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Agricultural Intensification: Determinants and Impacts in the Mae Ram Watershed of Northern Thailand

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Introduction

Northern Thailand has undergone rapid agricultural transformation during the last few decades due to various factors which include market penetration, cash crop promotion by the state, establishment of Royal Project Foundation and increased immigration of people from neighbouring countries (Latt, 2008). All these factors are contributing to increase mechanization, use of fertilizers and agrochemicals in the region which are parts of agricultural intensification (Nakagawa, 2008). Agricultural intensification (AI) therefore forms a key aspect in the rural transformation of Northern Thailand. These AI activities however have impacts. Some researchers sees intensification as having positive effects on the livelihood of farmers by contributing to higher yield and household income while others consider it for accelerating harmful negative effects such as soil degradation resulting from toxicities, soil erosion and declining soil fertility; decrease in water availability from high use of water for irrigation; water quality deterioration through concentrations of nutrients and agrochemicals (Nambiro 2008, Gregory et al 2001). Also, these negative environmental effects often result in conflict of interests on natural resources utilization. For instance there have been increasing reports of conflicts over water resources between lowland and upland communities caused by agricultural expansion and forest clearing in upper-watershed areas in Northern Thailand in recent years (Walker, 2003).

This study was therefore undertaken with the aim of finding out the characteristics and driving factors of AI in Mae Ram watershed and examines its impact on socio-economic and environmental conditions as well as on conflicts regarding the utilization of natural resources.

Study area and data collection

The study was conducted in Mae Ram, a sub-watershed of Mae Rim watershed located in the province of Chiang Mai; District Mae Rim and Sub district Mae Ram. The watershed has an area of 54.2km² and is 5km from Mae Rim city. It is divided into three

areas where the upper stream is mountainous with elevation range of 900-1500masl; the middle - mountainous to flat land with 600-900masl and the lower predominated by flat land ranging from 300-600masl. The different ethnic groups in the watershed include the Hmong people in the upper, the Karen in the middle and the Muang in the lower stream, (Aumtong et al, 2009). Three villages, Ban Mae Khi, Ban Pang Eka and Ban Pang Haew were selected from the upper, middle and lower zone respectively for the study. Data was mainly qualitative and was collected by carrying out 25 key informant interviews, 3 focus group discussions, 42 household surveys, soil and water sampling and use of Participatory Rural Appraisal methods.

Results and discussion

Intensification strategies

Agricultural intensification is dominant in the upper zone of the watershed, where the inhabitants use land, labour and capital intensification strategies to grow vegetables for commercial purpose throughout the year. The main vegetables grown are cabbage, Chinese cabbage, lettuce and tomato. Other vegetables grown include cauliflower, pumpkin, chilli and onion. About 88% of the farmers in zone practice multiple cropping. Most farmers in this area have access to irrigation hence are able to engage in double or continuous cropping in a year. Most of the farmers (70%) were practicing short fallow which indicates a high degree of land intensification (Boserup, 1981).

Capital intensification in the watershed is mainly characterized by wide use of various fertilizers (Urea and NPK), pesticides (Abamectine, Chlorpyrifos and Cypermethrin), improved seeds (vegetables and rice) and manure. It is furthermore, characterized by the use of irrigation system, tractor and conservation practices like terracing. Labour is also used intensively in the watershed. Planting, weeding and harvesting crops were done manually in the study area. Labour source was either from immediate family members and/or hired and a few help (shared) labour. Most of the hired labourers are immigrants from Burma (Myanmar) and Laos.

