# IRMLA:
# Systems Research for Integrated Resource Management and Land Use Analysis in East and South-east Asia


## IRMLA Kick-off Workshop
## held at the Army Hotel
## Hanoi, Vietnam
## 23-27 February 2002

**R Roetter (ed.)**
**Alterra, Wageningen UR,**
**The Netherlands**

***IRMLA Project Report no. 1***

ALTERRA

# IRMLA
# Project Planning Workshop
# 23-27 february 2002
# Hanoi, Vietnam


http://www.alterra.dlo.nl/websites/irmla

## Preface

This first report of the 'Systems Research for **I**ntegrated **R**esource **M**anagement and **L**and Use **A**nalysis' (IRMLA) project is the result of thorough preparation and excellent organization of the kick-off workshop held at Hanoi, 23-27 February, 2002. The workshop was jointly organized by the National Institute of Soils and Fertilizers (NISF, Hanoi) and a committee consisting of the European teamleaders.

In-depth presentations of methodological aspects and case studies and lively discussions among project partners laid the foundation for fruitful results comprising a joint project strategy, detailed workplans and identification of training needs, mode of collaboration and required scientifc innovations.

The workshop process greatly benefitted from stimulating contributions of representatives from the Vietnamese Ministry of Agriculture and Rural Development (MARD), the Dutch Embassy and various research groups (from Thailand, Philippines and Australia) working on related subjects in the region.

The report provides an overview of workshop objectives, presentations and main findings from the various sessions, characterization of the four case studies and a synthesis in form of detailed workplans. A comprehensive annex comprises background materials on research methodologies, case studies, other project information and workshop activities. Hence, the report constitutes an important milestone serving as guideline for project implementation and monitoring. As such the report is directed to all project partners and collaborators and to the European Commission. The report also can serve as a source of materials for communicating project information to a wider audience, e.g. via internet (www.alterra.nl/websites/irmla), brochures and other publication means.

I would like to take the opportunity to thank all workshop participants for their contributions to the workshop. The National Institute for Soils and Fertilizer (NISF) and its organizing committee is greatly acknowledged for hosting this workshop and making it a fruitful and pleasant experience. A special word of thanks is extended to Drs TT Son and LN Chien for their professionalism and untiring efforts in organizing the event and making it a success.

Wageningen, 16 July, 2002

Reimund P Rötter
IRMLA Project Coordinator

## Table of Contents

# Major Project Partners

**Coordinator:**

1. SOIL& LAND USE DIVISION, ALTERRA, P.O. Box 47, 6700 AA Wageningen, The Netherlands
Dr. Reimund Rötter
Phone 31-317-474229
Fax 31-317-419000
Email r.p.roetter@alterra.wag-ur.nl

**Contractors:**

2. DEPARTMENT OF NATURAL RESOURCE SCIENCE, ZHEJIANG UNIVERSITY, Huajiachi, Hangzhou 310029, Zhejiang, China
Prof. Wang Guanghuo
Fax 86-571-6049815
Email ghwang@mail.hz.zj.cn

3. NATIONAL INSTITUTE FOR SOILS AND FERTILIZERS (NISF), Chem, Tu Liem, Hanoi, Vietnam
Dr. TT Son
Phone 84-4-8362380
Email tsonnisfacvn@hn.vnn.vn

4. MARIANO MARCOS STATE UNIVERSITY (MMSU), Batac, Ilocos Norte, Philippines
Dr. Epifania Agustin
Phone 63-77-792-3131/ 2547
Fax 63-77-792- 3191 /3447
Email rddirectorate@hotmail.com

5. AGROTECHNOLOGY TRANSFER CENTER (ATTC), CUU LONG DELTA RICE RESEARCH INSTITUTE (CLRRI), O Mon, Can Tho, Vietnam
Dr. NX Lai
Phone 84-71-861392
Fax 84-71-861457
Email attc@hcm.vnn.vn

6. FZK-IMK4 (FORMERLY IFU-FHG), INSTITUTE FOR METEOROLOGY AND CLIMATE RESEARCH. ATMOSPHERIC ENVIRONMENTAL RESEARCH FORSCHUNGSZENTRUM KARLSRUHE GMBH, Kreuzeckbahnstr. 19, D-82467 Garmisch-Partenkirchen, Germany
Dr. Reiner Wassmann
Phone 49-8821-183-139
Fax 49-8821-183-294
Email reiner.wassmann@imk.fzk.de

7. GROUP PLANT PRODUCTION SYSTEMS, DEPARTMENT OF PLANT SCIENCES, WAGENINGEN UNIVERSITY, PO Box 430, Haarweg 333, 6700 AK Wageningen, The Netherlands
Dr. Ir. Martin Van Ittersum
Phone 31-317-482382
Fax 31-317-484892
Email martin.vanittersum@pp.dpw.wau.nl

8. AGROSYSTEMS DEPARTMENT, PLANT RESEARCH INTERNATIONAL, PO Box 16, 6700 AA Wageningen, visiting address: Bornsesteeg 65, 6708 PD Wageningen, The Netherlands
Prof. Dr. Ir. Herman Van Keulen
Phone 31-317- 75955
Fax 31-317-423110
Email h.vankeulen@plant.wag-ur.nl

# 1 Introduction

Opening session
Chair: TT Son
Rapporteur: NX Lai

## 1.1 Purpose of the workshop

In September 2000 the project proposal 'IRMLA: Systems Research for Integrated Resource Management and Land Use Analysis in E and SE Asia' was submitted to CEC at Brussels for being funded by the EU – INCO development programme. The project proposal was approved in January 2001 and contract negotiations had been completed by 16 november 2001, resulting in the contract ICA-CT-2001-10055. The 4 years project officially started on 1 december 2001. One of the first activities was to organize and carry out an inception workshop

The objectives of the workshop were as follows:

- Objective 1: To inform partners about concepts and demonstrate selected tools for land use systems analysis at farm and (sub-) regional levels

- Objective 2: To present and exchange information about resource management problems and characterize physical and socio-economic environments in the various study areas: Jinhua district (China) Batac and Dingras municipalities (Philippines), Omon district (S Vietnam) and Tam Dao district (N Vietnam).

- Objective 3: To identify required innovations and further development of problem-oriented land use analysis methodologies.

- Objective 4: To review and further develop specific objectives, research strategy, overall outputs of the project and associated activities, the mode of collaboration among partners, and required training activities

- Objective 5: To develop and document an overall project plan and detailed workplans for years 1 and 2.

To meet the objectives a five-day meeting was organised.

This report summarizes the contents of the various presentations and the major results from the plenary discussions and planning sessions. The document combines information on

- objectives, concepts and approaches, and activities of the project proposal
- the workplans for years 1 and 2 and partner responsibilities as agreed upon during group discussions
- the timing of activities
- the agreements reached regarding communication, training, money transfer, reporting requirements, ownership of information

## 1.2 Opening: Welcome Speeches by Director NISF, Dr B H Hien, Hanoi, and Vice-Minister for Agriculture, Dr BB Bong (MARD), Hanoi, Vietnam

Dr Hien welcomed all participants to the meeting. He stated that the project starts on the right moment. Unless a lot of research effort is put in different countries, conflicts in land use objectives and resource use cannot be resolved properly. Lack of improved technologies and methodologies developed are often not adopted by the farmers. The actual development in research approaches is that local knowledge and participation of different stakeholders becomes more and more important.

In his keynote address "Demand for systems approach and new tools for analysing NRM problems" Vice-minister Dr BB Bong of MARD stresses the high demand for approaches and projects that combine research in agro-technology innovation, analysis of farmers' situation related to adoption of new technologies and examination of meaningful policy measures. This is the kind of research that can guide farmers and policy makers to fully exploit opportunities under the economic reform.
Dr Bong is pleased by the approach of IRMLA project which intends to makes full use of local knowledge and advanced research methods and techniques to combine farm level research with policy analysis. The use of advanced technologies (such as ICT) for creating an analytical modelling framework for land use planning at different decision levels is highly appreciated as well as the participatory approach, involving farmers and farmer groups and all other stakeholders to ensure that the system addresses the right questions.
The vice-minister stresses his high expectations of the project which are partly fed by successful previous collaborative projects with the European and Asian partners in IRMLA. He underpins that the project will enjoy full support by his Ministry.

