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Institutions for Integrated Water Resources Management in Upland Watersheds of Southeast Asia

A Comparative Analysis of
Thailand and Lao PDR

Mathew Kurian

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1. Introduction

The relationship between environmental degradation and poverty is complicated. Previous research suggests that poverty can drive rural populations to extend their agricultural frontier, causing deforestation and setting off soil erosion especially in hill environments. On the other hand, in the context of greater market integration, farmers may exploit natural resources more intensively with a view to accumulate profits by relying on the increased use of inorganic inputs, excessive groundwater exploitation and harvesting of timber and Non Timber Forest Products (NTFPs). The deterioration of the natural environment that emerges from such a pattern of resource use may exacerbate poverty in the long-term through food insecurity arising from the declining productivity of agricultural lands and stagnating farm incomes that can potentially curb food purchases, especially in situations where nonfarm incomes are limited.

In recent years many developing countries have adopted Integrated Water Resources Management (IWRM) as a cornerstone of their natural resource management strategies to mitigate effects of poverty and environmental degradation. IWRM has been attempted through the integrated management of multiple land uses—forested catchments, agriculture or riverine lands in a watershed context. In the water resources sector, it is assumed that the integrated management of multiple end uses of water—municipal, irrigation, environmental or domestic—could enhance the accountability and transparency of policy procedures. Still others have argued that when issues of access for upstream and downstream communities in watersheds or of head-end and tail-end farmers within an irrigation system are integrated in management plans, service provision may be enhanced, conflicts minimized and the effects of poverty alleviated.

Notwithstanding the perceived benefits of IWRM, we do not have an adequate analytical framework that would enable us to assess the extent to which institutions are integrated for the management of watershed resources. This paper is an attempt to develop such a framework through a comparative analysis of natural resource management strategies in two upland watersheds of Thailand and Lao PDR that are characterized by poverty and environmental degradation. Three research questions are posed:

1. How has market integration facilitated by changes in state policies influenced the use of natural resources in the uplands of Southeast Asia? How have patterns of natural resource use affected forest condition, soil erosion and water quality in upland watersheds?
2. What institutional options have emerged at multiple levels for the integrated management of diverse land uses in upland watersheds?
3. What influence has the trajectory of institutional development for the management of natural resources had on rural poverty (household incomes and food security, in particular) in the uplands of Lao PDR and Thailand?

This paper is organized as follows. The following section provides an overview of policy changes and market integration against a backdrop of discourses on decentralization and soil erosion in Southeast Asia. Section 3 describes the research methods adopted for field studies in Southeast Asia. Section 4 reports on the main findings of the study, focusing on a comparative analysis of market integration, natural resource degradation and poverty in Thailand and Lao PDR. Section 5 outlines the main conclusions of the study.

2. Market Integration, State Policies and Discourses on Soil Erosion in Mainland Southeast Asia

A. Decentralization in Mainland Southeast Asia

The upland regions of Vietnam, Thailand and Laos are characterized by natural resource degradation and poverty. Decentralization trends in the Southeast Asian region take place against this backdrop. The major driving forces for decentralization in the region are:

- Need to improve fiscal discipline
- Donor influence
- Alignment of political and intellectual interests in some countries of the region

Decentralization trends have gathered momentum in mainland Southeast Asia in the wake of the dismantling of the collective ownership of the agriculture and household responsibility system. Instead, user rights to agricultural lands were privatized, the contract responsibility system was extended to forest lands, and households were granted user rights to barren lands through an auction system. However, the major problems emerging from decentralization in the region can be considered as the unclear specification of property rights and improper enforcement leading to tenure insecurity.

In Vietnam, state policy has had a major influence on the evolution of land and water management practices in upland regions. In recent years under the *doi moi* phase, grass root organizations have been given legal standing. However, IWRM potential remains unexplored. Other problems emerging from decentralization include inadequate attention to equity issues like ensuring access of landless households to water and unregulated groundwater pumping. In Laos on the other hand, there has been a dramatic decrease in forest cover arising from the granting of private property rights. There have also been limited non-farm employment opportunities that make reliance on subsistence forest resources high especially in the face of population growth.

The Laos land allocation program with Swedish support was initiated in 1996. This program provides for the allocation of temporary user rights to farmers for agricultural and barren hilly lands, reducing poverty and deforestation through the halting of shifting cultivation. This process involves two steps:

- Agreeing on boundaries of forest and agricultural land in a village
- Detailed classification of land-use types and allocation of fields to households through co-management

The big challenge arising from decentralization in Laos remains that of ensuring sustained market access for agricultural and forest products.

In Thailand the Tambon Administrative Act of 1994 called for the creation of new local government entities at 'tambon' or sub-district level. The tambon (the unit of local government at village level) was expected to generate plans and revenues to implement programs as well as receive budgetary allocations from the centre to cover a broad number of sectors like education, health and NRM (Natural Resource Management). However, the tambon is not entirely autonomous since the district officer still needs to ratify allocations. Although the role of NGOs has been increasing, NRM issues remain low on the priority list of the TAO (Tambon Administrative Order). Further, the staff capacity is not strong enough to address NRM issues.

The challenges for decentralization programs in Thailand include reducing water shortages, reducing water contamination, increasing bio-diversity and reducing soil erosion.

B. The MSEC Research Project

Management of Soil Erosion Consortium (MSEC) catchments in South and Southeast Asia total 34. MSEC project sites focus on generating technologies that reduce soil erosion, methodologies for assessment and pathways for the institutional scaling-up of adopted IWRM strategies using a watershed approach. MSEC research has drawn on data regarding climate, soils, topography and land use to develop the Predict and Localize Erosion (PLER) model. The PLER model focuses on the identification of “Best Bet” land and water management options. In the ensuing paragraphs we provide an overview of some of the main issues surrounding land and water management in MSEC watersheds in Thailand and Lao PDR.

