Report on

Land Management Study Tour to Chiang Mai Province, Northern Thailand

22nd to 29th May, 2005

Land Management Component
Soils Survey and Land Classification Centre

Lao-Swedish Upland Agriculture and Forestry Research Program
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1 Summary of Activities and Practices Observed

1. The study tour was conducted between 22nd and 29th May, and was hosted by the World Agro-forestry Centre (ICRAF) which is based at the Chiang Mai University (CMU) in Thailand.

2. Nine staff members working with the LSUAFRP based at NAFRI and in the provinces and districts participated, including the Land Management Component, NAFReC, the Program Co-ordinators and Deputy Governors from Phonesay and Na Mo Districts. The Land Use adviser organized and participated in the study tour.

3. Three organizations and agencies presented briefings on their work and organized field trips to observe activities at village level; ICRAF, Multiple Cropping Centre of Chiang Mai University, and the Land Development Department, Region 6 Office. There were two days of briefings and three days of field trips.

4. The focus of the study tour was on: GIS tools and participatory mapping tools used in land use planning at village level, digital information systems for agriculture and resource management at provincial, district and watershed levels, crop suitability zoning and the constraints in the uplands, upland conservation farming and cropping systems, village land use and natural resource management practices and networking methods in upland communities, opium substitution strategies and land use transitions resulting from opium replacement policies.

5. The ICRAF presentations concentrated on research on changing land use in Thailand and mountainous areas in south east asia, ie, the main components of deforestation, complex and difficult issues, incentives and pressures on land use change, changing land use patterns, policy responses to land use changes, and ICRAF’s participation in the ASB (alternatives to shifting cultivation) framework and partnership.

6. In relation to these issues ICRAF is undertaking research studies on livelihoods, cropping and farming systems, rice and maize yields. Within these study areas the focus is on understanding the following six areas of interest and variation:

- Cash crops introduced by the Royal Project Foundation
- Long fallow shifting cultivation
- Short fallow shifting cultivation
- Permanent field cropping
- Intensive cash crop area using high inputs (vegetables)
- Cabbage areas close to the new national park

7. Promising institutional changes & pilot project innovations include;
   - Localized participatory land use planning that builds on traditional knowledge & landscape management systems
   - Experimentation with local multi-village watershed management networks in sub-catchments
   - National constitutional & legal reforms may provide a basis for formal land use agreements in mountain watersheds

8. ICRAF has developed tools with local communities and networks to involve them
in participatory watershed management, including: community based monitoring using local knowledge by village volunteers, participatory mapping procedures at village and sub-watershed network level, crop growth modeling to provide information for describing crop domains in areas of different elevation and soil types, matching aerial photo categories with village land use categories, and opportunities for different approaches in biodiversity conservation in the protected area system, eg, integrated landscapes comprising permanent forested areas, forest fallow, upland fields, grassland, forest patches and paddy land.

9. In the current phase ICRAF is examining the possibilities and opportunities for using the lessons of the research in Mae Chaem in the Ping River basin and broader mountainous south east asian eco-region, including the “New Basin Management Approach”; (building on build on a foundation of local sub-watersheds, local management networks and local government support), and a comprehensive Spatial Information System.

10. The challenge for sustainable watershed as defined by ICRAF is “localized management of natural resources in major basins and nations that also meets the needs of broader societies, nations, and the global community”.

11. Field Trip: (ICRAF) Mae Kongkha sub-watershed, Mae Chaem District. The following activities were observed:
   - Science based tools for monitoring participatory watershed management practices
   - Village networking practices and rules
   - Participatory land use planning and mapping
   - Village land use zoning and land use categories
   - Upland cropping practices and soil conservation methods(introduced & indigenous)
   - Discussions on Mae Chaem Network system; potentials and constraints

12. Field Trip: (ICRAF) Mae Suk sub-water, Mae Chaem District. The following activities were observed:
   - Ban Pui : Explanation of history of land use changes by village leaders (Karen).
   - Ban Pui Neua: Briefing on Land Use Practices by Village Head (Hmong)
   - Ban Kong Karn: Briefing on Land Use Practices (Northern Thai)
   - Ban Pui Neau School: Village and Network Land Use Maps
   - Procedure for Identifying Natural Resources Management Activities - Mr Somkuan Chareon-tempium – Rak Thai Foundation (formerly CARE Thailand)
   - Tambon Organisation (Or Por Tor) Responsibilities Mr Manit Saeyang of Ban Pui Village

13. The MCC of CMU presentation focused on a digital support system for agriculture and resource management (DSSARM), which is a GIS based information system for the purpose of “developing methods and information systems to support natural resource management decisions by various stakeholders at field, farm, watershed and regional levels utilizing a systems approach, information technology and analytical tools”

14. The components of DSSARM are spatial databases and attribute data bases (socio-economic and natural resources and agriculture). The technologies used are GIS, remote sensing and image processing, and modeling and simulation. The
analytical tools used are: Soft System Methods (PRA and resource mapping), Multi-criteria Decision Making (eg, crop suitability), Spatial Statistics: eg, conversion of point climate data to area climatic data, and Scenario Analysis: eg, impacts from actions; (eg, introducing irrigation in tree crop systems (longan))

15. The objectives of the DSSARM are to:
   - Design and build spatial databases for agriculture & NR planning & management
   - Design and implement customized decision support systems based on ArcGIS
   - Integrate image processing, and GIS for land use system analysis and land evaluation
   - Predict crop yield and crop management strategies using crop modeling and simulation in combination with spatial information
   - Apply watershed models in predicting runoff and sedimentation
   - Facilitate agro-climatic data monitoring and analysis
   - Provide technical advice for various software

16. Analyses/projects are being undertaken at national, provincial and landscape levels. Various software applications have been developed by MCC including: Soilview 2.0, Land Plan 3.0, Thai Pedon 1.0, Land Suit 1.0, Ag Zone 1.0, Consplan 2.0, Erosview, Phosop 1.0, Oythai.

17. The Land Development Department (LDD) Region 6 Office presented on:
   - Procedures, GIS tools and participatory mapping tools used in Village LUP
   - Upland conservation farming and cropping systems
   - “The Mor Din” program

18. The roles and responsibilities of LDD are:
   - Agricultural land use planning and policy development
   - Soil survey and classification
   - Soil & water conservation and soil improvement
   - Increasing crop production
   - Sustainable agriculture
   - Transferring land management technology
   - Providing an information service on sustainable land use and increasing productivity

19. In the Development Village Program; improved land use practices are demonstrated in selected villages as examples for other villages within the Tambon. The village boundary is determined, family land parcels are surveyed and present land uses recorded. A land ownership map is overlaid with aerial photos to understand the slope regimes in the individual farm plots. Agricultural land, forest areas, irrigated land and irrigation systems are mapped in a GIS. Small infrastructure, such as access tracks, farm, ponds, check dams etc are planned and designed.

20. The LDD promotes a variety of soil conservation measures in the uplands and highlands to increase soil sediment trapping, nutrient trapping, rain water infiltration and to improve soil moisture availability. These are: contoured strip cropping, vegetative contour strips (legume trees, saleable plants and grasses), rotational cropping of cereals and legumes, contour ditches incorporating Vetiver grass, continuous contour terracing, intermittent contour terracing, green
manuring, and agro-forestry incorporating fruit trees.

21. The concept of the Mor Din Program is to develop the basic technical skills of selected villagers in land management related practices so they can act as village “extension” agents in their communities and also within their Tambons. There are two mor din per village and nationwide they have contact with 2,000,000 families. Broadly their key roles are to help: a) increase farm productivity by 10%, b) reduce farm production costs by 10%, c) reduce the use of farm chemicals by 30%

22. LDD Field Trip – Nong Hoi Royal Project Development Centre: This is an opium eradication and alternate occupation project in Mae Sa involving a community of 500 Hmong families. The main commercial crops are cabbages, carrots, lettuce which are produced both in the wet season and the dry season using sprinkler irrigation from elevated dams. The program has three components; extension and development, research and marketing.

23. All the 4000 rai of steeply sloping agricultural is protected by soil conservation measures including: continuous bench terraces, intermittent bench terraces, and contour grass strips using Vetiver grass. Vetiver grass is used to reinforce the terrace faces. These intensive agricultural systems involve the use of agricultural chemicals and the project has introduced a “Good Agricultural Practices” (GAP) program with the aim of reduce the dangers of chemical residues in farm produce.