## 1.3 Introduction to workshop procedure and research challenges (by R. Roetter)

*Workshop procedure*
As part of the planning phase, the planning and training (kick-off) workshop attended by all partners is intended to review the technical annex to the project proposal, sharpen objectives, expected results and research strategy, elaborate detailed workplans, exchange information on scientific-technical and management aspects of the project, identify bottle-necks and required action and document the results.

The IRMLA project focusing on land use systems analysis and planning in selected areas in the humid tropics of Asia builds upon and continues a strong and fruitful systems research partnership in Asia – and it partly builds on tools (integrated in the Land Use Planning and Analysis System (LUPAS)) developed by the SysNet Project during 1996-2000 for land use planning at the regional level.
IRMLA, however, aims at multi-scale analysis of options for resolving land and resource use conflicts. Therefore, first various concepts and tools for land use analysis and policy evaluation at regional and farm level will be reviewed and demonstrated. Through a field trip and presentations, current and expected resource mangement problems in four different case study areas will be identified. Subsequently, the merits and limitations of existing, alternative systems approaches and methodologies for analysis of resource management problems and land use options will be discussed. Finally, the specific challenges of the four case studies and the required innovations in research approaches, tools and activities will be identified. This will be documented and, eventually, result in overall workplans and detailed plans for years 1 and 2 of the project.
The workshop will be concluded by a training-session on SysNet tools and additional tools considered useful in the framework of multi-scale land use analysis.

*Research challenges*
The core problem in many parts of East and Southeast Asia leading to conflicts in land use objectives and resource use, is the demand for more food under increasing competition for scarce natural resources and socio-economic resources. An increase in agricultural production has to be achieved with less land, water, labor and other resources

Different approaches are to be followed at different scales to overcome this problem:

- Technology-oriented, at field/farm scale: examines methods to increase production while increasing resource use efficiency (e.g. most NRM research of NARES and Advanced international Research Centers)
- Policy-oriented, at regional to national scale: analyses options for sustainable rural development through land use planning by taking into account both, technical possibilities for meeting agricultural production targets and also other land use objectives such as farmer's income, employment, claims on land by other sectors, and relations between available and required resources (e.g. multiple goal analysis as in SysNet-LUPAS)
- Participatory, at farm to national scale: takes explicitly into consideration the active role of resource managers and planners (at different levels ) in the research process

While systems thinking has entered NRM research at different levels, in practice, there is usually a "gap" between NRM research at the farm and field level directed at production technology improvement (SSNM, IPM, water-saving practices ) and future-oriented analysis of options for policy and technical change at regional level in support of NRM. This becomes ***one of the challenges of this project:*** multi-scale analysis of land use conflicts and resource management options. Other specific challenges pertain to (a) the design of new types of Farmhousehold Models with a.o. less data demands and (b) to throrough examination of planning processes, information requirements of stakholders and decision behavior of resource managers' at different levels.

Methodology – unfinished business

Although in recent years major research efforts were directed at developing appropriate methodology for land use analysis at different scales (e.g. SOLUS and LUPAS methodologies (Bouman et al., 2000; Hoanh et al., 2000), these methodologies have several shortcomings which still need to be resolved:

- Accurate quantitative description of agricultural production activities and technologies
- Improvements in data screening , storage, model development and evaluation
- Improved spatial differentiation of data on biophysical and socio-economic resources and harmonization of data resolutions
- Incorporation of farmers decisions in response to policy measures and to new improved technologies
- Consideration of uncertainties in environmental and economic factors in the analysis

# 2 Day 1: Concepts & demonstration of tools

## 2.1 Session 1: Concepts of land use systems analysis (presentations)

Chair: BB Bong
Rapporteur: AG Laborte

### 2.1.1 Concepts underlying land use optimization from farm to regional level (Martin van Ittersum & Chu Thai Hoanh)

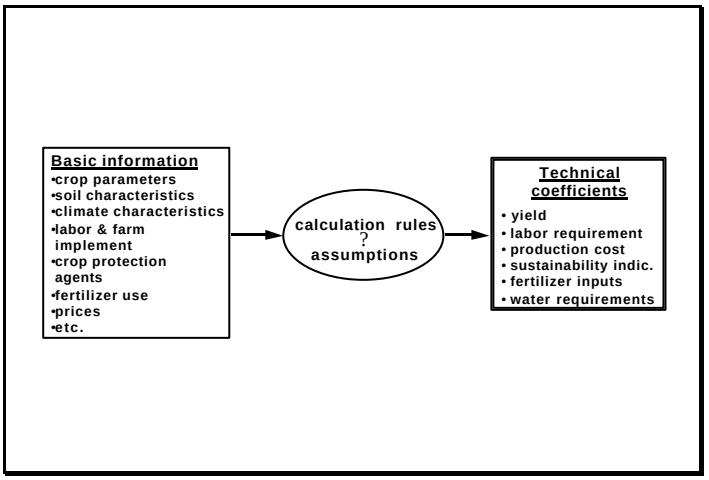
In this presentation exisiting (SysNet) methodology for exploring land use options at the regional level was reviewed (Roetter et al., 2000a,b) – with special emphasis on the technique of Interactive Multiple Goal Linear Programming (IMGLP) (De Wit et al., 1988) (Annex 4). One example (regional study Ilocos Norte) was presented to illustrate capabilities and limitations of the technique. Implications of these limitations for use in IRMLA and required improvements were discussed. Recent results from a recent study in Vietnam (Bac Kan) were presented to illustrate new ways of presenting land use optimization results (Annex 5).

### 2.1.2 Concepts underlying Farm Household Modelling (FHM)

Since farm household modelling was a new subject to most participants, Nico Heerink first lectured about the basic concepts underlying this technique (Annex 6) and lateron, illustrated the concepts by several simple exercises. He concluded that FHM can be used for production analyses if markets are not perfect – which obviously applies to all case study sites.

### 2.1.3 Introduction to quantitative input-output models

Prof. Van Keulen presented basic concepts of quantitative description of input –output relations of production activities in the context of explorative and predictive land use studies. Such quantitative relations constitute the core of input-output models as used within the IMGLP technique. So-called technical coefficients (Hengsdijk et al., 1999) represent the input – output relations for each combination of land use type, land unit and technology level at a given socio-economic situation.




Examples were provided to illustrate the capability of existing tools (technical coefficient generators) - as developed in research projects in Mali, Costa Rica and SE Asia.

### 2.1.4 Discussion: Limitations of current techniques

Overall objective of IRMLA is to contribute to sustainable agricultural development in selected areas of East and Southeast Asia through novel techniques of resource use analysis and land use planning. This approach contains elements of science and elements of facilitating impact of research results.
In the current session, the science of land use systems analysis was discussed, i.e. concepts and techniques from farm to regional level. Major conclusions were that limitations of current analytical procedures (see, e.g. Laborte et al., 2000) can be overcome by IRMLA through three innovations:

- taking uncertainties in environmental factors explicitly into account in land use optimization
- linking /iterating land use scenario analysis at farm and regional level (outputs of regional model serving as input of farmhousehold model and vice versa), and
- developing new, less data demanding types of farm household models.

## 2.2 Session 2: Demonstration of tools

Chair: Martin van Ittersum
Rapporteur: Ino Lansigan

Short demonstrations of three different tools were prepared for this session:

- Multiple goal linear programming for regional analysis of land use options (Laborte)
- TechnoGIN: generation of technical coefficients for different land management units in Ilocos Norte Province (Roetter)
- WOFOST Generic crop simulation model for estimating potential, water-limited and nutrient-limited yields for several field crops (Van Diepen)

# 3 DAY 2: Field Trip

***Guided by: Dr TT Son & CT Hoanh***

Rapporteur: R Wassmann

**Destination: Tam Dao District**

The field trip was conceived to demonstrate important land use system within the IRMLA case study 'Tam Dao' in Vinh Phuc Province. Tam Dao district has recently been divided into two districts . Under the old administrative units (prior to a recent reform that has divided the old districts), Tam Dao district comprised an area of 39000 ha and a population of 230000. The land of Tam Dao district is divided into agriculture land (40 %), forests (32 %, incl. plantation) and other land (28 %). The agriculture land is distributed within 31 communes and dominated by annual crops, namely rice. Income is very low; the average GDP per capita (for Vinh Phuc Province) is 175 US$ per year.
In the alluvial plains, the most common cropping cycle comprises spring rice (Febr.-May) and summer rice (July to Oct.) and an additional winter crop, namely maize. The rice area is slightly decreasing while maize area remained at a stable level since the mid-90s. Rice yields range from 3 to 3.6 t/ha in spring rice and 3.3 to 4 t/ha in summer rice. Maize yields can reach up to 5,3 t/ha in Tam Dao district whereas the average yield of winter maize in the entire Red River

delta is app. 3-3.5 t/ha. The mountainous areas of Tam Dao district are sparsely populated and are developing relatively slow – with some notable exceptions of profitable agroforestry systems.

