

# Managing Agroforestry Landscapes in Mountain Watershed Regions

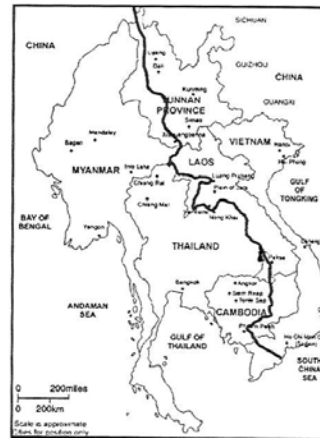
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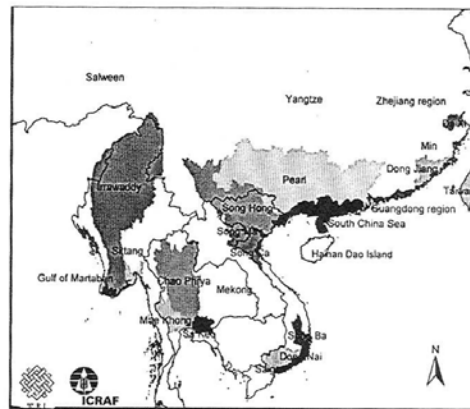
Mountainous areas of the Greater Mekong Sub-Region (GMS) are one of the global focal points for research and development programs conducted by the International Centre for Research in Agroforestry (ICRAF), as well as for research activities conducted under the CGIAR system-wide Alternatives to Slash-and-Burn (ASB) Initiative. Delineation of the GMS (Figure 1) is based on administrative boundaries of five mainland Southeast Asian nations and the Yunnan Province of China.

Although the sub-region takes its name from the Mekong River basin, it also includes all or portions of several other major river basins. Major river basins in the region, as depicted in Figure 2, include those with base flow influenced by watershed headlands high in the Tibetan Plateau (Mekong, Salween), relatively large basins with their headlands located lower in the region (Red, Chao Phraya, Irrawaddy), and a substantial number of smaller local basins, such as the series of small basins along the central coast of Vietnam.

The vast majority of people in the GMS, as well as centers of political and economic power, are located in downstream lowland portions of these basins. These areas are also home to major lowland agricultural production zones, including famous 'rice bowl' production areas that feed most people in the region and fuel the two largest national suppliers for the global rice market. On the other hand, the upper reaches of these basins, which are now often vaguely referred to as 'montane mainland Southeast Asia', is home to a range of ethnic minorities who have long led relatively independent lifestyles based on livelihood traditions that are considerably different from their lowland counterparts.



Source: Asian Development Bank  
**Figure 1. GMS: The Greater Mekong Sub-Region**



**Figure 2. Mainland Southeast Asia Watersheds**

As a result of rapid change during recent decades, landscapes of the region are being transformed, and the social, economic and ecological 'distance' between lowland and upland areas is disappearing. This paper reviews some of the major forces underlying this transition of mosaic land use patterns in upper tributary sub-basins in Northern Thailand, and approaches to improved agroforestry management systems that build on local knowledge, new developments in local governance, and some of the promising directions that pilot-scale implementation projects have identified for further development efforts.

In order to help clarify the potential domain for these issues and research and development efforts, we have offered a preliminary approach for demarcating the montane mainland Southeast Asia (MMSEA) 'eco-region'. Our preliminary definition centers on areas that are between 300 to 3,000 m.a.s.l. in elevation, and located within river basins that at least partially overlap with a Southeast Asian nation. This domain is indicated by the darkly shaded area in Figure 3. In comparison to lowland areas, this domain includes most of the forest cover remaining in the region, as well as important watershed headlands. The area is populated by a diverse range of ethnic groups whose traditional land use systems have generally involved various forms of shifting cultivation. These groups are now increasingly dominated politically and economically by rapidly developing lowland societies, where concerns about rural poverty, land use change in upper watersheds and narcotics production are making MMSEA areas primary targets for both development and environmental policy.



Figure 3. Montane Mainland Southeast Asia

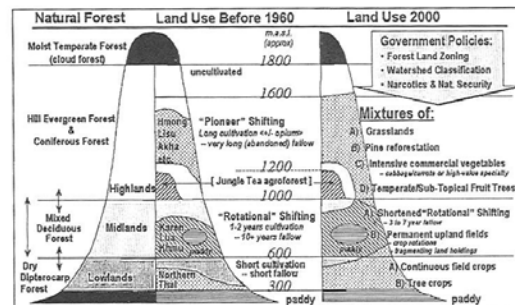
### Forces and Patterns of Land Use Change in Northern Thailand

An increasingly complex mix of incentives and pressures have been driving transformation of land use practices and patterns in MMSEA portions of northern Thailand during recent decades. Major components include:

- **Population growth and migration** have resulted in relatively more rapid rates of growth than those experienced in rural lowland areas during recent decades;