24. The GAP program includes advice on the use of agricultural chemicals, a system of field recording of agricultural practices to monitor agricultural chemical use, and random testing for chemical residues in produce prior to processing in the project processing plant.

25. The research activities include the GAP program, IPM, lettuce production using hydroponics, earth worm production, compost production, and low cost “glass house” construction techniques appropriate for small farmers. The project has also introduced hydro-cooling of unprocessed farm produce, forced air cooling of produce prepared for marketing, and organic grading of produce.

26. LDD Field Trip – Ban Tha Mon, Mae On District: On this field trip the study group observed Development Village and Mor Din activities including; the LDD extension unit based at the Tambon Health Centre from which the development activities are planned and implemented, the Tambon network map showing the different land use areas, technical leaflets, methane gas production, vetiver grass propagation, farm ponds stabilized with vetiver grass, upland conservation cropping areas using contour cropping, check dams and improved pastures for livestock production.

27. The Mor Din, leading farmers and women’s representatives briefed the group on the Or Por Tor network activity and the “development village” activities
2 Important Lessons Learned

Watershed Management

- Many factors contribute to land use changes in watersheds and sub-watersheds including, population growth and migration, agricultural production expansion (cultivation “down from the ridges” and “up from the lowland”), commercialism, infrastructure, urbanization, tourism, industrialisation, forest policy and administration, and environmentalism (popular and “deep green” views)
- Forest protection and expansion policy has a significant impact on village land use changes and livelihood systems, ie, it restricts land available for agriculture, results in rapid agricultural commercialization and increases “upstream – downstream” interactions between villages living in the watersheds.
- It also contributes to more intensive use of sloping agricultural land, increases the likelihood of soil erosion from available lands, results in the use of more agricultural chemicals and places increasing demands on available water
- The elimination of opium cultivation has similar consequences as reported by villages; rotational fallow systems are replaced by permanent agriculture, field fallow periods diminish, inter-village conflicts over land and water increase, the use of agricultural chemicals is increasing.
- Participatory village land use mapping and the development of village natural resource management rules help villagers to manage the changing land use patterns and socio-economic changes
- The establishment of sub-watershed networks is a very important tool in improving sub-watershed management by the resident village communities and has potential as a system for the management of larger watersheds and eco-systems.
- Research has shown that river basin management systems must build on a foundation of, local sub-watersheds, local management networks and local government support. Success depends on effective “upstream – downstream” negotiations which have to be conducted in a fair and equitable manner
- Villagers can assist with monitoring of sub-watershed conditions and health using practical monitoring tools at village level, eg, rainfall, temperature, humidity, stream flow, stream water quality (using biological indicators) and soil erosion and deposition.

Land Management and Conservation Farming Methods

- The introduction of “foreign or external” conservation farming systems in sloping land areas is very difficult to achieve because villagers are more concerned with increasing family incomes and reducing production risks and costs.
- Villagers will adopt new conservation farming practices, ie, terracing etc, only if these interventions are heavily subsidized as was observed at the Nong Hoi project
- The “whole village development” approach as implemented by the LDD is very expensive and the indications are that villagers are unprepared for large scale introduction of semi-mechanised methods such as contour cultivation, contour vegetative strips etc. The gradual introduction of these new methods through small field demonstrations would probably be a better approach.
- While villagers living in declared forest areas have no opportunity to acquire secure land use entitlements for agriculture, (areas > 30% land slope), and villagers claim this is a significant problem, it appears not to have been a major constraint in the rapid expansion of commercial agriculture in upland ecosystems by village communities.
• Farm based systems for monitoring the use of agricultural chemicals in intensive vegetable production areas is being demonstrated by the Royal Project. This aims at reducing the risks of produce containing residues of the organophosphate and carbamate groups of chemicals.

Digital Support Systems for Agriculture and Resources Management

• GIS based support systems for agriculture and natural resources management (DSSARM) have great potential for assisting district and provincial administrations with “key crop” and “priority crop” planning.
• The effectiveness of these systems depends largely on having available adequate and accurate data sets of both bio-physical and socio-economic variables.
• The DSS can be used to plot different crop suitability scenarios, ie, impacts if different interventions are introduced to reduce bio-physical constraints, eg, irrigation for longan production.
• The systems have been developed mainly for lowland agro-ecosystems and have limitations in upland areas where forest protection policies and the lack of bio-physical data render them less reliable. The cost of traditional soil survey methods in the upland areas is quite prohibitive and “representative” soils survey methods are more appropriate
• In the lowland areas the DSS are available down to Tambon and landscape level but not practical at village level because soils data, for example, is inadequate for such analyses. Soils surveys are undertaken in “special areas” such as the LDD “development villages” and in Royal Project sites to assist with local land use planning.
• The CMU is also co-operating with the LDD and the Royal Projects with DSSARM, and the LDD is using the information for the Development Village program and using the application programs.
• DSSARM information can be accessed on the internet: mccweb.agric.cmu.ac.th
3 Introduction and Objectives

A land management component study tour to northern upland areas in Chiang Mai Province of northern Thailand was planned in April – May 2005 and implemented from 22nd to 29th May 2005. The host and organizer of the study tour was the Chiang Mai country office of the World Agro-forestry Centre (ICRAF) which is based at the Chiang Mai University (CMU).

A Study Tour Proposal prepared by the Land Management Component provides details on important aspects of the tour including, justification, objectives, expected outputs, organizers, organizing methodology, training evaluation and budget.

The key organizations visited were the ICRAF office, the Multiple Cropping Centre of CMU, and the Region 6 Office of the Land Development Department in Mae Rim, Chiang Mai. The tour included 2 days of briefings and presentations by the host organizations and three days of field trips to various project sites in Mae Chaem, Mae On and Mae Rim Districts. A feature of the tour was the presentations by Tambon Organization representatives, small watershed network representatives, Village Committee representatives, and the discussion sessions that followed each presentation.

The body of information provided by the hosts was far in excess of the material that is possible to present in this report. A list of references is therefore presented for readers who would like to access further information.

3.1 Objectives

The objectives of the study tour were:

1. Study systems and GIS tools for supporting area planning at provincial, district and watershed levels
2. Study procedures, GIS tools and participatory mapping tools used in land use planning at village level
3. Observe the use of crop suitability zoning systems and the constraints in undertaking crop suitability mapping in the uplands
4. Observe upland conservation farming and cropping systems
5. Observe multi-ethnic village land use and natural resource management practices and networking methods in upland communities
6. Observe the problems associated with boundaries and management areas at sub-district level, ie, “administration boundaries” and “natural resource boundaries”
7. Observe opium substitution strategies and land use transitions resulting from opium replacement policies in upland communities

3.2 Participants and Timetable for Study Tour

The study tour participants were as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Position-Organisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Houmchitsavath Sodarak</td>
<td>Director, Northern Agricultural and Forestry Research</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Position</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------</td>
<td>-------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2.</td>
<td>Thongphath Leuangkhamma</td>
<td>Director, Forest Inventory and Planning Division, Dept of Forestry, Vientiane</td>
</tr>
<tr>
<td>3.</td>
<td>Phaythoun Pilakorn</td>
<td>GIS Unit, Information Division, NAFRI; Integrated Upland Agricultural Research Project, Luang Prabang</td>
</tr>
<tr>
<td>4.</td>
<td>Khamphou Phouttavong</td>
<td>Soils Survey and Land Classification Centre, NAFRI; Land Management Component LSUAFRP, Vientiane</td>
</tr>
<tr>
<td>5.</td>
<td>Somsak Sysomvang</td>
<td>Land Use Planning Unit, Forest Inventory and Planning Division, Dept of Forestry, Vientiane</td>
</tr>
<tr>
<td>6.</td>
<td>Khamphou Phouttavong</td>
<td>Deputy District Governor, Na Mo District, Oudomsay Province</td>
</tr>
<tr>
<td>7.</td>
<td>Chankham Homdarak</td>
<td>LSUAFRP Co-ordinator, Na Mo District, Oudomsay Province</td>
</tr>
<tr>
<td>8.</td>
<td>La Soudaphorn</td>
<td>Deputy District Governor, Phonesay District, Luang Prabang Province</td>
</tr>
<tr>
<td>9.</td>
<td>Khamsomphaeng Intavong</td>
<td>LSUAFRP Co-ordinator, Phonesay District, Luang Prabang Province</td>
</tr>
<tr>
<td>10.</td>
<td>Peter Jones</td>
<td>Land Management Adviser, LSUAFRP, NAFRI, Vientiane</td>
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</tbody>
</table>

The timetable for the study tour is presented in Appendix 1.