*F1: Irrigated rice fields at the early stage of the spring rice; the typical cropping cycle is spring rice (ca. 5000 kg/ha ), summer rice (ca. 4000/ha) and maize (4500 kg/ha)*

List of Photographs (photos to be found on Hanoi workshop CD-ROM)

F2: Rice and vegetable fields in the vicinity of residential area

F3: Field preparation for spring rice

F4: The fields of the IRRI-NISF cooperation within the RTOP project ('Reaching towards optimum productivity', formerly dubbed as 'megaproject')

F5: Common practice of manual irrigation; ca. 25 % of the canal system is made of concrete

F6: Another practice of manual irrigation

F7: Mushroom production adds income for some communes

F8: Buffalo are still used for draft, though actual densities of buffaloes are rather low.

F9: Children in a schoolyard

F10: Agroforestry area

F11: Private enterprise working primarily on plantation systems

F12: Production of roses as cut flowers

F13: Blossoms are wrapped in paper to maintain perfect shape

F14: Roses are transported by bike to wholesalers

# 4 Case studies and methodologies

## 4.1 Session 4: Characterization of case studies

Four case study regions have been pre-selected, all located in important agricultural areas, characterized by increasingly intensive rice-based systems, with varying degrees of diversification:

1) Pujiang county, Zhejiang Province, China (rice-rice)
2) Tam Duong & Binh Xuyen districts (Tam Dao), Red River Delta, Vietnam (double rice-winter crop)
3) Batac and Dingras municipalities, Ilocos Norte Province, Philippines (rice-dry season crops
4) Omon district, Mekong Delta, Vietnam (double or triple rice)

During day 3 of the workshop, the teamleaders of the 4 Asian teams made presentations on the most important characteristics of their study region, following a pre-described format:

- Location
- Biophysical characteristics
  - Climate
  - Soils /Topography
  - Hydrology
  - Land Use

- Socio-economic characteristics
  - Population
  - No. of farms
  - Agricultural policy changes
  - Cropping system changes
  - Economic dynamics
  - Major bottle-necks to agricultural development

Based on these presentations, case study descriptions have been compiled (see Chapter 8)

The complete PowerPoint presentations for the Chinese and Philippine case studies are attached as annexes 10 and 11.

## 4.2 Session 5: Alternative approaches to policy evaluation

In this session alternative approaches to evaluate the effects of policy measures on sustainable agricultural development were presented by N Heerink and T Jakeman. These served as a basis for discussing strengths and weaknesses of the different approaches within the context of characteristics and specific land use problems of the case study regions. This discussion finally led to a synthesis of important questions related to methodological and case study aspects, and to identification of research direction and challenges– as documented in the presentation ‘Steps in land use scenario analysis’ (Annex 12).

# 5 Elaboration of IRMLA workplans

## 5.1 Workpackages & deliverables

Starting point for the plenary sessions on day 4 was a discussion on the major (stakeholders') questions to be answered for the various case studies. Subsequently, the main outputs of the IRMLA project were re-defined. This resulted in an updated list of workpackages and deliverables as presented in the technical annex (Annex 14) proposal. For each workpackage, the specific outputs, inputs, survey needs, expertise requirements and activities were defined in detail (Chapter 7). The present section gives a brief overview of the main project outputs, workpackages and deliverables.

? Main outputs:
    1. Methodology for land use planning & analysis developed and evaluated
    2. Application of methodology in case study :
        2.a Land use options and trade-offs at regional level
        2.b Ex-ante analysis of adoption of selected technologies for different farm types under current policy (baseline scenarios)
        2.c Ex-ante analysis of innovative, sustainable farming systems under future policies

? Work Packages

WP1. Regional resource use analysis
WP2. Assessment of yield gaps and climate-induced risks
WP3. Generation of input/output coefficients for future production activities
WP4. Farm Household Model development
WP5. Development of integrated approach for multi-scale land use optimization
WP6. Project coordination

? Project deliverables (and tentative dates of completion) can be roughly summarized as follows :

| | | |
|---|---|---|
| WP1: | (Deliverables 1-4): | Regional model output & analysis of resource use conflicts for case studies 1-4 (by Oct 2002) |
| | (D5): | Report on resource use conflicts in the various case studies (by April 2003) |
| WP2: | (D 6): | Database with yield estimates (by Dec. 2002) |
| | (D 7): | Results from analysis of yield-limiting factors and climatic risks in the study sites (by June 2003) |
| WP3 | (D 8 – 11) | Input-output models for major production activities established for each study site (by Sept. 2003) |
| | (D 12) | Input – output databases available for case studies 1-4 (by Dec 2003) |
| | (D 13) | Description expert system /software (TCG) for 1 case (Dec 2003 ) |
| WP4 | (D 14-17) | FHM designed/developed – for at least 2 cases (Apr 2004) |
| | (D 18-21) | Farm household model results generated and interpreted for at least 2 out of 4 cases (Oct 2004) |
| WP5 | (D 22-25) | Output from multiscale Land use analysis available. Results documented for each case study, and operational link between farm and regional model established for at least 1 case |
| WP6 | (D 26-28) | Project planning, mid term and training workshop and impact symposium held, monitoring of progress and dissemination of research results (through multiple outlets) realized |

## 5.2 Project activities and organization

- Partners and Roles: As documented in project proposal, parts B and C
- Funding : As documented in approved contract ICA4-CT-2001-10055,
- Objectives: Basically objectives as expressed in the project proposal /technical annex (Annex 14) will be followed – specific focus for individual cases will crystallise during first year of project, among others through consultative stakeholder-scientist meetings
- Activities -> see workplans (Chapter 7 and Annex 3)
- Time frame - > see, Chapter 7
- Budget constraints --- > the reduction of proposed budget during contract negotiations by about 30% has serious consequences for project coordination and delivering the output proposed earlier: For example, the farm household modelling approach can probably only be realized for 2-out of 4 case studies, while the other two should mainly focus on the regional analysis. The full link between different decision levels to carry out multiscale land use analysis (province-municipality-farm) can only be realized for 1 case study; There is urgent need to source additional funding for carrying out coordinating /project meetings and trainings and in-depth studies on specific aspects of the case studies and methodology (apply for research grants such as PhD scholarships, networking support etc -- approach European and International investors/institutions as well as local governments in Asia)

For more details see chapter 7 and annex 3.

# 6 Training and Communication

## 6.1 Training component

A high demand for training on concepts and various tools required for IRMLA was identified by the various project partners. The specific requirements became apparent during day 5 of the workshop. Instead of organizing just one training event (with focus Farm household modelling) as scheduled earlier, the project needs to expand the training component. There'll be an additional workshop (September 2002) on components of the land use planning and analysis system (LUPAS) and on-the-job training of scientists of Asian teams (with different foci) facilitated and/or conducted by a regional training coordinator :

Training demand is on:

a) methodology and tools for regional land use analysis with emphasis on IMGLP technique (in particular scientists from MMSU, ZU and CLRRI)
b) Farm household modelling (all partners)
c) GIS /yield and input-output estimation tools (scientists from all partners but taylored to specific needs)

The establishment of an extended training component was made an extra project goal. Furthermore, it was realized that exchange of information among partners on scientific-technical aspects needs particular attention in the initial phases of the project. For this purpose, the project needs to recruit a suitable regional training and coordination officer.

Training will take place in different forms:

? on-the-job training of individual scientists (e.g through regional coordinator or other
? formal training workshops lasting 5-8 days --- 1 workshop on LUPAS/IMGLP will be held in September 2002 ; another workshop on FHM and input-output models is scheduled for May/June 2003

## 6.2 Project communication

Among teams:

? Regular scientific and administrative communication via electronic mail (and website if required) to/through project coordinator and regional coordinator – who serve as main link between European and Asian partners
? Communication on specific scientific- technical aspects via email to/through coodinators and nodes for each case study
  - Pujiang China (CA van Diepen)
  - Tam Dao (MK van Ittersum)
  - Batac/Dingras (H Van Keulen)
  - O Mon (R Wassmann)
? Communication to the outside world about project activities and research results to a large degree via project website and conventional communication means / print media (project report series, working documents, posters and international journal papers).
? Assessment/exchange on project progress either through specific project workshops (about 3-4 during the projects' life time), visits of teams by coordinators/teamleaders of partners and/or through exchange of regular progress reports

Within teams:

? Through regular (BI-monthly) project team meetings – at least 6 per year ; and through specific team meetings (e.g. workshop preparations)

# 7 Major results

The most important tangible result from the workshop is the detailed workplans for years 1 and 2. These were developed on day 4 and 5 starting from the research problem and defining successively project outputs, inputs, data/survey needs, expertise required and activities (and, finally, proposed dates for specific trainings). A summary of the workplan is provided in section 7.1 (a more detailed version is attached as annex 3). Note, that, in first instance, the plans for years 1 and 2 of the project were elaborated – including activities of WP 1-4.