(1) Chao Phraya Watershed (MSEC Thailand)

Most natural forests in Thailand are located in the northern provinces. The confiscation of teak, especially from the Mae Hong Son province bordering Burma remains high. Over the last decade there has been a dramatic increase in the production of paper, newsprint, fire board and plywood. These items have become major export items in recent years and contribute to the share of manufacturing in national GDP. The national population growth rate has declined from 2 percent in the early nineties to 0.7 percent in 2001. Levels of primary education in particular are high with no constraints on female participation in the labor force.

In 1982 the Thai government undertook watershed classification which was approved in 1991. Head-water upper catchment areas which were classified as being highly prone to deforestation and soil erosion were under the control of the Royal Forest Department. Ten million people, mostly hill tribes, inhabited upland watershed areas. The 2001 budget for the first time allocated money towards forest management. Prior to this the focus was on forest conservation and forest development (both of which underwent a decline between 1997 and 2001). Similarly there has been a decline in the number of employees of the Forest Department. Tourism revenues continue to increase and so does economic growth in the wake of the economic crisis of 1997. This recovery has primarily been driven by export growth and tourism revenues.

Between 1994 and 1998, a decline in the size of farm holdings and forest area was noted. On the other hand, the land-rented area increased from 12,244 ha to 13,140 ha during the same period. Between 1994 and 1998:

- Farm area under field crops declined
- Area under fruit trees and tree crops increased from 8143 ha to 13,794 ha
- Area under vegetables and flowers increased from 378 ha to 775 ha
- The three major production crops in 1998 were sugarcane (industry), cassava (industry), banana, guava and sugar apple.
- The agricultural fallow period has declined

Moreover, infrastructure development in the Phrae province where the MSEC project site is located underwent an improvement as reflected in increase in the number of telephone exchanges, telephone lines and public/residential telephone lines. Similarly deposits and loans in banks increased from 1992-2001. The Phrae province ranks last among all provinces in northern region with regard to its Gross Provincial Product per capita, which is 25,496 Baht.

Upper watersheds in Thailand are characterized by forest-cover, ethnic populations with relatively poor access to markets and services, and agricultural systems that include shifting cultivation.

In recent years government policies have influenced change with regard to:

- Opium substitution
- Settling shifting cultivators
- Providing infrastructure and
- Forest protection/management

The MSEC watershed is characterized by a monsoonal climatic condition with the rainy season occurring between June and October. The average slope of the watershed is 38 percent while the elevation is 400 degrees. The predominant soils in the area include sandstone and clay shale. Furthermore, the soils in this area consist of high erodibility levels. The natural vegetation includes *Dry Dipterocarp* and mixed deciduous forest. There are about 59 tree species in the watershed with a DBH (Diameter at Breast Height) in the range of 30-320 cms and a crown cover of between 60-80 percent. Sixty percent of the watershed area is under forests while the rest is under agriculture. The illegal logging of timber is high in the watershed area. Thirty three streams drain the MSEC watershed. Sedimentation and reduction of the life of dams in Thailand and the accumulation of heavy metals in the Mae Thang Reservoir are the main management challenges in the area.

The main source of income for people in the watershed area is the cultivation and sale of upland rice, maize, vegetables and mung beans (during winter). Recently, forest trees such as mango and tamarind were introduced. Rainfed agriculture predominates. Additional household income usually arises from the collection and sale of NTFPs (Non-Timber Forest Products). In 1997, poor road facilities as well as the lack of electricity were persistent problems. Since a number of hill tribes lived in the area, shifting cultivation covered 5 percent of the land use, while 22 percent remained uncultivated fallow. The major problems encountered in the watershed area were deforestation, flash floods, land slides and water shortage. Three development problems identified by MSEC scientists include:

- Water quality
- Sedimentation of the Mae Thang Reservoir
- Water availability

Most of these changes may be traced to trends in markets for upland crops. Market demand for certain crops has pushed the agricultural frontier to forest areas, reduced the fallow period and soil fertility, caused deforestation and exacerbated soil erosion from steep catchment areas. Field visits in the area highlighted the following points:

1. Almost all households have land to cultivate
2. The government has played a role in the creation of infrastructure for the storage of agricultural crops/co-operatives
3. There is no levy of an agricultural income tax
4. Dam construction has been a boon causing a rise in agricultural productivity and groundwater recharge
5. Saw mills are an important source of jobs in the Phrae province
6. The area cultivated with soya bean has increased dramatically
7. Private contractors are involved in the soya bean cultivation business

8. Prices of soya bean grown in upland areas during the dry season have fluctuated
9. If a market for soya bean did not exist, people of the area say they would not crop upstream at the expense of forest area
10. The government had given people land titles in upland areas but now want them back to contain deforestation
11. People have replaced the cultivation of two varieties of paddy during the dry season with the cultivation of soya bean crop because of higher prices for the latter crop
12. Input costs have also increased especially for fertilizers
13. A decline in water quality has been noticed by farmers
14. Routine repairs of the dam are not being carried out by farmer's groups
15. Trends in family and land size

Parameter	10 years ago	Present
Land size (in ha)	5-10	2-3
Family size (number)	5-10	2-3

16. Land sub-division is taking place. Nonfarm jobs are needed. Land and education are given equally to children regardless of gender
17. Groundwater pumping has increased dramatically in the last 15 years in watershed areas
 - a. Domestic household use
 - b. Electricity driven pumpsets
 - c. No change in electricity price
 - d. Baht 3000 to purchase pumpset