4 Agency Presentations and Field Visits

4.1 ICRAF – “Land Use Planning and GIS Tools”

Dr David Thomas and Ms Pornwilai Saipothong made a series of presentations dealing with “Research on Changing Land Use in Thailand and Mountainous Areas in South East Asia”. This focused on the problems and complex issues of associated with deforestation and land use among communities living in the watersheds of Mae Chaem District.

The Three Main Components of Deforestation:

- Land conversion
- Logging
- Farmers in forest areas

ICRAF has a focus on the latter component, ie, farmers in forest areas.

Complex and Difficult Issues: These include;

Ethnic minorities, opium cultivation, shifting cultivation, rural poverty, environmental services and protected forest areas

Incentives and Pressures on Land Use Change: These include;

Population growth and migration, agricultural production expansion (cultivation “down from the ridges” and “up from the lowland”), commercialism, infrastructure, urbanization, tourism,
industrialisation, forest policy and administration, and environmentalism (popular and “deep green” views)

In Thailand there is no formal land tenure system in forest areas (areas under the jurisdiction of the Royal Forestry Department), meaning that the “farmers in the forest” have no avenue for acquiring formal land use rights to land they cultivate.

**Changing Land Use Patterns:**

There are three primary land use classes in Mae Chaem based on elevation:

1. **Lowlands**: 300 - 600 masl - dry diptorcarp forest
2. **Midlands**: 600 - 1,000 masl - mixed deciduous forest
3. **Highlands**: 1,000 - 1,600 masl - hill evergreen forest, coniferous forests
   1,600 – 1,800 masl - moist temperate forest (cloud forest)

During the period between 1960 and the year 2000 the primary land use patterns changed as follows:

<table>
<thead>
<tr>
<th>Altitude Range</th>
<th>Ethnic Groups</th>
<th>Natural Vegetation</th>
<th>Land Use 1960</th>
<th>Land Use 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;300 masl (Lowlands)</td>
<td>Northern Thai</td>
<td>Dry diptorocarp forest</td>
<td>Short cultivation, (short fallow) and paddy fields</td>
<td>Continuous field crops, tree crops and paddy fields</td>
</tr>
<tr>
<td>300 - 600 - 1,000 masl (Midlands)</td>
<td>Karen, Lua, Khumu</td>
<td>Mixed deciduous forest</td>
<td>Rotational shifting cultivation: 1-2 years cultivation &amp; then 10+ years of fallow</td>
<td>Shorter “rotational” shifting cultivation (3 to 7 years), permanent upland fields, (<em>crop rotations, fragmented land holdings</em>)</td>
</tr>
<tr>
<td>1,000 - 1,600 masl (Highlands)</td>
<td>Hmong, Lisu, Akha</td>
<td>Hill evergreen forest &amp; coniferous forests</td>
<td>Pioneer shifting cultivation with opium; long period of cultivation</td>
<td>Grasslands, pine reafforestation, temperate &amp; subtropical fruit trees, intensive high value vegetables (<em>cabbage, carrots</em>)</td>
</tr>
<tr>
<td>1,800 + masl</td>
<td></td>
<td>Moist temperate forest</td>
<td>No cultivation</td>
<td>No cultivation</td>
</tr>
</tbody>
</table>

The attendant issues that have gained prominence during this period are:

- Fragmentation of land holdings
- Increasing competition for land
- Changes in land use practice of the ethnic groups, eg, the Karen; shorter fallows, adoption of permanent fields, etc
- Use of all year irrigation in upland fields
- Increasing use of chemicals and fertilizers
- Stronger perceptions and sensitivity about positions in watersheds, ie lowlanders “looking upstream” (diminishing water flows)
- Small watersheds within basins (low areas and high areas)
- Closer inter-ethnic group interaction and sensitivities

**Policy Responses to Land Use Changes:**

The responses, as illustrated below, have been:
In response to these changing land use patterns and the land use policy responses from government, various organizations have developed a framework and partnerships to build the knowledge base on shifting cultivation and viable alternatives. This is called the Alternatives to Slash and Burn (ASB) Partnership Framework. The partners include, the Royal Forestry Department, ICRAF, the CMU and other Universities, Suan Pah Sirikit Project, CARE Thailand, Local Government Institutions, other Thai Institutions, and ASB global partners. The activities of the Northern Mountain Region Agro-forestry Systems Research and Development Project are indicated below.
4.2 Phases and Scope of ICRAF Research

The ICRAF research and method development program has been conducted in three phases:

1. Overall land use patterns, characteristics and impacts on livelihoods & environmental services in the Mae Chaem Watershed

2. Developing and testing science-based tools to strengthen participatory watershed management in local sub-watersheds

3. Extending analyses to the Ping River Basin and the broader Mountainous Mainland SE Asia eco-region

4.2.1 Phase 1: Studies on Overall Land Use Patterns

These studies cover overall land use patterns, characteristics and impacts on livelihoods & environmental services in the Mae Chaem Watershed.

The Research sites in Mae Chaem are indicated on the map below.
Three Key Research Areas in the Alternative to Slash-and-burn Project

- Economic using PAM (Policy Analysis Matrix)
- Biodiversity using Proforma and VegClass software
- C-stock and Green House Gas Emissions

Specific studies are undertaken on:
- Livelihoods
- Cropping and farming systems
- Rice and maize yields

Within these study areas the focus is on understanding the following six areas of interest and variation:

- **Watchan** - Cash crops introduced by the Royal Project Foundation
- **Mae Yot** – Long fallow shifting cultivation
- **Mae Hae Tai** – Short fallow shifting cultivation
- **Mae Raek** – Permanent field cropping
- **Long Pong** – Intensive cash crop area using high input (vegetables)
- **Mae Tho** – Cabbage areas close to the new national park

Aerial photo interpretation is used to understand and map land use changes, as illustrated in the following maps for four different years: 1954, 1976, 1984 and 1996.

![Maps of land use changes from 1954 to 1996](image)

**Promising Institutional Changes & Pilot Project Innovations**

- Localized participatory land use planning that builds on traditional knowledge & landscape management systems to identify mutually-acceptable land use practices
- Experimentation with local multi-village watershed management networks in sub-catchments
- National constitutional & legal reforms may provide a basis for formal land use agreements in mountain watersheds
  - constitutional provision for local participation in natural resource management
  - local governance institutions up-graded
  - community forestry law in Parliament

These innovations are illustrated in the figure below
4.2.2 Phase II: Developing Science Based Tools for Participatory Watershed Management.

Various tools have been developed with local communities and networks to involve them in participatory watershed management. These include:

1. Community Based Monitoring Using Local Knowledge by Village Volunteers
   - Rainfall
   - Temperature
   - Humidity
   - Streamflow
   - Water quality (biological indicators)
   - Soil erosion and deposition

These activities are undertaken with communities and local networks to increase awareness of changing conditions in the watersheds, with the aim of engaging villagers in improved watershed management practices. Villager assessments of usefulness of the monitoring activities are conducted to understand which activities are seen as more appropriate by villagers.

The monitoring activities are undertaken by village volunteers. The Tambon Organisation (Or Por Tor) supports this activity. Monthly meetings are held to review progress and problems and to assess the usefulness of the data collected. Comparisons are made between government and village rainfall distribution; government data is available only from the District.
Meteorology Station, while the data collected from the village networks is location specific and helps “fill the gaps”.

<table>
<thead>
<tr>
<th>Score</th>
<th>Quality of water</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>extremely dirty water (no life at all)</td>
</tr>
<tr>
<td>1.0-2.9</td>
<td>very dirty water</td>
</tr>
<tr>
<td>3.0-4.9</td>
<td>dirty water</td>
</tr>
<tr>
<td>5.0-5.9</td>
<td>average</td>
</tr>
<tr>
<td>6.0-7.9</td>
<td>rather clean – clean water</td>
</tr>
<tr>
<td>8.0-10</td>
<td>very clean water</td>
</tr>
</tbody>
</table>

2. Participatory Mapping Procedures

This procedure is very similar to the one being used in the ADB Shifting Cultivation Stabilisation Pilot Program (SCSPP) in Houa Phan Province in Lao PDR. The procedures in participatory mapping are:
The following figure provides a simplified explanation of the process.
3. Crop Modelling

Crop growth in different conditions is measured to provide information for describing crop domains in areas of different elevation and soil types.