## 7.1 Workplan (Summary)

Out of a number of possible questions from local stakholders regarding agriculture and land management in the four case studies, six questions that apply to all cases were prioritized:

Questions from stakeholders:

1. **Which cropping systems to be applied?**
2. **demand/supply analysis? (Where is market?)**
3. **Economic returns?**
4. **Sustainability?**
5. **Short-term & long-term action plan?**
6. **Package of technologies for current & future?**

**For each workpackage, the specific outputs, inputs, survey needs, expertise and activities are described in the following. Output from the various workpackages will address one or more of stakeholders' major questions.**

**WP1. Regional resource use analysis: Questions 1, 4, 6 (see, above)**
**WP2. Assessment of yield gaps and climate-induced risks: Questions 4, 6**
**WP3. Generation of input/output coefficients for future production activities: Questions 4, 6**
**WP4. Farm Household Model development: Questions 1, 3, 4**
**WP5. Development of integrated approach for multi-scale land use optimization: Questions 2, 5**

**WP6. Project coordination**

**WP1. Regional resource use analysis: 1, 4, 6**

*a. Outputs*

Regional resource use (resource availability, constraints, characterization, objectives)
Land use options at regional (district) level & tradeoffs

*b. Inputs*

Resource characterization & possible technological options
Description: Soil, water, topo, past & current land use, climate, labor, capital
Stakeholder views, development targets
LUPAS modified from existing provincial versions for O Mon & Batac (from WP5)
LUPAS developed for new case studies for Tam Dao & Wucheng (from WP5)

*c. Survey needs*

Collection of available data/inventory
Stakeholder interview

*d. Expertise requirement*

Land evaluation — Agronomy
Socio-economic — Land use modeling

*e. Activities*

1. Data collection (data/maps)
2. Stakeholder consultation
3. Data processing (keying in, digitizing)

4. Analysis of past/current resource use
5. Analysis of future options in resource use (modeling)
   - Modification of LUPAS (O Mon & Batac) Training BT at the site (May-Dec)
   - Developing new LUPAS (Tam Dao & Wucheng) Training WC at the site (Jun-Dec)
6. Training

*f. Data sources*
*Omon: hydrological map; new land use map; stakeholder consultation in april*
*Batac: land use map; stakeholder consultation*
*t*

**WP2. Assessment of yield gaps and climate-induced risks : 4, 6**

*a. Outputs*
Compare potential yield with water-limited/actual yield
Compare yield under different climate conditions
Adaptation to climatic risks (?)

*b. Inputs*
Climate data (long-term available, year to year variations)
Hydrological data (long-term available, year to year variations)
Crop yields (year to year variations, all (?) crops at plot level, by variety)
Irrigation data
Soil property data
Fertilizer use data
Crop management practice (IPM)

*c. Survey needs*
Collection of available data/inventory
Additional surveys may be needed

*d. Expertise requirement*
Climatology Crop modeling
Socio-economics Statistic analysis

*e. Activities*
1. Data collection (data/maps)
2. Data processing
3. Potential/water-limited yield: calibration, validation, simulation Training OM-BT-TD-WC (optional)
4. Yield gap analysis
5. Risk analysis

**WP3. Generation of input/output coefficients for production activities : 4, 6**

*a. Outputs*
Input/output coefficients for current / future production technologies

*b. Inputs*
Climate data (average)
Land unit (from WP1)
Target yields (from WP2)
Information on current / future production technologies

*c. Survey needs*
Collection of available data on input/output coefficients
(inventory/survey/experimental/on-farm trials)

*d. Expertise requirement*
Agronomy Crop modeling
Forest production ecology Inland fisheries

*e. Activities*
1. Data collection (data/inventory)

2. Data processing
3. Defining production techniques — Training OM-BT-TD-WC (Sep-Dec)
4. Generating I/O tables for current production techniques
5. Development of I/O CG
6. Generating I/O tables for future production techniques
7. Training

**WP4. Farm Household Modeling: 1, 3, 4**

*a. Outputs*

Farm Household Typology
Farm (Household) Model
- evaluation of performance of FHM for selected farm types
- identification of scope for farming system innovation
- response of farm households to policy measures / technology innovation
- risk analysis

*b. Inputs*

Detailed farm household database
Input/output coefficients (from WP3)
Policy measures
Market information

*c. Survey needs*

Collection of available farm household data
Additional surveys may be needed

*d. Expertise requirement*

Agro-economy/ Modeling
Farming system analysis — Agronomy

*e. Activities*

1. Training — Training OM-BT-TD-WC (Sep-Dec 2001)
2. Data collection / survey?
3. Data processing
4. Farm typology analysis
5. Model development
6. Scenario analysis
   - 6.a Analysis on adoption of technology
   - 6.b Response to policy measures
   - 6.c Adaptation to risks
7. Ex-post evaluation of FHM

**WP5. Development of integrated approach for multi-scale land use optimization: 2, 5**

*a. Outputs*

Procedures to integrate outputs from WP1 (regional) & WP4 (farm household)
- soft linkage (through analyzing data)
- hard linkage (technical links)

Boundary conditions to WP1 (regional) & WP4 (farm household)
Integrated land use options from farm household & regional levels
Risk analysis at farm household level aggregated to higher level
Conflict analysis at higher level

*b. Inputs*

Outputs from WP1 & WP4 (including WP2 & WP3)

## 7.2 Stakeholder consultations

Interactions with different interest groups (stakeholders) in the four case study regions at the different phases of model development and analysis/interpretation of results will be an inherent, and core business that will remain an important element throughout the project. While EU funds are not sufficient to look in-depth into stakeholder-scientist relationships, regular meetings will ensure that close feed-back from stakeholders on research approach and outputs can be maintained :

The consultations between scientists and stakeholders in each study regions may take place in different settings and extent but should be at least twice per year – and prerably 3-4 times in the initial and final year of the project

## 7.3 Planning of activities in time

Project activities will be carried out in four major phases :

- Planning phase: Dec 2001 – Jun 2002-
- Training and design phase: Jul. 2002 – Apr. 2003
- Main execution phase: May 2003 – Apr. 2004
- Dissemation/reporting phase: May 2004 – Nov. 2005

A time schedule showing the planned duration of individual activities and delivery of specific outputs is given in the following (see, Figure).

## 7.4 Responsibilities

Responsibilities for the workpackages and deliverables have been outlined in section 7.1. The overall responsibility for delivering the various outputs rests with the teamleaders and, towards the EC, with the overall project coordinator. A regional coordinator is resposnible for realization of the training /research capacity building component of the project.

## 7.5 Project organisation and communication

IRMLA consists of eight multi-disciplinary research teams - each being headed by an experienced teamleader. More information on team composition and contact details can be found on the IRMLA website (http://www.alterra.dlo.nl/websites/irmla), partner information and publications (progress report). Training activities and specific technical communications are coordinated by the regional coordinator. Overall scientific and adminstrative responsibility rests with the overall project coordinator. Individual teamleaders report to the overall project coordinator. Teamleaders and coordinators form the steering committee meeting at least once per year. An advisory function to the project is fulfilled by representatives from respected land use research groups and local stakeholders who are invited to meetings organized by the project.

## 7.6 Bottle-necks

There's no bottle-neck so far that would hamper project progress. However, foreseen the high training requirements had not been anticipated at the outset of the project. Sourcing of additional funds for fully meeting training requirements will be required.