(2) *Mekong Watershed (MSEC Lao PDR)*

Laos is slowly emerging from a long period of war and significant pieces of legislation have been passed in the last 10 years like the Forestry Law (1996), Land Law (1997) and Agriculture Law (1998). Greater market integration has resulted in the shortening of the fallow period, which has resulted in:

- Biomass reduction
- Weed infestation
- Increased workload
- Drop in crop yields
- Drop in household incomes
- Increase in soil erosion

Slash and burn agriculture is perceived as a problem by the state. However, the practice is crucial for upland populations characterized by poor market access for the following reasons:

- Poverty
- Lack of clear specification of property rights
- Compatibility with local culture

The MSEC project was initiated to identify "Best Bet" options for integrated land and water resources management from a watershed perspective. MSEC research reveals that run-off is co-related with orchard land use, slope and rainfall. Significantly, there is no relation between run-

off and land occupied by forests. Annual crops under intensive cultivation produced more soil loss. Natural grasses reduce run-off and run-off velocity which consequently reduces soil loss. Soil erosion decreases with an increase in slope. Dredging costs arise downstream from upland soil run-off.

Alternatives to slash and burn agriculture in Lao PDR are important for the following reasons:

- Improved fallow involving inter-cropping of 'pigeon pea'
- Contour planting of 'job's tear' with 'pigeon pea'
- No tillage with use of herbicides
- Results in less labor use

Field visits to the MSEC project site in Luang Prabang revealed the following:

1. The allocation of agricultural land is determined by the following criteria: 3 plots maximum per household with the surface areas of the plots determined in accordance with household size and number of workers. The remaining land is classified as Protected Forest. A population resettlement program was initiated in three phases: 1975, 1982-1983 and 1996-1997.
2. 50 percent of the population have gone through primary school
3. Land is state property but can be leased out to individuals, groups or private companies
4. The state levies a tax depending on land use every year
5. Upland rice is inter-cropped with:
 - Maize
 - Cucumber
 - Vegetables
 - Root crops
 - Chillies
6. A one to 3 year period is allocated for rice cropping
7. On average, labor requirements for upland rice cultivation are high, at 260 days/ha
8. Exchange labor is common mainly for sowing and weeding operations
9. Reduced fallows show increased weed infestation
10. There is a very limited use of chemical pesticides
11. Upland rice productivity has dropped due to intensive cropping, leading in some places to rice shortages
12. Nonfarm employment is limited to industries in the Luang Prabang town
13. Livestock production has increased by 20 percent in the last 20 years
14. Three big changes in the watershed in the last 10 years were seen:
 - Electricity
 - Paved highways
 - Private land titles
15. Villagers from outside the watershed area rent land due to population pressure and land subdivision in the region
16. Land is distributed equally among sons and daughters

17. The poor enforcement of property rights due to poor capacity leads to government-appointed monitors themselves clearing forests and selling trees
18. Water from the watershed site is used for:
 - Agriculture
 - Fisheries
 - Domestic household needs of washing etc
 - Luang Prabang town municipality
19. A Thai company is involved in the purchase of 'job's tears' in the watershed area. Firewood is now sold due to the emerging market for it
20. Around 1972, the Americans built an unpaved road during the Vietnam war. A previous road had been built by the French during the colonial rule
21. No official data on socio-economic and bio-physical aspects of IWRM exist
22. Under extreme poverty women and children suffer most from malnutrition

(3) *Vietnam—Red River Watershed*

Market liberalization has resulted in the growth of private ventures such as aquaculture which has in turn resulted in an increase in income inequality among the lowland population of North Vietnam. Privatization and household decision making was retained in South Vietnam at the time of collectivization in the north. Nonfarm remittances can be targeted by policy makers to reduce regional inequality. The liberalization of markets has resulted in an improved agricultural productivity to compensate for the reduction in state protection. Income inequality is rising in Vietnam in contrast to Central Europe because of a rise in inter-regional inequality, since growth is concentrated in accessible coastal and urban areas.

When land distribution is even, nonfarm income can potentially increase income inequality as is the case in China, Vietnam and the former USSR. But when land distribution is uneven as is the case in most of South Asia, nonfarm income can decrease income inequality, as is the case in India, Pakistan and Bangladesh. Vietnam's new Forest Policy has 3 objectives:

- Development of village economy through tree plantations
- Introduction of sedentary livelihood to reduce shifting cultivation
- Protection of forest resources

Agrarian reforms that began in 1954 following independence established land as state property and followed it up by the collectivization of lowland agriculture. The use of uplands remained open to all households. In 1981, Decree 100 marked the beginning of decollectivization with the return of all means of agricultural production to individuals. In 1992, the state began distributing forest-land user rights to individual households. This allocation prevented migration as there was no free-access land available for shifting cultivation.

During the collectives era, cultivation on sloping lands served as a source of supplementary income. This resulted in forest degradation during this period. But with the famine and the growing bankruptcy of co-operatives, food insecurity increased leading to decollectivization. This resulted in increases in agricultural productivity since farmers now had the incentive to invest in improved land and water management practices.

