The Fourth Regional Workshop on Project to Demonstrate the Multi-functionality of Paddy Fields in the Lower Mekong Basin

Workshop Proceedings

24 August 2007
Vientiane, Lao PDR

Organised by the Mekong River Commission Secretariat
Supported by the Government of Japan

Published in Vientiane, Lao PDR in October 2007 by the Mekong River Commission

Acknowledgements
The Mekong River Commission would like to express its gratitude to the Government of Japan for its support of the Demonstrate the Multi-functionality of Paddy Fields in the Lower Mekong Basin Project and for supporting this workshop

TABLE OF CONTENTS

ANNEXES

REPORT ON FOURTH REGIONAL WORKSHOP

The project to demonstrate the multi-functionality of paddy fields in the Lower Mekong Basin (DMPF)

(24 August 2007, Mekong River Commission Secretariat, Vientiane, Lao PDR)

1 Background

The project to demonstrate the multi-functionality of paddy fields in the Lower Mekong Basin (DMPF) is one project under the Agriculture, Irrigation and Forestry Programme (AIFP) of the Mekong River Commission (MRC). The project has been implemented since 2002 and will be completed by the end of 2007.

The project was funded by the Ministry of Agriculture, Forestry and Fisheries, Japan and implemented by the Mekong River Commission Secretariat (MRCS) in close consultation with the National Mekong Committees (NMCs) and relevant national Line Agencies.

The context of the project was to further understand and quantify the many roles, or functions, that paddy fields performed in the Lower Mekong Basin. As well as the agricultural and productive functions of growing rice, paddy fields also function to assist in flood mitigation, soil conservation, water reuse, water purification, ground water discharge, fish-raising, wild species support and survival, food security, income-generation and other community activities. These functions have far-reaching economic, social, cultural, ecological and environmental benefits.

The initial project aim was to "provide a means by which MRC member countries can measure and improve the multi-functionality of the paddy fields over the Mekong River Basin" for sustainable development with active participation and cooperation of concerned stakeholders from the international community, regional and national level.

During implementation and after facing a number of constraints, the project aim was adapted to achieving a "better understanding of multi-functionality of paddy fields in the Lower Mekong Basin". The immediate objective is "to show visible examples of paddy fields' functions with quantified evaluation".[1]

This fourth and final regional workshop was organised to present and discuss findings of the research projects and summarise the achievements of the project. This report summarises the workshop, which was held in Vientiane at the MRC Secretariat on 24th August 2007. Workshop participants were provided with copies of all presentations prior to the meeting. The final research papers and the GIS database will be distributed at a later date by the MRC Secretariat.

The workshop programme is attached at *Annex 1*.

[1] This agreement was reached at the third project regional workshop in Doson, Haiphong, Viet Nam from 27 28 July 2005.

2 Organisation

2.1 Participants

A total of 27 participants attended the workshop. These included five (5) participants from the Lao PDR, and three (3) participants each from Cambodia, Viet Nam and Thailand. There were three (3) resource persons from Thailand and Viet Nam respectively. There was one (1) diplomat from the Embassy of Japan, and four (4) professional staff and two (2) support staff from the MRC Secretariat.

A list of the participants is given in *Annex 2*.

2.2 Opening Remarks

The Workshop started at 9:00 on Friday 24 August 2007 in the MRC conference room Vientiane, Lao PDR. Proceedings commenced with an opening address by Mr Do Manh Hung, OPD Director of the MRC. This was followed by an address by Mr Yuichi Metoku, second secretary of the Embassy of Japan, Lao PDR.

Mr Hung started by expressing the MRC's appreciation for the support and hard work of the member countries, as well as appreciation for the close cooperation and funding support from the Government of Japan. He hoped that this workshop would contribute toward the establishment a common vision and understanding for paddy agriculture practices with this multiple roles amongst the member countries.

Mr Metoku emphasised both the agricultural and non-agricultural benefits created by irrigation and paddy rice farming, and that the economic criticisms of water costs of paddy farming insufficiently recognised the contributions of the multi-functions of paddy fields. He said that the Government of Japan, along with Korea and other countries, is leading the discussion on the concept of the multi-functionality of paddy fields. He told the meeting that the International Network for Water and Ecosystems in Paddy Fields (INWEPF) was established in 2004 and to promote these issues.

The full speeches by Mr Do Manh Hung and Mr Yuichi Metoku are in *Annex 3*.

2.3 Outlining workshop agenda

Senior Advisor of AIFP, outlined the agenda. He asked that participants introduce themselves and called for any comments on or approval of the agenda.

3 Outlining project objectives and overall progress

The Programme Officer in charge of DMPF delivered a presentation outlining the project objectives and progress.

This was a six-year project, starting in 2002 and finishing in 2007. The original objective was modified due to a range of constraints. Agreement between all four member countries to adapt the project was obtained during the Third Regional Workshop (Haiphong, Viet Nam, August 2005).

As such, some studies were limited to Thailand and Viet Nam where resources and data could be made available.

The original objective was "to provide means by which MRC member countries can measure and improve the multi-functionality of paddy fields over the lower Mekong Basin". The revised main project objective was to "make better understanding of multi-functionality of paddy fields in the Lower Mekong Basin" with an immediate objective of showing visible examples of paddy fields' functions with quantified evaluation.

The main activities conducted since 2002 were (1) data collection, including field survey, measurement and experiment for filling up data gaps, and remote sensing analysis; (2) staff training (3) establishing a GIS database, which included processing and converting the data into digital format; (4) assessment of irrigation water use & rice farming; and (5) analysis of the multiple roles of paddy fields with field survey measurements.

The past research established that paddy fields fulfilled a number of roles or functions, such as: recharging groundwater; stabilising river flow and reuse of irrigation water; food mitigation; soil conservation and erosion control; moderating rural micro-meteorological condition; nurturing aquatic ecosystems; cultural issues such as nurturing traditional culture; and socio-economic benefits. Negative impacts were also found and these included methane gas emission and chemical fertiliser use. Among those, the DMPF selected four specific functions to analyse, which are (1) flood mitigation, (2) soil conservation, (3) nurturing aquatic eco-systems and (4) socio-economic benefits.

The major conclusions of the project were:

- The database under GIS format should be continuously updated and maintained for future use.
- Multiple roles of paddy fields were evaluated with quantified evaluation.
- Based on the results of some analysis of paddy field functions, the project could enhance public awareness of the linkage between paddy field and environment.

The detailed summary of project activities and outcomes are outlined in the presentation in *Annex 4.*

Discussion

MRCS agreed with the proposal from the delegates of Lao PDR, that the MRCS will (1) circulate the final report on project findings to all member countries and (2) share the GIS dataset with all member countries and relevant line ministries. MRCS explained that the original data collection completed by four countries during the first phase of the project and that dataset is now stored in a database in Geographical Information System (GIS) format. This GIS could be used as a reference in each country for land use and irrigation use analysis in each country. As a technical note, it is recommended to each country that they must continually maintain and update the dataset for it to be a useful analytical tool.

A delegate from Viet Nam recommended to the MRC that they organise detailed follow-on studies across the four member countries. He believed the outputs could be used to increase the public awareness of the importance of paddy fields.

Viet Nam also noted that because of six-year project timeline, the characteristics of the land being studied changed a lot during the research period. Secondly, an assessment to calculate irrigation use was very complicated. The techniques to calculate this should be shared with each member country.

4 Presentations and discussions

4.1 Flood mitigation

4.1.1 Flood mitigation in north-eastern Thailand

The study "Flood Mitigation Functions of Paddy Fields in north-eastern Thailand" was presented by Dr Somsak Sukjan, from Khon Kaen University, Thailand. The project background is that land use is changing in many towns and cities, with paddy fields being filled in for domestic and commercial land use. The impact is that flash-flooding of these towns and cities are more likely to occur on an annual basis.

The specific objectives of this research included calculating the current capacity of paddy fields to store water by use of a GIS tool; calculating the areas at risk of flash flooding by analysis of past rainfall data; predicting the future conversion of paddy fields into other land use through scenario analysis; identifying the change of flood risk areas by abolition of paddy fields; and identifying the influence of paddy field abolition to expansion of flood risk.

The conclusions of the research are that when land use rapidly changes from paddy fields to urban areas, cities need to plan city drainage systems carefully. If this is not done properly, flash flooding can happen regularly if there is heavy rain (more than 100 mm). Many cities with low altitude should pay attention to the role paddy fields play in flood mitigation. Proper land use planning to keep paddy fields may be more cost effective in flood mitigation than other means such as building dykes or ring roads as dams for flood prevention.

4.1.2 Flood mitigation in Mekong Delta Viet Nam

The study "Analysing the Functional Role of Paddy Fields on Flood Mitigation in the Mekong Delta Viet Nam" was presented by Dr Nguyen Ngoc Anh, from the Southern-Institute of Water Resources Planning, Viet Nam.

Results of the study show strong effects of the paddy fields on flood mitigation, especially on storage, regulation and sediment accumulation. Further, Dr Anh reports that not only do paddy fields function to store flood water and assist sediment accumulation, but they also have capacity for a number of other functions, or factors. The researchers recommend larger and deeper studies to assess all these factors as variations of flood flow and sediment transportation in the Mekong Delta is complicated.

Flooding in the Mekong Delta causes much damage, but also brings many advantages. Mitigation of damages and taking full advantage of floods form both sides of the flood management process. The concept and direction of "Living with floods" would help local people approach flood management more effectively.

4.1.3 Discussions on flood mitigation role of paddy fields

Viet Nam praised the two interesting presentations on paddy fields, noting that the research sites were complicated, and while there were differences between upstream areas (north-eastern Thailand) and downstream areas (Viet Nam Delta), particularly with regard to salinity and sediment levels, paddy fields had a useful function for mitigating floods in both areas.

As Dr Somsak clarified in response to a question from Viet Nam, in the Thai research it was shown that the paddy can store 25% of water if the rainfall is 100m. Viet Nam made the point that based on this finding of 25%; you can calculate the actual impact on the city. A

quantifiable figure is a beneficial way to promote practical awareness and help to make the science understandable.

Viet Nam said it was a pity that more models could not be explored and researched during this project; especially ones enable a more detailed analysis. The response from MRCS was that because the project had time constraints and budget limitations, the intention was only to explore some examples and provide practical lessons, not do a comprehensive study of all functions and models.

4.2 Nurturing aquatic eco-systems

4.2.1 Nurturing aquatic eco-systems in north-eastern Thailand

Dr A. Terry Rambo from Khon Kaen University, Thailand, presented the study "The Role of Paddy Fields in Nurturing Aquatic Ecosystems and maintaining Agro-system Biodiversity in Northeast Thailand".[2]

There were four objectives of the study: (1) to inventory all useful wild species that rural households obtain from different rural ecosystems, including paddy fields; (2) to record the quantities of useful wild species collected by villagers; (3) to estimate the value of useful wild species collected from different types of rural ecosystems, including paddy fields and (4) to assess the contribution of irrigated fields in comparison to rain-fed paddy fields to preserving biodiversity.

The research found that there were 94 wild species collected by villagers – 40 species were found in rain-fed paddy and 54 species in irrigated paddy fields. Of these 96 species, there were 38 plants, four fungi and 54 animals. 19 species were sold at market, with the remaining 75 species rest being eaten or used within the household.

With regard to the economic value of these species, it was found that on rain-fed paddy villagers were able to collect species worth $70 annually. On irrigated paddy, it was worth $199 annually. In all, this represented 15% of total household income, so provided a significant contribution to overall rural livelihoods.

There were four major conclusions from this research:

- Paddy fields in Northeastern Thailand are multifunctional. In addition to producing rice, the paddy fields are the habitat for valuable wild species. These wild species contribute to the food security of rural households. They are also an important source of cash income for rural households.
- Paddy fields are the habitat for more than 70% of the 96 useful wild species collected by villagers.
- Irrigated paddy fields support a higher biodiversity of useful wild species than rain-fed paddy fields. This probably reflects the greater sufficiency of water in irrigated paddy fields.
- Any reduction in the area of paddy fields resulting from changes in rural land use patterns will have important consequences for rural biodiversity in Northeastern Thailand.

[2] Paper by Yuko SHIRAI, A. Terry RAMBO, and Suwit LAOHASIRIWONG. Dr Rambo presented the research findings on behalf of Ms Yuko Shirai who was not able to be present. Ms Shirai did the field research as part of her Masters degree at Khon Kaen University.

4.2.2 Nurturing aquatic systems in Mekong Delta Viet Nam

Mr Vu Ngoc Ut from Cantho University (Viet Nam) conducted the following research: "Analysing the Functional Role of Paddy Fields on nurturing and restoring the aquatic ecosystems in Mekong Delta Viet Nam." Dr Ut was unable to attend the meeting and Dr Le Van Khoa presented the paper on his behalf.

The objectives of the research were to investigate and make clear the functional role that the paddy field performed on nurturing and restoring the aquatic ecosystem. The research was done through an analysis of data on the nutrient load trapped in the paddy fields, including an analysis of its purification capacity. The role of the paddy field to nurture wild aquatic species, such as fish, was also explored. The specific tasks were to (1) review existing aquatic ecosystems in the paddy field in the Mekong Delta of Viet Nam; (2) assess the purification function of paddy fields; (3) assess the nurturing function of paddy fields; (4) propose and recommend models for the integration of land use between aquaculture and paddy cultivation for nurturing and recovering the aquatic ecosystems in the Mekong Delta.

Most of the farmers in these areas aware of the importance of paddies in nurturing fish and the role of fish in the paddies as predators and controller of pests. Controlling pests was also done through pesticide use. 80% of interviewed farmers used pesticides in which 53.8% used highly toxic pesticides. However, more than 56% of farmers reported no mass mortality of fish when they applied pesticides to their paddy fields. Solutions for protecting fisheries resource included limiting pesticide use, regulating over-fishing and fish-sizes and stocking fish in the paddies.

The research also found that rice cultivation played an important role on fish abundance in the paddies. In 64% of households has higher fish yields were when rice present in the paddy field.

The main findings of the research were:

- Paddy fields perform a nurturing function: they are the 'cradle' of fish, as well as a variety of aquatic organisms that are the natural food supply for these fish.
- Paddy fields are the main income source for families to improve their livelihoods. The dual function of rice and fish assists in better livelihoods.
- Restoring the function of paddy fields: purification of nutrients to reduce eutrophication[3] (depletion of oxygen in water) and pollution.

There were two major recommendations:

- If there is an application of integrated culture system in the paddies, this leads
  (1) increased income for farmers, and
  (2) mutual benefits between rice and fish in the paddies
- Further study on purification feasibility of paddies on waste treatment from catfish ponds is needed.

[3] When a body of water (e.g. paddy fields) becomes rich in dissolved nutrients, the oxygen is depleted in the water. This encourages the growth and decomposition of oxygen-depleting plant life and results in harm to other organisms.

4.2.3 Discussion on nurturing aquatic eco-systems

There was discussion and clarification from the Thai study about the income generation from collection of wild species. There was a notable difference between rain-fed and irrigated paddy fields: income from irrigated fields was 2.5 times higher. $199 was the average value of all wild species that they collected, regardless of source.

The Vietnamese team asked why the total species list seemed rather low, in comparison to other environments. The response was that the methodology was household survey (that is, surveying householders as to what species they find and use) rather than a comprehensive bio-diversity survey of all species that exist in the field sites.

A difference between the use of pesticides and fertilisers in both Viet Nam and Thailand was noted. Dr Rambo replied that Thai paddy fields are less affected because usage rates of pesticides and fertilisers are much lower in north-eastern Thailand than in Viet Nam. Rain-fed fields in Thailand use almost no pesticides because the field economics do not provide for such usage.

Cambodia asked a question about the Viet Nam research, as to whether there were estimates for income that included other activities, such as rice production and whether nutrient levels affected this. Dr Le Van Khoa replied that it was not ideal to grow rice continuously as this would cause problems. He recommended that it was best to apply an integrated land use analysis as a basis of the assessment, as it was necessary to look at total income: rice + fish + other activities.

There was a discussion from Viet Nam about the application of integrated land use as a basis for evaluation: how and when should this be applied? MRCS stated that the expectation was the study would be used in relation to the land use planning process in each country.

4.3 Soil conservation

4.3.1 Soil conservation issues in the Mekong Delta Viet Nam

Dr Le Van Khoa from Cantho University presented a research paper: "Analysing Functional role of Paddy Fields Related to Soil Productivity and Soil Conservation."

In the Mekong Delta area of Viet Nam, the agricultural practice is such that there is a high speed of soil rotation and mono-agriculture, often three crops per year. This leads to a situation where rice yield tends to be stable in the first instance, but where crop yields progressively decline and where response of soils to fertilisers becomes low.

There are two main soil types in the area (1) "Non-problem" soils, which are recent alluvial soils and where intensive rice cultivation is practised and (2) "Problem" soils, of which the main type are acid sulphate soils.

The research methodology included field soil sampling and measurement. Land where different cropping techniques had been applied was tested (2 rice crops per year, 2 rice crops + 1 alternate crop, 3 rice crops, etc).