## 7.7 Research Challenges and innovations

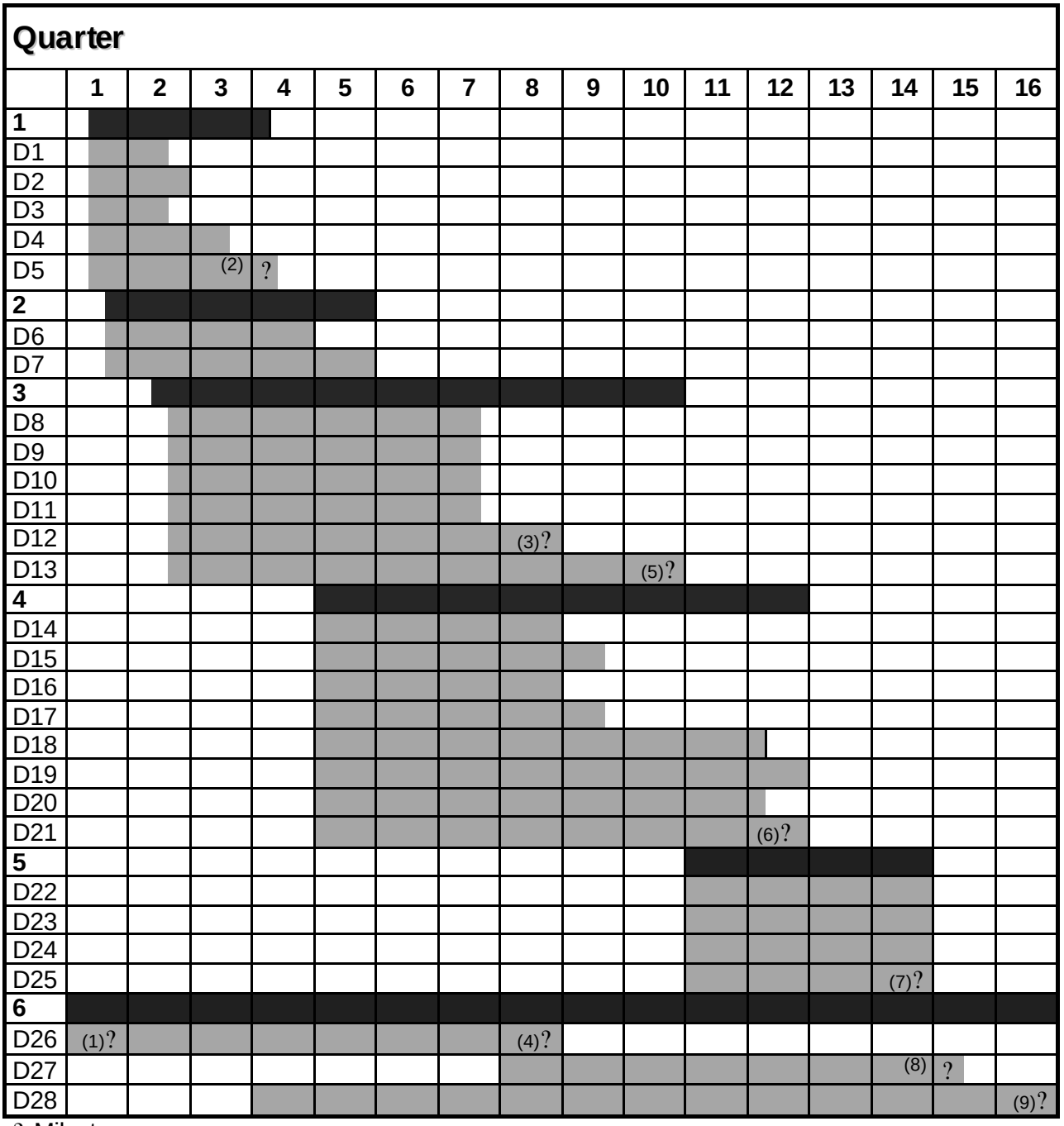
Several research challenges were identified in the course of the planning workshop:

- The way of characterizing current status of agro-ecosystems (in particular the presentation of conflicts in land suse objectives and resource use) and comparing these under different settings needs to be improved
- New methods /techniques and tools for multi-decision level analysis of future land use /rural development options have to be developed – there's presently no convincing method to link analysis at different levels effectively
- Reduction of input data and simplification of FHMs would essential for better a transfer of the methodology to scientists with different backgrounds and dissemination of results to local stakholders
- A closer look into planning structures of the individual cases and interaction /participation of scientists and stakholders for their mutual benefit is a pre-requisite for successfully carrying out research activities and communicating results effectively

In terms of innovations in relation to exisiting 'land use systems analysis' (LUSA) methodology and tools IRMLA will concentrate on :

- Multi-scale spatial analysis of resource availability and quality (at farm, district and province)
- Incorporation of risks in land use scenario analysis
- Consideration of both farmers behavior and preferences of regional planners and policy makers in the analysis and the negotiation of feasible resource management options.

**TIME TABLE**




? Milestones

(1) Planning meeting held and project monitoring systems developed
(2) Project report on land use and resource conflicts
(3) Input-output databases generated for all study areas
(4) Mid-term progress meeting (Brussels) and training workshop (Wageningen) held
(5) TCGs for all study areas documentated (Technical Bulletin)
(6) FHM results generated for current policy
(7) FHM results for different policy measures generated and documentated
FHM module linked to regional model
(8) Final stakeholder-scientist symposium conducted
(9) Project reports, brochures published; and scientific papers (2-3)

# 8 Characterization of case studies

## 8.1 Case study, Pujiang county, Zhejiang Province, China

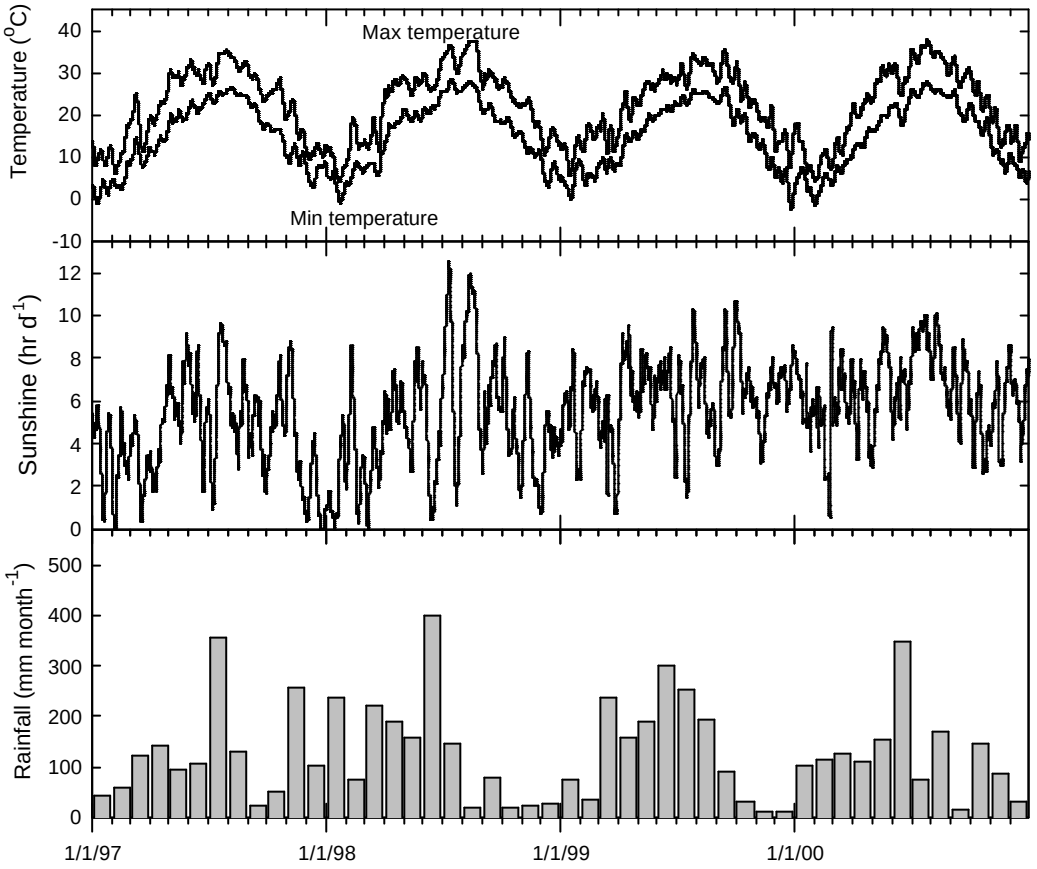
Location:
Pujiang county is located east of Jinhua City (29° 5' N, 119° 47' E), in the center of Zhejiang Province. Located in important agricultural areas, characterized by intensive rice based systems, with varying degrees of diversification

**Biophysical characteristics**

Climate:

Subtropical
Annual rainfall 1386 mm
Annual mean temperature 17.2?C
Annual radiation 2087 hrs
Annual >= $10^0$C accumulate 5523$^0$C

There is no distinct wet and dry season. However, there is more rain in spring and summer (Feb-July), less rain in autumn and winter (July-Jan.), so called warm spring, hot summer (July-Aug), sunshine autumn (July- Sept), cold winter (Dec.-Feb.).