Forest regeneration was encouraged by regional specialization through:

- Livestock production in the uplands

- Sylviculture plantations in the midlands
- Agriculture in the delta areas

The classification of forests was undertaken in 1992. Although the process was participatory in the sense that the creation of community groups was provided for in the law, in reality the whole process was top-down since there was no room for flexibility and innovation. It was realized that forest protection can work on hill slopes only if farmers are given alternative sources of income or NTFPs, or livelihoods that rely less on the use of NTFPs. Many problems were identified with regard to plantation schemes:

- Long gestation period
- Market access differs
- Theft
- Demand not certain in the long term

New economic zones in the south of Vietnam offer a source of employment in Central Highlands. Between 1993 and 1998, the level of poverty reduced from 53 percent to 37 percent, while per capita GDP grew by 7.2 percent. During the 1990s, Vietnam became the world's second largest exporter of rice. Since 1990, farmers have attempted to re-claim the paddy fields of their ancestors thereby reproducing the land inequities of the pre-independence era. However, the availability of a labor force determines the level of capital accumulation by farmers. The Labor Point System of the collectives era was calculated by the number of mouths to feed divided by the number of workers in a household. Decree 100 induced upland cultivation, which led to the clearing of forests and increased soil erosion between 1982 and 1989. The important policy changes that are required with a view to improve land and water management include:

- Scientific forest management
- Livestock management
- Crop diversification
- Information sharing
- Investment in capacity to mobilize credit through the creation of banking institutions

Some assessments conclude that external projects tend to be executed in areas that are close to roads and markets. In the future, the challenge will be not so much Rural to Rural migration as Rural to Urban migration. The demand for water in the Red River watershed is growing. Only 20 percent of forest cover remains and population growth is increasing. The MSEC basin serves as a "benchmark" for information on land and water management trends. The MSEC site covers one village of Dong Cao that has a total of 40 households. The slope in the area is in the range of 45 to 120 percent. Ninety-five percent of the children attend primary school. However, the High School is located quite far away from the village. The average land size is 2.1 ha and cassava and taro are grown on sloping lands. However, farmers spend most of their time on growing lowland crops such as paddy, maize, spring peanuts and sweet potatoes. Starting from 1970 the primary forest has been progressively harvested in the watershed. The climate in the Red River region is humid sub-tropical with the average annual rainfall in the range of 1500mm. The soil depth is greater here when compared to MSEC sites in Thailand and Laos and the color of the soil is a dark yellowish brown.

Field visits to the MSEC site in Vietnam highlighted the following:

1. Water quality and deforestation are seen as two major development problems
2. The runoff calculation methodology is suspect (normal years/location and number of gauges)
3. Bacava (fodder), cassava and eucalyptus are grown.
4. One individual has leased out all the sloping land in the MSEC watershed after getting to know of the MSEC project treatments. Grass from the watershed area is given free by this individual to those who are engaged in soil and land conservation work on his land.
5. Policy changes in 1993 have led to huge forest clearance
6. The use of fertilizers as well as the productivity of crops have increased
7. Chinese businessmen play a role in the marketing of seeds and the purchasing of milk from livestock farms
8. The population in Dang Cao has increased from 14 to 42 households within the last 25 years.
9. Agro-tourism has been contemplated by a single individual
10. Two new species of trees have been planted by the owner of the watershed area. Both tree species have potential to supply fruit for markets in China.
11. People with connections to the Communist Party have greater access to opportunities to exploit markets because they have money, information and influence within the organization.

C. Hypothesis of Study

Based on the above discussion of trends relating to market integration, state policies and discourses surrounding soil erosion in Southeast Asia, we generated the following hypotheses:

- Greater market integration facilitated by changes in state policies may result in relatively more intensive use of natural resources in watersheds
- The more intensive use of natural resources may result in higher levels of natural resource degradation, resulting in institutional responses to remedy such patterns of environmental deterioration
- The trajectory of institutional development for the management of diverse land uses in a watershed may influence patterns of poverty within watersheds

3. Data and Methods

A. Selection of MSEC catchments

Between 10 and 14 March, 2004, a considerable amount of time was spent using maps, trying to identify the boundaries of the Lak Sip catchment in Laos and the Hua Mani catchment in Thailand. Once the boundaries and the resident human populations were identified, the basic edaphic features of both sites (watershed area, slope and elevation) were compared. At the end of this exercise we were convinced that both sites were not very different from each other with regard to edaphic conditions. We then held discussions with the Head of the Agriculture and Forestry office in Luang Prabang (Mr. Houpheng Sivilaysack) to collect secondary information relating to ongoing projects and recent policy changes relating to natural resources management. Following the identification of this basic information, we generated three hypotheses, key words, data sources and methods for data collection. A checklist was prepared to identify the major sources of secondary data that need to be collected. A household questionnaire was also prepared and pre-tested.

B. Research Methods

The household interviews were undertaken to cover farmers owning land in the Houay Pano catchment (Lao PDR) and the Hua Mani catchment (Thailand). We conducted 15 household interviews with farmers at the Lao site and 11 interviews with farmers at the Thai site. We used a structured interview schedule. We originally wanted to undertake 25 interviews with all farmers who owned plots of land in the Houay Pano catchment (Lao PDR). However, we reasoned that since we would not be able to do statistical analysis with a small data set of only 25, it would be more useful to focus on interviews with 15 farmers who were easily available for discussion and compliment this with detailed group discussions with farmer representatives and officials of the Agriculture and Forestry office. We also believed that since at least two rounds of household surveys had already been conducted in the MSEC site in Phrae (Thailand), it would be possible to only cover 15 households in the area that had not been subjected to earlier surveys. Farmers who participated in the previous surveys were reluctant to meet any more researchers. The household interviews we conducted with 26 households in the Thai and Lao sites raised a number of different issues which we clarified during two rounds of group discussions with farmer representatives. Some of the issues that we raised during these discussions at the Lao site were as follows:

- Mapping of land tenure and major land uses
- Link between soil erosion and agricultural yields
- Process of government land-titling program
- Changes in prices of major crops over time
- Population growth and sub-division of agricultural land
- Crop diversification and food security