There were the following findings from the research:

- On *non-problem* soils, paddy fields where farmers have three rice crops per year (intensive cultivation) will gradually reduce the soil productivity, based on declining physical soil fertility;
- On the problem soils (acid sulphate soils) paddy fields will effectively improve soil productivity and chemical soil fertility. This is because the pH becomes soluble and exchanges, and the aluminium content is reduced by cultivation activities.
- Alternative land use is the best solution for soil conservation and sustainable agricultural production in the Mekong Delta in Viet Nam in the areas that have non-problem soils. Crops, such as soybean, which can be selected as cash crops should be alternated with rice cultivation;
- Wise use of the land should be considered versus rice or other land uses in areas with the problem soils, specially acid sulphate soils;
- Deep soil tillage with proper tractors in the suitable soil condition should be done;
- It is advised to apply organic and compound fertilisers in areas with non-problem soils, rather than chemical fertilisers.

Recommendations

- Pre-conditions for quantitative land evaluation and alternative cash crops are:
    - agricultural development strategy of the national government
    - market requirements
    - technical/scientific level of local farmers
    - no influence to the main rice cropping in the area

4.3.2 Discussion on soil conservation

Viet Nam asked why, if farmers continue to cultivate with three rice crops per year with the qualities of the soil being depleted, did the study compare soils from areas where they have only one or two crops per year? Dr Khoa answered that within the purpose of the study it was difficult to convince the people to only plant one or two crops, as they perceived this had a negative impact on their income.

Thailand asked if the research sites had sandy soil and whether it had been compacted. There are six measures of soil distribution in Mekong delta, but the study only selected two measures of soil. There was further discussion about compacting soils.

There was a technical discussion generated from the Cambodian delegation about strategies to reduce acid sulphate in soils. Given that there are 1.5 million hectares of acid soils in the region, did the research determine strategies to manage this when growing rice? The answer summarised that the practical methods to manage an acid sulphate soils to be capable to grow rice are: water table control; leaching; suitable for plant crops and soil conditioning (provide CaCo3).

4.4 Socio-economic issues

4.4.1 Socio-economic issues in north-eastern Thailand

Dr Suwit Laohasiriwong from Khon Kaen University presented the following paper: "The Function of Paddy Fields in Buffering the Income of Farm Households against Environmental Risks [4].

There were four objectives to this research:

1. To record the number of different kinds of the income-generating activities engaged in by households with only irrigated paddy fields and only rain-fed paddy fields.
2. To measure the share of their total income that irrigated and rain-fed households gain from each source of income (including paddy fields).
3. To measure the share of their total time that households spend in gaining income from each source (including paddy fields).
4. To measure the share of their total time that irrigated and rain-fed households spend in each type of income generating activity.

The activities for all household members were recorded on a daily basis by the heads of the households using standardised record-keeping sheets. The data was collected during 30 days in the rainy season and 30 days in the dry season. The main crops in the research site were rice, cassava, sugarcane and peanuts.

The major quantified outcome of the study was that irrigated paddy fields help stabilise rural livelihoods and maintain agricultural employment in the countryside. This was supported by the specific study conclusions, as follows:

1. Paddy fields play a very important role in the economic life of both rain-fed and irrigated households in Northeastern Thailand.
2. On average, irrigated households engage in a larger number of income-generating activities than do rain-fed households with comparable sized land-holdings.
3. Households with smaller areas of land, regardless of whether they own rain-fed or irrigated paddy fields, engage in fewer income-generating activities than households with larger landholdings.
4. Irrigated households obtain more of their income from agricultural activities than rain-fed households.
5. Rain-fed households are more dependent on non-farm and off-farm activities than the irrigated households (sources of income: off-farm, home, pond, forest, garden, upland, paddy).

4.1.2 Socio-economic issues in Mekong Delta Viet Nam

Dr Nguyen Duy Can from Cantho University, Viet Nam, presented his research paper on: "Analysis of the Functional Role of Paddy Fields in Focusing on Assessing the Income of Farm Households and Employment Generation of Farmers."

The context of this research is that despite rice cultivation shaping the economies of millions of farmers as well as being at the centre of family life and culture, the socio-economic aspects of rice paddies is not well understood. Using participatory methodologies, the study analysed

[4] Paper by Suwit Laohasiriwong and A. Terry Rambo, with the assistance of Phoolpatra Penchome.

income and employment indicators of farm households, and assessed the socio-economic effects of existing paddy production systems.

During the community-based research, it was determined that farmers perceived paddy fields as fulfilling many functions in their households: providing food (food security), income-generation, employment generation, property of household, and heritage from ancestor. Other perceptions and beliefs included:

- The paddy field is home (field and home together)
- Paddy farming is a starting point of the life
- Rice is "precious grain" given by Heaven
- Paddy fields have a landscape value
- As a whole, "paddy fields are life"

The findings of the study are summarised below:

- Paddy fields have contributed to an increase in income of farm households, from US$1187 to US$2312 per household per year.
- Paddy fields have contributed to the employment generation of farm households.
- Paddy fields have contributed to economic development, food security and export in the Mekong Delta region.
- Paddy fields also functioned as playing a crucial role in the rural peoples' life.

4.4.3 Socio-economic issues discussion

Dr Rambo from Thailand asked for clarification about the Viet Nam study: in the "Function in Employment Generation" slide, as non-paddy crops were included in the classification, however they were not included in the reports for Site 4. Perhaps another separate row of "non-paddy agriculture" needed to be added on the table. The answer was that the researchers tried to include the non-paddy (non-crop) to compare with paddy field (mono-rice, and 2 rice crop, 3 rice crop). However, in the comparison of labour, the non-paddy crop yield was very different so they didn't include it in the labour slide.

Viet Nam discussed the issue of cross-sectoral comparison, where paddy land use could be compared to industrial or tourism land use. Was there a demonstrated cost-benefit and benefit-loss analysis to be used as an advocacy tool? More comprehensive studies and evaluation on functions of paddy fields were needed on this issue. MRCS said that Korea and Japan have researched these topics and the results were presented at INWEPF.

Viet Nam also asked about income generation in the Thai report. It was clarified by Dr Suwit that income from farm and non-farm activities were reported as a percentage, not currency, as they were interested in providing a comparative tool. Further, he clarified the definition of 'environmental' in the title of the report: they were interested only in role of paddy fields in terms of risks that come from whether the farmers can do cropping in the paddy field or not. So it was the narrower sense of "environmental", rather than the wider one.

The Thai team clarified two questions from the Lao delegation: the research was done by household record-keeping, with the householder recording daily activity, as well as how much income is generated and (2) cassava and sugarcane were upland crops, but lotus farming was not an upland crop as this was only found in central areas in Thailand.

The discussion concluded that irrigated paddy fields have stabilised rural livelihoods at the same time as acknowledging that livelihoods consisted of more than just paddy fields, incorporating farm and non-farm sources of livelihood.

4.5 Summarising workshop discussions

MRCS provided a summary list of points that were discussed in the question and answer sessions after each set of presentations. These points are documented in the relevant discussion sections in this report, above.

5 Wrap-up of DMPF activities

MRCS summarised the project achievements:

- The DMPF project has achieved its objective after a six-year implementation period, overcoming a number of constraints and unforeseen issues. The project will be completed with final reporting by the end of 2007.
- A series of reports have been completed and submitted; in order these are the progress reports for year 2002, 2003, 2004; the study report to estimate irrigation water use in the Basin; and the various study reports on the multiple roles of the paddy fields in North-eastern Thailand and Mekong Delta Viet Nam that were presented during this meeting. These study reports are important and are the key outputs of the DMPF project.
- The visible examples of the functions of paddy fields, based on quantified research evaluation presented in this workshop, can provide people and agencies with a better understanding of paddy fields in terms of their multiple roles.
- Almost all activities of DMPF have been completed except the final report. Compilation of this report will start in September 2007 and is expected to be ready for submission to the donor by the end of 2007.

MRCS told participants the Programme Officer in charge of DMPF was leaving MRCS at the end of August, and a short-term consultant would be hired to complete of the final project report. As this is the final workshop to close DMPF activities, he took the opportunity to thank all participants for close cooperation and valuable contributions to the DMPF project.

6 Concluding remarks

The workshop invited concluding comments from the participants.

Viet Nam said that this project was very important as rice was the most important crop in the Mekong River Basin. The many and different functions, or roles, of the paddy fields should be better understood. The outputs of this project must be “promulgated to the people” to be recognised and included in policy, practice and decision-making. This project should not “become a book on the shelf”. MRC was encouraged to seek more funds for the further study on this subject, and to also find some ways to organise training or information-dissemination to convey the findings of this research work to the relevant organisations and people.

Viet Nam presented two concrete proposals to further this point: (1) all research should be translated into the languages of the member countries, and (2) there is a need for an out-reach communication strategy, as this information needs to be disseminated to the lower levels such as extension officers and farmers.

MRCS responded by confirming that, in terms of output, MRCS will distribute the reports and GIS dataset to all member countries, and the reports will also be posted to the MRC website. With regards to further disseminate, there is an opportunity to present the report at the INWEPF Conference in Bali.

With regard to translation of reports and materials into national languages, it was confirmed that there was no project budget for translation. MRCS would expect member countries to take this responsibility.

Mr Do Manh Hung of the MRC provided the concluding remarks to the workshop. He stated that he hoped the outcome would provide useful information for each of the member countries.

He agreed that all participants should continue demonstrating and communicating the benefits found during the project. He said MRC would try its best to seek more funding to continue this work, but for now the project had to close.

Mr Hung thanked all members of the project for their active participation, and thanked MRC staff for the preparation and arrangement of this fourth and final workshop.

The workshop finished at 16:00 on Friday 24 August 2007.

ANNEXES

Annex 1: Workshop programme

Fourth Regional Workshop:
The programme to Demonstrate the Multi-functionality of paddy fields in the Lower Mekong Basin

Workshop Programme

Workshop date: 24 August 2007

Time	Theme
08:30-09:00	**Registration**
09:00-09:10	**Opening Remark** Mr Do Manh Hung (Director, Operations Division, MRCS)
09:10-09:20	**Remark** Mr Yuichi Metoku (Embassy of Japan)
09:20-09:30	**Outlining Workshop Agenda** Mr Hiroshi Okudaira (AIFP Senior Advisor, MRCS)
09:30-09:40	**Introduction of Participants**
09:40-10:00	**1. Outlining of the project objectives and overall progress** Mr Cao Tuan Minh (Programme Officer AIFP, MRCS)
10:00-10:20	**Coffee break**
	Analysis results of multiple roles of paddy fields
10:20-10:40	**2. Flood mitigation in Northeastern Thailand** Mr Somsak Sukjan – Khon Kaen University
10:40-11:00	**3. Flood mitigation in Mekong delta Viet Nam** MSc. Nguyen Ngoc Anh – Southern Institute for Water Resources Planing Viet Nam
11:00-11:20	**Q&A on flood mitigation function facilitated by Mr Okudaira**
11:20-11:40	**4. Nurturing aquatic ecosystems in Northeastern Thailand** Dr Terry A Rambo - Khon Kaen University
11:40-12:00	**5. Nurturing aquatic ecosystems in Mekong delta Viet Nam** Dr Le Van Khoa - Cantho University
12:00-12:20	**Q&A on the nurturing aquatic ecosystems function** facilitated by Mr Okudaira
12:20-13:30	**Lunch at MRC courtyard**
	Analysis results of multiple roles of paddy fields (continue)
13:30-13:50	**6. Soil conservation issues in Mekong delta Viet Nam** Dr Le Van Khoa - Cantho University
13:50-14:10	**Q&A on the Soil conservation function** facilitated by Mr Okudaira
14:10-14:30	**7. Socio-economic issues in Northeastern Thailand** Dr Suwit Laohasiriwong - Khon Kaen University
14:30-14:50	**8. Socio-economic issues in Mekong delta Viet Nam** Dr Nguyen Duy Can – Cantho University
14:50-15:10	**Q&A on the Socio-economic function** facilitated by Mr Okudaira
15:10-15:30	**Coffee break**
15:30-16:20	**Summarizing workshop discussions** **Wrap-up of whole DMPF activities** facilitated by Mr Minh
16:20-16:30	**Concluding Remark** by Mr Do Manh Hung

Annex 2: List and pictures of workshop participants

The 4th Regional Workshop
Programme to Demonstrate the Multi-Functionality of Paddy Fields in the Lower the Mekong River Basin (DMPF)
24 August 2007, Vientiane, Lao PDR

LIST OF PARTICIPANTS

Cambodia

1.	Dr Theng Tara	Director of Water Resources Management and Conservation, MOWRAM and Focal Point of IIEPF
2.	Mr Cheang Hong	Chief of Office of Water Resources Management
3.	Mr Sok Khom	National AIFP Coordinator, CNMC

Lao PDR

4.	Mr Sourasay Phoumavong	Deputy Director of LNMC
5.	Mr Chanthaboun Sonethavy	Technical Division, Department of Irrigation, MAF
6.	Mr Khamtanh Thadavong	Chief of Planning Division, Department of Agriculture, MAF
7.	Mr Pheng Sengxua	Land Classification Center, NAFRI/MAF
8.	Mr Phonepaseuth Phouliphanh	National AIFP Coordinator, LNMC

Thailand

9.	MrBurachat Buasuwan	Department of Water Resources
10.	Mr Satit Sueprasertsuk	Department of Water Resources
11.	Mr Kanchadin Srapratoom	Royal Irrigation Department

Viet Nam

12.	Dr Dao Trong Tu	Deputy Secretary General, VNMC
13.	Ms Nguyen Hong Phuong	National AIFP Coordinator, VNMC
14.	Ms Vo Thi Be Nam	Sub Institute for Agricultural Planning and Projection, Ho Chi Minh City

Resource Persons

15.	Dr Le Van Khoa	National Consultant, Can Tho University
16.	Dr Nguyen Duy Can	National Consultant, Can Tho University
17.	Mr Nguyen Ngoc Anh	National Consultant, Southern Institute for Water Resources Planning, Ho Chi Minh City
18.	Dr Suwit Laohasiriwong	President, Nakhon Phanom University, Thailand
19.	Prof. Terry A. Rambo	Visiting Professor, Program on System Approaches in Agriculture, Khon Kaen University, Thailand
20.	Mr Somsak Sukjan	Land Development Office Region 4, Khon Kaen University, Thailand

Donor Representative

21.	Mr Yuichi Metoku	Second Secretary, Embassy of Japan

MRC Secretariat

22.	Mr Do Manh Hung	Director, OPD/OIC, MRCS
23.	Mr Okudraira Hiroshi	Senior Advisor, AIFP
24.	Mr Cao Tuan Minh	Programme Officer, DMPF/AIFP
25.	Mr Fongsamuth Phenphaengsy	Programme Officer, AIFP
26.	Ms Louise Sampson	Editorial Assistance for DMPF workshop
27.	Ms Aksone Phaniphong	Secretary, AIPF

Director Do Manh Hung and Mr. Yuichi Metoku

Resources Persons

Lao Participants

Cambodian Participants

Vietnamese Participants

Thai Participants

Annex 3: Opening remarks

Opening Address by Mr Do Manh Hung
Director Operations Division, Mekong River Commission Secretariat

The 4th Regional Workshop on Programme to Demonstrate the Multi-Functionality of Paddy Fields over the Mekong River Basin (DMPF)
on 24 August 2007
MRC Secretariat, Vientiane, Lao PDR

Mr Yuichi Metoku, Second Secretary, Embassy of Japan in the Lao PDR,
Distinguished participants,
Ladies and Gentlemen,

On behalf of the Mekong River Commission Secretariat, I would like to extend a warm welcome to all of you to the fourth Regional Workshop of the Programme to Demonstrate Multi-Functionality of Paddy Fields over the Mekong River Basin (DMPF).

On this occasion, I would like to express our high appreciation on the close cooperation and fund support from the Ministry of Agriculture, Forestry and Fisheries, Government of Japan to this project.

The LMB is located in the tropical monsoon and has been historically, developed based mainly on rice cultivation however except productive function, paddy fields may have some other unique functions, such as flood mitigation, soil conservation, water reuse, ground water discharge, water purification, socio- economic function, etc. In order to achieve the sustainable development in LMB, consideration of these kind of additional functions of the paddy fields is also essential.

Being one of the Sub-components of the Agriculture, Irrigation and Forestry Programme (AIFP) of the Mekong River Commission the DMPF project has been commenced with its original aim to "provide a means by which MRC member countries can measure and improve the multi-functionality of the paddy fields over the MRB" for sustainable development with active participation and cooperation of concerned stakeholders from the international community, regional and national level and has now slightly changed direction and is focusing on "making better understanding of Muti-functionality of paddy fields in the Lower Mekong Basin". The project has been implemented since 2002 and is being completed by the end of 2007.

Most of the activities of DMPF in the first year to second year were to set up a feasible executing structure for data collection in MRC's member countries then data collection activities were conducted by member countries. Based on the collected data basin wide and at experiment fields, the data set in GIS format has been set up.

Third and fourth year was focus on the two main activities: i) the estimation of Irrigation Water Use in the Lower Mekong Basin activities was conducted in order to evaluate the irrigation water use and has prepared basic information on rice farming and agriculture water use in the LMB. and ii) An analysis of multiple roles of paddy fields was also conducted in at upstream and downstream area of the lower Mekong basin I mean Thailand and Viet Nam respectively.
As you may know well, the mechanism of the paddy fields multiple roles is quite complicated, to carry out detail study and investigation for explication with quantitative analysis requires

long time. That's why we have compromised and aimed to show some visible examples of paddy fields' functions to demonstrate the multi-functionality of the paddy fields, we believe it is practical solution under limited budget and time. In spite of constrains above mentioned the analysis of paddy fields' function has been completed by two researches on "the multi-functional roles of paddy fields in north-eastern Thailand" and that of Mekong delta Viet Nam.