- **Agricultural expansion, commercialization and capitalization** is spreading up from lowland areas with expansion of domestic economies and major agro-industries, as well as down from ridges where successful opium crop substitution efforts have resulted in a new range of profitable intensive agricultural alternatives;
- **Expansion of infrastructure and a range of public services** are integrating formerly remote areas and communities into national transportation and communication networks, health and education programs, and rapidly evolving national governance systems;
- **Urbanization, industrialization and tourism** are bringing new activities and land use pressures to formerly remote areas, including land speculation and perceptions of land as an asset rather than a basis for agricultural production;
- **Forest policies and administration** are exerting increasing pressure to limit land use in mountain areas, through mechanisms such as watershed classification schemes, expansion of parks and protected areas, efforts to control illegal logging, and activities related to national security concerns;
- **Several types of environmentalism** have emerged as elements in this increasingly complex equation, with the growing environmental awareness of the general public supplemented by a spectrum of activism, from populist groups advocating community management of natural resources, to 'deep green' groups advocating mandatory relocation of existing communities located in protected areas.

In response to these driving forces, land use is now being transformed in all major mountain area zones. Major components of this change are diagrammed in Figure 4. Natural ecological gradients result in a transect of natural forest types that correspond roughly to altitudinal zones. Prior to about 1960, these zones also corresponded with relatively distinct forms of land use practiced by ethnic groups associated with each zone. Change during the last 40 years has now blurred these zones, and brought a range of new approaches to land management in the highlands.



source: ASB-Thailand

Figure 4. Changing land use patterns in north Thailand

## Agroforestry Practices in Northern Thailand

Two major types of agroforestry systems can be observed in northern Thailand today:

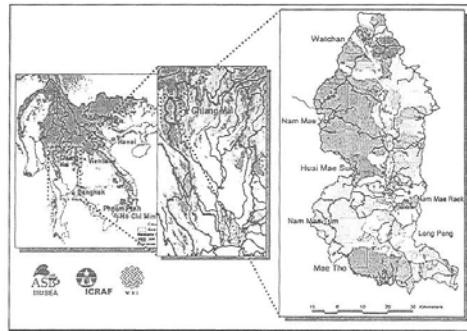
**1. Sequential agroforestry systems** are those where maximum growth rates of agricultural and forestry components occur at different times.

- *Field-based sequential systems* include 'pioneer' forms of shifting cultivation, relay and transitional intercropping (such as taungya), as well as crop rotations between annuals and perennials (such as upland rice-paper mulberry rotations that have now shifted to Laos).
- *Landscape-based sequential systems* include the classic long forest fallow rotational shifting cultivation systems of groups such as the Lua and the Karen, which also include various types of protected areas in the landscape, often in addition to pockets of irrigated paddy land carved into small upper valleys below their upland fields and forests. As classic systems are transformed under today's pressures for land use change, various more intensified fallow management and shorter-term rotational systems are sometimes emerging as a response to conditions in various areas.

**2. Simultaneous agroforestry systems** are those where maximum growth rates of agricultural and forestry components occur at the same time, so that competition and trade-offs become central design and management issues.

- *Field-based simultaneous systems* include such 'classic' forms of agroforestry as alley cropping, contour plantings, live fences, windbreaks and related types of plantings that form regular patterns. They also include more recently-recognized forms of 'complex' agroforests, that may be structured by humans (such as home gardens) to mimic the structural complexity of natural tropical plant communities, or may be based on integrating 'agricultural' activities into managed natural forest ecosystems (such as 'miang' tea, forest grazing, or Sumatra's 'jungle rubber').
- *Landscape-based simultaneous systems* appear to be the newest type, and various forms are still in the process of emergence and testing. Basically, these systems tend to focus on adaptation of landscape-based sequential systems, wherein the long forest fallow shifting cultivation components of the system are replaced by a mosaic of permanent agricultural and forest components. Individual land use components in the landscape may be based on segregation of agricultural fields and community forests, or may involve various forms and degrees of simultaneous agroforestry integration. Major forces underlying the emergence of these systems are largely related to increasingly severe limitations on land use in upper watersheds, combined with the apparent inability of lowland societies to accept any form of shifting cultivation as a legitimate form of agroforestry land use management.

Detailed investigations into the effects of land use change on agricultural and agroforestry practices and the livelihoods of rural communities is being conducted at a benchmark research site in northern Thailand that centers on the 4,000 square kilometer Mae Chaem watershed (Figure 5). This sub-basin is an upper tributary that contributes about 40 percent of the water flowing into the upper Ping River, which itself is the largest tributary of the Chao Phraya River. About 90 percent of the land in Mae



**Figure 5. Mae Chaem Benchmark Site: an upper tributary sub-basin of the Chao Phraya River System**

Chaem is classified as Class 1 or 2 protected watersheds, but more than 60,000 people in Mae Chaem (72 percent of whom are ethnic minorities) are primarily dependent on these lands for their livelihoods. A reasonable range of rural development and opium crop substitution activities have been conducted in Mae Chaem during the last 20 years, which together with the impact of other processes driving land use change have resulted in a wide range of spatially distributed land use practices that reflect various stages and pathways of transformation. The ASB-Thailand consortium, which is chaired by the Royal Forest Department, provides the overall organizational umbrella for multi-institutional interdisciplinary research into the impacts of various forms of land use change on rural livelihoods and environmental services. Studies are conducted under the RFD's Northern Mountain Area Agroforestry Systems Research and Development Project, in close collaboration with researchers from the RFD Forest Research Office, Chiang Mai University and other universities, as well as with staff from our partner implementation institutions in Mae Chaem, which includes the Queen Sirikit Forest Development Project and the Care-Thailand Collaborative Natural Resources Management Project, in addition to local governance bodies and other local actors. We also coordinate closely with Royal Project Foundation staff in sites under their responsibility. Funding support has been primarily from the Asian Development Bank, the Ford Foundation, the Rockefeller Foundation and ICRAF.