4. Matching Aerial Photo Categories with Village Land Use Categories
Village categories are more attuned to actual land use as the above figure shows, eg, villagers classify forest areas as follows:

**Planted and Other**
- Trees without further designation
- Government tree plantings
- Village forest rehabilitation areas

**Community Protected**
- Community protected trees
- Birth spirit forest groves
- Cemetery forest groves
- Other spiritual forest groves

**Subsistence Use**
- Community subsistence use forest
- Community forest
- Food bank forest

### 5. Biodiversity Conservation in the Protected Area System

Generally the approach for biodiversity conservation focuses on segregating landscapes into separate components of “natural forest” and “intensive agriculture”. The ASB research is looking at the possibilities for more multifunctional landscapes in protecting and managing biodiversity. The diagram below depicts fully segregated and multifunctional landscapes and asks the question, “Is there more scope for a multifunctional approach in protecting and managing biodiversity?”

In this context the example below highlights the positive aspects of an integrated landscape comprising permanent forested areas, forest fallow, upland fields, and paddy land in filtering sediment runoff.
4.2.3 Phase 3: Extending Analyses to the Ping River Basin & SE Asia eco-region

This phase focuses on the possibilities and opportunities for using the lessons of the research in Mae Chaem in the Ping River basin and broader mountainous south east asian eco-region. The following are some lessons from Mae Chaem.

1. “New Basin Management Approach”

In Thailand there are 25 official river basins and 255 official river sub-basins

Research has shown that river basin management systems must build on a foundation of:
- Local sub-watersheds
- Local management networks
- Local government support

Success depends on effective upstream –downstream negotiations which have to be conducted in a fair and equitable manner.

The figure below illustrates the natural resource management system co-ordination complexities, and the local institutional relationships that exist in watershed management in northern Thailand.
2. Spatial Information System

A spatial information system can be used to highlight the complexities and opportunities to improve co-ordination by the various watershed management partners. For example, information is required on land areas, population and distribution, income distribution, upland minoritory groups, urban settlements, industries, agricultural systems, irrigated agriculture, forest cover, state forest land claims, national parks and wildlife sanctuaries, the watershed classifications, annual stream flows, dry season flows, altitude zones in the basins, land use conflicts with mountain communities, resettlement patterns (multiple small settlements grouped into larger administrative villages), and the sub basins in watersheds.

3. The Challenge

As expressed by ICRAF this is to achieve: “Localized management of natural resources in major basins and nations that also meets the needs of broader societies, nations, and the global community”.

4. Covering Wider Scales

At the lower levels this may be facilitated through the engagement of local governance units, villages, tambons & sub-watersheds. At the broader levels it may be facilitated through higher level organization at District, Basin & Sub-basin, and Provincial levels.

4.3 Field Visits and Activities – ICRAF – Mae Chaem District
Field visits were made to Mae Kong Kha and Mae Suk Sub-watersheds, brief descriptions of which are presented below.

4.3.1 Field Activities in Mae Kongkha Sub-watershed

Mae Kongkha sub-watershed

The sub-watershed is inhabited by two ethnic groups;
1) Karen (Pgakanyaw) make up the majority of the population and most live at higher elevations, in the upper and middle reaches of the watershed. However a few Karen live at low elevations in the downstream areas.
2) Northern Thai (Khon Muang) are the majority group and live in the flat downstream areas.

In the past, poppy was cultivated in the upper areas of the sub-watershed. However forestry officials, the Mae Chaem Watershed development project and the police worked to encourage the villagers to stop planting opium, and replace the area with pine. At the time the villagers practiced only shifting cultivation, although officials had been making efforts to discourage them from these practices. Subsequently areas under shifting cultivation changed into permanent fields, approximately 20 years ago. About 7 years ago, the Suan Pah Sirikit project supported the villagers to establish the Mae kongkha-Moung Luang Watershed Network, which combines natural resources management, livelihoods and culture in an effort to establish a resource management system that is appropriate for the local communities. Member villages of the network have representatives on the network committee, and have established regulations for the network. For example, if there is a case of illegal cutting of logs the network will handle the problem with internal discussions. Fines and other penalties are decided and handed out by the network itself.

The communities of the Mae Kongkha sub-water have diverse land uses, which are a product of the livelihood strategies, cultural beliefs and local needs of each group. Land uses include: grassland, cemetery, birth spirit forests, spirit forests, community rehabilitation forests, use forests, forest, forest plantations, paddy fields, fallow fields, field crops, fruit trees, urban areas, and water bodies.

1. Visit to Pha Luang village (Karen)- 25th May

- Explanation by village volunteers and observation of science based tools for monitoring participatory watershed management practices, including: rainfall, temperature, humidity, stream-flow, water quality (biological indicators), soil erosion and deposition
- Village networking practices and rules
- Participatory land use planning and mapping
- Village land use zoning and land use categories, including: cemetery, birth forest and trees (pa sadai), spirit forests (pa liang pee), conservation forests (pa anarack), rehabilitation forest (pa foon foo), community forests (pa choom chon), use forest (pa chai soi), unspecified forest (pa), planted forest (pa blook), paddy (na), upland fields (ray), fruit trees (mai pon) village area (ban), and water bodies (nam).
- Upland cropping practices, including: rain-fed soybean and maize, and stone soil erosion retention bunds
2. Discussions on Mae Chaem Network - 25th May

Mr Veerapol Prasopsak, the Secretary of the Mae Chaem Natural Resources Network explained the origins, the activities and the difficulties and constraints of the network. This was a very interactive discussion and exchange of views. Mr Veerapol is a teacher at the Mae Chaem secondary school.

There are 24 local networks representing all the sub-watersheds in the Mae Chaem watershed area. Each network has their set of rules and transgressions of the rules are dealt with by the local network. Broader issues between network villages are discussed at periodic network meetings where solutions are sought. The main issues being dealt with by the networks are land and water use conflicts (upstream and downstream villages), the use of agricultural chemicals and pollution of stream water, and issues related to conservation farming practices and erosion.

The network activities are integrated with the Tambon Organisations (Or Por Tor) and the Or Port Tor support the activities of the networks as much as they are able within the limitations of funds available to them.

The main problems reported were:

- Insufficient funds for the Or Por Tor to undertake activities requested by villages and local networks
- The possibility of less support from Projects such as CARE and ICRAF should these programs not continue
- A lack of funds for natural resource management activities (because most funds are allocated to infrastructure projects)
• Conflicts between villages over access to land and water (partly due to upstream dry season irrigators)
• Increasing chemical use for agriculture
• Soil loss due to concentration of populations and the change to permanent or semi-permanent land use practices

4.3.2 Field Activities in Mae Suk sub-watershed

Mae Suk sub-watershed

Until the 1980’s the upper Mae Suk sub-watershed was an area of opium production. Opium was grown primarily by the Hmong, with small areas being cultivated by Karen and Northern Thai. The government then identified the upper area of the sub-watershed as a priority area for development, and encouraged the production of cash crops such as coffee and red kidney bean. These crops did not catch on but the effort did bring a shift in the awareness of new market opportunities for cash crops. The completion of the all weather road and the establishment of a large cabbage market in Mae Chaem stimulated a rapid and broad based shift in agriculture. Cabbages were soon followed by carrots, potatoes and shallots as crops of choice. The transition was driven by the Hmong and new technology continues to spread from the Hmong to the Karen. This upland economy is characterized by multi-layers of integration. Hmong and Karen production for larger national regional markets, inter ethnic labour relations, and increasingly intense and complex competition for access to land and water resources. Tension over water and land are present between neighboring villages and more broadly within the sub-watershed between upstream and down stream communities. Dry season irrigation by upstream communities is increasing the tension.

There are three Tambons within the Mae Suk sub-watershed;

• Hin Pon
• Chang Koeng
• Mae Suk

1. Visit to Ban Pui Neua, (Hmong) Ban Pui (Karen) and Ban Pui Tai (Hmong)

1. Explanation of history of land use changes in the Ban Pui village cluster by village leaders of Ban Pui (Karen).

Forty years ago the government promoted the growing of opium as a cash crop in the higher elevation areas as a means to reduce pioneer shifting cultivation. The Hmong villagers adopted this practice. Hmong villagers settled in the Ban Pui area about 30 years ago and at that time the planting of coffee and red kidney beans was promoted. These crops, while tried for some
time, were not adopted as crops of choice, and later cabbage became the preferred cash crop. There is no opium grown in the area since commercial cropping has been adopted.