Participants,
Ladies and Gentlemen,

This is a final workshop of the project to sum up the DMPF project and present the results of researches on paddy fields' functions. The workshop also provides the opportunity to participants to share their point of view on the multi-functionality of paddy fields to natural environmental conservation and sustainable rural/agricultural development.

The DMPF project is one of the important activities of the Agriculture, Irrigation and Forestry Programme (AIFP) of MRC. Achievement of DMPF will benefit to local people, scientists and managers of relevant agencies to manage the impact from rice growing. The outputs will provide useful information for member countries both directly through better data for planning purposes and indirectly through enhanced MRC capacity. Results of research under DMPF have shown that paddy fields contribute to increase income of farmers with natural environmental conservation, maintaining ecosystem of aquatic life and soil conservation.

I hope that this workshop will contribute toward the establishment a common vision and understanding for Paddy Agriculture Practices with its multiple roles amongst the member countries.

I would like to thank the MRC's member countries for their cooperation and supporting to the project. Once again, I would like to express my sincere thanks and gratitude to the Government of Japan for continuous assistance and support, extended to our organization. We would like to give special thanks to the Embassy of Japan here in Lao PDR for their steady support and paying much attention to MRC's activities.

Finally, no workshop would be a success without well-prepared, committed and knowledgeable speakers and participants. I would encourage and appreciate all of you active involvement.

On behalf of the Secretariat, I wish you an impressive and successful workshop.

Thank you for your attention.

Speech by Mr Yuichi Metoku,
Second Secretary, Embassy of Japan in the Lao PDR

The 4th Regional Workshop on Programme to Demonstrate the Multi-Functionality of Paddy Fields over the Mekong River Basin (DMPF)
on 24 August 2007
MRC Secretariat, Vientiane, Lao PDR

Mr Do Manh Hung, OIC of MRC Secretariat
Representatives of the MRC member countries,
Ladies and Gentlemen,

It is my pleasure to participate in the fourth regional workshop of the DMPF (Demonstration of Multi-functionality of Paddy Fields) project to wrap-up the project activity. As this project is funded by the Ministry of Agriculture, Forestry and Fisheries, Japan, in this opportunity, I would like to deliver a few words of our appreciation on behalf of the Government of Japan.

Needless to say, agriculture is one of the biggest industries in this region. Agricultural production occupies nearly half of GDP in Laos and Cambodia and also occupies a big portion of export in Thailand and Viet Nam. Among agriculture, especially rice farming which supplies staple food production, is the most important, because it contributes farmers' economy, and stabilize rural society and so on.

Even though importance of rice farming is widely recognized, it is frequently criticized its economical ineffectiveness in terms of water consumption. As paddy fields require big amount of water in order to keep inundated the fields for land preparation and for other growing stages, it is wrongly recognized that rice farming consumes huge amount of water.

However various researches are revealing that most of diverted water is not simply consumed but returns to the river downstream, recharges groundwater through percolation. Further inundation creates a kind of artificial wetland and contributes to foster aquatic species. Recently researches have proved that rice farming and paddy fields have such non-productive functions and make good impact on environment. And this is called multiple roles or multi-functionality of irrigation or paddy fields.

Within the trend of globalization and acceleration of boarder free trade context, protectionism of trade is sometimes blamed or denied. I do not simply support to protect domestic agriculture. I also fully recognize merits of global trading on national level economy and on benefit to individuals. However some non-agricultural benefits created from irrigation and rice farming cannot be traded beyond the border or even within one country. Agricultural activities should not be discussed only in terms of economical efficiency. It should be taken into account of multiple functions at the same time.

With this background, Government of Japan, together with Korea and some other countries, is now leading the discussion to disseminate the concept of multi-functionality. In this context INWEPF – International Network for Water and Ecosystem in Paddy Fields – was established in 2004 and is actively working on.

In parallel with this movement, the MAFF Japan contributed trust fund to MRC focusing on paddy fields' multi-functionality. That is for this DMPF project. After five years of intensive effort by the Secretariat, National Mekong Committees and their line agencies, the DMPF project has completed its planned activities and hails the day to wrap up the project.

Here I would express my sincere appreciation to all the persons involved in and may wish all of you to deepen understanding and to become supporters of multi-functionality. I may wish you had fruitful outcome through today's workshop.

Thank you very much for your attention.

Annex 4: Summary of project activities and outcomes

1

Project to Demontrate Multi-Functionality of Paddy fields (DMPF)

Outline of project objectives and overall progress

By Cao Tuan Minh
OPD, MRCS

Project Summary

- **Project name: Project to Demonstration of multi-functionality of paddy field over the Mekong river basin (DMPF).**
- **Funded agency: Japan Government (through MAFF)**
- **Project Cost : US$1,227,000**
- **Project Duration: 6 Years (2002-2007)**
- **Current Status: Being ended by the end of 2007**

Project direction change

Original objective

- " To provide means by which MRC member countries can measure and improve the multi-functionality of paddy fields over the LMB".

Project has been delayed due to

- Unforeseen reasons in terms of weather changes, SARS disease, late submission of data collection, coordination between MRC and member countries, etc.

Discussion at 3rd workshop

- How to deal with huge work within a limited time? changing direction of DMPF was proposed and decided.

Current Project Objectives

Overall objective:

- **To make better understanding of Muti-functionality of paddy fields in the Lower Mekong Basin.**

Immediate objective:

- **To show visible examples of paddy fields' functions with quantified evaluation**

Main activities conducted

- Data collection (field survey, measurement and experiment for filling up data gaps, Remote sensing analysis).
- Training/workshop.
- Establishing of GIS database (incl.processing and converting data into digital format).
- Assessment of irrigation water use & rice farming.
- Analysis of the multiple roles of paddy fields.

Data collection

Basin-wide data

- **Irrigation;** (updating irrigation dataset, especially on water use)
- **Land use;** (digital land use map focused on paddy fields)
- **Rice crop;** (rice production, rice eco-system, cropping pattern, etc.)

On-farm data (8 experimental fields)

- **Background information on the experimental field** (land use, infrastructure, rice production, farmers' activities, etc.)
- **Water and other conditions** (water inflow, outflow, rainfall, evapo-transpiration, percolation, water quality, etc.)

Main results

Practical Training for Field Measurement

- Conducted on 7-9 October 2003, in Cambodia (Collaborated with JICA project)
- For measurement technique of evapo-transpiration and percolation in paddy field.

Regional Workshop of DMPF

- 1st - Conducted on 7-9 June 2003, in Cambodia
- 2nd - Conducted on 11-12 May 2004, in Thailand.
- 3rd - Conducted on 27-28 July 2005, in Vietnam.

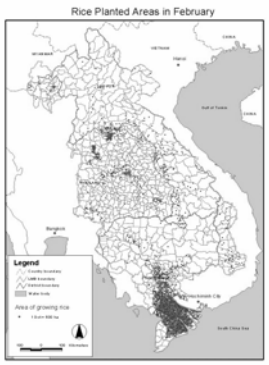
Main results

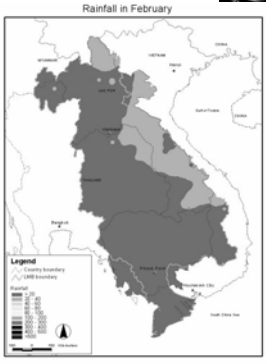
The GIS Database

- Paddy rice farming database (updated)
- Monthly rice growing areas (created)
- Monthly rice growing areas (updated)
- Fertilizer use mapped
- Generate rainfall mapped
- Updated Land use map
- Update paddy rice farming with land use mapped

Main results

Rice planted area





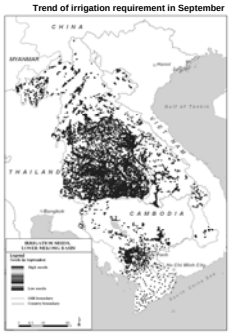
Assessment of irrigation water use

- Output-	Water use scheme by scheme
River Recharge	Empirical values from the countries
Efficiency Factors	Estimate by soil types, irrigation level, scheme type, maintenance level
Water Use Factors	Estimate Water Use from requirement
Ponding + Preparation	from Experimental sites data
Infiltration	Soil type database checked by sites
Rainfall	Effective rainfall from past studies
Evapotranspiration	ET from climate stations
Crop Schedule	19 standard patterns estimated
Rice Crop Areas	Spatial database & Statistic data

Main results

Assessment of irrigation water use

Trend of irrigation requirement in September



Trend of irrigation requirement in March

Main results

Assessment of irrigation water use

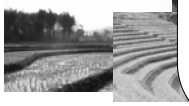
Annual water use (billion m^3)	
Cambodia	2.7
Laos	3.0
NE Thailand	9.4
Vietnam Delta	26.3
Vietnam Highlands	0.5
LMB total	**41.8**

Analysis of the multiple roles of Paddy fields in LMB

Multi-functionality of paddy fields

Selection of paddy fields' functions

- Multiple roles of paddy fields
- Selected function to analyze
  - Flood mitigation
  - Soil conservation
  - Nurturing aquatic ecosyster
  - Socio-economic



- Recharging groundwater
- Stabilizing river flow and reuse of irrigation water
- Food mitigation
- Soil conservation and erosion control
- Moderate rural micro-meteorological condition
- Nurturing aquatic ecosystems
- Cultural issues such as nurturing traditional culture
- Socio-economic
- Negative impact such as methane gas emission or chemical fertilizer
- And so on

Multi-functionality of paddy fields

Two research packages under DMPF

- **Thailand (Northeastern)**
  - Analyzed functions (3)
  - Location (Roi-Et & Khon Kaen)
- **Vietnam (Mekong delta)**
  - Analyzed functions (4)
  - Location (Dong Thap Tien Giang, Can Tho & Soc Trang)

Analysis of paddy fields' functions

- 1-Flood mitigation function (Roi-Et -Thailand)
- 2-Flood mitigation function (Dong Thap -VN)
- 3-Nurturing aquatic ecosystems and maintaining agro ecosystem biodiversity function (Thailand).
- 4-The Nurturing and restoring the aquatic ecosystems function (Can Tho,Soc Trang -VN)
- 5- Soil productivity and conservation function (Dong Thap, Tien Giang -VN).
- 6-The Socio-economic function-Buffering the income of farm households against environmental risks (Dong Yen site- Thailand)
- 7-The Socio-economic function (Tien Giang VN).

Summary & Conclusions

Project to Demonstrate the Multi-functionality of paddy fiel

Overall Progress

Main activities	'02	'03	'04	'05	'06	'07
•Data collection	1 May.02- 28 Feb.05			Oct. 03- Oct.06		
•Establishing of GIS database (inc. converting data into digital format)	Feb.02- 31 May.04			Mar. 04- May.05		
•Assessment of irrigation water use & rice farming			1 May.05- 15 Jul.05			
•Analysis of the multiple role of paddy fields	Aug.02- 31 Jun.07				Aug.02- 31 Aug.07	
•Training/workshop	16,17 June.03	7-9 Oct.03	11,12 May.04	27,28 July.05		24 Aug.07

Major Outputs

- Inception Report
- Data Review Report
- Workshop Reports
- GIS Dataset on Rice Farming
- Progress Report 2002, 2003, 2004
- Study Report on the estimation of irrigation water use in the Basin
- Study Report on multiple roles of the paddy fields in Northeastern Thai Land.
- Study Report on multiple roles of the paddy fields in Mekong delta Vietnam.
- Project final report

Conclusions

- Achieved the objective of the project although significant delay. Changing of project direction is a practical solution
- The database under GIS format should be continuously updated and maintained for future use.
- Multiple role of paddy fields evaluated with quantified evaluation.
- Based on the results of some analysis of paddy field's functions, it could enhance public awareness of the linkage between paddy field and environment.

Thank you

for your attention

Annex 5: Workshop presentations

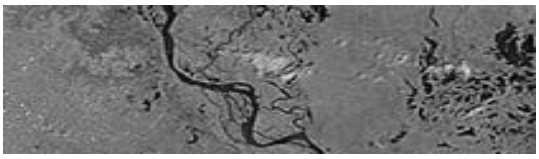
Flood mitigation	
1.	*Flood Mitigation Functions of Paddy Fields in north-eastern Thailand* Dr Somsak Sukjan, Khon Kaen University, Thailand.
2.	*Analysing the Functional Role of Paddy Fields on Flood Mitigation in Mekong Delta Viet Nam* Dr Nguyen Ngoc Anh, Southern Institute of Water Resources Planning, Viet Nam.
Nurturing aquatic eco-systems	
3.	*The Role of Paddy Fields in Nurturing Aquatic Ecosystems and maintaining Agro-system Biodiversity in Northeast Thailand* Yuko SHIRAI, A. Terry RAMBO, and Suwit LAOHASIRIWONG, Khon Kaen University, Thailand. Dr Rambo presented the study.
4.	*Analysing the Functional Role of Paddy Fields on nurturing and restoring the aquatic ecosystems in Mekong Delta Viet Nam.* Mr Vu Ngoc Ut Cantho University, Viet Nam. Dr Le Van Khoa presented the paper on his behalf.
Soil conservation	
5.	*Analyzing functional role of paddy fields related to soil productivity and soil conservation, in Mekong Delta Viet Nam* Dr Le Van Khoa from Cantho University, Viet Nam
Socio-economic issues	
6.	*The Function of Paddy Fields in Buffering the Income of Farm Households against Environmental Risks* Suwit Laohasiriwong and A. Terry Rambo, with the assistance of Phoolpatra Penchome, Khon Kaen University , Thailand. Presented by Dr Suwit
7.	*Analysis of the functional role of paddy fields in focusing on assessing the income of farm-households and employment generation of farmers.* Dr Nguyen Duy Can from Cantho University, Viet Nam

Project Title:
The multifunctionality of paddy fields in Northeastern Thailand

Office of the System Approaches in Agriculture Program
Faculty of Agriculture, Khon Kaen University
Khon Kaen 40002, Thailand

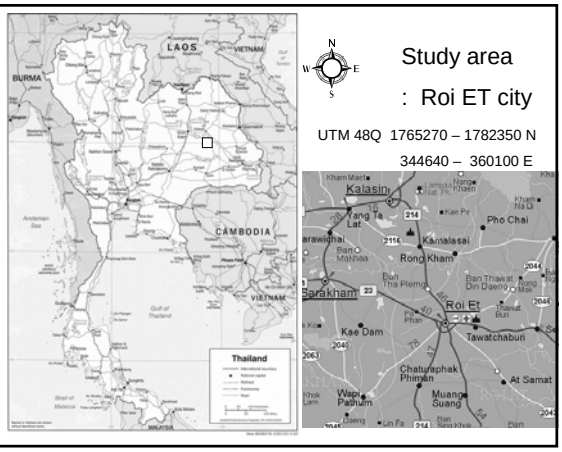
Sub-project 1. Flood mitigation

Somsak Sukchan M.Sc.(Agr.) DLD
Suwit Laohasiriwong, Ph.D. KKU



Background:

- **Many towns and city in Thailand normally surrounded by paddy fields. With vast expansion of urban area, many of these paddy fields are filled up or turn to be housing areas, industrial factories and other non agricultural areas. Once this happen, some cities are facing flash flood every annually.**

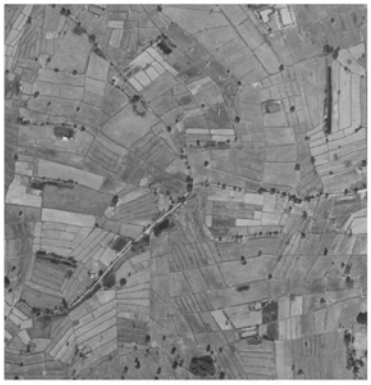


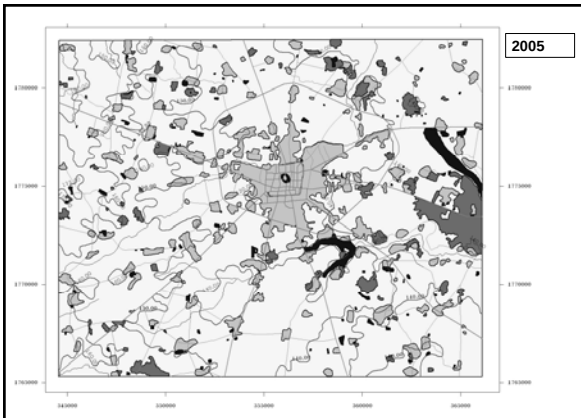
Specific objectives

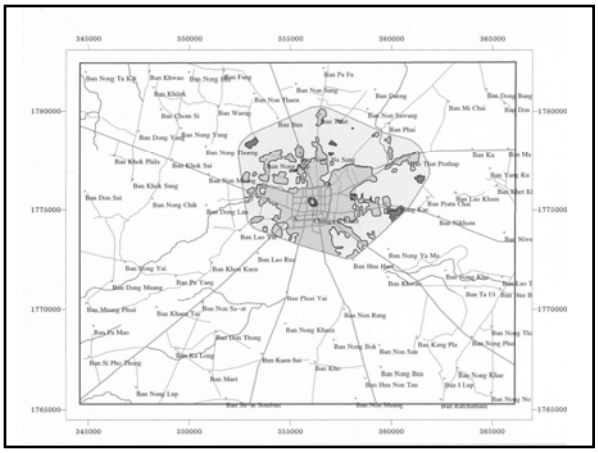
- To calculate present capacity of paddy fields to store water by GIS tool
- To calculate the areas under flash flood risk by past rainfall data
- To predict future conversion of paddy fields into other land use through scenario analysis
- To identify the change of flood risk areas by abolition of paddy fields

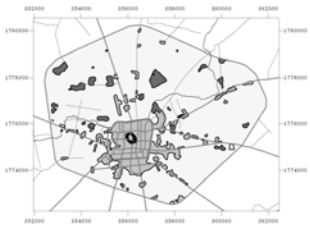
Methods

- Data collection and data preparation to GIS format
- Aerial photo interpretation for detail land use maps, interpretation of both historical and recent data.
- Making draft of land use maps.
- Input land use maps to GIS format.
- Classify urban and paddy fields area.
- Calculate historical and present capacity of paddy fields to store water by GIS tool.
- Predict future conversion of paddy fields into other land use through scenarios analysis.
- Identify the change of flood risk areas by abolition of paddy fields.