Drivers of agricultural intensification

The drivers of AI in the watershed can be categorized as pull or push factors which are interlinked and it is presented in the table below. It was found that the proximate driver of agricultural intensification in the region is the promotion by the Royal Project which facilitates easy access to micro-credit, inputs and market. The Royal Project (RP) is a foundation launched by the King Rama IX in 1969 and was originally aimed at eradicating opium culture in all Northern Thailand through implementing local development actions and providing alternative agricultural options. The first stage of this operation was to propose new types of crops, helping them financially to switch from subsistence farming on a slash-and-burn mode to innovative and diversified productions on permanent plots. It first involved the massive introduction of fruit tree, mainly lychee, but this orchard operation lasted only a dozen of years in the Mae Ram watershed and was abandoned. After 1997, new crops were promoted, mainly vegetables from temperate climate such as cabbage, lettuce and other brassicaceae.

Implementation of the RP facilitated infrastructural development such as roads and connection to electricity which led to better access to markets, inputs, schooling, medical care, etc.

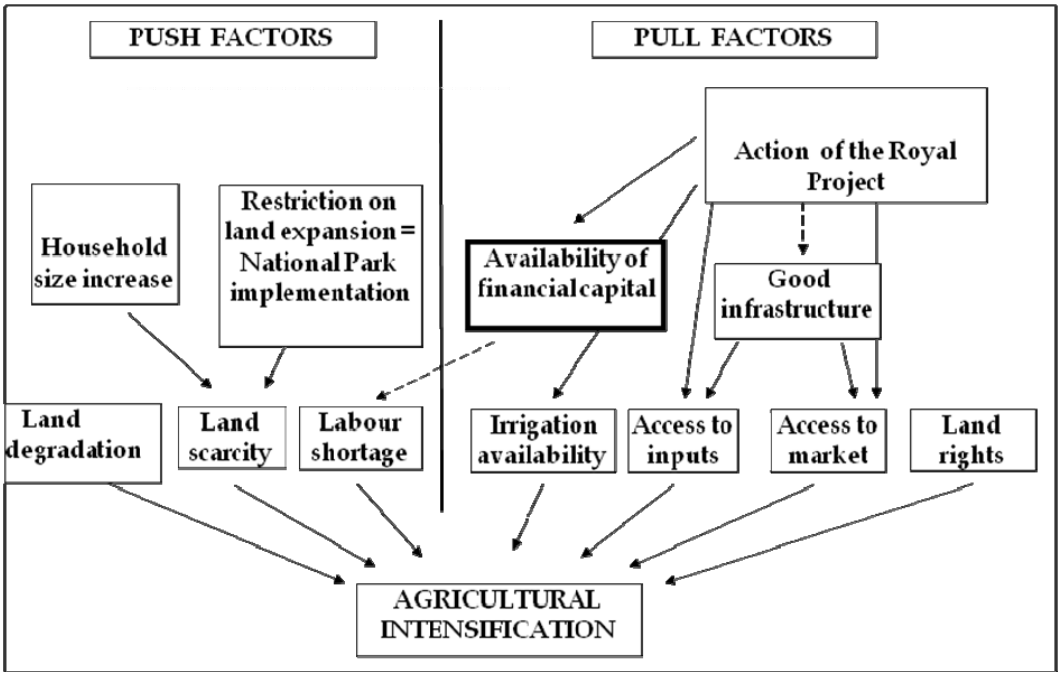

Table 1: Drivers of agricultural intensification in Mae Ram Watershed

Other important drivers of AI are the restriction on land expansion and increase in household size. The delimitation process by the Royal Project in the upper zone and the National Park in the middle and this has prevented agricultural land expansion and couple with the increase in household size is forcing farmers to practice intensification

Impacts of agricultural intensification

The wealth status and living standard of households have generally improved after practicing AI. Most household interviewed can now afford good access to education, health, and food, clothing, housing and potable water as a result high income generated from AI activities. It was found that the Royal Project which is a key factor of AI facilitated the improvement of infrastructure such as electricity, public telephone and tarred road in the watershed. Apart from the socio-economic impacts, AI has also impacted on soil and water in the area. It has been associated to increase soil concentrations in soil organic matter, nitrate, potassium and contamination with phosphorus as well as pesticide residues (organophosphate and carbamates) and increased in the frequency of erosion, flooding and siltation in the watershed. