, water availability, land use map and crop zoning.
- Lack of modelling to monitor efficiency (Tool and capacity) for land and water use
- Lack of modelling crop cut forecasting
- Lack of information about availability of land/soil and water resources for development agriculture
- Lack of knowledge on modelling on MK11, SWAT to analysis surface and ground water
- Lack of knowledge on collecting and analysing data on Hydro-meteorology
- Lack of knowledge on Operation and maintenance and planning
- Assessment and analyses of ground water availability
- Lack of capacity on modelling
- Agriculture and irrigation research and development

2. *Data/information and capacity are necessary to implement sub-basin level IWRM in agriculture and irrigation development*

- Improve soil and land use data for clear land classification and crop zoning
- Climatic data and information for farming seasonal calendar
- Ground water data and information
- Food security calendar in LMB
- Irrigation database
- Capacity building to generate data/information and use modelling/tools
- Improve agriculture statistics
- Improve information sharing among stakeholder
- Integrated river basin management and planning
- Hydro-Meteo (Rainfall, discharge)

3. *Knowledge gaps link to the long-term goal of food production with current agriculture and irrigation planning*

- Trend Land and water variability (both surface and underground water)
- Change of land use
- Modelling for climate change adaptation and mitigation
- Technologies for improving food production
- Operation and Maintenance of irrigation
- Water distribution

Thailand

1. *Urgent knowledge gaps in the agriculture and irrigation sectors to make basin development basin scenarios more realistic, reliable, and informative.*

- Conjunctive use of irrigation water and groundwater
- Groundwater irrigation

- Crop modelling related water stress
- Climate change modelling and downscaling modelling
- GIS and remote sensing application on agricultural and irrigation planning
- Planning for crop diversification and rotation
- Agricultural intensification for good practice
- Capacity building for integrated government agencies to support Good Agriculture Practice (GAP)

2. *Data/information and capacity are necessary to implement sub-basin level IWRM in agriculture and irrigation development*
- Integration of databases of all related sectors
- Pilot project for demonstrating implementation of IWRM planning in sub-basin

3. *Knowledge gaps link to the long-term goal of food production with current agriculture and irrigation planning*
- Monitoring and assessment techniques
- Dynamic planning

Viet Nam

1. *Urgent knowledge gaps in the agriculture and irrigation sectors to make basin development basin scenarios more realistic, reliable, and informative.*
- Lack of skills in processing database,
- Lack of knowledge and information about the database of the irrigation system at upper basin and hydropower operation, dams.
- Lack of processing of information about the irrigation system / updating data

2. *Data/information and capacity are necessary to implement sub-basin level IWRM in agriculture and irrigation development*
- Lack of knowledge about water resources management at basin level
- Need to increase awareness of the role of collaboration and coordination between the relevant sectors/ departments.
- The process of operation of the irrigation system, works in upper and lower basing regions (update data)

3. *Knowledge gaps link to the long-term goal of food production with current agriculture and irrigation planning*
- Due to climate change, water demand changes, the system also changes. (there is no detailed scenario to the sub regions of the basin, the reliability is not high)
- Sea level rising may affect the old design of preventing saltwater intrusion, affecting agricultural productions.
- Lack of investment funds in researching projects and building constructions
- Roles of non- governmental agricultural organisations, private companies
- Increasing understanding techniques of using irrigation system.

4. Panel discussion. Next steps towards IWRM – based agricultural development

Four panel members facilitated discussion on answers to the three questions posed to the working groups. On the panel were representatives of crop modelling, basin wide modelling and development, sub-basin development planning and food security. Although the country presentations were different in depth and focus, one panellist summarised them in the following manner.

1. *Urgent knowledge gaps in the agriculture and irrigation sectors to make basin development basin scenarios more realistic, reliable, and informative.*

- Data processing skills,
- Poor data transfer from one country to next.
- Lack of data coming from inter-government agencies
- Lack of scenarios (models) on climate change
- O&M knowledge at the local level
- Knowledge on good agricultural practices

2. *Data/information and capacity are necessary to implement sub-basin level IWRM in agriculture and irrigation development*

- Statistics from local level
- Integrated data bases
- Pilot study to demonstrate modelling

3. *Knowledge gaps link to the long-term goal of food production with current agriculture and irrigation planning*

- Updated data on land use changes (includes dynamic planning)
- Consistent monitoring and evaluation.
- Uniform Operations and Maintenance across basin
- Modelling for climate change
- Technologies for improving food production (including varieties and seed)

Although this list was not exhaustive, it did elicit discussion by panel members and symposium participants.

The crop modeller discussed the availability of models suitable for tracking the effects of climate change and the MRC has considerable experience in collecting and analysing data sets related to agriculture. A number of sources of data are available. For example, IRRI, through the Rice Knowledge Bank, has information on rice ranging from technical issues to IT. Much of the required information may also be collected by different Government departments in the same country. Sharing of this information between Departments and Ministries in the same country and between countries would improve the capacity of various scenarios to be developed.

It was suggested that data should be collected on a regional, national and local level. The AIP will be collecting data on a regional level (see Section 5 below). Data collection needs to be such that it can be used on a number of levels with much of this being generated in a participatory manner to be most effective.

Capacity building was a consistent theme in the discussion. A long-term approach needs to be taken with capacity building and needs to be tied to national planning. The

riparian countries can help each other out in this respect transferring necessary skills through closer cooperation. For example, the capacity to model one sub-basin can be transferred to another.

The AIP is able to support the country programmes with many of the aspects mentioned in the country presentations and discussed in the panel discussion. A small 5 year programme (2011-2015) has commenced which is comprised of data collection and analysis, mapping, overviewing of agricultural trends, feasibility studies and planning exercises outlined in the AIP work programme mentioned below. Included in the programme is capacity building to assist member countries improve IWRM – based agricultural development. Other suggested additions to the programme emerging from this mini-symposium and not mentioned in the work plan will be incorporated at a later date.

5. Follow up proposals included in AIP work plan 2011-2015

Below is an outline of the AIP work plan for the five year period from 2011 to 2015. Proposals mentioned for inclusion in the programme during the mini-symposium are already listed in this programme or can be incorporated at a later date.

AIP work plan outline

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*

Within this sector will be

a) Synergy and priority setting including institutional mapping and country consultation. This mini-symposium is part of the country consultation process.
b) Basin mapping with maps describing agro-ecological zones, land use and soils.
c) Overview of agriculture with developed country sector plans, trends of rural poverty and long term food security assessments.
d) Agricultural water use data base on irrigation, groundwater and irrigation weirs.

2 *Development of synergy and harmony between national agricultural planning and MRC Strategic Plan implementation*

Within this sector will be

e) Irrigation feasibility studies with an inventory of irrigation projects, an interpretation of the BDP scenario outputs, harmonisation in irrigation and bulk water monitoring.
f) Agricultural planning will be facilitated through improved land use maps in BDP, the use of future BDP scenarios and seasonal forecasting services

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

g) The capacity for IWRM will be improved after undertaking a capacity needs assessment, the compilation of regulations, guidelines and extension policies and through training on land use mapping.
h) Trans-boundary exercises will include the management of trans-boundary aquifers and the development of road boundary use between Cambodia and Viet Nam.