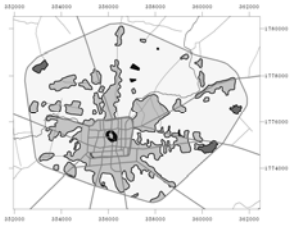




Year: 1987

Paddy = 26,914 rai

Urban = 3,802 rai



Year: 1997

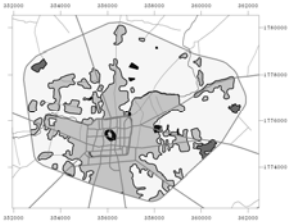
Paddy = 22,109 rai

Urban = 9,218 rai

Year: 2005

Paddy = 19,626 rai

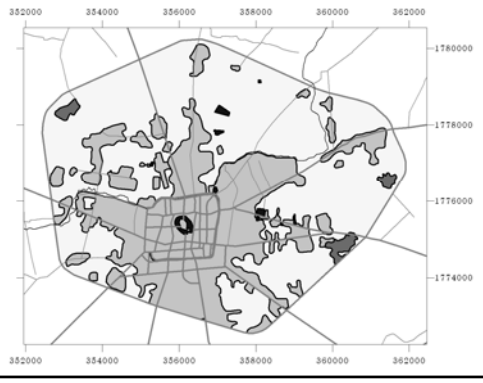
Urban = 11,618 rai



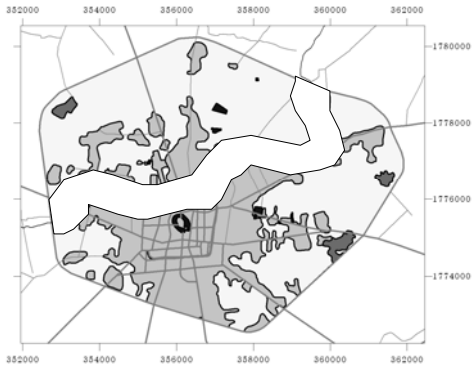
Water holding capacity of paddy fields

Rainfall (mm)	Total rain water in city area (m^3)	Water level in paddy fields (m), maximum water holding capacity (m^3) and surplus water needed to be drained out (in red)			
		.10 m	.20 m	.30 m	.40 m
		3,140,160	6,280,320	9,420,480	12,560,640
100	4,999,040	(1,858,880)			
200	9,998,080	(6,857,920)	(3,717,760)	(577,600)	
300	14,997,120	(11,856,960)	(8,716,800)	(5,576,640)	(2,436,480)
400	19,996,160	(16,856,000)	(13,715,840)	(10,575,680)	(7,435,520)

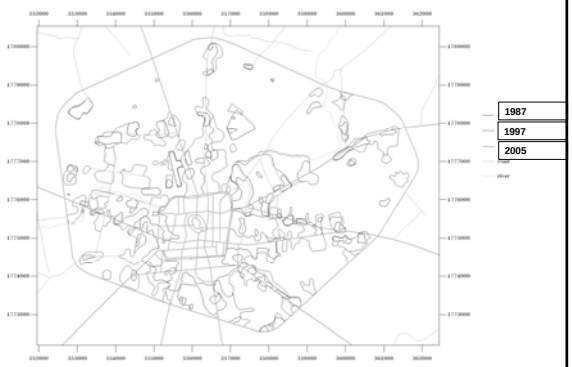
Flood risk areas

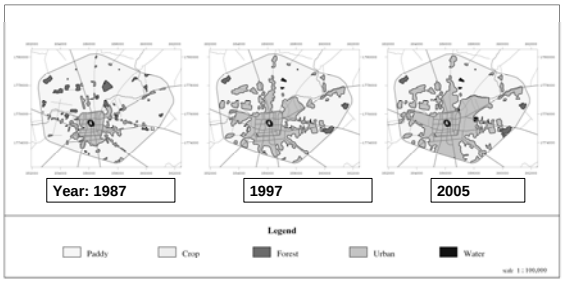


Flood risk areas



Future conversion of paddy fields





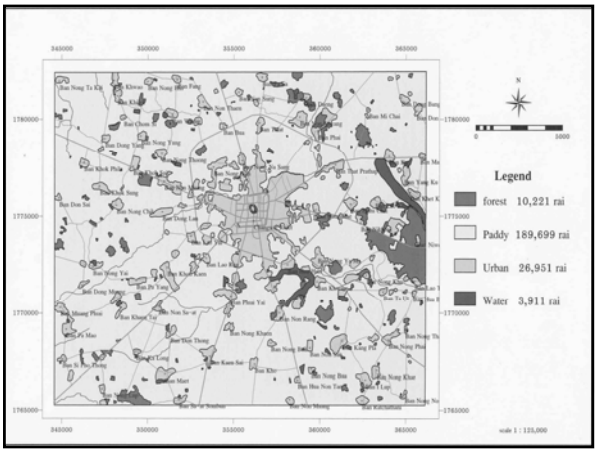
Conclusions

With rapid changing of paddy fields to urban area, city like Roi-Et need to carefully plan for drainage system of the city, because if it is not properly done, flash flood can happen regularly if there is heavy rain (more than 100 mm).

Many cities with low altitude should pay attention to the role of paddy fields for flood mitigation.

Proper land use planning to keep paddy fields may be more cost effective in flood mitigation than other means like building dyke or ring road as dam for flood prevention.

THANK YOU



The programme to Demonstrate the Multi-Functionality of the Paddy Fields (DMPF) over the Mekong River Basin

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

SIWRP
VIEN QUY HOACH THUY LOI MIEN NAM

Prepaired by Nguyen Ngoc Anh, Deputy Director, SIWRP

Analyzing Functional Role of Paddy Fields on Flood Mitigation

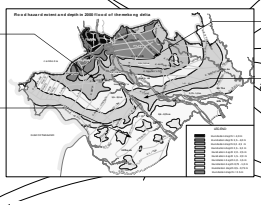
DMPF-MRB

Long Xuyen Quadrangle

Trans-Bassac

Plain of Reeds

Between Mekong and Bassac Rivers



Medium flooded areas

Flood Control Planning in the Mekong Delta

Deeply flooded areas

Shallow flooded areas

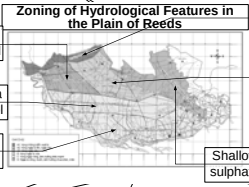
Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

Zoning of Hydrological Features in the Plain of Reeds

Deeply flooded area and early flood control

Deeply flooded area and uncontrolled flood

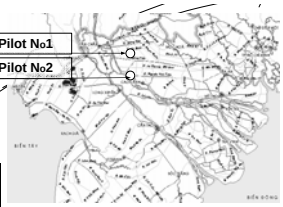


Medium flooded area and early flood control

Medium flooded area and early flood control

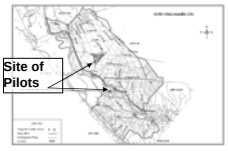
Shallow flooded area and full flood control

Shallow flooded area and acid sulphate soils/salinity intrusion



Pilot No1

Pilot No2



Site of Pilots

Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

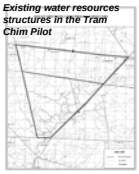
Tram Chim National Park

Dong Tien canal

Dong Tien Road

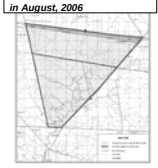
Tam Nong center

Existing water resources structures in the Tram Chim Pilot

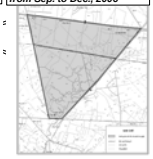


Duong Gao Road and Canal

Existing agricultural cultivation at Tram Chim Pilot in August, 2006



Existing agricultural cultivation at Tram Chim Pilot from Sep. to Dec., 2006



Khang Chien Embankment & Canal

Tram Chim Pilot

Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

Cao Lanh Pilot

Hoa Tay Road and Canal

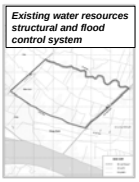
Cai Da Road and Canal

Pilot No.2
110 ha

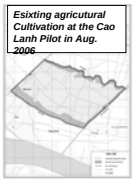
Cai Tom Road and Canal

Hoa Dong Road and Canal

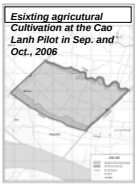
Existing water resources structural and flood control system



Esixting agricutural Cultivation at the Cao Lanh Pilot in Aug. 2006



Esixting agricutural Cultivation at the Cao Lanh Pilot in Sep. and Oct., 2006



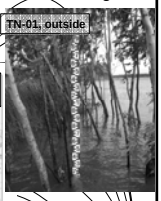
Esixting agricutural Cultivation at the Cao Lanh Pilot in Dec. 2006

Analyzing Functional Role of Paddy Fields on Flood Mitigation

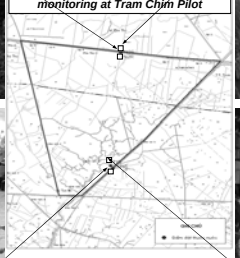
DMPF-MRB

TN-01, inside

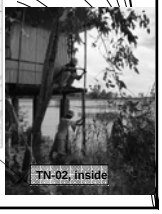
TN-01, outside



Site of staff gauges for water level monitoring at Tram Chim Pilot



TN-02, outside



TN-02, inside

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

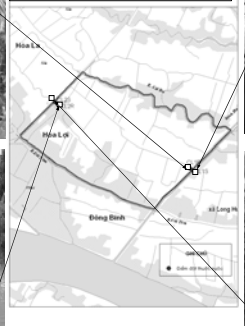
CL-01, inside

CL-01, outside

CL-02, inside

CL-02, inside

Sites of staff gauges for water level monitoring at Cao Lanh Pilot



RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

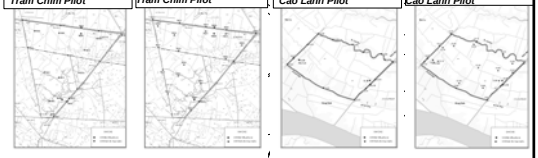
DMPF-MRB

Sites of sediment sampling in Aug 2006 in Tram Chim Pilot

Sites of sediment sampling from Sep. to Nov. 2006, Tram Chim Pilot

Sites of sediment sampling in Aug 2006 in Cao Lanh Pilot

Sites of sediment sampling from Sep. to Nov.2006, Cao Lanh Pilot



Research methods and time frame schedule for implementation

Field surveys

- **Set up staff gauges and sites of sediment sampling for 2 pilots.**
- **Staff gauges are set up at 4 sites inside and outside of each pilot area.**
- **Monitoring regime is twice daily, at 0600 h and 1800 h, during 4 months, from 15 August to 15 December.**
- **All sites are linked with MSL by the National Elevation Benchmark System.**
- **Flood water depth of each pilot is directly calculated by WL and elevation.**
- **Map of flood depths are built to estimate the monthly storage capacity of flood water.**
- **Sediment content is analyzed at 20 sites for each pilot (some outside pilot area).**

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

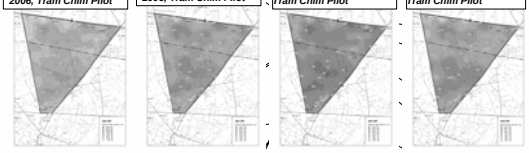
DMPF-MRB

Flooded depth distribution in Aug. 2006, Tram Chim Pilot

Flooded depth distribution in Sep. 2006, Tram Chim Pilot

Flooded depth distribution in Oct. 2006, Tram Chim Pilot

Flooded depth distribution in Nov. 2006, Tram Chim Pilot



Max.WL in the MD from 2000-2006

Year	Tan Chau	Chau Doc
2000	506	489
2001	478	448
2002	482	442
2003	406	351
2004	441	401
2005	435	390
2006	417	371

Total volume of stored flood water at Tram Chim Pilot, 2006

Time	Average flooded area (m^2)	Average flooded depth (m)	Total water volume (m^3)
Aug.	12,003,204	0.31	3,720,993
Sep.	24,582,562	0.52	12,782,932
Oct.	32,648,715	0.68	22,201,126
Nov.	18,576,488	0.35	6,501,771

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

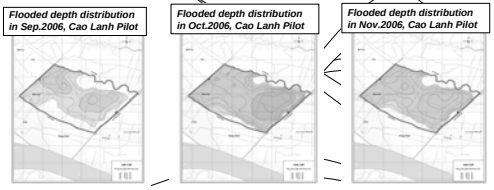
Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

Flooded depth distribution in Sep.2006, Cao Lanh Pilot

Flooded depth distribution in Oct.2006, Cao Lanh Pilot

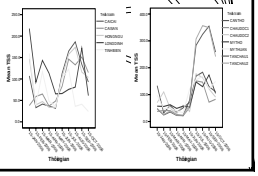
Flooded depth distribution in Nov.2006, Cao Lanh Pilot



Total volume of stored flood water at Cao Lanh Pilot

Time	Average flooded area (m^2)	Average flooded depth (m)	Total water volume (m^3)
Sep.	437,500	0.20	87,500
Oct.	896,000	0.37	331,520
Nov.	677,087	0.27	182,813

TSS content along Vietnam-Cambodia border and internal paddy fields, 2006



RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

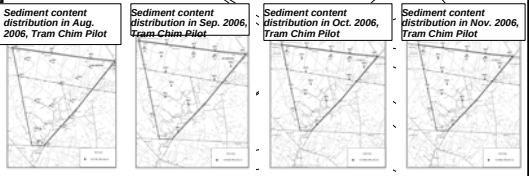
DMPF-MRB

Sediment content distribution in Aug. 2006, Tram Chim Pilot

Sediment content distribution in Sep. 2006, Tram Chim Pilot

Sediment content distribution in Oct. 2006, Tram Chim Pilot

Sediment content distribution in Nov. 2006, Tram Chim Pilot



Results of total sediment accumulation at Tram Chim Pilot

Month	Average sediment content in canals (mg/l)	Average sediment content in fields (mg/l)	Flooded area in fields (ha)	Average flooded depth in field (m)	Total volume of sediment (ton)
Aug.	137	102	1,200	0.31	129.57
Sep.	93	73	2,458	0.52	293.33
Oct.	81	68	3,265	0.68	137.06
Nov.	37	21	1,858	0.35	305.77

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

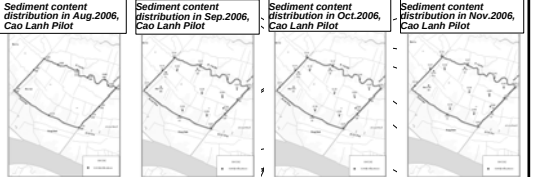
DMPF-MRB

Sediment content distribution in Aug.2006, Cao Lanh Pilot

Sediment content distribution in Sep.2006, Cao Lanh Pilot

Sediment content distribution in Oct.2006, Cao Lanh Pilot

Sediment content distribution in Nov.2006, Cao Lanh Pilot



Results of total sediment accumulation at Cao Lanh Pilot

Month	Average sediment content in canals (mg/l)	Average sediment content in fields (mg/l)	Flooded area in field (ha)	Average flooded depth in field (m)	Total volume of sediment (ton)
Sep.	92	68	44	0.20	209.90
Oct.	84	67	90	0.37	428.90
Nov.	71	64	90	0.27	65.90

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

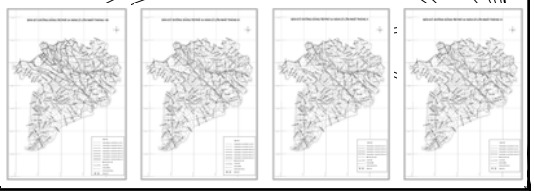
DMPF-MRB

Analyzing Functional Role of Paddy Fields on Flood Mitigation

Storage capacity of flood water and sediment in the flood areas for the high flood year (2000) under existing conditions in the MD