In our discussions with government officials in Lao PDR, we raised the following issues as points of clarification:

- District statistics on area under cultivation, irrigated land area, area under different crops
- Management of watershed resources

- The government's livestock policy
- Access of rural communities to forest products in the wake of the government's land-titling program
- Length of fallow period and soil erosion

The round of household interviews we undertook with 11 households in the Thai site raised a number of different issues which we clarified during two rounds of group discussions with farmer representatives. Some of the issues that we raised during these discussions were as follows:

- Mapping of land tenure and major land uses
- Link between soil erosion and agricultural yields
- Process of government land-titling program
- Changes in prices of major crops over time
- Management of the stone masonry dam in Mae Thaeng
- Access to nonfarm labor, credit, factor and product markets

C. Household Sampling Techniques

In Thailand and Lao PDR we decided to sample at least three farmers with farm plots in each of the four weirs set up by MSEC hydrologists at the site. Since socio-economic information on the average size of land holding was available, we decided to sample households from each of the four weirs: one above the land-size average, one of average land size and one below average. In Thailand we interviewed only 11 farmers since weir 4 had only two farmers meeting our land-size criteria.

In Thailand we met two officials in the Watershed Conservation Development Study Centre in Phrae. From our discussions at the Forestry office in Phrae we were given access to information on government policy on land tenure changes in recent years. During our discussions, we raised the following issues as points of clarification:

- District statistics on the area under cultivation, irrigated land area and area under different crops
- Management of watershed resources
- Access of rural communities to forest products in the wake of the government's land-titling program

4. Discussion of Study Findings

A. *Extent of Market Integration*

Molle (2003) points out in his study of the Chao Phraya Delta that from the mid-70s onwards, the state played an important role in providing institutionalized credit, property rights, economic and social infrastructure and public security in Thailand. Income increased for those who had access to irrigation in the dry season. In the 1980s, the cultivation of cash crops provided enough income to make out-migration unnecessary. The resulting economic change from subsistence to market economy stimulated social mobility. As a result, the continuum between the village and city began to blur. From the mid 1980s there was an expansion in the cultivation of high value products, like fruits, vegetables and shrimps. Co-operatives and contract farming facilitated integration in markets for capital. Simultaneously, nonfarm jobs in the construction and manufacturing sector have drawn the younger generation to towns and big cities. Interestingly, integration in rice cropping, shrimp farming and engagement in factory work has been influenced by a family's access to land and capital assets, and education.. In contrast, Lao PDR is recovering from years of war and social unrest that only ended in the early 1990s.

Market integration is evident in the average household incomes from farm and nonfarm sources. The average farm income in the Thai site in 2004 was about US\$700 compared to US\$342 in Lao PDR (table 1). Fifteen years ago, farm income in Thailand was about US\$12,000 compared to only US\$2,961 in Lao PDR. Income from nonfarm sources in the Thai site in 2004 was US\$9,015 compared to US\$808 in the Lao site. Fifteen years ago nonfarm income averaged US\$390 in the Thai site compared to US\$939 in the Lao site. This suggests that with the devaluation of the Kip in Lao, living standards of rural communities have actually declined over the last 15 years. Institutional changes as reflected in market prices for certain crops also explain why changes have occurred in major sources of farm income.¹ For instance, in 2004 in the Thai site, the major source of farm income was maize cultivation compared to 'Job's Tears' in the Lao site. But 15 years ago soyabean cultivation was the major source of farm income in the Thai site. In contrast, under a communist system when markets were still heavily regulated, the major source of farm income in Lao was livestock rearing.

Table 1. Trends in Household Income by Source (all figures in US\$).

MSEC Site	Farm Income in 2004	Farm Income in 1991	NonFarm Income in 2004	NonFarm Income in 1991
Thailand	700	12,050	9,015	390
Laos PDR	342	2,961	808	939

B. *Patterns of Natural Resource Use*

The comparative analysis of the Thai and Lao sites reveals interesting differences in patterns of natural resource use. In the Lao site, the government's land-titling program and improved access to markets actually resulted in an increase in the cropping intensity rate, from 19.5 percent to 23 percent. Significantly, the fallow period declined on average by 2.7 years (table 2). At the Thai site in contrast, the average cropping intensity rates actually declined from 106

¹Discussions with farmers at the Thai MSEC site revealed that in 1990 they received Baht 6 per kilo for Soya bean. In 2004 the price they received for soya bean had risen to Baht 16 per kilo. However, Maize, a new crop species that was introduced a few years ago commands a higher selling price of Baht 40 per kilo.

percent to 95.6 percent, reflecting an insufficient increase in agricultural terms of trade for rice² and expansion in nonfarm employment opportunities. At the Thai site, the average decline in the fallow period was much smaller at only 11 months compared to 2.7 years at the Lao site.

Table 2. Patterns of Natural Resource Use.

MSEC Site	Changes in Cropping Intensity Rate (1991-2004)	Changes in Fallow Period(1991-2004)
Thailand	-10.4%	-11 months
Lao PDR	+ 3.6%	-2.7 years

There are other indications that natural resources were being used more intensively in the Thai site as a result of a longer history of market integration when compared to the Lao site. For instance, the average fertilizer use on farms was 384 kilos in 2004 at the Thai site when compared to 3.9 kilos for the same period at the Lao site. The average pesticide use at the Thai site in 2004 was 13.6 kilos compared to 6.6 kilos at the Lao site for the same period (table 3). Farmers at the Thai site purchased on average 36 kilos of seeds while Lao farmers purchased a smaller amount of seeds (2.8 kilos). Such patterns of natural resource use were clearly being aided by state policies; access to irrigation at the Thai site was higher at 0.33 ha compared to no access at all in the Lao site. Further, access to institutionalized credit was higher at US\$923 at the Thai site compared to negligible access at the Lao site.