Appendix 1Mini-Symposium Programme

13 and 14 November 2012, Vientiane

Time	Topic	Note
	Day One	
8:00-8:30	Registration	All
8:30-8:45	Welcome Remarks	Prasong Jantakad, MRCS
8:45-9:45	Keynote speech: Needs for basin-wide collaboration towards lasting food security in the LMB	Harry Nesbitt, UWA
	Session One: Irrigation in the basin planning	
9:45-10:15	Issues and questions in the irrigation sector in the LMB	Itaru Minami, MRCS
10:15-10:30	Coffee Break	
10:30-10:55	Water resources and irrigation systems in Cambodia	Theng Tara, MOWRAM
10:55-11:20	Irrigation development in Lao PDR	Khammai Vongsathien, MAF
11:20-11:45	Water resources and irrigation in NE Thailand	Chawee Wongprasittiporn, RID
11:45-12:10	Water resources development plan for irrigation. Sub Area 7V, Viet Nam	Dang Thi Kim Nhung, SIWRP
12:10-13:30	Lunch	
13:30-13:40	Group Photo	
13:40-14:25	Irrigation sector review and scenarios for irrigation development	Thanapon Piman
14:25-15:00	Modelling and calibration practice in the BDP2	Ornanong Vonnarart, MRCS
15:00-15:15	Coffee Break	
15:15-15:40	Establishing capacity of river basin water resources development and management in Pursat river basin of Cambodia: A case study.	Masahiko Hiraiwa, JICA-MOWRAM
15:40-16:15	A framework for deriving the groundwater irrigation potential at the basin scale accounting for human and environmental requirements	Paul Pavelic, IWMI
16:15-16:40	Assessment of water quality and implications for agricultural development	Kongmeng Ly, MRCS
	Day Two	
	Session 2: Agriculture for food and poverty	
8:30-8:55	Agricultural production development in the Mekong Delta Region, Viet Nam	Pham Huy Hoang, SIAPP
8:55-9:20	National agricultural development plan in Thailand	Sutara Yindeerod, DLD
9:20-9:45	National agricultural development plan in Lao PDR	Khamsay Phothideth, MAF
9:45-10:10	Agricultural Plan towards Development and Food Security	Mak Soeun, MAFF
10:10-10:30	Coffee Break	
10:30-11:00	Baseline and trends of agricultural groundwater use in the LMB	Hiromasa Hamada
11:00-11:30	Climate change scenarios and their implication for agricultural development	Itaru Minami, MRCS
11:30-12:00	Crop models for prediction of rice production and cropping management	Tao Li, IRRI
12:00-13:30	Lunch	
13:30-14:30	Group Discussion: Knowledge and capacity needs towards agricultural development and MRC's roles for basin-wide collaboration	MC participants
14:30-15:10	Report from each group	MC participants
15:10-15:30	Coffee Break	
15:30-16:30	Panel discussion: Next steps toward IWRM-based agricultural development	Harry Nesbitt Tao Li Masahiko Hiraiwa Thanapon Piman
16:30-16:45	AIP Proposal to follow up the workshop and BDP 2 process	Prasong Jantakad, MRCS
16:45	Closing	

Appendix 2. List of participants attending mini-symposium

Cambodia

1. Mr. Kim Seyha, Cambodian National Mekong Committee, Phnom Penh, Cambodia
2. Dr. Teng Tara, Deputy Director of Technical Affairs and Director of Water Resources Management and Conservation Department, Ministry of Water Resources and Meteorology (MOWRAM), Phnom Penh, Cambodia;
3. Dr. Mak Soeun, Director of Department of Agricultural Extension, Ministry of Agriculture, Forestry and Fisheries, Phnom Penh, Cambodia
4. Mr. Suos Bunthan; National AIP Coordinator of Projects Department, Cambodian National Mekong Committee, Phnom Penh, Cambodia
5. Mr. Sin Samnang; National DMP Coordinator, Cambodian National Mekong Committee, Phnom Penh, Cambodia

Lao PDR

6. Mr. Khammai Vongsathien, Director of Irrigation Development and Drainage Division, Department of Irrigation, Ministry of Agriculture and Forestry, Vientiane, Lao PDR
7. Mr. Khamsay Phothideth, Chief of Planning Division, Department of Planning, Ministry of Agriculture and Forestry, Vientiane, Lao PDR
8. Mr. Pasonexay Insisiengmay; Deputy Head of Planning and Cooperation Division, Department of Irrigation; Ministry of Agriculture and Forestry, Vientiane, Lao PDR
9. Mr. Oudong Keomipheth, Ministry of Agriculture and Forestry, Vientiane, Lao PDR
10. Mr. Saleumsy Phitayaphone; Deputy Chief of Division; Department Agriculture Ministry of Water Resources and Environment, Vientiane, Lao PDR
11. Mr. Souksakhone Phoutthaamath; Technical Officer; Department of Water Resources Ministry of Water Resources and Environment
12. Mr. Thongthip Chandalasane, Ministry of Water Resources and Environment
13. Ms. Sonephavanh Liemphachanh; Technical Officer; Lao National Mekong Committee Secretariat; Ministry of Water Resources and Environment