Month	Depth (m)	Area (ha)	Sediment cont. (g/m³)	Flood water volume (m³)	Sediment volume (tons)
Aug.	0.5-3.0	1,113,126	50 - 200	9,632,958,273	1,369,587
Sep.	0.5-3.0	1,108,048	25 - 200	15,990,137,583	1,966,798
Oct.	0.5-3.0	1,131,692	25 - 200	16,448,190,946	2,179,792
Nov.	0.5-3.0	1.135.195	25 - 200	12,682,034,367	932,789

Monthly sediment content contours from Aug. to Nov. 2000



RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

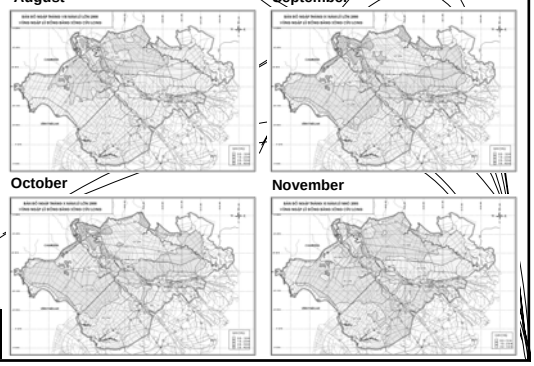
DMPF-MRB

Analyzing Functional Role of Paddy Fields on Flood Mitigation

Map of monthly flooded area of the Mekong Delta in 2000

August **September**

October **November**



RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

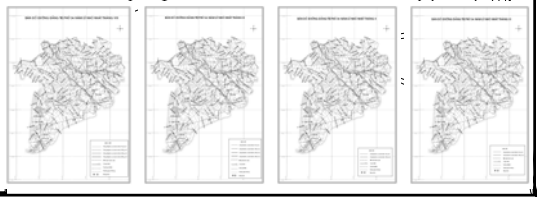
DMPF-MRB

Analyzing Functional Role of Paddy Fields on Flood Mitigation

Storage capacity of flood water and sediment in the flood areas for the weak flood year (2005) under existing conditions in the MD

Month	Depth (m)	Area (ha)	Sediment cont. (g/m³)	Flood water volume (m³)	Sediment volume (ton)
Aug.	0.5-3.0	1,131,089	25 - 200	8,303,305,845	876,911
Sep.	0.5-3.0	1,149,767	25 - 200	11,965,716,668	903,049
Oct.	0.5-3.0	1,217,521	25 - 200	14,679,840,950	868,977
Nov.	0.5-3.0	932,012	25 - 200	11,776,720,057	569,048

Monthly sediment content contours from Aug. to Nov. 2005



RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

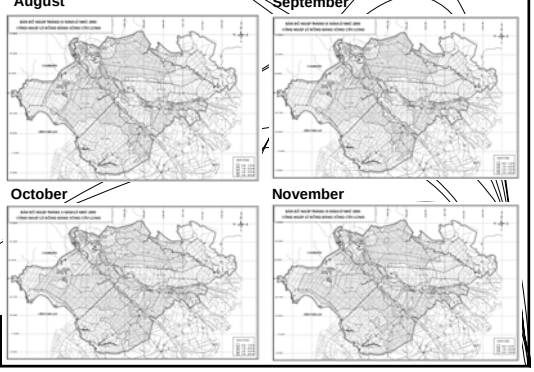
DMPF-MRB

Analyzing Functional Role of Paddy Fields on Flood Mitigation

Map of monthly flooded area of the Mekong Delta in 2005

August **September**

October **November**



RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

DMPF-MRB

Analyzing Functional Role of Paddy Fields on Flood Mitigation

Storage capacity of flood water and sediment to 2010

For the high flood case (2000 year)

Month	Depth (m)	Area (ha)	Sediment cont. (g/m³)	Flood water volume (m³)	Sediment volume (tons)
Aug.	0.5-3.0	764,868	25-250	7,141,244,484	1,033,579
Sep.	0.5-3.5	771,756	25-200	12,864,329,943	1,516,549
Oct.	0.5-3.5	783,691	25-200	13,534,609,829	1,621,222
Nov.	0.5-3.0	785,919	25-250	10,239,592,183	708,109

For the weak flood case (2005 year)

Month	Depth (m)	Area (ha)	Sediment cont. (g/m³)	Flood water volume (m³)	Sediment volume (tons)
Aug.	0.5-2.5	754,094	25-200	5,845,939,677	655,601
Sep.	0.5-2.5	689,785	25-150	7,469,527,088	644,328
Oct.	0.5-3.0	775,664	25-150	8,860,407,654	596,533
Nov.	0.5-2.5	730,536	25-100	7,936,797,309	410,518

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

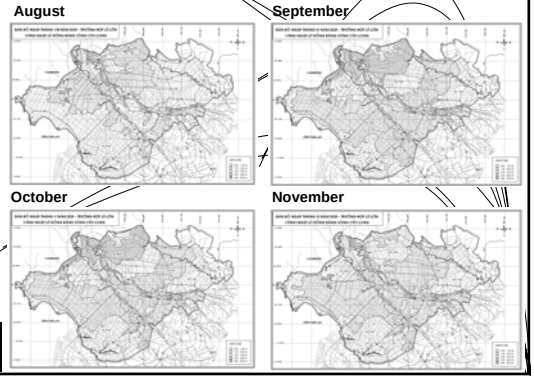
DMPF-MRB

Analyzing Functional Role of Paddy Fields on Flood Mitigation

Map of flooded area in 2010 with the high flood year of the MD

August **September**

October **November**



Storaged capacity of flood water and sediment to 2020

For the high flood case (2000 year)

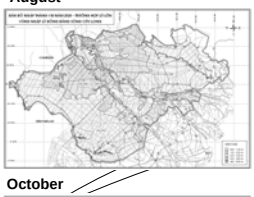
Month	Depth (m)	Area (ha)	Sediment cont. (g/m³)	Flood water volume (m³)	Sediment volume (tons)
Aug.	0.5-2.5	829.589	25-250	7.374.555.715	722.961
Sep.	0.5-3.0	829.614	25-200	13.333.637.879	1.078.377
Oct.	0.5-3.0	829.612	25-200	12.937.694.022	848.356
Nov.	0.5-2.5	829.614	25-250	10.987.013.202	368.251

For the weak flood case (2005 year)

Month	Depth (m)	Area (ha)	Sediment cont.(g/m³)	Flood water volume (m³)	Sediment volume (tons)
Aug.	0.5-2.5	829.525	25-150	6.024.538.560	362.034
Sep.	0.5-3.0	829.597	25-100	7.690.707.698	272.253
Oct.	0.5-3.0	829.598	25-100	8.745.950.106	242.961
Nov.	0.5-2.5	829.586	25-50	7.168.483.573	169.593

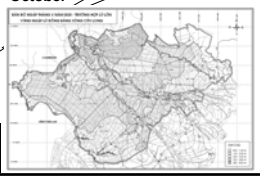
Map of flooded area in 2020 with the weak flood year of the MD

August

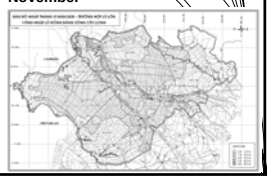


September

October



November



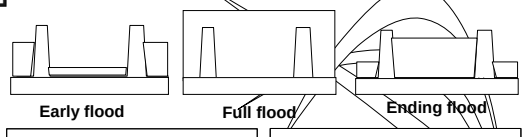
PROBLEMS ENCOUNTERED AND RECOMMENDATIONS

Remarks on advantages and problems encountered

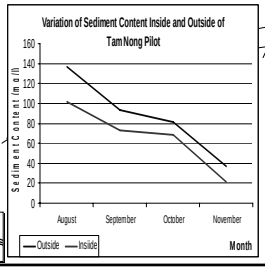
- **Variation of flood flow and sediment transportation in the Mekong Delta is very complicated.**
- **More pilot studies are needed to estimate the multi-functionality of paddy fields on flood mitigation.**
- **Effect of tides on the flood flow are moderate.**
- **Measurement of flood characteristics for the whole flooded area in the Mekong Delta is very difficult and costly.**
- **Measured flood data and information from recent years are moderately synchronous and accurate, but sufficient for estimating trends and effects of the paddy fields on flood mitigation.**

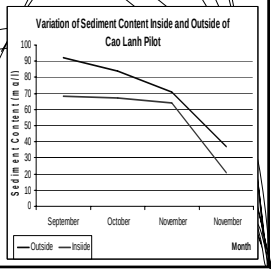
Recommendations for further use / study of paddy field functions on flood mitigation

- **The estimation and calculation results of this study are the first step only. The effects of the paddy fields on flood mitigation is not only capacity for flood water storage and sediment accumulation, but also other factors. In order to assess all these factors, larger and deeper studies are required.**
- **Results of the study show strong effects of the paddy fields on flood mitigation, especially on storage, regulation and sediment accumulation.**
- **Flooding in the Mekong Delta causes much damage, but also brings many advantages. Mitigation of damages and taking full advantage of floods from both sides of the flood management process. The concept and direction of "Living with floods" would help local people approach flood management more effectively.**



Early flood **Full flood** **Ending flood**





- **Investment is needed to study the relationship between paddy fields and the variability of floods in order to control and manage floods more efficiently.**
- **To study floods in the Lower Mekong River, MRC has used hydraulic models as ISIS, VRSAP… for simulation and forecasting of flood phenomena. Now, MRC needs to research into models for sediment transportation and processes for the future in FMP.**

CONCLUSIONS AND SUGGESTIONS

- **Data and information from 2 pilot studies are not enough for the very complicated problems of flood mitigation in the paddy fields in 2006 flood.**
- **The 2006 flood is the normal one. The variations of flood flow and sediment transportation may be more complicated for high or weak floods.**
- **Deeper and larger studies are needed to assess the multi-functional role of paddy fields on flood mitigation in MD.**

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

RESEARCH ON ANALYZING THE MULTI-FUNCTIONAL ROLE OF PADDY FIELDS IN THE MEKONG DELTA, VIETNAM

Analyzing Functional Role of Paddy Fields on Flood Mitigation

DMPF-MRB

Many thanks for your attention!

The Role of Paddy Fields in Nurturing Aquatic Ecosystems and Maintaining Agroecosystem Biodiversity in Northeast Thailand
(Sub-project 2)

Yuko SHIRAI, A. Terry RAMBO, and
Suwit LAOHASIRIWONG
Khon Kaen University

Objectives of Sub-project

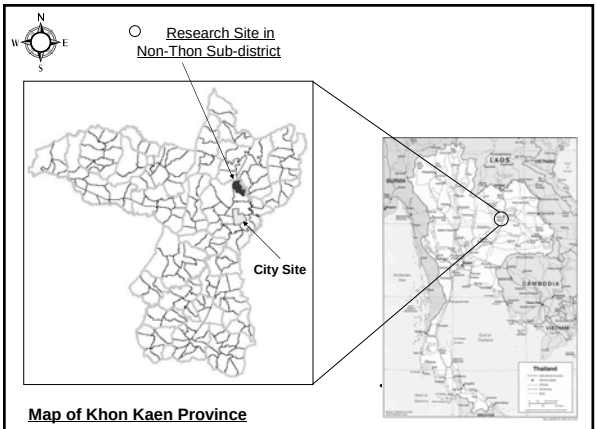
1) To inventory all useful wild species that rural households obtain from different rural ecosystems, including paddy fields

2) To record the quantities of useful wild species collected by villagers

Objectives of study, cont.

3) To estimate the value of useful wild species collected from different types of rural ecosystems, including paddy fields

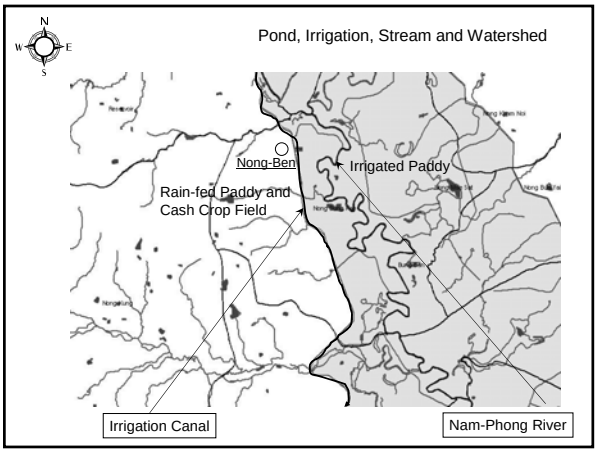
4) To assess the contribution of irrigated fields in comparison to rain-fed paddy fields to preserving biodiversity.



Map of Khon Kaen Province

The Study Site in Nong Ben Village

- **Population: 1,237 people**
- **337 households**
- **Total surface area: 1,007 ha**
- **Agricultural land area: 806 ha**
- **Area of paddy fields: 411 ha**

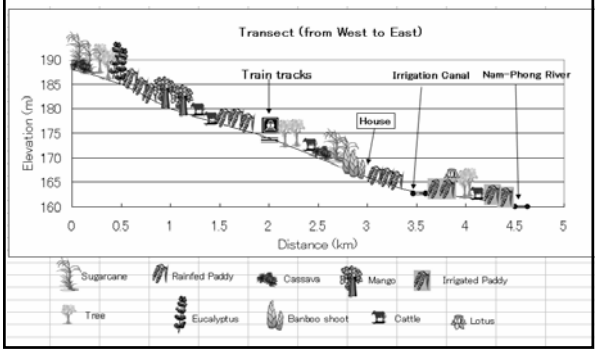


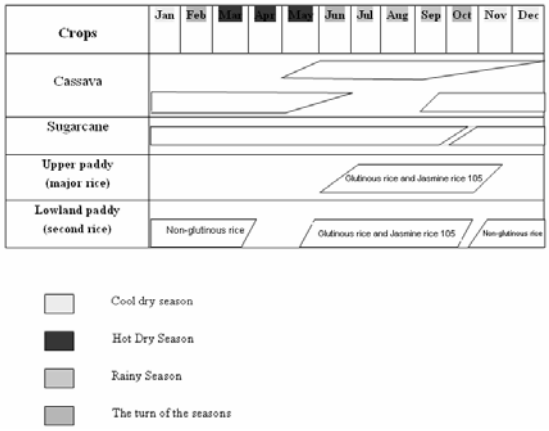
The Nong Ben Village Agroecosystem

The agroecosystems contains diverse habitats:

- **rainfed paddy fields**
- **irrigated paddy fields**
- **upland cash crop fields (cassava and sugarcane)**
- **home gardens**
- **forest**
- **ponds**
- **river and canals**
- **livestock**

Transect of agricultural landscape in Nong Ben Village





Research design and methodology

1. **Group interview with 20 villagers in order to gain preliminary knowledge about the village**

2. **Comprehensive survey of all village households as base for selecting sample:**
   - **Stratify sample households according to:**
     - ***Rainfed or irrigated paddy fields***
     - ***Size of landholding***

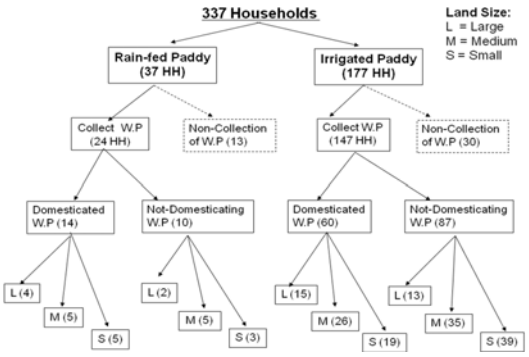
Methodology, cont.

3. **Selection of sample households:**

   -10 households that only have rain-fed paddy fields

   -14 households that only have irrigated paddy fields

Sampling design



Sample Households with Rainfed Paddy Fields (n=10)

Land Size (rai)	Domesticated		Non-Domesticated	
	Noo of HHs	No. of Sample HHs	Number of HHs	No. of sample HHs
>10 (Large)	4	2	2	1
5-10 (Medium)	5	2	5	2
0.01 - 4.99 (Small)	5	2	3	1
Total	14	6	10	4

Sample Households with Irrigated Paddy Fields (n=14)

Land Size (rai)	Domesticated		Non-Domesticated	
	Number of HHs	No. of sample HHs	Number of HHs	No. of sample HHs
>10 (Large)	15	2	13	2
5-10 (Medium)	26	2	35	3
0.01 - 4.99 (Small)	19	2	39	3
Total	60	6	87	8

Methodology, cont.