Preliminary findings have identified various promising local innovations and pilot project efforts to improve land use technologies, thereby achieving more food security, higher cash returns to labor and land, and improved community forest management. Notable pioneering efforts by the Royal Project Foundation are discussed in other papers in this volume. While various problems also exist, such as the very low returns to labor associated with upland rice production in 2-3 year fallow or permanent fields, there is general agreement that the most immediately important limitations on further progress toward more sustainable land use management now focus on the needs for institutional improvements, official land use recognition, and growing upstream-downstream tensions.

## An Information Support System for Local Agroforestry Landscape Management

In order to help address these urgent needs, ICRAF staffs are collaborating with our ASB-Thailand research and development partners to develop and test science-based tools that can provide critical support for participatory landscape agroforestry management in upper watershed areas. These efforts build on experience with participatory land use planning under several pioneering pilot projects, along with new mandates for local participation in natural resource management contained in the 1997 national constitution and recent local governance legislation. Negotiations among local communities, governance institutions, emerging watershed management networks, government agencies and other stakeholders have been successful in identifying what is effectively local land use zoning patterns that all parties find to be an acceptable arrangement. These patterns are usually delineated on simple 3-dimensional scale models, that we are helping local project field staff to transfer to maps to be digitized and entered into the sub-basin GIS system that we are developing.

Other components of the GIS are obtained from a variety of other sources, and we have begun working closely with local leaders to identify which types and forms of information they find most useful in assisting local planning and management efforts. We are also aggregating local land use plans in order to demonstrate to resource management agencies the types of patterns and impacts on broader natural resource landscapes that are likely to result from such localized efforts. If community forestry legislation currently pending in the Thai parliament is passed, we hope to test use of these zoning arrangements as a basis for establishing official land use agreements in protected watershed areas. In order to help assure transparency and accountability in land use management under these plans, we are also beginning to test use of remote sensing to monitor actual land use against locally-formulated plans. Such information on compliance should be made public information. The overall flow of the various components being tested are depicted in Figure 6.

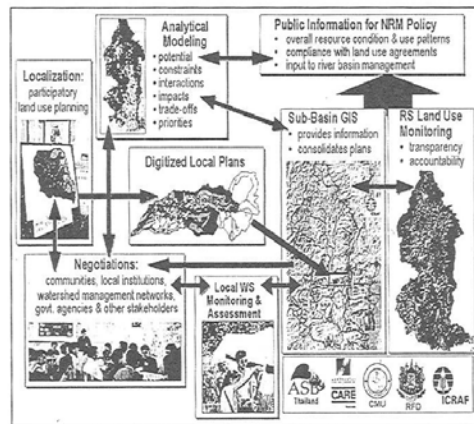


Figure 6. Pilot information support system for local agroforestry landscape management

A second important component also seen in Figure 6 centers on local monitoring and assessment of watershed services. Although various ethnic groups have indigenous indicators of water and watershed quality, these indicators may be problematic when upstream-downstream tensions cross ethnic lines, as is often the case. Thus, we are testing use of simple science-based indicators of water quality (based on differential sensitivities of aquatic invertebrates), water timing and quantity, and erosion and sedimentation, with monitoring measurements made by local community members working in association with local watershed management networks and local governance institutions. The goal is to monitor the 'bottom line' quantity and quality of watershed services from locally-managed landscapes. Such information should be helpful in identifying local successes and problems, and in managing tensions and conflict between upstream and downstream communities at various scales.

### **Conclusion**

In short, approaches to agroforestry most relevant to immediate concerns in mountain watershed areas of northern Thailand and many other parts of the MMSEA eco-region, are increasingly focused on management of agroforestry landscapes. The degree to which agricultural and forestry components of these mosaic landscapes are integrated or segregated depends on conditions that are the current focus of much of our analytical effort. Meanwhile, we are also seeking to adapt some of our scientific research tools to help strengthen local efforts in participatory land use management in mountain watershed areas, aimed at more secure, transparent and accountable land use arrangements, as well as improved common understanding and reduced tension and conflict among upstream and downstream interests.

ICRAF is also in the process of developing relationships for expansion of agroforestry research and development programs into other areas of the MMSEA eco-region within the GMS, including northern Lao PDR, Vietnam, and Yunnan, China. More concrete initial arrangements should be concluded during 2001. Moreover, one of the major overall goals of these efforts will be to foster and facilitate cross-country collaboration among relevant institutions in various countries of the Greater Mekong Sub-Region.