Thailand

14. Mr. Chatchai Boonlue, Director, Foreign Financed Project Administration Division, Royal Irrigation Department (RID),Bangkok, Thailand
15. Dr. Chawee Wongprasittaporn, Senior Civil Engineer, Royal Irrigation Department, Thailand
16. Ms. Sutara Yindeerod, Senior Professional Level, Land Development Department (LDD), Bangkok, Thailand
17. Mr. Chaiyant Chaitanont , Director, Operational Promotion Division, Bureau of Water Resources Development, Department of Water Resources, Thailand
18. Ms. Panporn Suwan; Senior Civil Engineer, TNMC Secretariat, Department of Water Resources, Thailand

Viet Nam

19. Mr. Le Thanh Bac, Viet Nam Mekong River Committee, Viet Nam
20. Ms. Dang Thi Kim Nhung, Chief of Planning, Division for Central and Central Highlands, Ministry of Agriculture and Rural Development, Institute of Water Resources Planning, Hanoi, Viet Nam
21. Mr. Nghiem Dinh Thanh, Southern Institute for Water Resources Planning (Ho Chi Minh City), Viet Nam
22. Mr. Pham Huy Hoang, Sub Institute for Agricultural Planning and Projection, Ho Chi Minh City, Viet Nam
23. Dr. Hoang Quang Huy, Southern Institute for Water Resources Research, HCM City

Speakers

24. Mr. Masahiko Hiraiwa, JICA Advisor to Ministry of Water Resources and Meteorology, Phnom Penh, Cambodia
25. Dr. Tao Li, Scientist, Crop Modeller, Crop and Environmental Sciences Division, International Rice Research Institute, Los Baños, Philippines

Resource person

26. Dr. Thanapon Piman, Postdoctoral Fellow in Water Resources, University of Canterbury, New Zealand
27. Dr. Harry Nesbitt, Adjunct Professor, Faculty of Agriculture And Natural Sciences, University of Western Australia, Perth Australia

MRC

28. Mr. Prasong Jantakad, Programme Coordinator, Agriculture and Irrigation Programme, Mekong River Commission Secretariat, Phnom Penh, Cambodia
29. Mr. Itaru Minami, Technical Advisor, Agriculture and Irrigation Programme, Mekong River Commission Secretariat, Phnom Penh, Cambodia
30. Mesiya Tikampornteerawong, Junior Riparian Professional, Batch 7, Agriculture and Irrigation Programme
31. Ms. Ornanong Vonnarart, Modelling team, Information and Knowledge Management Programme, Mekong River Commission Secretariat, Phnom Penh, Cambodia
32. Dr. Paul Pavelic. International Water Management Institute, Vientiane, Lao PDR
33. Dr. Hiromasa Hamada, Consultant
34. Mr. Kongmeng Ly, Water Quality Specialist, Environment Programme, Mekong River Commission Secretariat, Vientiane, Lao PDR

Mekong River Commission

www.mrcmekong.org

Office of the Secretariat in Phnom Penh (OSP)
576 National Road, #2, Chak Angre Krom,
P.O. Box 623, Phnom Penh, Cambodia
Tel: (855-23) 425 353.
Fax: (855-23) 425 363

Office of the Secretariat in Vientiane (OSV)
Office of the Chief Executive Officer
184 Fa Ngoum Road,
P.O. Box 6101, Vientiane, Lao PDR
Tel: (856-21) 263 263.
Fax: (856-21) 263 264