4. Recall interviewing of all sample households:

- ***14 days in cool dry season***
- ***14 days in hot dry season***
- ***14 days in rainy season***

- **Each household was interviewed to identify the useful wild species they collected from all rural ecosystems on the preceding day.**
- **Information recorded on standardized data collection sheets**

Species Inventory

A total of 96 useful wild species are collected by villagers:

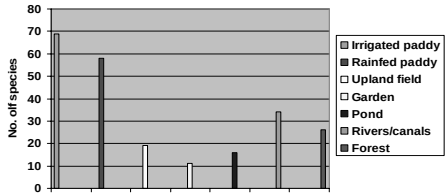
38 plants

4 fungi,

54 animals

2 amphibians (frog, toad),
8 birds
2 crustaceans (crab, prawn),
19 fish
16 insects,
2 mammals,
2 mollusks
3 reptiles (lizards, terrapin)

Number of species collected from different habitats in Nong Ben Village



Estimated economic value (in US dollars) of wild products collected by village households

	Hot Dry Season (67 days)		Rainy Season (159 days)		Cool Dry Season (139 days)		Whole Year
	Average daily value	Total value	Average daily value	Total value	Average daily value	Total value	Total value
Households with rainfed paddy fields (10HH)	$ 0.77	$ 51.69	$ 1.23	$ 195.34	$ 1.80	$ 250.20	$ 497.23
Households with irrigated paddy fields (14HH)	$ 0.69	$ 45.94	$ 1.34	$ 213.51	$ 0.60	$ 91.34	$ 350.80
Average of all households	$ 0.73	$ 48.81	$ 1.29	$ 204.43	$ 1.20	$ 170.77	$ 424.01

Habitats of Useful Wild Species

- **Irrigated paddy fields: 69 species**
- **Rainfed paddy fields: 58 species**
- **Rivers/streams/canals: 34 species**
- **Forest: 26 species**
- **Upland fields: 19 species**
- **Ponds: 16 species**
- **Backyard gardens: 11 species**

Annual value (US dollars) of species collected by an average village household from different habitats

Habitat	Plant	Fungi	Animal	Total
Irrigated paddy	49.55	0.77	149.25	199.55
Rainfed paddy	15.57	0.70	53.83	70.09
Upland field	3.90	0.64	7.96	12.49
Forest	5.99	0	12.49	18.49
Garden	1.53	0	2.52	4.04
Aquatic	6.63	0	114.45	121.10
Total	83.21	2.11	315.44	425.94

Conclusions

- **Paddy fields in Northeastern Thailand are *multifunctional*. In addition to *producing rice*, the paddy fields are the *habitat for valuable wild species*. These wild species contribute to the *food security* of rural households. They are also an important *source of cash income* for rural households.**

Conclusions, cont.

- **Paddy fields are the habitat for 77 species (>80%) of the 96 useful wild species collected by villagers.**
- **Irrigated paddy fields support a higher biodiversity of useful wild species than rainfed paddy fields.**
- **This probably reflects the greater sufficiency of water in irrigated paddy fields.**

Conclusions, cont.

- **Any reduction in the area of paddy fields resulting from changes in rural land use patterns will have important consequences for rural biodiversity in Northeastern Thailand.**

Sub-project 3: Analyzing functional role of paddy fields on nurturing and restoring the aquatic ecosystems

Vu Ngoc Ut

College of Aquaculture and Fisheries

Cantho University

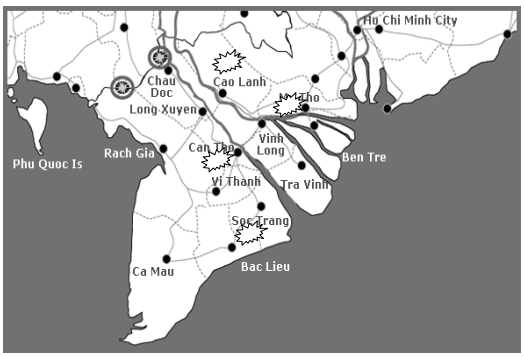
Objectives

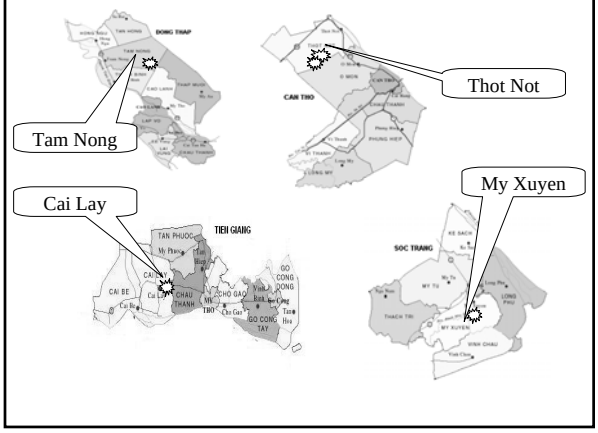
To investigate and make clear the functional role on nurturing and restoring aquatic ecosystem of paddy field in the Mekong Delta through analysis of data on nutrient load trapped in the paddy fields and its purification capacity as well as nurturing function for wild aquatic species such as fish.

Specific tasks

- Reviewing existing aquatic ecosystems on paddy field in the Mekong Delta of Vietnam
- Assessing the purification function of paddy fields
- Assessing the nurturing function of paddy fields
- Recommending and proposing models for integration of land use between aquaculture and paddy cultivation for nurturing and recovering the aquatic ecosystems in the Mekong Delta.

Sites selected for study





Tam Nong, Dong Thap

Irrigated area

Thot Not-Co Do, Can Tho

Flooded area

My Xuyen, Soc Trang

Rain-fed paddy fields

= brackish water in the dry season and freshwater in the rainy season

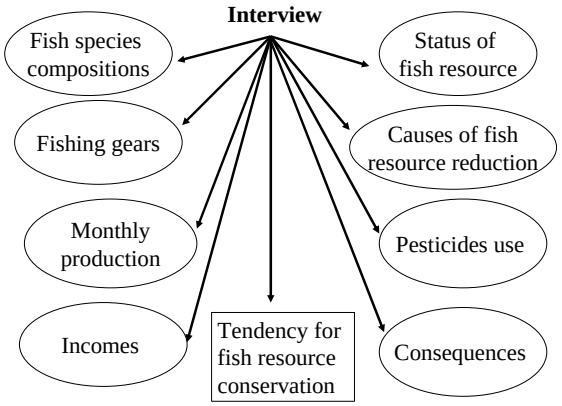
METHODOLOGY

➢**Function on nurturing aquatic ecosystems**

✓ Recall-interview for fisheries resource data

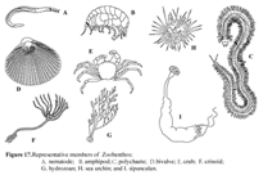
Total 80 farmers were interviewed: 30 in My Xuyen, 10 in Tam Nong, 15 in Cai Lay, 25 in Thot Not-Co Do

✓ Daily record for fish fishing and harvest using established recording book: 13 farmers selected in Thot Not, Can Tho



Aquatic fauna sampling

Zooplankton and benthos were sampled in the surrounding trenches of the paddies to investigate the biodiversity of the aquatic fauna



➢**Function on restoring = purification of aquatic ecosystems**

Sampling for water parameters in and out side paddy fields

- TSS: Total suspended solid.
- -OSS (organic suspension solid)
- TDS (total dissolved solid)
- TKN (total Kejdahl nitrogen)
- TN (total nitrogen),
- NO_2^- (nitrite),
- NO3- (nitrate),
- PO43- (phosphate),
- TP (total phosphorus)

All parameters were sampled in two periods of rice growth: one and two months before harvest

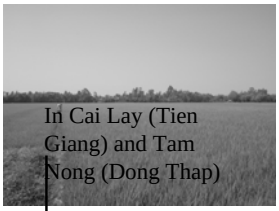
Cai Lay (Tien Giang): water parameters were measured from a paddy where not adjacent to aquaculture areas

Tam Nong (Dong Thap): water parameters were measured in the paddy which was influenced by an intensive prawn pond

Thot Not (Can Tho): water parameters were measured in paddies where catfish ponds are surrounding

RESULTS

Difference in paddy construction



Surrounding trenches

No surrounding trenches

➔ Difference in collection/harvest practice of fishery resource

In brackish water area (My Xuyen, Soc Trang)

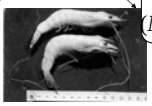
15 species of fish & shrimp recorded

3 main species produce higher incomes

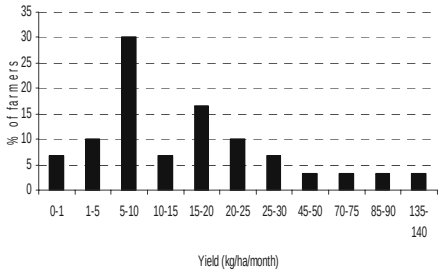
Mud skipper (*Pseudapocryptes elongatus)*

Greasy back shrimp (*Metapenaeus ensis*)

Bird shrimp (*Metapenaeus lysianassa*)



Yield of wild catches varied from farm to farm but common between 5-10kg/ha/month



Production of wild catches was at peak in 2000 but dramatically declined in 2005 due to causes:

Chemicals used In shrimp farming (46.7%)

Polluted effluents discharged during pond preparation of shrimp culture (40%)

Effects of pesticides on fisheries resources

- 80 % of interviewed farmers used pesticides in which 53.8% used highly toxic pesticides
- however, >56% reported no mass mortality of fish when applied pesticides

Role of rice on fisheries resources in the paddies

- >50% admitted rice is important to fish abundance ➔ more fish in paddies with rice
- 26% addressed opposite situation

In freshwater areas (Thot Not, Can Tho)

13 species of fish & shrimp recorded

2 main species produce higher incomes

Snakehead (*Channa striata*)

Climbing perch (*Anabas testudines)*

1 species occurs abundantly in the flooded period resulting high income

Siamese mud carp (*Cirrhinus siamensis)*

- High production of wild catches in 2000 (64%)
- Strong decline of production since 2001 (68%)

Causes of decline

- ✓ Use of pesticides (golden snail killing): 60%
- ✓ Use of electricity for catching fish: 24%
- ✓ Others: 12%

Important role of rice on fish abundance in the paddies: 64% ➔ more fish when rice presence

Solutions for protecting fisheries resource

✓Limit of pesticide use (64%)

✓Regulation of over-fishing (20%) and fish sizes (32%)

✓Stocking fish in the paddies (60%)

Daily records from 13 households

	Total	%
Production of catches (kg)	**1,312**	**100**
For family consumption (kg)	**191**	**14.6**
For sales	**1,121**	**85.4**

➔ Important source of household income = important role of paddies in nurturing aquatic resource

Incomes from fish resource in the paddies recorded by 13 households

Income/household/crop (VND)	2,060,169
Income/household/month (VND)	686,723
Production/ha/crop (kg)	37.8
Production/ha/month (kg)	12.6
Highest production/household/crop (kg)	644.2
Highest income/household/crop (VND)	16,270,000

In Tam Nong and Cai Lay

No fish concentrated in the paddies ➔ fish were harvested only form the beginning and the end of the crop

No surrounding trenches

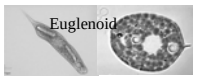
Fish caught mainly on flooding period

Most of the farmers in these areas aware of the importance of paddies in nurturing fish and the role of fish in the paddies as predators and controller of pest

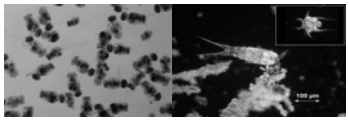
Constructing surrounding trenches to have more fish and practicing integrated culture

Composition of plankton and benthos are diverse in the paddies

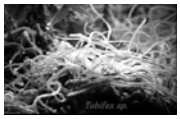
61 species of algae



Indicator of nutrient richness



49 species of zooplankton with high densities



Zoobenthos mainly with oligochaeta (worm)

⇨ Rich in natural food for fish and aquatic organisms = nurturing role of paddy fields

Purification function of paddies

In Tam Nong (Dong Thap): non-fertilized paddy

Date of sampling	TDS	OSS	% OSS	TAN	NO_2^-	TKN	TN	TP
20/01/07	0,218	21,2	59,6	0,909	0,082	3,968	4,299	0,175
23/02/07	0,099	9,3	15,5	0,102	0,026	0,596	1,168	0,055
% reduction	54,6	56,1	73,9	88,8	68,1	85,0	72,8	68,4

In Tam Nong (Dong Thap): fertilized paddy

Date of sampling	TSS	OSS	% OSS	TAN	NO_2^-	TKN	TN	PO_4^{3-}	TP
20/01/07	75,8	42,2	55,7	0,93	0,03	6,33	6,98	0,78	1,87
23/02/07	43,2	12,6	29,1	0,03	0,02	0,83	1,59	0,03	0,05
Reduction (%)	**43,0**	**70,3**	**47,8**	**96,6**	**36,3**	**86,9**	**77,2**	**96,5**	**97,6**

In Tien Giang: measurement done at the same time between river and paddy

Date of sampling	Sources	TDS	TSS	NO_2^-	NO_3^-	TN	PO_4^{3-}	TP
08/02/07	River	0,13	91,0	0,03	2,09	3,21	0,06	0,09
08/02/07	Paddy	0,10	77,8	0,02	0,54	1,74	0,02	0,06
% reduction		**22,7**	**14,5**	**55,5**	**74,3**	**45,9**	**70,1**	**30,1**

In Tien Giang: measurement done at one month interval in the paddy

Date of sampling	Sources	TDS	TSS	NO_2^-	NO_3^-	TN	PO_4^{3-}	TP
20/01/07	Paddy	0,17	94,6	0,02	0,79	1,88	0,03	0,136
08/02/07	Paddy	0,10	77,8	0,02	0,54	1,74	0,02	0,061
% reduction		39,6	17,8	10,1	32,1	7,8	34,3	55,0

In Thot Not: turbulence caused by ducks and fish

Sampling date	Sources	TDS	TSS	OSS	%OSS	TAN	NO_2^-	NO_3^-	TKN	TN	PO_4^{3-}	TP
05/02/07	River	0,327	118,2	35,2	29,8	0,10	0,07	1,67	0,99	2,74	0,05	0,10
05/02/07	Paddy 1	0,192	141,0	44,6	31,6	0,07	0,02	4,08	1,22	5,33	0,07	0,19
05/02/07	Paddy 2	0,127	202,0	48,0	23,8	0,15	0,05	0,69	1,49	2,23	0,06	0,14
05/02/07	Paddy 3	0,099	25,1	17,7	70,6	0,04	0,02	0,37	1,29	1,68	0,03	0,19
% reduction (P1)		**41,3**	**-19,3**	**-26,7**	**-6,2**	**33,4**	**63,8**	**-143,8**	**-22,6**	**-94,6**	**-28,2**	**-90,0**
% reduction (P2)		**61,2**	**-70,9**	**-36,4**	**20,2**	**-42,8**	**24,6**	**58,7**	**-49,9**	**18,4**	**-13,4**	**-41,3**
% reduction (P3)		**69,7**	**78,7**	**49,6**	**-136,9**	**65,3**	**63,8**	**78,0**	**-29,5**	**38,5**	**33,9**	**-92,9**

Conclusions

- Nurturing function of paddy fields: cradle of fish and variety of aquatic organisms as natural food for fish
- Main income source to improve livelihood
- Restoring function of paddy fields: purification of nutrients to reduce eutrophication and pollution

Recommendations

- Application of integrated culture system in the paddies ➔ increase income and mutual benefits of rice and fish in the paddies
- Study on purification feasibility of paddies on waste treatment from catfish ponds

Sub-project 2
ANALYZING FUNCTIONAL ROLE OF PADDY FIELDS RELATED TO SOIL PRODUCTIVITY AND SOIL CONSERVATION

Le Van Khoa
Department of Research Affairs
Can Tho University
Can Tho city
Vietnam
Tel: 84-71-832971
Fax: 84-71-838474
E-mail: lvkhoa@ctu.edu.vn

Content of presentation

1. Introduction
2. Methodology
3. Results and discussions
4. Conclusions and recommendations

Vietnam in SEA

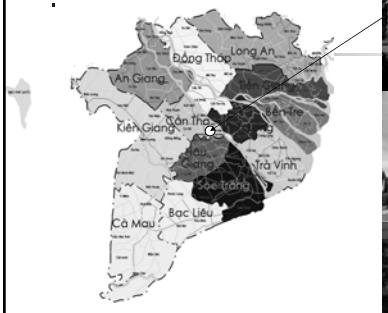
- Natural area: 33 Mha
- 2/3 hills and mountains
- Red and Mekong river system
- Agricultural land: about 50%
- Population: app. 82 millions (2005)

Mekong Delta in Vietnam

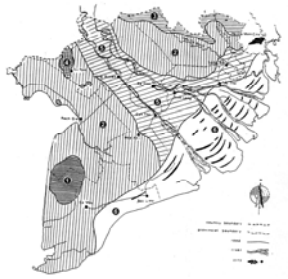
Mekong delta General information

- Natural area: 3.96 Mha (12% compared to VN)
- Average elevation: ± 2 m
- 50 % national agricultural produce
- 50% national rice produce
- 60% national fruit produce
- 65% marine products
- Population: app. 18 million peoples, 20% of VN (2005)

Can Tho University in MD



Mekong delta
Geology



❶ Peat dome U Minh forest
❷ Holocene bracket water marine deposits in depression area
❸ Pleistocene alluvial deposits
❹ Granite hills and mountainous area
❺ Holocene fluvial deposits, complex of levees and backswamps
❻ Beach ridges and clay plains

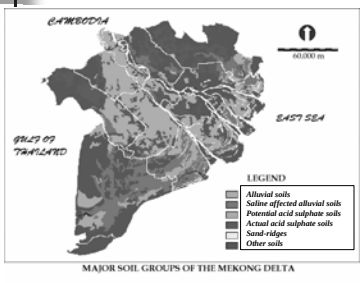
7

Mekong delta
Climate and hydrology

- Monsoon climate
- Rainy season: May – November
- Dry season: December – April
- Rainfall: 1200 – 2400 mm
- Evaporation: 420 – 660 mm
- Flooding period: Aug – Nov. (0.8 – 1.5 m)
- Average temperature:
  Max: 31ºC - 33ºC
  Min: 23ºC – 25ºC