While the Hmong villagers were the first to adopt cabbage growing, Karen villagers also adopted the practice. Dry season sprinkler irrigated cabbage production was started 4 to 5 years ago by the Karen villagers. The household income from cabbage varies from Baht 1,000 to Baht 10,000. At present, Karen villagers generally use three, four or five plots of land, some of which are used for upland rice planting, although because of population increase in the area, fewer households retain rotational upland rice fields. A common household practice is to use approximately half of their fields for rice and the other half for cash crops. Shallots have also become an important cash crop. Villagers are not entitled to receive land use rights or certificates for agricultural fields because they are farming in declared forest areas. The villager’s measure of living in poverty is “not having enough to eat”.

The main land use problems reported by the villagers at present are: reduction in forest area, (agricultural production expansion) land conflicts), soil erosion, increasing use of weedicides, access to water (diminishing water availability), and rotation fallow system disappearing. The local network system and network rules are used to discuss the problem of diminishing water availability and other land use issues such as the use and indiscriminate disposal of chemicals and chemical containers, however the villagers acknowledged that the implementation of the network rules is difficult because villagers are still adjusting to the new land use and crop husbandry practices. The villagers are now encouraged to burn or bury chemical containers. The Karen maintain fire breaks to control forest fires and the unwanted spread of fires from upland field cultivation.

2. Ban Pui Neua (Hmong) Briefing on Land Use Practices by Village Head

Agriculture

Ban Pui Neua has 63 households, 126 families and a population of 540 people. There is approximately 700 ray of agricultural land or about 11 ray per household or about 5-6 ray per family. Thirty to 40 years ago the villagers migrated quite frequently, however the village has been permanently settled since villagers adopted permanent commercial cropping. The main cash crops are cabbage, carrots and potatoes, nor mai bong (bamboo shoots) and more recently, fruit trees including lychees and persimmons. Cabbage cropping started about 20 years ago. Currently there is very little upland rice grown, with villages preferring to buy rice. Maize is grown mainly for livestock food; pigs, ducks and chickens. Each family owns about 2-3 pigs and about 10 families own cattle and buffaloes, which are free ranged in the protected state
owned forest area. Opium production has ceased because vegetable production is more profitable. There is no opium addiction in the village.

It was reported that there was insufficient land for agriculture, and to overcome this problem some families rent land. Commercial crop marketing is “farm gate” and produce is transported to the north east and Bangkok by 10 wheel trucks. Cash crops are planted on 2-3 plots of land per family. Income is approximately Baht 40,000 to Baht 50,000 per family. Potatoes provide the highest income per unit area however stoney soils are a problem for potato production. The dry season irrigation systems are all self financed (no project assistance).

Forestry

In the past, forest use was indiscriminate, however since the advent of sedentary upland agriculture and participatory land use planning, the village has designated areas of protected forest, ie, Pa Dong Xeng (spirit forest). The villagers believe there is a “jao tee presence” and a jao tee tree is revered as a symbol of the spirit forest. A liang jao tee ceremony is celebrated each year at the tree.

A state forest adjoins the village boundary, and is a collection area for forest products such as mushrooms. This state forest area is also used as a free–ranging grazing area for village cattle and buffaloes, consent having been given purpose by the Forestry Department.

Soil Conservation

Villagers have tried vegetative strips (Vetiver grass) for preventing run-off and conserving soil. However this measure is not popular, and villagers are actually removing grass strips planted in the past, either by digging it out or with weedicides. The reason expressed by the Village head was that it competes with the inter-planted crops (a view not shared by the Land Development Department), and reduces yield. When asked about alternatives to grass strips, the village head said villagers prefer to rotate the plots available to them if they have enough plots, and observed that the rate of soil loss was not high. Note: It was observed that the adoption and maintenance of vetiver strips did not appear to be increasing in this area.

Credit and Tax

It is common for the villagers to finance their own agricultural inputs for vegetable production. The Bank of Agriculture and Co-operatives (BAAC) does not provide individual loans to villagers using land for agriculture in declared forest areas, however they are prepared to offer activity group guaranteed loans for groups of about 10 families.

No land tax or production tax is collected by the government because villagers do not have any land use entitlement documents for cultivation in declared forest areas.

3. Ban Kong Karn – Briefing on Land Use Practices (Northern Thai)

This village is located at lower altitude than the Hmong and Karen ethnic minorities and villagers have different farming systems.

Agriculture

Glutinous paddy rice provides subsistence rice needs supplemented by some upland rice. Garlic is the main commercial dry season paddy land crop. Unlike the upstream villages, the Northern
Thai are not engaged in cabbage production. Maize is planted on upland fields for livestock food, often inter-planted in tamarind orchards. Longan and tamarind are the main commercial crops, Longan production was reported at about 20 tonnes annually, and villagers experience price inconsistencies for longan because longan growers are competing for markets with the large producers in the Hot and Hang Dong areas. Land use changes and diminishing access to land have prompted villagers to develop population control measures. Currently the maximum family land holding is 20 rai (about 3.5 hectares). The villagers say families these days have a maximum of four children to contain population growth (now 120 families and 90 households in the village). In-migration into the village is not allowed for the same reason.

The use of agricultural chemicals by upstream villages was reported as a problem, as was the impact of dry season irrigation of commercial vegetables on stream flow at the lower altitudes. The village network system is used to discuss and seek solutions for these problems, although this was reported as a very sensitive issue. A major problem reported was the inability to acquire official land tenure rights (sitti tam kin”) for areas of upland (rice maize, tamarinds, longan) because of forestry policy.

**Forestry**

Some years ago a forest conservation group was formed in the village and rules established by the community, with responsibility for rules implementation and enforcement being vested in the village committee. For infringements within the village community fines of Baht 200 to Baht 500 are imposed, and for offences by outsiders, the fine rate is Baht 5,000 to Baht 10,000. The villagers stated that there are no forest conservation rules infringements. The villagers usually purchase timber for housing purposes rather than cut timber in the village conservation and use forest areas, these areas being reserved for fuel wood and NTFPs collection, eg, mushrooms.

The village also practices wildlife conservation but there are few wildlife remaining due to exploitation by various people in the area over the last 30-40 years.

**4. Village and Network Land Use Maps**

The digitized land use maps show the network and village boundaries and the village land use zones. However the areas of the different village agricultural land and forest categories are not indicated on a map legend. The reason for this is that it is believed this could cause problems between villages during networking meetings if the area calculations verified that some villages had access to more land than others. (See the land use map below)
5. Presentation by Mr Somkuan Chareon-tempium – Rak Thai Foundation (formerly CARE Thailand)

Mr Somkuan gave a presentation on “Collaborating Natural Resources Management in Mae Chaem District Project”. He briefly described the land use problems in the District, the role of Project Steering Committee, and the work of the District Program Management Committee chaired by the District Governor. He then focused on the procedures followed by the CARE program to identify and develop activities to address natural resources management issues and problems.

These are illustrated in the figure below.

The Procedure for Identifying Natural Resources Management Activities
The process is done in adjoining villages concurrently so that there is collaboration between villages when the village boundaries are delineated and land use agreements prepared. These steps are used to initiate the local village networks.

The NRM rules for each village are different, as they are developed by the villagers themselves. The project and the District government have the role to ratify the rules. It often requires as many as 3 to 4 network meetings to resolve the more sensitive land use issues. The process illustrated above can take as long as three years to implement.
In the last five years the CARE project has subsidized the salaries of Or Por Tor members to the value of Baht 750,000 with a view to leveraging the Or Por Tor to allocate funds for natural resources management activities, however only minimal funds have been allocated for that purpose, ie, some firebreaks. It was explained that Or Por Tor, CARE, the District Administration and other district agencies have the major say in deciding Or Por Tor activities.

6. Presentation by Mr Manit Saeyang of Ban Pui Village on Tambon Organisation Responsibilities

Mr Manit is the Chairman of the Tambon Organisation (Or Por Tor). It receives funds from the government, and taxes collected within the Tambon itself. It usually has a budget of Baht 4,000,000 to Baht 5,000,000 per year. There are eight villages in the Tambon and each village has 2 representatives on the Or Por Tor. All members of the community are eligible for election, including village officials, respected village leaders and women, but they must have household registration for at least one year before becoming eligible. Each elected committee has a four year term.