Table 3. Patterns of Input Use for Agriculture.

MSEC Site	Fertilizers (in kilos)	Pesticides (in kilos)	Electric pumpsets (% of households owning pumps)	Seeds (in kilos)	Labor hiring (dry season under irrigation) (No. hired)
Thailand	384	13.6	82	36	36
Lao PDR	3.9	6.6	0	2.8	0

Greater access to irrigation resulted in Thai farmers resorting to greater labor hiring in the dry season (36 days compared to nil at the Lao site). Reflecting a decline in agricultural terms of trade for rice, farmers at the Thai site used hired labor for fewer days during the wet season when compared to farmers at the Lao site. Reflecting greater integration in a cash-based market economy, Thai farmers paid wages for hired labor. Lao farmers on the other hand, preferred to pay in kind and relied heavily on customary labor-sharing techniques. Molle (2003) points out that reliance on paid wage labor in Thailand reflects past experience with complex contracts in irrigated agriculture and a growing scarcity of labor due to non-farm employment expansion there. The relatively lower expansion of nonfarm employment at the Lao site explains why up to 34 percent of households there relied on NTFP collection as a livelihood strategy. In contrast, none of the Thai households relied on NTFP collection for a livelihood. Greater integration in nonfarm labor markets in Thailand may also explain relatively higher levels of affluence. For instance, 82 percent of Thai households had access to electric pumpsets in order to obtain groundwater. In contrast, none of the Lao households had pumpsets. A larger number of Thai households also had motorbikes, tractors and pick-up trucks compared to Lao households, a great majority of whom only owned bicycles.

²Discussions with farmers at the Thai MSEC site revealed that the price they received from selling a kilo of paddy rose from Baht 5 in 1990 to Baht 7 (sticky rice) and Baht 9 (Jasmine rice) in 2004.

C. Extent of Natural Resource Degradation

In a watershed context we view natural resource degradation from the point of view of multiple land uses. As a result, natural resource degradation may be reflected in the degradation of forests, soils and water. The analysis of information from Thai and Lao sites reveals interesting differences. Quite clearly, greater market integration has some benefits for the environment as well as a few drawbacks. But it is evident that the drawbacks outnumber the benefits. In the case of drinking water we discovered that 27 percent of Thai households found that the quality of drinking water had declined compared to 20 percent of Lao households. Forty-five percent of Thai households said the quality of drinking water had improved compared to 53 percent of Lao households (table 4). It must be pointed out that in the Thai case most households reporting an improvement in drinking water quality also had access to bottled water. In the case of the Lao households, a relatively smaller number of households had access to bottled water.

In the case of access to irrigation, 63 percent of Thai households stated that with the construction of the dam, their access to irrigation had improved. In contrast, 80 percent of Lao households reported that their access to irrigation had declined. The same proportion of households in Lao also said that with the increase in population, the quality of water in streams had deteriorated due to pollution. Water quality was also affected by deforestation in the head reaches of the watershed. For instance, 93 percent of Lao households reported that forest condition (as reflected both in tree density and bio-diversity) had declined in the wake of the government's land-titling program. In Thailand as well, a majority of households (81 percent) said that forest condition had declined in the last 15 years. Further, in Thailand, the degradation of groundwater resources was much higher when compared to Lao. This may be explained by the greater dispersion of electric pump-sets among households in Thailand. Interestingly though, about 28 percent of farmers in Thailand said that the construction of check dams in the upper reaches of the watershed had actually improved groundwater quality by facilitating the recharge of underground aquifers.

Table 4. Patterns of Natural Resource Degradation.

Indicator	MSEC Site (Thailand)			MSEC Site (Lao PDR)		
	S	I	W	S	I	W
Drinking water	3	5	3	5	8	3
Quality of irrigation/streams	4	7	0	1	2	12
Forest condition	2	1	9	1	0	14
Soil erosion	2	1	9	1	0	14
Flooding of agricultural fields	4	4	2	1	5	7
Groundwater quality	2	3	5	10	0	4
Agricultural yields	2	7	2	0	0	12

Note: S= same, I= improved, W= worse. Qualitative ranking of change between 1991 and 2004. Figures in columns refer to number of households.

Large scale deforestation that took place in Lao and in Thailand had clearly influenced people's views on soil erosion. At both the Thai and Lao sites, an overwhelming majority of households reported that soil erosion had worsened in the last 15 years. Bio-physical research undertaken by MSEC scientists in Laos reveals that "the sub-catchment with the smallest proportion of fallow land and with 8 percent of upland rice had the highest soil loss of 2.8 ton/ha" (Maglinao et al. 2003). In contrast, no erosion was observed in the sub-catchment with the largest proportion of fallow land and about 12 percent of forest. Discussions with farmers in

Lao revealed that they think “big trees lead to less erosion.” Lao farmers also pointed out a shortening of the fallow period and an increase in the area under slash and burn agriculture as reasons for an increase in soil erosion. Thai farmers revealed that mechanized tillage led to greater soil erosion. Recent research by MSEC scientists at the Thai site revealed that soil losses had actually declined between 2001 and 2003 for two reasons. First, the total rainfall has shown a downward trend between 2001 and 2003 (Bricquet et al. 2003:12). Second, a larger number of households have switched from soya bean to maize which is known to have greater soil conservation characteristics (Bricquet et al. 2003:14).