**Weather data 1997-2000 for Jinhua, Zhejiang Province, China (source: Wang et al., 2001)**

Soils and topography:

1. Rice soils:

    a. Derived from alluvial deposits (80%) along the Wujiang river reaches with medium to high fertility

    b. Derived from red soils (20%) along the low hills. Because of the relative low fertility of their parent materials, these soils belong to the medium- or low-yielding rice soils.

2. Red soils: Various upland crops, fruit and tea trees are grown on these soils.

Land use

Salient rice-based cropping systems

? Early rice- late rice

- Winter crop (vegetables, strawberry, wheat, or barley, ) - late rice
- Taro, watermelon, potatoes, sweet corn, or vegetables - late rice
- Single late rice

Rice cropping : Rice can grow from late March to early November. Double rice cropping is the main cropping system. Early rice is grown from early April to mid or late July using both hybrids and modern conventional rice varieties. Late rice is to 90% hybrid rice grown from mid July to late October.

Main agricultrual products

Rice, tea, orange, grapes, strawberry, watermelon, peach, pear, vegetables, taro, potatoes, sweet corn, ornamentals ; Pig, chicken, milk, fish, etc.

**Socio-economic characteristics:**

(basic data collection not yet completed)

Agricultural policy changes

The liquidation of the original collective farm system in early 80's.
Farmers can decide freely to grow crops they think that can be more profitable.
Pay more attention to the environment protection by establishing better agro-ecosystems.

Cropping system changes

Shift from rice-rice cropping to other more profitable cropping systems.
Decreased rice growth area, especially early rice growth area.
Crop diversity in the fields

Economic dynamics

Farmer's income increased from growth of other crops other than rice and from off-farm work;
More labor force move to city from countryside (16.3% on average in China in 2001).
Labor costs for farming also increased.
Increased input for infrastructure development , roads are improved
Markets for agricultural products are extending in situ and in big cities.

Major bottle-necks to agricultural development

- From farmers:

Low price of rice ( about 1 yuan per kg grain) and high costs for production, low profit in rice production.
Farmers do not know what cropping systems are most suitable for their situation.
Lack of technology, experience and capital to grow high profitable crops and go to the market as well.

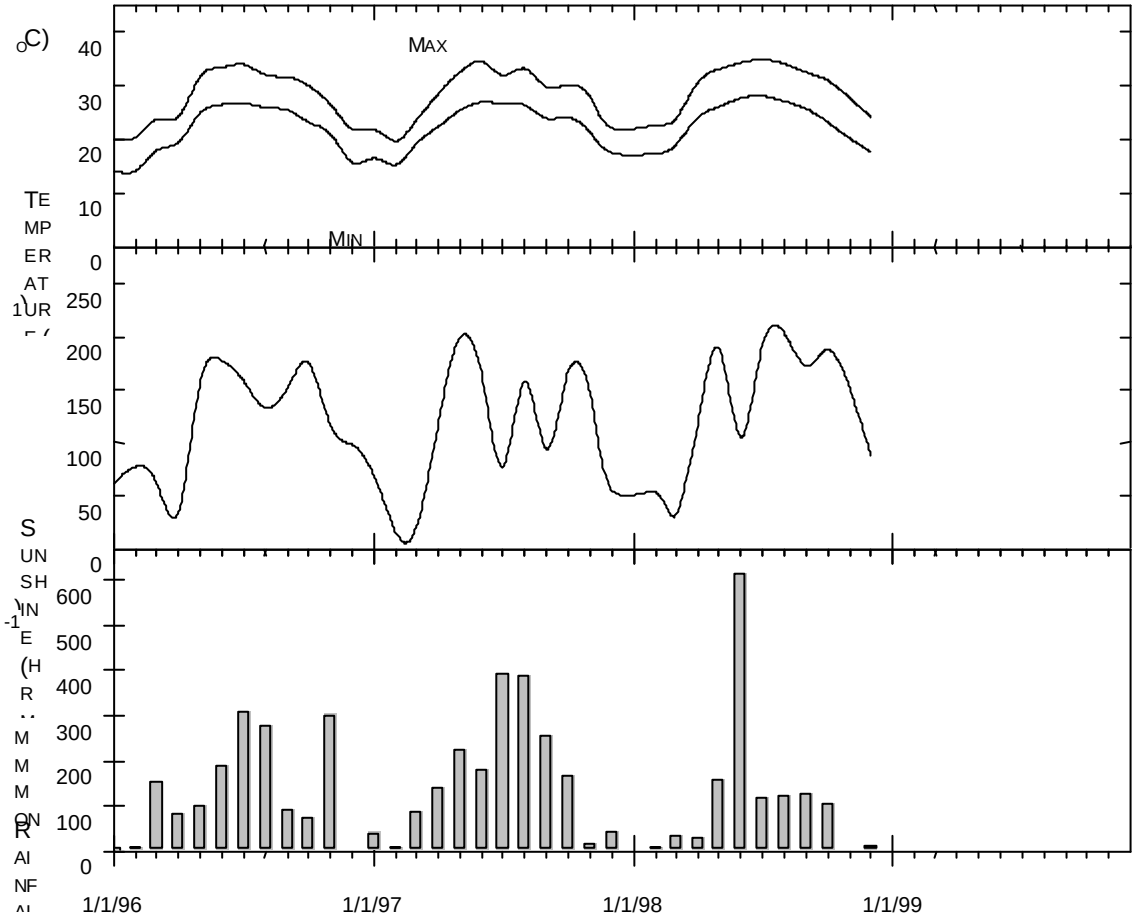
- From policy makers:

High risk of market for agricultural products
Lack of experience to adjust to new developments.
Consulting problems-lack of funds

## 8.2 Case study, Tam Dao (Tam Duong and Binh Xuyen districts), Vinh Phuc Province, Vietnam

[biophysical and socio-economic characterization only partly available in digital form]

Climate:




CLIMATIC CONDITIONS AT HANOI, VIETNAM DURING 1996 TO

Soil properties:

**Table** General soil properties of 12 farms near Tam Dao, Red River Delta, Vietnam.

| Soil Properties [a] | Degraded soil [b] | |
|---|---|---|
| | Mean | SD |
| Clay content (%) | 11.0 | 5.4 |
| Silt content (%) | 64.8 | 4.3 |
| Sand content (%) | 24.2 | 7.6 |
| Soil organic C (g $kg^{-1}$) | 10.8 | 2.0 |
| Total soil N (g $kg^{-1}$) | 1.20 | 0.20 |
| Soil pH (1:1 $H_2O$) | 4.9 | 0.3 |
| Cation exchange capacity ($cmol_c$ $kg^{-1}$) | 5.0 | 0.9 |
| Exchangeable K ($cmol_c$ $kg^{-1}$) | 0.13 | 0.05 |
| Exchangeable Na ($cmol_c$ $kg^{-1}$) | 0.07 | 0.03 |
| Exchangeable Ca ($cmol_c$ $kg^{-1}$) | 2.80 | 0.64 |
| Exchangeable Mg ($cmol_c$ $kg^{-1}$) | 0.16 | 0.08 |
| Extractable P (Olsen-P, mg $kg^{-1}$) | 10.28 | 4.62 |
| Extractable Zn (0.05N HCl, mg $kg^{-1}$) | 1.53 | 0.36 |

[a] Measured on initial soil samples collected before the 1997 ER.
[b] Mean and standard deviation (SD) of 12 farms near Tam Dao.