Most funding goes to infrastructure such as roads, small hydro-power systems and some to NR management. The level of funding from the government and the staff that can be engaged depends on the grading of the tambon which is decided by the amount of finance the tambon can raise from local sources, ie:

<table>
<thead>
<tr>
<th>Grading</th>
<th>Local Finance Raised</th>
<th>Officers permitted (No)</th>
<th>Temporaries Allowed (No)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&gt; Baht 20,000,000</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Baht 12,000,000 - 20,000,000</td>
<td>10</td>
<td>5-20</td>
</tr>
<tr>
<td>3</td>
<td>Baht 6,000,000 - 12,000,000</td>
<td>6</td>
<td>5-24</td>
</tr>
<tr>
<td>4</td>
<td>Baht 3,000,000 - 6,000,000</td>
<td>4</td>
<td>5-24</td>
</tr>
<tr>
<td>5</td>
<td>&lt; Baht 3,000,000</td>
<td>3</td>
<td>5-18</td>
</tr>
</tbody>
</table>

5 because they raise less than Baht 3,000,000 locally. Or Por Tor develop a five year work plan and establish priorities for activities in the plan.

Problems

1. A cumbersome administrative activity approval system. The District Governor must approve and sign all activities proposed in the annual work plan
2. Inadequate funding for projects planned
3. The Or Por Tor is based at the District office which necessitates travel from the villages to attend to Or Por Tor business.
4. Small allocations to natural resource management activities

4.4 CMU (MCC) - Digital Support Systems for Agric. & Resource Management

The Multiple Cropping Centre (MCC) of the Faculty of Agriculture of Chiang Mai University (CMU) was established in 1975. Research is undertaken by a multi-disciplinary Research Unit of MCC with a focus on three research areas:

1. Sustainable agriculture:
2. Agri-business and management
3. Decision support system for agriculture and resource management

The research teams are comprised of people of the following disciplines; soil science & conservation, agronomy, and multiple cropping.

Dr Methi Ekasingh gave a presentation on a digital support system for agriculture and resource management (DSSARM), which is a GIS based information system for the purpose of:

“developing methods and information systems to support natural resource management decisions by various stakeholders at field, farm, watershed and regional levels utilizing a systems approach, information technology and analytical tools”

The system has been developed over a period of 8 years. The initial work concentrated on the lowland landscapes and in more recent times has also encompassed upland and highland areas.

The components of DSSARM are illustrated below:

The technologies and analytical tools of the DSSARM are:

**Further Detail on Analytical Tools**

1. **Soft System Methods**: eg, PRA and resource mapping

2. **Multi-criteria Decision Making**: eg, Crop suitability
3. **Spatial Statistics:** eg, Conversion of point climate data to area climatic data

4. **Scenario Analysis:** eg, Impacts from actions; ie, planting various crops, introducing irrigation in tree crop systems (longan)

**The objectives of the DSSARM are to:**

- Design and build spatial databases for agriculture and natural resources planning and management
- Design and implement customized decision support systems based on ArcGIS
- Integrate image processing, and GIS for land use system analysis and land evaluation
- Predict crop yield and crop management strategies using crop modeling and simulation in combination with spatial information
- Apply watershed models in predicting runoff and sedimentation
- Facilitate agro-climatic data monitoring and analysis
- Provide technical advice for various software used in agricultural science and natural resource management

The projects being undertaken at the various levels are:

**National Level**

- National Soil Geodatabase Development
- Land Use Geodatabase and Land Resource Planning System
- A GIS-based Automated Land Evaluation System
- Agricultural Zoning for Economic Crops of Thailand

**Regional Level**

- Development of spatial database for representative soil series of Thailand
- Soil erosion view of Thailand
- Development of rice decision support system
- Estimation of sugarcane areas using a computer model and GIS interfaces
- Decision support system for agricultural resource management for northern provinces of Thailand

**Landscape Level**

- Integrated land resource management for small watersheds in the highlands
- A DSSARM for Royal Projects Development Centres
- A DSS for soil conservation planning in the “Development Village” Program of the Land Development Department
Methane emission from various land use types in the Mae Chaem watershed

An example of a Land Use Map of the Nong Hoi Royal Project Area is illustrated below.

**Application Software Developed by MCC**

Various software applications have been developed by MCC including:

- **Soilview 2.0** (soil units down to Tambon level; not possible at village level because it would be too expensive and because there is pronounced variability in soils at village level); effect on plant growth; soil characteristics such as pH and organic matter
- **Land Plan 3.0** (land use constraints for land types)
- **Thai Pedon 1.0** (soil taxonomy, soil profile descriptions; correlates soils and vegetation; only up to 30% land slope)
- **Land Suit 1.0** (land suitability based on physical and socio-economic parameters; ie, soil series, rainfall, proximity to roads etc; soil management and workability; costs for crop production under various conditions per unit area (rai))
- **Ag Zone 1.0** (At provincial level; suitability criteria for key commercial crops and priority crops; 12 crops in Thailand lowland areas below 30% slope; relates to processing factories)
- **Consplan 2.0** (for soil conservation planning based on contour lines and slope categories)
- **Erosview** (erosion sensitivity of different soil types)
- **Phosop 1.0** (Rice DSS; rice suitability criteria)
- **Oythai** (Sugar DSS; sugar suitability criteria)

All these applications may be viewed on the MCC website: mccweb.agric.cmu.ac.th

Numerous examples were provided on the use of these software applications; mainly at the provincial level, eg, a) land suitability for maize in Phitsanulok Province using various variables such as soil series and rainfall statistics; b) sugar suitability in Phitsanulok Province
taking into account soils, minimum economic areas (52 rai) access to processing factories, road access and production costs.

Lessons Learned

1. In Thailand these DSS have been developed primarily for lowland areas with slopes below 30%. This is so because specific soil series data is not available in more steeply sloping zones.
2. In addition, lands with slopes higher than 30% are classified as forest lands and officially are not available for agriculture, so detailed soil surveys and classification have not been undertaken.
3. Exceptions are made for locations of higher elevation where minority groups undertake agriculture under the auspices of the Royal Project Organisation. In these areas approval for agricultural activity is sought from the Royal Forestry Department, and the CMU and the Land Development Department are active in developing and applying DSS for these areas.
4. All the DSS applications are available down to Tambon level. At levels below this, ie, village, accurate data sets are not available and so land suitability zoning is not possible.
5. The DSS are designed to undertake analyses to define: a) areas for priority commercial crops as requested by particular provinces and districts, and b) for crop suitability mapping for all the 12 key crops.
6. The DSS has the capacity to compare the potential economic variability between the key crops in similar situations and to undertake analyses for different scenarios, eg, changed potentials should irrigation be introduced in areas previously dependent on rainfall.
7. Relative profitability can be calculated by applying different input costs for the different key crops.
8. In upland areas, where no formal soil classification exists, a system using key crop soil requirements can be used, ie, working from an understanding of what crops different soils support in particular areas.
9. With the available data sets, it requires only about one day to run the analyses for any of the key crops for any region and /or province, and about one year to complete land suitability and agricultural zoning at the “whole country level” (all provinces)

4.5 LDD - Conservation Farming Systems and Village Development Planning

A visit was made to the Land Development Department (LDD) Region 6 Office where three of the study tour objectives were covered:

• Study procedures, GIS tools and participatory mapping tools used in land use planning at village level
• Observe the use of crop suitability zoning systems and the constraints in undertaking crop suitability mapping in the uplands
• Observe upland conservation farming and cropping systems

Dr Kanchana Cheunpichai was our host. A summary of subject matter presented using a power point presentation is provided below.
4.5.1 LDD, Organisation, Roles and Responsibilities

Roles and Responsibilities of LDD
- agricultural land use planning and policy development
- soil survey and classification
- soil & water conservation and soil improvement
- increasing crop production
- sustainable agriculture.
- transferring land management technology
- providing an information service on sustainable land use and increasing productivity

4.5.2 Land Use Planning in Land Development Villages

The Department has a program of village land use planning and land development in villages where there are soil fertility and land use constraints. This is called the “Land Development
Village” program. Usually funds are allocated for implementing these activities in two needy villages in each of the four provinces each year and the activity is undertaken in two stages, a land use planning stage (Year 1) and an implementation stage Year 2). The procedure used is illustrated below.