The farmers’ responses to questions of change in agricultural productivity reveal differences between the external policy and physical environment in Thailand and Laos. In Thailand, close to 64 percent of farmers said that agricultural yields had improved due to a variety of reasons. They included improved access to irrigation from the dam, more rainfall, an increase in fertilizer use and transfer of soil as a result of soil loss in the upper reaches of the watershed. While Thai farmers viewed soil erosion in uplands as bestowing benefits in downstream areas, Lao farmers blamed declining agricultural yields on a reduction in the fallow period in upland areas and reduction in rainfall. In Laos 100 percent of farmers interviewed said that agricultural yields had declined with adverse consequences for their livelihoods, especially since external policy interventions in the form of provision of irrigation infrastructure, institutionalized formal credit mechanisms and access to markets for fertilizers, were limited.

D. Institutions for Integrated Water Resources Management in River Basins—Evidence from Thailand and Lao PDR

It is clear from the previous discussion that national policies in Thailand have tended to facilitate greater market integration by farmers when compared to Lao PDR. National policies in Lao PDR, in strong contrast to Thailand, have evolved against a backdrop of market regulation and decades of political instability due to war. As a result of greater market integration by Thai farmers, it is clear that land-use practices such as the cultivation of cash crops have exacerbated deforestation and soil erosion in upper catchments and accelerated groundwater exploitation in plain areas. This has served as an impetus for institutional responses by the Thai government, which have taken a number of forms, such as the documentation of baseline information on land rights and natural resources, prioritization of development needs and natural resource management strategies and inter-sectoral policy coordination.

Greater integration in international markets for value-added forest products such as paper board, for example, is likely to have resulted in revenues for the Thai State. Such forms of revenue generation would have definitely influenced the capacity of the Thai State—the Royal Forest Department and Royal Irrigation Department. This is evident, for instance, in the level of the computerization of land-rights databases and natural resources in Thailand. A history of much longer interaction with aid donors has also paved the way for awareness regarding discourses on deforestation, soil erosion and land-use change. This is evident for instance in the Thai government’s openness towards political decentralization (Tambon Act of 1984) and decentralized farmer-managed irrigation schemes. Reflecting a close relationship between market integration, natural resource degradation and the resulting water scarcity, Thailand has also begun addressing complex institutional issues relating to inter-basin water transfers and regulation of groundwater use.

In contrast, Lao PDR has poor baseline information on land rights and natural resources. Staffing levels of government agencies like the Forest and Irrigation Departments are poor in relation to the enormous management challenges that they face. In the case of forest

management, government agencies rely heavily on self-appointed watchers in villages to monitor forest use. Only recently has forest legislation been passed and it would be no surprise if such laws are poorly understood by stakeholders at the village level. Very often such self-appointed village watchers are themselves responsible for harvesting large expanses of forest illegally. Only recently has the Lao PDR begun documenting stocks of natural resources, allocating land rights and creating laws for the use of natural resources. Most of this has been undertaken largely with external donor support. Most probably the sudden decentralization of natural resources, in particular those relating to the allocation of private land titles in the absence of effective institutional mechanisms to monitor and sanction rule breakers, is bound to have deleterious consequences for the environment. How the Lao State responds in the medium to long term to such challenges would provide a study in contrast to those that Thailand has faced.

E. Implications for Poverty

From the above discussion it is clear that in Thailand (aided by state policies) greater market integration has resulted in relatively higher levels of natural resource degradation due to a greater intensity of resource use. On the other hand in Laos PDR, lower levels of market integration have resulted in relatively lower levels of natural resource degradation. As a result of such patterns of natural resource use against a backdrop of policies that have aided greater market integration, institutions for IWRM in river basins have evolved differently in both Thailand and Lao PDR. What implications do both these trajectories of institutional development have with regard to poverty? This is an issue we discuss in this section by examining data on a number of variables including food security, access to drinking water, credit and information and ownership of endowments.

1. Food Security: It may be true that market integration has resulted in higher levels of natural resource degradation. This is clear from our analysis of data from Thailand. However, it is also clear that levels of poverty are much lower in the Thai site when compared to the Lao site (table 5). For example, all households in Thailand reported that they had sufficient food for 12 months when compared to only 20 percent of Lao households. Actually, 33 percent of Lao households said that food security had declined in the last 15 years. The reasons they gave for this trend included crop diversification which gave them less area to grow food crops like rice, reduced agricultural yields and growth in family size. In contrast, a larger number of Thai farmers complimented the cultivation of cash crops like soya bean and maize with engagement in nonfarm labor markets. This enabled them to resort in greater measure to food purchases if necessary. In other words, while market integration may exacerbate natural resource use, it still offers the potential for people to escape poverty and reduce their dependence on natural resources for a livelihood in the long term through diversification into nonfarm employment and improving returns from such engagement (Kurian and Dietz 2004a).

Table 5. Changes in Poverty Indicators.

Indicator	MSEC Site (Thailand)			MSEC Site (Lao PDR)		
	S	I	W	S	I	W
Food security	9	0	0	3	3	5
Access to safe drinking water	1	9	1	0	10	5
Access to safe sanitation	2	9	0	2	8	3
Access to public lands	0	11	0	2	0	13
Access to credit	1	9	1	3	10	2
Access to information on market prices	0	11	0	1	15	0
Ownership of land	9	1	1	3	8	2
Ownership of livestock	11	0	0	0	3	12
Ownership of capital machinery	5	4	2	2	6	5
Residential accommodation (traditional/modern)	1	10	0	7	7	1
Family business	9	2	0	7	2	0

Note: S= same, I= improved, W= worse. Qualitative ranking of change between 1991 and 2004

Figures in columns refer to number of households.