**Changes in rice production in the Red River Delta, North Vietnam.**

| | **1980** | **1985** | **1990** | **1995** | **1997** | **1980-1985** | **1985-1990** | **1990-1995** | **1995-1997** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Growth rate (% $yr^{-1}$) | | | |
| Rice area (1000 ha) | 937 | 1052 | 1058 | 1042 | 1044 | 2.3 | 0.1 | -0.3 | 0.1 |
| Irrigated rice area (%) | 60 | 65 | 70 | 73 | 78 | 1.6 | 1.5 | 0.8 | 3.4 |
| Rice yield (t $ha^{-1}$) | 2.29 | 2.94 | 3.43 | 4.44 | 4.86 | 5.1 | 3.1 | 5.3 | 4.6 |
| Rice production (1000 t) | 2145 | 3092 | 3628 | 4627 | 5076 | 7.6 | 3.2 | 5.0 | 4.7 |
| Fertilizer consumption (1000 t) | | | | | | | | | |
| N fertilizers (N) | 56.2 | 78.9 | 86.7 | 93.8 | 109.7 | 7.0 | 1.9 | 1.6 | 8.1 |
| P fertilizers ($P_2O_5$) | 14.1 | 27.6 | 32.0 | 39.4 | 43.9 | 14.4 | 3.1 | 4.2 | 5.5 |
| K fertilizers ($K_2O$) | 8.4 | 8.2 | 10.9 | 26.3 | 36.8 | -0.5 | 5.8 | 19.2 | 18.3 |

Compilation by TT Son et al. 2002, from the folloeing sources: Statistical data of the socialist Republic of Vietnam 1976 to 1990, Statistical Publishing House, Hanoi, 1991; Statistical Yearbooks 1996, 1997, 1998, Statistical Publishing House , Hanoi, 1997-1999; Research Institute of Water Management (irrigated area); FADINAP and NISF (fertilizer consumption data).

## 8.3 Case study, Batac and Dingras municipalities, Ilocos Norte Province, Philippines

Ilocos Norte is characterized by considerable agricultural diversification. A wide range of crops including garlic, onion, tomato, sweet pepper, tobacco and maize is cultivated during the dry season from November to April in the lowlands, whereas rice is the main crop during the wet season. In recent years, accelerated urbanization has resulted in conversion of favourable agricultural lands for urban and industrial purposes. High fertilizer, pesticide and water use of the profitable dry season crops has led to environmental concerns about nitrate leaching, water quality and quantity in the lowlands; at the same time, scarcity and land leads farmers to cultivate the hilly upland soils, which are prone to soil erosion.

**Batac municipality, located in the central lowlands of the province (Figure), is the district exhibiting the highest diversity in production systems at a high level of intensification as far as dry season crops are concerned.**


**Ilocos Norte province, Municipalities**

SALIENT CROPPING SYSTEMS IN BATAC MUNICIPALITY

1. Rice-WhiteCorn
2. Rice-YellowCorn
3. Rice-Garlic
4. Rice-Mungbean
5. Rice-Peanuts
6. Rice-Tomato
7. Rice-Tobacco
8. Rice-Fallow
9. Rice-Rice
10. Rice-Cotton
11. Rice-Onion
12. Rice-Pepper
13. Rice-Eggplant
14. Rice-Vegetables
15. Rice-Garlic-Mungbean
16. Rice-WhiteCorn-Mungbean

Rice-Rice-Rice can be found in Dingras Municipality, only

## Biophysical characteristics

**Climate:**

As in the entire province, the climate of Batac and Dingras municipalities is characterized by a distinct wet and dry season: Predominantly dry from November to April and wet from May to October. Men annual rainfall in the central lowlands is between 1700 and 2000 mm with a maximum occurring during August, and 5 to 7 dry months. The region is frequently visited by storms of very high intensity associated with typhoons which usually pass the province during the wet season. (Figure)

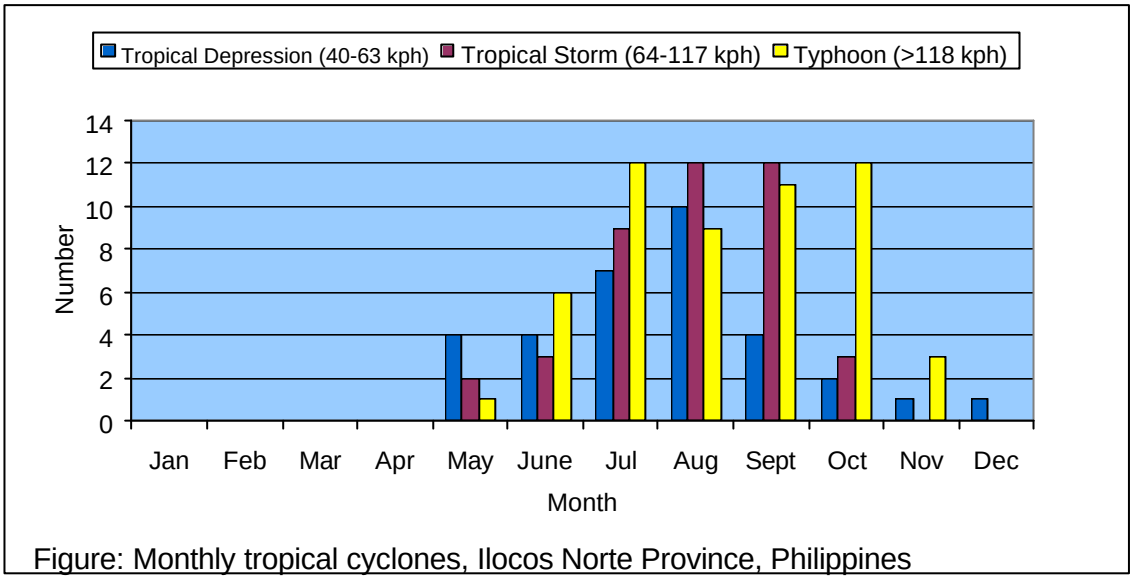



Figure: Monthly tropical cyclones, Ilocos Norte Province, Philippines

**Hydrology:**

- The proportion of irrigated (service) areas varies among municipalities, with Dingras having 93% and Batac less than 10%.
- Pumping of groundwater (shallow tube-wells) during the dry season is practiced in Batac municipality

**Soils and topography:**

Sandy clay loams, loams and silty clay loams are predominating. Areas are classified as gently sloping; Batac is characterized by a number of small micro-catchments of similar shape and size.

**Environmental issues:**

Research into groundwater quality revealed that in the most intensively cultivated areas with (predominantly) sweet pepper and tomato, locally nitrate concentrations in the groundwater indeed exceed permissible levels (Figure); this risk can, however, be minimized by adjusting fertilizer management practices (Tripathi et al., 1997).

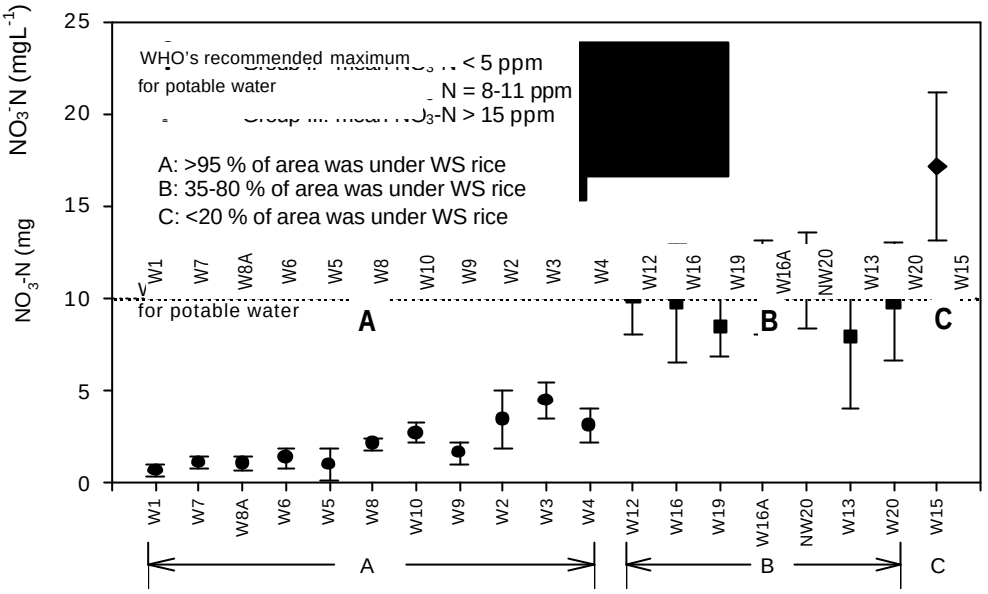



Figure: Measured nitrate concentrations in the groundwater, Batac municipality (Gumtang et al., 1999)