In the past the procedure was not very participatory, however the department is moving towards more participatory approaches with the introduction of socio-economic surveys in the development villages and discussions using base maps with village officials and land users during the planning phases. The village boundary is determined, family land parcels are surveyed and present land uses recorded. A land ownership map is overlaid with aerial photos to understand the slope regimes in the individual farm plots. Field information is mapped in a GIS to indicate agricultural land, forest areas, irrigated land and irrigation systems. Small infrastructure, such as access tracks, farm ponds, check dams etc are planned and mapped.

Soil surveys are conducted, not just to know the properties of the soils but to determine the soil constraints and possible corrective measures. Soil transects and soil colour charts are used in discussions with farmers. All soil survey information is systematically recorded.
4.5.3 Conservation Farming Systems and Practices

Soil Conservation

In Northern Region of Thailand there is 17 million hectares of land of which there is:

- Highland: 52 %
- Upland: 30 %
- Lowland: 18 %

The problems associated with sloping land cultivation are:
- Increasing population pressure
- Increasing land pressure
- Slash and burn cultivation (shifting cultivation)
- Accelerated soil erosion (52 t/ha/yr has been measured)
- Using unsustainable land and crop management practices

LDD is recommending the following soil conservation measures in sloping land situations:

- Contoured strip cropping
- Vegetative contour strips (legume trees, saleable plants and grasses)
- Rotational cropping of cereals and legumes
- Contour ditches incorporating Vetiver grass
- Continuous contour terracing
- Intermittent contour terracing
- Green manuring
- Agro-forestry, incorporating fruit trees

Vetiver grass has become the preferred vegetative soil conservation measure of the LDD, *(although it may not be the soil conservation choice of farmers).* The so called Vetiver System Technology is promoted widely in sloping land agriculture for:

- sediment trapping
- nutrient trapping
- rain water infiltration
- improving soil moisture availability

The basic recommendations for Vetiver establishment and maintenance are:

1. Single row planting of Vetiver
2. Hill spacing 5-10 cm.
3. Distance between rows 8 to 10 meters
4. Use of vigorous struck cuttings
5. Early planting mid-May to July
6. Re-planting during 1<sup>st</sup> and 2<sup>nd</sup> year to maintain continuous strips

Vetiver is also recommended for stabilizing road cuttings, farm ponds, dam walls, and drainage ways (vegetative check structures)

Soil Organic Matter Improvement

The Department is also promoting quite vigorously soil improvement measures including: seed inoculants for leguminous crops, composting, and the use of soil inoculants applied with compost to field crops and fruit trees; 100 Kg per rai for field crops and 3 Kg per tree for tree crops.

These are promoted at village level through the “Mor Din” (soil doctor) program.

4.5.4 The “Mor Din” (Soil Doctor) Program

The concept of the mor din program is to develop the basic technical skills of selected villagers in land management related practices so they can act as village “extension” agents in their communities and also within their Tambons. The Development Village and Mor Din programs run parallel to each other with the mor din being a point of contact for the LDD and the families involved in the development village activities.

There are two mor din per village and nationwide they have contact with 2,000,000 families. Their key roles are to help:

- Increase productivity by 10%
- Reduce production costs by 10%
- Reduce the use of chemicals by 30%

The mor din receive two days of formal training in basic land use and land management practices and communication methods to improve their ability to relate to the community. They are provided with gold coloured jackets to help create a sense of identity. They are provided with basic equipment including a soil testing kit (pH) and technical leaflets. They do not receive any salaries or allowances. In addition they are the leaders and local extension persons to popularize LDD programs such as:

- Compost preparation and extension (pui muk)
- Direct sale of brochures and tapes on improved land management practices
- The “9 extension charts” to promote increase productivity, reduce production costs and reduce the use of chemicals
- Methane gas production using manure from housed animals
- Vetiver grass promotion, propagation and distribution
- The LDD farm pond program
- Soil conservation on sloping lands

In each Tambon a “mor din tambon” is elected by his /her fellow colleagues from the 8 or 9 villages in the Tambon. The objective of this is to create a sense of co-operation and support among the mor din using a networking approach.

With regard to chemical use, the LDD has sought the co-operation of the Health Department in providing a blood testing service to help raise villager awareness about the dangers of excessive and careless use of agricultural chemicals on human health. They also use the Seven to Eleven store chain as outlets for educational materials.

4.6 Soil Surveys

A presentation was provided on soil survey methods and activities of the DLD. These are available on CD from the LM component.

In “slope complex” areas (areas with slopes greater than 30%), the soil surveys are done for “representative areas” within the village not necessarily following a survey grid. In the case of Royal Project area villages, comprehensive soil surveys are undertaken.

Soil maps are available for each Tambon at a scale of 1:5,000; provincial soils maps are at scale 1:50,000 scale. The Or Por Tor has access to the land use planning and soil survey data. There are 62 soil units in the soil classification system in Thailand.
**Field Visits Organised by the Land Development Department**

Two field visits were conducted, one to Nong Hoi Royal Project site in Mae Sa and another to Mae On District, both in Chiang Mai Province

### 4.6.1 Nong Hoi Royal Project – Mae Sa

The purpose of this visit was to observe conservation farming systems and commercial marketing systems of vegetable crops in a high altitude sloping land situation, which was formerly an opium production area. Our host was Khun Paradon Suemanotham the Director of the Nong Hoi Royal Project Development Centre.

The project area is at elevations on 1,000 to 1,200 masl. The Royal Forestry Department has given approval for agricultural activities to be undertaken in the declared forest area by a cluster of Hmong villages under the auspices of the Royal Projects Organisation. A total area of 8,000 rai was delineated, of which about 4,000 rai is used for agricultural production, 1,000 rai for other purposes, (settlements, marketing infrastructure etc) and about 3,000 rai of forests surrounding the production areas. Temperatures range from a maximum of 35 degrees to a minimum of 4 degrees C. Average annual rainfall is 1,125 mm.

It was 36 years ago that the King of Thailand took an interest in providing alternatives to opium production after being in contact with Hmong opium producers. This was one reason for the establishment of the royal projects. There are 37 royal project centres in Thailand and they tend to focus on different commodities, ie vegetables, fruit crops, flowers etc. .

**Components, Staffing, and Re-current Costs**

The Nong Hoi project, established 20 years ago, has three integrated components:

- Extension - Development
- Processing & Marketing
- Research

There are 10 permanent technical staff, 5 permanent labourers, and 7 temporary employed by the project. The annual budget for staff is about Baht 5,000,000. Annual running costs are in the order of Baht 2,500,000

**Extension and Development**

Commercial production of opium ceased 15 years ago at Nong Hoi as producing villagers changed over to alternate crops. At this centre the focus is on vegetable production, the main crops being head cabbage, carrots and various varieties of lettuce. The land on which agriculture is undertaken is quite steep and a combination of soil conservation measures have been introduced, including: continuous contour bench terracing, intermittent contour bench terracing, and contour vegetative strips (vetiver grass).

The approximate unit costs of terracing as provided by the LDD are as follows:

- Intermittent contour terraces: (slopes 15 to 35%): Baht 19,500 per km of terrace
- Continuous bench terraces: (slopes >35 %): Baht 24,000 per km of bench
Costs for vetiver contour strips were not provided.

Extension – Development

Conservation Farming Systems

Agriculture & Forest Conservation

It was reported that indicative gross incomes per household were between Baht 166,000 to Baht 270,000 per year. The villagers access credit from the bank of Agriculture and Co-operatives using group guarantees. Loans are commonly used for seed, fertilizer, and agricultural chemicals. The annual cabbage production from the area is about 10,000 tonnes.

The agricultural land was allocated to families when the project started. At present there are now 500 families which has placed pressure on the available land because of population increase and the fact that the program wishes to retain the surrounding forest areas. Families are dividing their available land for re-distribution to siblings. This in turn has resulted in a reassessment of viable commercial alternatives such as weaving and “ethno-agro-tourism”.

Research

Research is undertaken in the fields of IPM, hydroponics, soil conservation, nursery practices, chemical residues in produce, organic fertilizers, and cool storage systems.