8

Mekong delta
Soil distribution

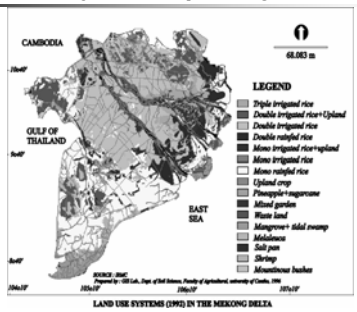


MAJOR SOIL GROUPS OF THE MEKONG DELTA

End of Holocene period
- Entisols
- Inceptisols
- Ultisols
- Histosols

9

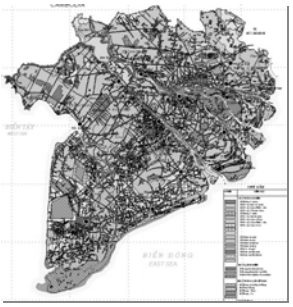
Mekong delta
Land use system: Triple irrigated rice



LAND USE SYSTEMS (1992) IN THE MEKONG DELTA

10

Mekong delta
Existing land use system



11

Situation of Agricultural production
Rice cultivation and Paddy field

- ☞ High speed of soil rotation and mono-agriculture
- ☹ Rice yield tends to:
  - ➢ stable and,
  - ➢ reach to a danger of yield decline
- ☹ Fertilizer response of soils is low

12

Scope of the study

☞ Identifying the role of paddy field to soil fertility related to soil degradation and conservation in the Mekong delta, Vietnam

Typical Mekong delta soils:

- Recent alluvial soils (intensive rice cultivation)
- Problemed soils
  - ✓Acid Sulphate Soils

13

Study locations

❶ Phu Tho, Tam Nong
❷ Hoa An, Cao Lanh
❸ My Thanh Nam, Cai Lay
❹ Hoa An, Phung Hiep

14

Main objectives

❶ **Determining and analyzing the indicators on physical and chemical characteristics of the paddy soils,**

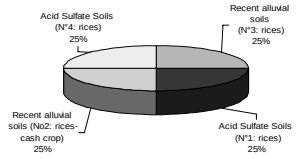
❷ **Identifying the status and types of soil degradation in cases of the fields used for paddy cultivation and paddy cultivation with alternative crops,**
- ✓**Soil preparation**
- ✓**Cropping pattern**

❸ **Measuring the available soil-water storage capacity of the top soils (cultivated soil layer) which is sharing the water resources and water economics for agricultural production,**

❹ **Providing recommendation and introduction:**
- **Prospective Land Utilization Types,** LUTs
- **Appropriable farming practices**

15

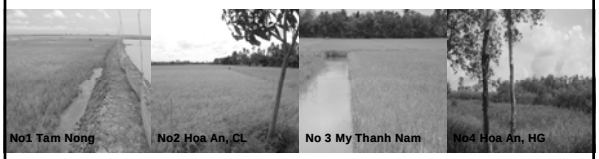
Major soil groups and locations under study



16

Methodology

❶ Pre-fieldwork
- Data collection, maps and document reference



17

Methodology

❷ Fieldwork on the selected study locations
- Typical soil profile description
- Soil physical measurements and soil sampling in the field

18

Methodology
Typical soil profile description

- FAO guidelines
- Other specific informations of MD

19

Methodology
Physical soil measurements in the field

Soil consistency measurement

20

Methodology

❸ Soil analyses and laboratory measurements
- Physical soil determinants
  - ✓ Soil texture
  - ✓ Bulk and particle density
  - ✓ ASWS
  - ✓ Sl and SQ
  - ✓ Soil ripening stages
  - ✓ Soil consistency

21

Methodology

❸ Soil analyses and laboratory measurements
- Chemical determinants
  - ✓ pH (H_20 and KCl), O.C
  - ✓ N, (total)
  - ✓ P (total and available)
  - ✓ Amorphous iron
  - ✓ Exchangeable Na, Ca, Mg and K
  - ✓ Soluble aluminum
  - ✓ Exchangeable aluminum
  - ✓ CEC

22

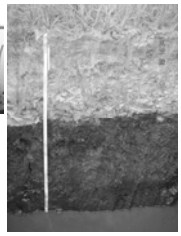
Methodology

❹ Land suitability assessment
- Quantitative land evaluation (FAO)
  - ✓ RPP
  - ✓ WPP
  - ✓ LPP
- Selected alternative crops
  - ✓ Soybean
  - ✓ Mungbean
  - ✓ Maize

23

Study locations
Nº1 Phu Tho village, Tam Nong district, Dong Thap province

Two rice crops since 1995



Typical soil profile

24

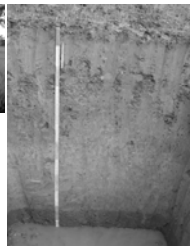
Study locations

Nº2 Hoa An, Cao Lanh town, Dong Thap province

Two rice crops

Alternated with cash crop

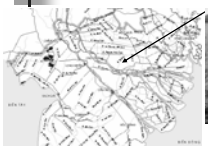
since 1986



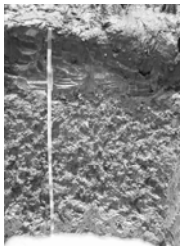
Typical soil profile

Study locations

Nº3 My Thanh Nam village, Cai Lay district, Tien giang prov.



Three rice crops since 1980



Typical soil profile

Study locations

Nº4 Hoa An village, Phung Hiep district, Hau Giang province

Two rice crops since 1995

Typical soil profile

Present land and crop management in the study locations

❶ Soil preparation
- Tractor (medium and small handle)
- Animal (buffalo)
- Human (land levelling)

❷ Management activities
- Fertilizer application (inorganic ones)
- Crop protection (pesticides / insecticides)
- Crop growing control (monitor / weed control)
- Irrigation

☞ Ploughing and inorganic fertilization (highest proportion)

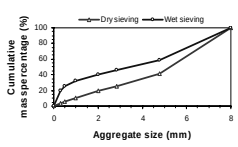
Paddy field and soil conductivity

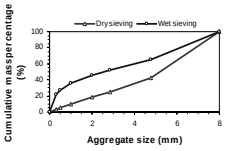
Real soil constraints related to the function of paddy field ?

☞ **Physical ?**
Chemical ?
Other ones ?

SOIL AGGREGATE STABILITY

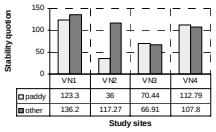
On the study locations



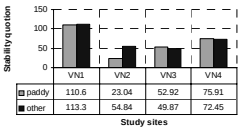


The mean weight diameter of soil aggregates at wet and dry sieving of A (left) and B (right) master soil horizon on study location Nº3

SOIL AGGREGATE STABILITY
On the study locations



Stability Quotion (SQ) of A soil horizon in the different study sites



Stability Quotion (SQ) of B soil horizon in the different study sites

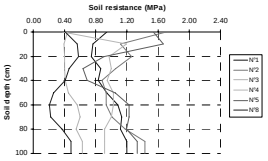
SOIL COMPACTION
on the study locations

Physical soil characteristics related to soil compaction of B master soil horizons, spread over the study locations

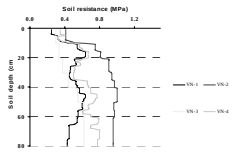
N°	Study sites	Soil depth (cm)	Physical soil characteristics			
			ρ_b (Mg/m^3)	ρ_p (Mg/m^3)	ϕ (%)	SR (stage)
1	VN°1	**25-80**	0.77	1.71	55	r
		(25-80)	0.71	1.70	58	r
2	VN°2	**15-65**	1.47	2.55	42	R
		(15-65)	1.30	2.55	49	R
3	VN°3	**20-65**	1.34	2.46	45	Rr
		(20-65)	1.38	2.40	42	Rr
4	VN°4	**45-90**	1.03	2.43	57	r
		(45-90)	1.15	2.51	54	r

(...): indicated for the soil depth of other cultivation (alternated with cash crop, wild land and mono rice)
ρ_b: bulk density
ρ_p: particle density
ϕ: porosity
SPR: soil penetration resistance; SR: soil ripening

SOIL COMPACTION
on the study locations



Variation of vertical soil penetration resistance (in MPa) in the soil profiles in 1998.



Variation of vertical soil penetration resistance (in MPa) in the soil profiles in 2007

SOIL COMPACTION
on the study locations

☞ In the area of intensive rice cultivation

- ➢ Formed and developed in the subsoil horizons so-called as 'plow pan'
  - ✓ Variable
  - ✓ 20 – 40 cm from the soil surface
  - ✓ Thickness: 35 – 50 cm

SOIL WATER - cuASWS
on the study locations

☞ Cumulative available soil water storage (50 cm topsoil)

❶ In the different study locations
- ➢ 34 – 128 mm

❷ In the area of intensive rice cultivation
- ➢ 89 – 126 mm

❸ More improved in the alternative paddy fields

❹ High amount in ASS

CHEMICAL SOIL FETILITY
on the study locations

Qualitative assessment of the analysed chemical soil determinants involved in the study sites

N°	Study location	Chemical soil characteristics*						
		pH_{H2O}	SOM (%)	Total N (%)	Avail. P (mg/kg)	P_2O_5 (%)	Al** (cmol(+)/kg soil)	CEC (cmol(+)/kg soil)
1	VN°1	Very strong acidic	Moderate to rich	Moderate to rich	very poor	Moderate to very poor	High to very high	Moderate
	Wild land	*Extreme acidic*	*Moderate to rich*	*Rich*	*very poor*	*Rich to moderate*	*Very to extreme*	*Moderate*
2	VN°2	Slight to neutral	Poor to very poor	Moderate to very poor	Poor to moderate	Moderate to poor	Extreme low	Moderate
	After 10 yr.	*Neutral to slight*	*Moderate to poor*	*Moderate to poor*	*Poor to moderate*	*Rich to moderate*	*Extreme low*	*Moderate*
3	VN°3	Slight to neutral	Poor to very poor	Moderate to very poor	Moderate to rich	Poor	-	High
	After 10 yr.	*Strong acidity*	*Moderate to very poor*	*Rich to very poor*	*Very poor*	*Rich to moderate*	*Extreme low*	*High*
4	VN°4	Very strong acidic	Rich to moderate	Rich to moderate	Moderate to poor	Moderate to poor	High	Morderate
	Wild land	*Extreme acidic*	*Rich to moderate*	*Rich to moderate*	*Moderate to poor*	*Moderate to rich*	*Very high*	*Morderate*

(*) : classified from top soil to subsoils
(**): soluble aluminum content
SOM: soil organic matter

Evaluation
Current land use system

❶ Rice production
- Increasingly depends on fertilizer application (inorganic)
- Crop yield seems to reach a stagnation and tends to decline

❷ Cultivation practices
- Less attention on soil management
- Only expected from the external factors, not on soil capacity
- Spontaneously alternated with the interested cashcrops

37

Evaluation
Soil productivity

☞ Aggregate and structural stability

❶ Stronly influenced by soil organic matter and soil texture

❷ Tends to decrease from topsoils to subsoils

38

Evaluation
Soil productivity

☞ Soil compaction

❶ Formed and developed in the B master soil horizons at slight degree

❷ Mainly caused by illuviation, mono-cultivation, soil preparation in wet condition

39

Evaluation
Soil productivity

☞ Soil water characteristics

❶ Most of the cases, cuASWS range 100-120 mm in the paddy fields

❷ Waterlogged phenomenon in rice fields can occur in rainy season

40

Evaluation
Soil problems

☞ Chemical soil fertility

❶ Soil nutrients are poor in the subsoil horizons even on the intensive rice cultivation

❷ Soil surface enriched with some nutrients from annual flooding (favourable only for the first rice crop: Winter/Spring)

41

Evaluation
Soil productivity

☞ Actual soil productivity

❶ Physical soil degradation
- Soil compaction (recent)

❷ Chemical soil degradation
- Nutrient depletion (recent)
- Acidification (recent)

42

CONCLUSIONS

❶ ***Paddy fields with three rice crops cultivation intensively on the non-problemed soils will gradually reduce the soil productivity, essentially to the physical soil fertility,***

❷ ***Paddy fields on the problemed soils (Acid Sulphate Soils) will effectively improve soil productivity, Chemical soil fertility***

❸ ***Alternative land use is the best solution for soil conservation and sustainable agricultural production in the Mekong delta, Vietnam in the non-problemed soils. In which a soybean can be selected as a cash crop alternated with rice cultivation,***

43

CONCLUSIONS

❹ ***Wise-use of the land should be considered versus rice or other land uses in the problemed soil, specially Acid Sulphate Soils,***

❺ ***Deep soil tillage with proper tractors in the suitabe soil condition should be done,***

❻ ***Organic and compound fertilizers have to advice to apply in the non-problemed soils.***

44

RECOMMENDATIONS
Perspective cash crop land use system

☞ Pre-conditions for Quantitative land evaluation and perspective alternative cash crop

- Agricultural development strategy of the State
- Market requirement
- Technology-Science level of local farmers
- Not influence to the main rice cropping in the area

45

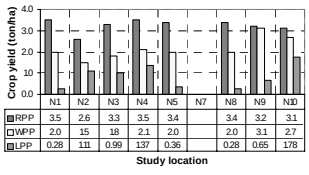
RECOMMENDATIONS
Perspective cash crop land use system

Soybean
Mungbean

46

LAND SUITABILITY ASSESSMENT
For alternative crops on the study locations

Soybean

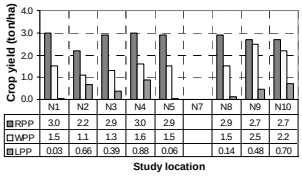


The yield gaps of soybean at the different study locations

47

LAND SUITABILITY ASSESSMENT
For alternative crops on the study locations

Mungbean

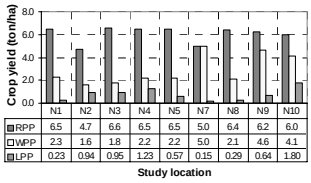


The yield gaps of mungbean at the different study locations

48

LAND SUITABILITY ASSESSMENT
For alternative crops on the study locations

Maize



	N1	N2	N3	N4	N5	N7	N8	N9	N10
RPP	6.5	4.7	6.6	6.5	6.5	5.0	6.4	6.2	6.0
WPP	2.3	1.6	1.8	2.2	2.2	5.0	2.1	4.6	4.1
LPP	0.23	0.94	0.95	1.23	0.57	0.15	0.29	0.64	1.80

The yield gaps of maize at the different study locations

49

RECOMMENDATIONS
Perspective cash crop land use system

☺ Soybean is the suitable and best perspective crop in the area of intensive rice cultivation

- Sown in the second cropping (Spring-Summer or early Summer-Autumn
- Few soil constraints: pH, SOM, K, Ca and Mg
- Positive affects: support to soil development

50

RECOMMENDATIONS
Soil care and management

☞ Soil conditioning

❶ Organic matter
- Organic fertilizers and compound fertilizers
- Avoiding/minimizing: fallow, field burning

❷ Calcites application

51

RECOMMENDATIONS
Soil care and management

☞ Soil and water management

❶ Proper soil preparation
- Not in wet condition
- Deep ploughing

❷ Water-table control (ASS)

❸ Monitoring ASWS in the field
- Crop water requirement
- Water economics in irrigation

52

RECOMMENDATIONS
Agricultural extension work for new LUTs

❶ Capital support and transfer the science-technology knowledges

❷ Encourage local farmers with new LUTs

❸ Assuring consumable market and reasonable price

53

SUGGESTIONS
For future researches in the region

☺ **Survey and evaluation the "soil health" or soil degradation status on major soil groups in the region, combination with quantitative land evaluation for perspective economic crops,**

☺ **Survey and calculation the total available soil water storage and its evolution during a year. Establishing the irrigation schedule to meet the selected crop water requirement on the way of water economics in the different major soil types of the region.**

54


THANK YOU VERY MUCH
FOR YOUR ATTENTION
55

Sub-project on Socioeconomic Issues: The Function of Paddy Fields in Buffering the Income of Farm Households against Environmental Risks

Suwit Laohasiriwong and A. Terry Rambo
with the assistance of
Phoolpatra Penchome

Research Objectives

1. **To record the number of different kinds of the income-generating activities engaged in by households with only irrigated paddy fields and only rainfed paddy fields**
2. **To measure the share of their total income that irrigated and rainfed households gain from each source of income (including paddy fields)**

Research Objectives, Continued

3. **To measure the share of their total time that households spend in gaining income from each source (including paddy fields).**
4. **To measure the share of their total time that irrigated and rainfed households spend in each type of income generating activity**

Methodology

Household record keeping by stratified sample of 20 households:

- **Irrigated HHs:** 5 HHs with <1 ha of paddy fields, 5 HHs with >1ha of paddy field
- **Rainfed HHs:** 5 HHs with <1 ha of paddy fields, 5 HHs with >1ha of paddy field

The activities for all household members were recorded on a daily basis by the heads of the households using standardized record-keeping sheets

Sample of daily record for irrigated HH member

Time	Activity	Income	Location
0600-0900	Collect rattan	100 baht	Home garden
0900-1200	Work in Paddy	-	Paddy field
1200-1300	Lunch break	-	Paddy field
1300-1700	Work in Paddy	-	Paddy field
1700-2000	Collect crabs	25 baht	Paddy bund
2000-0600	Sleeping	-	House

Methodology, Cont.