2. Access to Drinking Water and Safe Sanitation: The lower incomes of farmers in Lao, when compared to those of Thailand, seem to curtail their ability to access drinking water. Farmers in Thailand and Laos both reported that the quality of drinking water was deteriorating. As a result an increasing number of farmers in both sites were resorting to the purchasing of bottled water. In the Thai site, all farmers used bottled water. But lower household incomes in Lao meant that not all households were able to purchase bottled water.

Differences in levels of poverty are evident from our data which indicate that 81 percent of Thai households stated that access to safe drinking water had improved in the last 15 years compared to only 67 percent of households in Laos. The rest of the households in Laos actually reported that their access to drinking water had worsened during the same period. Similarly, 81 percent of Thai households reported that their access to safe sanitation had improved compared to only 53 percent of Lao households. As a matter of fact 20 percent of Lao households reported that their access to safe sanitation had declined in the last 15 years.

3. Access to Public Lands: Emerging from a period of Communist rule where private property was disallowed, Lao PDR resorted to the titling of previously state-owned lands. According to interviewed farmers, every household was given a minimum of three plots. Land allocation followed a three-step process: field inspection by government agents, negotiation with farmers to ascertain family size, and finalization of plot size and demarcation of plots in the field. Once the land had been allotted farmers were not allowed to graze their cattle openly since they risked sending them onto other's fields. Further, the potential for land rotation (slash and burn agriculture) was reduced since farmers now had only a well defined portion of land to cultivate.

It is no surprise that some farmers suggested that more plots were required "to maintain fallows and ensure productivity." Farmers also argued that land allocation must take into consideration not just the number of plots but also the quality of land that was being allotted. What became clear from interviews at the Thai and Lao sites was that access to public lands for the open grazing of cattle and slash and burn agriculture had declined in

Lao. On the other hand, in the Thai site where reliance on animal husbandry is anyway declining, the construction of roads had further improved access to open access³ public lands for the cultivation of cash crops such as maize and soya bean.

4. ***Access to Credit and Information on Market Prices:*** An overwhelming number of respondents at both the Thai and Lao sites reported that access to credit and information on market prices had improved in the last 15 years. Thai farmers with a longer history of integration in markets for credit and crops differed in their responses when compared to their Lao counterparts. For instance, Thai farmers said there were more sources of funding now when compared to 15 years ago. Further, there were government promotions, quicker processing of credit requests and higher incomes which permitted the pledging of more valuable assets and subsequently higher value loans. Thai farmers also pointed to the entry of private sector credit companies who were very aggressive about pushing their credit programs. In contrast, Lao farmers only referred to government promotion programs and improved access to information on credit from the electronic media. It is clear that the private sector is yet to make an entry in the Lao site.
5. ***Asset Ownership:*** As a result of the government's land-titling program Lao farmers did experience an improvement in the ownership of land. However, specification of property rights in Lao made it difficult for farmers to undertake animal husbandry since very often the plots allotted to farmers were just sufficient to undertake crop production. In contrast, none of the farmers in the Thai site relied on livestock rearing due to other more profitable ventures in both the farm and nonfarm sectors. Greater affluence in the Thai site resulted in 90 percent of respondents reporting an improvement in the quality of housing (between 1990 and 2004) compared to only 47 percent in the Lao site.

³Public lands under the management of the Royal Forest Department (RFD) in the vicinity of the Thai MSEC site have never been set aside for logging purposes. Further, monitoring of these lands by the RFD has been relaxed. In recent years the government has also given out long-term leases to these lands and permitted cultivation by lowland residents.

5. Conclusions

This paper argues that notwithstanding the perceived benefits of IWRM we do not have an adequate analytical framework that would enable us to assess the extent to which institutions are integrated for the management of watershed resources. This paper attempts to develop such a framework through a comparative analysis of natural resource management strategies in two upland watersheds of Thailand and Lao PDR that are characterized by poverty and environmental degradation. A number of conclusions may be drawn based on the analysis.

First, greater integration in markets influences the land-use practices of farmers. Integration in markets for cash crops has persuaded farmers in Thailand to extend the agricultural frontier to forest areas in upper catchments. In Lao PDR, the granting of private land titles led farmers to shorten fallow periods and accelerate the harvesting of timber from upper catchments. Second, land-use changes facilitated by market integration have resulted in environmental degradation. In Thailand, deforestation arising from the expansion of the agricultural frontier has resulted in soil erosion and excessive groundwater exploitation. In Lao PDR as well, deforestation in upper catchments associated with land-use changes there has set off a spiral of soil erosion.

Third, greater market integration in Thailand has also provided the state with important sources of revenue. Institutional responses by Thai agencies like the Royal Forest and Irrigation Departments to natural resources degradation have also been grounded in a longer history of the collection of baseline information on land rights and the environment, identification of strategies for natural resource management and interaction with external donors. Fourth, as a result of greater market integration and political stability, the Thai State had a stronger impetus to provide effective institutional responses to natural resource degradation. Institutional responses in Thailand range from the documentation of land rights, action plans for inter-basin water transfers and support for farmer-managed irrigation.

Finally, relatively more effective institutional responses have facilitated poverty reduction. This is evident in Thailand where we find that active state support for market integration—especially nonfarm employment expansion—has offered the rural poor an avenue out of poverty. Such forms of poverty reduction are in the long term bound to have an ameliorating effect on the environment through land-use changes such as a transition away from slash and burn agriculture and the excessive exploitation of groundwater. However, for such land-use changes to be sustained, market integration must be sustained. The state has an important role to play in ensuring that the vagaries of the market, such as price fluctuations for crops and the decline in export demand for certain value-added forest products etc, are monitored and effectively dealt with to ensure sustainable poverty reduction and environmental change.

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