**Socio-economic characteristics:**

**Population dynamics**

| | Ilocos Norte | Batac | Dingras |
|---|---|---|---|
| Area, km$^2$ | 3,399.34 | 152.10 | 100.20 |
| Total Population | | | |
| 1980 | 390,666 | 37,579 | 26,511 |
| 1990 | 460,684 | 43,071 | 30,512 |
| 2002 (projected) | 561,312 | 50,051 | 36,092 |
| % increase | 21.48 | 16.21 | 18.29 |
| % annual growth rate | 1.66 | 1.26 | 1.41 |
| % share of provincial | - | 6.94 | 5.55 |
| Climate: population growth | | | |
| Population Density, p km$^{-2}$ | | | |
| 1980 | 114.92 | 247.07 | 264.58 |
| 1990 | 135.52 | 283.18 | 304.51 |
| 2002 (projected) | 165.12 | 329.07 | 360.20 |

Urban and rural population growth, 1990 to 2002

| | Ilocos Norte | Batac | Dingras |
|---|---|---|---|
| Urban population | | | |
| Total population in | | | |
| 1990 | 130,586 | 12,842 | 5,801 |
| 2002 (projected) | 166,727 | 17,100 | 6,285 |
| % increase | 27.68 | 33.23 | 8.34 |
| % annual growth rate | 2.06 | 2.42 | 0.67 |
| Rural population | | | |
| Total population in | | | |
| 1990 | 330,098 | 30,229 | 24,711 |
| 2002 (projected) | 394,585 | 32,941 | 29,807 |
| % increase | 19.54 | 8.97 | 20.62 |
| % annual growth rate | 1.50 | 0.72 | 1.57 |
| Share of provincial rural population growth (%) | | 4.21 | 7.90 |

Number of Households and Average Household Size

| | Ilocos Norte | Batac | Dingras |
|---|---|---|---|
| Urban households | | | |
| Total in | | | |
| 1990 | 26,216 | 2,568 | 1,160 |
| 2002 (projected) | 33,345 | 3,355 (10.1%) | 1,232 (3.7%) |
| % change in urban households | 27.19 | 30.64 | 6.24 |
| Average household size in 1990 | 5.0 | 5.1 | 5.1 |
| Rural household | | | |
| Total in | | | |
| 1990 | 66,020 | 5,927 | 4,845 |
| 2002 (projected) | 78,477 | 6,459 (8.2%) | 5,845 (7.4%) |
| % change in rural households | 19.54 | 8.97 | 20.62 |
| Average household size in 1990 | 5.0 | 5.1 | 5.1 |

**Development problems and constraints:**

- Limited agricultural land and water resources
- Land use conflicts and competing uses of existing resources
- Lack of appropriate technology packages for marginal farm areas
- High cost of production inputs
- Inefficiency of market-related and post-harvest facilities
- Lack of agency coordination

**Land use objectives and development strategies:**

Development of area specific technology
Development of a system of hectarage and production control for market-sensitive crops
Intensification of land utilization
Crop improvement
Promotion agribusiness activities

## 8.4 Case study, Omon district, Cantho Province, Vietnam

Can Tho Province is in the heart of the Mekong Delta, and is Vietnam's rice bowl. With the transition from a centrally planned to a free market economy, Vietnam is on the move. Rice production must be intensified to feed the increasing population. This may mean two or three crops per year. At the same time, on the same land, farmers are starting to grow other crops to help increase their incomes, which are currently less than half of those of people in the cities. Both policymakers and farmers are currently grappling with their own sets of development issues.

Can Tho province, Vietnam has a total area of .3 million ha. It is located at the central part of the Mekong Delta and has a total population in 1994 of 1.82 million.
The province is located in the monsoon climatic zone with a high temperature throughout the year and is not affected by typhoon. It has a very flat topography with fertile soils and abundant freshwater sources.
Can Tho is located at the center of Mekong Delta's road, waterway and airline networks. A university and several research institutes in the province provide human resources for economic development, particularly in agriculture.

Omon district:

**Biophysical characteristics**

Climate:

- There are two distinct seasons: the dry and wet season. Wet season starts in May and ends in November.
- Average rainfall is about 2000 mm concentrated mainly between July and October (about 95% of rainfall).
- Average temperature is 26.6$^{o}$C (lowest: 24.4$^{o}$C and highest: 28.4$^{o}$C). Variation in temperature by month is not much (2.5$^{o}$C).
- Total solar radiation is 4.46 Kcal/cm$^{2}$/year.
- Heavy rain in wet season is adverse weather phenomenon

Hydrology:

- Located along Mekong river, Omon has a dense creek and channel system
- Surface water is main irrigation water source in Omon
- Annually, Omon is submerged with 50 to 100 cm flood water during 4 months of wet season (Aug-Nov).

Soils and topography:

| No | Soil type | **Area (%)** |
|---|---|---|
| 1 | Alluvial soil | 69.33 |
| 2 | Slightly acid sulphate soil | 10.60 |
| 3 | Moderately acid sulphate soil | 3.56 |
| 4 | Severely acid sulphate soil | 2.46 |
| 5 | Bed raised soil | 14.05 |

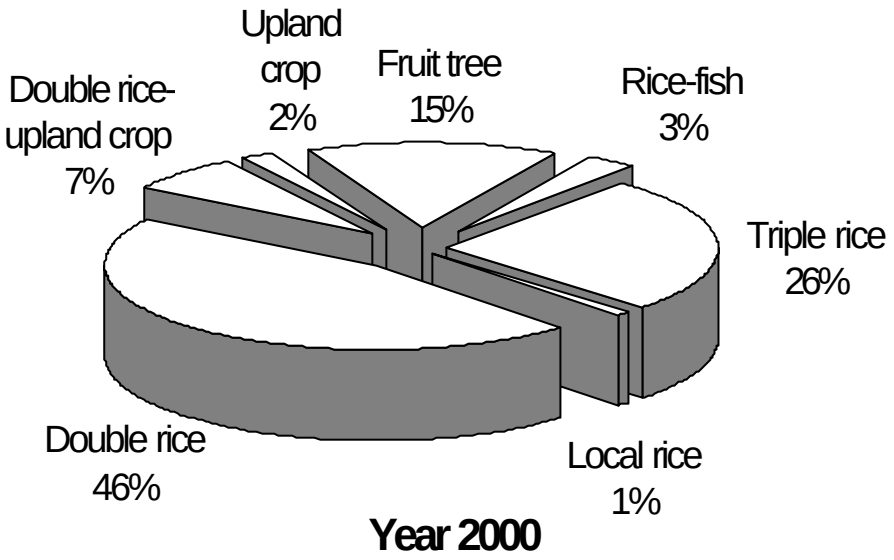
- Topography is level.
- Altitude varies from 3-4 m.

Land area and use:

? Total land area is about 54,000 ha, of which:
  - Agricultural land: 43,000 ha
  - Other land (settlement, road and river): 11,000 ha

? Main agricultural products:

- Rice
- Upland crops: soybean, greenbean and maize
- Fruits: mango, orange, and sapodilla plum.




**Present land use**

**Socio-economic characteristics:**

? Total population: 350,000
  of which:
    ? About 95% living in rural areas
    ? 90% living from agricultural activities
? Total labour force: 180,000
? Agricultural production contributes about 75% to total production value
? About 15% households are landless
? Number of poor farm households occupies is about 21% , only 25% of households can be labelled as rich

Farm Household characteristics:

- Average household size: 5.6 persons, of which 3.5 are main labours
- Farm size ranges from 0.1 to 4.5 ha/household with average of 0.75 ha
- Household heads have low education level:
  - 12% are illiterate
  - 53% attained primary level
  - 25% attained secondary level
- Household income varies from 8 to 80 million VND with average of 19 million VND/household/year, of which:
  - Rice production: 47%
  - Non rice crop: 23%
  - Non and off farm: 24%
  - Animal: 6%
- Per capita income: 3.4 million VND/year
- About 60% of available labours is used

Constraints to agricultural development:

- Capital
- Technologies
- Flood
- Price of inputs and outputs
- Market

Economic dynamics:

- There are changes of farming systems following trend of diversification
- Farm size is more and more smaller
- Income of farmers is increasing and number of pour farmers decreasing
- Price of agricultural inputs is increasing and increasing while price of outputs varies following adverse trend for farmers

Changes in policies related to agricultural development:

- Land ownership
- Diversification
- Modernization and mechanization in agriculture
- Development of infrastructure for agriculture and rural areas

Land use objectives

Food security

Employment generation (job) for rural area

Increased land productivity to raise income

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