Processing and Marketing
The produce is received at a processing and storage plant established at the project site. Farmers are allocated quotas of 200 Kg of produce a day. Leaf vegetables go through a process of hydro-cooling (at 4 degrees C), preparation hand sorting and packaging prior to going to a forced air cool storage room (2 degrees C). Carrots are graded, peeled and packaged in a similar way.

![Marketing](image)

Produce is transported by refrigerated trucks to markets in Bangkok and elsewhere. The gross income to the project farmers is in the order of Baht 50,000,000 per year.

### The Good Agricultural Practice (GAP) Program

The project has introduced the “GAP” program to monitor the quality of produce, in particular the presence of chemical residues. Eight conditions for crop production are stipulated with a view to reducing chemical residues in produce.

Farmers are required to record their field crop husbandry practices and these records are checked in the field two days before harvesting. Prior to the produce being accepted into the processing plant random produce testing is then undertaken at the production plant laboratory using a pesticide test kit to check for chemical residues of compounds in the organophosphate and carbamate groups. These monitoring measures raise farmer awareness on safe agricultural practice and aim at the supply of safe produce to the consumer.

### 4.6.2 Ban Tha Mon Development Village - Mae On District

Ban Tha Mon is a LDD “Development Village” located in Mae On District. Mr Teerarat Chaithep was the group’s guide to the project site located in hilly country 70 kms from Chiang Mai.

The development villages are “representative” focal villages which serve as demonstrations for neighbouring villages in a sub-district (Tambon). They are expensive to establish, about Baht 2,000,000 per village, including the physical inputs and the survey and planning costs. Therefore only two villagers per province per year are implemented. The premises of the the King’s New Theory are embodied in the village development activity, ie a 15 rai farm holding, having 10% for farm dwellings, 30 % for farm ponds and water storage, 30% for subsistence farming and 30% for commercial farming.
At Tha Mon the total development area was 1,200 rai, the main activities being upland cropping systems, (maize, soybean, cucurbits) using contoured vetiver strips and contour farming, farm ponds (13), minor access roads and drainage, and gully check dams, and improved fodder plots. In addition there are “mor din” program activities including: methane gas production using farm manure, vetiver grass propagation, and communal composting using various farm residues and soil inoculants. Villagers explained the process took 30 days including turning the compost after 15 days. Compost producers can sell the compost for Baht 50 per 5 litres in the village. Also located in the village was a small farm dairy (10 cows) which sells milk to the Sangkhampaeng Dairy Farmers Association.

The development village program also incorporates forest conservation of areas of surrounding forest, which are zoned and mapped with villagers during the planning phase. These protected forests are used for dry season grazing.

References

Compact Disc

The following information used in the briefings by the agencies during the study tour is available on CD from the Land Management Component:

1. ICRAF: Power Point presentation on “Research on Changing Land Use in Thailand and Mountainous Areas in South East Asia” (combination of English and Thai)

2. Multiple Cropping Centre, Chiang Mai University; Power Point presentation on “Digital Support Systems for Agriculture and Resources Management” (English)

3. Land Development Department, Region 6; Power Point presentation on “Land Use Planning in Development Villages, Conservation Farming Systems, and the Mor Din Program” (combination of English and Thai)

Documents

1. ICRAF Study Tour Background Document
2. ICRAF Brochure: Agroforestry Support Project for Vietnam and Lao PDR
3. LDD Documents and Brochures:
   • Land Development Department; Organisation, Roles and Responsibilities
   • The Soil Doctor Volunteer program
   • Vetiver Grass; Natural Engineering structure

4. CARE Document: Guide Book Regarding Co-ordination Between the Or Por Tor and the CARE Natural Resources Management Project in Mae Chaem District.
### Appendix 1: Land Management Study Tour Schedule – Chiang Mai Province

<table>
<thead>
<tr>
<th>Day</th>
<th>Main Activity</th>
<th>Host/ Organiser</th>
<th>Type of Activity</th>
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<tbody>
<tr>
<td>22nd May</td>
<td>Travel Vientiane - Luang Prabang - Chiang Mai</td>
<td>Land Management Component</td>
<td>Travel</td>
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<tr>
<td>(Sunday)</td>
<td>• Procedures and tools in participatory land use planning, using a combination of GIS and participatory mapping tools</td>
<td>Ms Pornwilai and Dr David Thomas ICRAF, CMU</td>
<td>Briefing and presentations</td>
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<tr>
<td></td>
<td>• Introduction to watershed networking systems</td>
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<td></td>
<td>• Boundary issues; “administrative” versus “natural”</td>
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<td>23rd May</td>
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<td>(Monday)</td>
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<td>24th May</td>
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<tr>
<td>(Tuesday)</td>
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<td></td>
<td>• Spatial Information System used for area planning, ie, provincial, district, sub-district, river basin, sub-basin and/or sub watershed levels:</td>
<td>Dr Methi Ekasing, Faculty of Agriculture, CMU</td>
<td>Briefing and presentations</td>
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<td></td>
<td>- “Economic” land suitability</td>
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<td>GIS tools etc</td>
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<td>- “Key crops” land suitability</td>
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<td></td>
<td>- “Crop priority” land suitability</td>
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<td></td>
<td>Nong Hoi Royal Project Area, Mae Sa</td>
<td>Mr Paradon LDD, Region 6</td>
<td>Field trip and briefings</td>
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<td></td>
<td>Highland farming systems &amp; sub-watershed management</td>
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<td>25th May</td>
<td>Mae Chaem District</td>
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<tr>
<td>(Wednesday)</td>
<td>Mae Kongkar Sub-watershed (mainly Karen ethnic group)</td>
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<td></td>
<td>• Natural resource management practices;</td>
<td>Ms Pornwilai ICRAF, CMU District Office</td>
<td>Field trip</td>
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<td></td>
<td>• Village networking, network rules, implementation &amp; network monitoring practices (stream flows etc)</td>
<td>NGOs (CARE) Local Government (Or Por Tor)</td>
<td>Briefings</td>
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<tr>
<td></td>
<td>• Shifting cultivation reduction programs &amp; outcomes</td>
<td>Mr Outhith, Chairman of Mae Chaem District Network</td>
<td>Discussions with network staff and villagers</td>
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<td></td>
<td>• Land use practices, technology adoption and transfer</td>
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<td>Field trip and discussions</td>
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<td></td>
<td>between the ethnic groups; commercial cropping (maize) and connections with lowland agro-industry &amp; marketing</td>
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<td>• Problems associated with “boundaries”, ie, administration boundaries &amp; natural resource boundaries</td>
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<tr>
<td>26th May</td>
<td>Mae Suk Sub-watershed (Two Or Por Tor &amp; three ethnic groups, Hmong, Karen, and Khon Muang)</td>
<td>Mr Sounthorn (ICRAF Field Co-ordinator)</td>
<td>Field trip</td>
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<tr>
<td>(Thursday)</td>
<td>• Impacts and issues associated with opium substitution with highland horticultural crops</td>
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<td>Briefings</td>
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<td>• Dry season irrigation of upland fields and market-oriented production (shallots and cabbages)</td>
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<td>Discussions with villagers</td>
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<td>• Land use issues related to the Mae Tho National Park</td>
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<td>• Problems with watershed management, land access and land use and water use competition</td>
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<td></td>
<td>• Return Chiang Mai</td>
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<td>27th May</td>
<td>Land Development Department, Region 6 Mae Rim</td>
<td>Dr Kanchana Chuenpichai</td>
<td>Briefings</td>
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<tr>
<td>(Friday)</td>
<td>• Crop suitability zoning systems</td>
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<td>Field trip</td>
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<td></td>
<td>• Conservation farming systems and practices</td>
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<td>Discussions with villagers</td>
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<td></td>
<td>• The “Mor Din” (soil doctor) program</td>
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<td>Land Development Village: Tambon Mae Ta, A Mae On</td>
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<td></td>
<td>• Village land use planning and mapping</td>
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<td>• Observe village conservation farming and cropping system practices</td>
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<td>Doi Saket</td>
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<td>• Discuss Mor Din (soil doctor) responsibilities and activities with village Mor Din.</td>
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<td>28th May</td>
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<td>Land Management Component</td>
<td>Travel</td>
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<td>(Saturday)</td>
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<td>29th May</td>
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<td>Land Management Component</td>
<td>Travel</td>
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<tr>
<td>(Sunday)</td>
<td>• Free time – Chiang Mai and environs</td>
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<td></td>
<td>• Travel Chiang Mai - Luang Prabang - Vientiane</td>
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