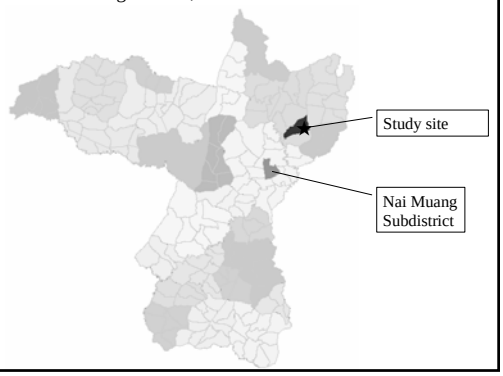
Data Collection Schedule:

30 days in rainy season (5 July-4 August 2006)

30 days in dry season (8 January-6 February 2007)

Data entered into Excel data base

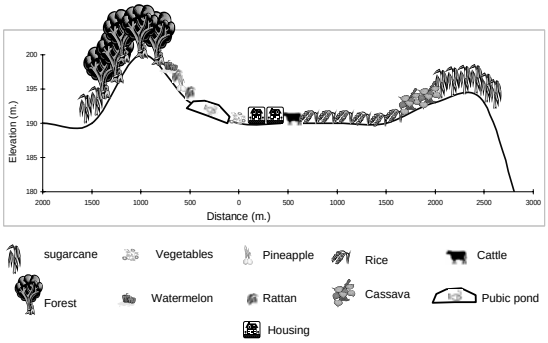
Study site: Dong Yen Village,
Nam Pong District, Khon Kaen Province



Dong Yen Village

- Population: 393 people in 65 households
- Total land area: 320 ha
- Area of paddy fields: 112 ha
- Both irrigated and rainfed paddy fields
- Main crops: Rice, cassava, sugarcane, peanuts

Land use transect of Dong Yen Village

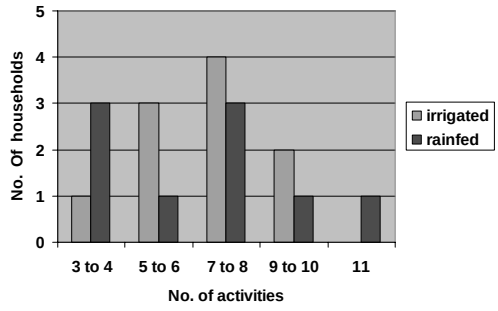


Key findings

On average, irrigated HHs engage in more activities than rainfed HHs

- Rainy season
  - Irrigated HHs: **6.9** activities
  - Rainfed HHs: **6.9** activities
- Dry season:
  - Irrigated HHs: **5.8** activities
  - Rainfed HHs: **5.1** activities

Comparison of number of livelihood activities of irrigated and rainfed households in rainy season



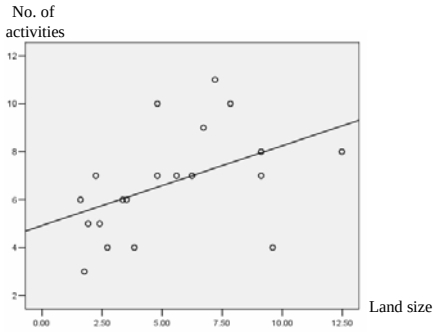
Key findings, cont.

- **Households with larger landholdings engage in more activities than households with smaller landholdings (regardless of whether their paddy fields are irrigated or rainfed).**
- ***It is hypothesized that households with larger landholdings have greater total resources so can obtain the capital needed to fund new activities and can also afford to take risks.***

Mean number of activities of HHs with larger and smaller landholdings

Season	Irrigated households		Rainfed households	
	<1 ha	>1 ha	<1 ha	>1 ha
Rainy	**5.4**	**8.4**	**5.2**	**7.8**
Dry	**5.0**	**6.6**	**4.4**	**6.0**

Scatter diagram of relationship between land size and number of rainy season activities



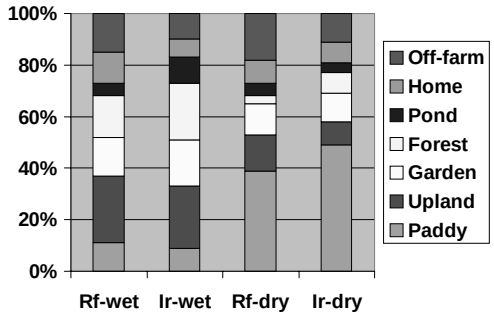
Key Finding: Sources of Income

- **Paddy fields are a more important source of income for irrigated households than for rainfed households**
- **Irrigated households gain a larger share of income from on-farm sources than rainfed households.**

Key Finding: Sources of Income, Cont.

- **Rainfed households gain a larger share of their income from non-farm sources (handicrafts, wage labor) than irrigated households**
- ***It is hypothesized that the greater stability of production of irrigated paddy fields allows households to profitably focus their attention on farming activities. Rainfed households must supplement income from agriculture with non-farm work.***

Share of income obtained by rainfed and irrigated households from different sources



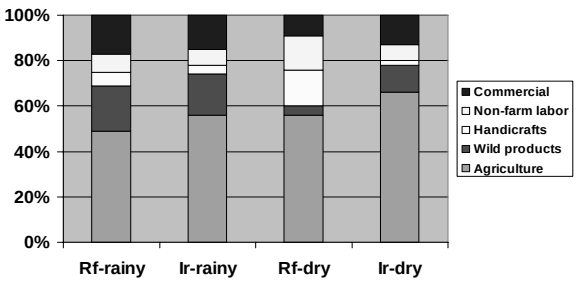
Key finding: Share of time spent gaining income from different sources

- **In the rainy season, rainfed and irrigated households both spend about 50% of their labor time in the paddy fields.**
- **In the dry season, households with irrigated fields spent >40% of their time in the paddy fields; rainfed households only worked 3% of their time there. Rainfed households spent more time in upland fields, gardens, and in non-farm and off-farm work.**

Key finding: Share of time spent in different income-generating activities

- **Irrigated households obtain a greater share of their total income from agricultural activities than rainfed households.**
- **Rainfed households are much more dependent on non-farm and off-farm activities than the irrigated households.**

Share of time spent in different income-generating activities



Conclusions

- **Paddy fields play a very important role in the economic life of both rainfed and irrigated households in Northeastern Thailand.**
- **On average, irrigated households engage in a larger number of income-generating activities than do rainfed households with comparable sized landholdings.**

Conclusions, cont.

- **Households with smaller areas of land, regardless of whether they own rainfed or irrigated paddy fields, engage in fewer income-generating activities than households with larger landholdings.**

Conclusions, cont.

- **Irrigated households obtain more of their income from agricultural activities than rainfed households.**
- **Rainfed households are more dependent on non-farm and off-farm activities than the irrigated households.**
- **This supports the view that irrigated paddy fields help stabilize rural livelihoods and maintain agricultural employment in the countryside.**

Thank you

Analysis of the functional role of paddy fields in focusing on assessing the income of farm-households and employment generation of farmers

Nguyen Duy Can
Mekong Delta Development Research Institute,
Cantho University, Vietnam

Outline

- **Background**
- **Research approach and methodology**
- **The study site**
- **Specific tasks**
- **Results of the analysis on function roles of paddy field**
- **Conclusions**

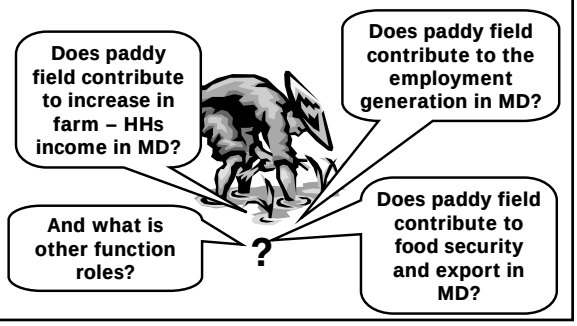
Background (1)

- Rice is the grain that has shaped the cultures, diets, and economics of billions of farmers
- The MD of Vietnam is considered as a "rice bowl" of the country, rice plays a crucial role in the economic development of the region
- Rice production and paddy field plays many other vital roles in the functioning of the rural life in the MD.

Background (2)

- But paddy fields (PF) functions and their impacts are not sufficiently understood.
- There are uncertainties of the functional role of PF regards to socio-economic issues and that leads to our research questions ?

Research questions



Research approach & methodology (1)

In this study, the participatory approach, particularly the PRA method was employed, and included 3 main activities:

- Selection of sample village & study site
- Selection of sample households
- Data collection

Study site

Four villages were investigated:

- **Phu Tho**
- **Hoa An**
- **My Thanh Nam**
- **Than Cuu Nghia**

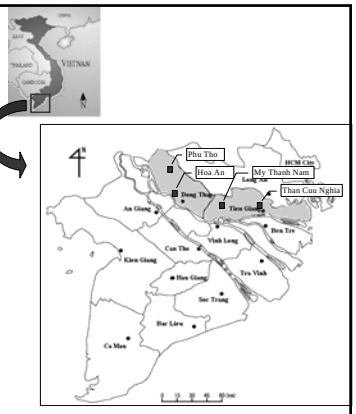


Fig. 1. The map showing the study sites of sub-project 4

Characteristics of the 4 sites under investigation

Site	Location	Agro-ecological zone	Soil characters	Field production systems
1	Phu Tho, Tam Nong, DT	Deep flooded	acid sulfate soils	2 paddy crops
2	Hoa An, Cao Lanh, DT	Shallow flooded	Undeveloped alluvial soils	2 paddy crops plus 1 upland crop
3	My Thanh Nam, Cai Lay, TG	Flood control area	Developed alluvial soils	3 paddy crops
4	Than Cuu Nghia, Chau Thanh, TG	Flood control area	Developed alluvial soils	Non-paddy crops

Selection of sample households

A total of 40 households (HHs) among 4 sites (villages) selected were interviewed. Sample HHs were divided into 4 sets.

- 1 set of 10 HHs in Phu Tho village
- 1 set of 10 HHs in Hoa An village
- 1 set of 9 HHs in My Thanh Nam
- 1 set of 11 HHs in Than Cuu Nghia village

Specific tasks/ activities

- Review the available data on socio-economic issues
- Select sites of paddy and non-paddy, and collect the socio-economic data of farm-households in the MD
- Analyze the indicators on income and employment generation of farm-households
- Assess the socio-economic effects of existing paddy production systems

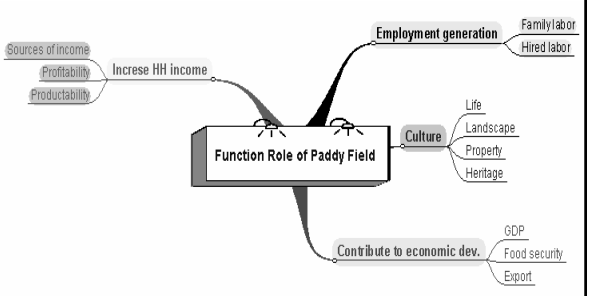
Results of the analysis on function roles of paddy field

Focusing to analyse the roles of paddy field on the following selected function:

- Functioning in increasing farm - households' income
- Functioning in employment generation of farmers
- Functioning in contributing to the economic development and food security
- Other function roles of paddy field

Illustrated

Analysing the function roles of paddy field



Functioning in increasing farm households' income

- Paddy farming contributes high proportion in household incomes

Sources of income	Hoa An	Phu Tho	TC Nghia	MT Nam
Paddy field farming	**60.6**	**72.1**	**65.6**	**41.9**
Livestock	**4.1**	**1.8**	**1.8**	**8.4**
Homestead	**5.7**	**-**	**-**	**13.9**
Agriculture wage labor	**6.3**	**18.2**	**3.1**	**5.9**
Non-agriculture	**-**	**-**	**17.7**	**16.9**
Services	**23.3**	**7.9**	**20.8**	**13.0**
Total	**100**	**100**	**100**	**100**

- Average income from the source for households by village

Sources of income	Hoa An	Phu Tho	Than Cuu Nghia	My Thanh Nam
Paddy field farming (1000VND)	19,106	36,670	24,772	22,571
Livestock (1000VND)	1,300	933	800	4,533
Homestead (1000VND)	1,800	-	-	7,480
Agric. wage labor (1000VND)	2,000	9,250	1,350	3,150
Non-agriculture (1000VND)	-	-	7,733	9,100
Services (1000VND)	7,333	4,000	9,125	7,000
Total income (1000VND)	31,539	50,854	43,780	53,834
Family size	6.3	4.7	4.6	4.9
Per capita income (1000VND)	5,006	10,820	9,443	11,012

Contribute to increase in income of farm – households (US$1187 to US$2312 per hh per year).

- **Profitability from paddy field production systems** :

	2 paddy + 1 non-paddy	2 paddy Crops	Non-paddy crop	3 paddy crops
Total costs (1000 VND)	9021	26618	12972	16820
Gross value of prod. (1000 VND)	28127	63289	37744	39391
Net income (1000 VND)	19106	36670	24772	22571
Net income/ total costs ratio	2.12	1.38	1.91	1.34
Use of family labor (days)	50	44	121	55
Farm size (ha)	0.46	2.06	0.18	0.82

- **Productivity from paddy field production systems**

	2 paddy + 1 non-paddy	2 paddy crops	Non-paddy crop	3 paddy crops
Productivity, rice equivalent (t/ha/year)	17.14	11.55	58.20	17.26
Rice yield (t/ha)	5.51	6.08	-	6.73
Total costs (1000 VND/ha/year)	18169	13507	52695	20820
Gross value of production (1000 VND/ha/year)	47144	31761	160058	48238
Net return (1000 VND/ha/year)	28975	18255	107363	27419
Net return/ total costs ratio	1.59	1.35	2.04	1.32

Functioning in employment generation of farmers

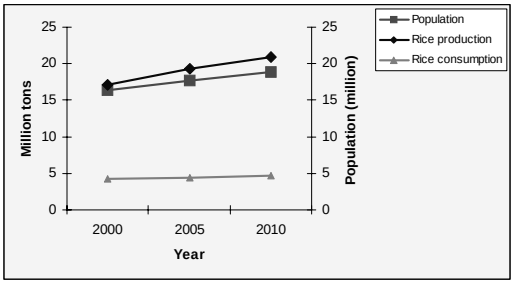
- Family labors and hired labors required per ha for paddy production

Production system	WS		SA		AW	
	Family labor	Hired labor	Family labor	Hired labor	Family labor	Hired labor
2 paddy crops	10	63	11	71	-	-
2 paddy + 1 non-paddy	27	55	25	63	32	50
3 paddy crops	20	56	24	61	23	58

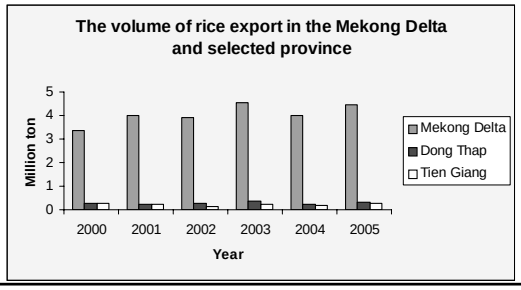
Functioning in contributing to the economic development & food security

- **Contribution to the economic development:** Agricultural production, especially paddy production continues to play a dominant role in the economy, accounting for over 23% of GDP (at current price)

- **Contribution to food security:** The MD produced rice to feed people in the MD and other regions of the country

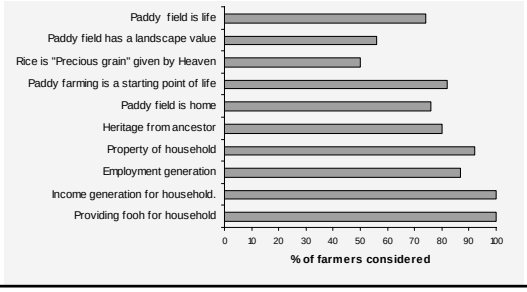


- **Contribution to rice export of the country :** MD has produced rice not only for meeting the domestic demand for food in the country but also for exports (contribute to 90% of total rice exported).

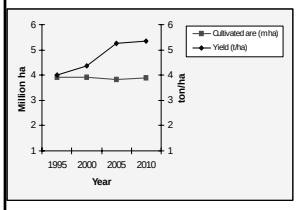


Other functions roles of paddy field

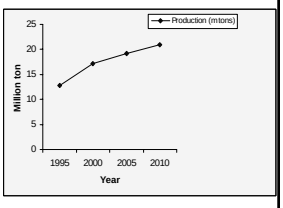
Perception of people on function roles of paddy field



The trends and the future of paddy production in the MD



- Cultivated area maintains at about 4 m ha
- Average rice yield increases to about 5.4 t/ha



- Rice production increases to about 21 m tons.

Conclusions

- The paddy fields have contributed to increase in income of farm – households (US$1187 to US$2312 per household per year).
- The paddy fields have contributed to the employment generation of farm - households.
- Paddy fields have contributed to economic development, food security and export in the MD region.
- Paddy field also functioned a crucial role in the rural people life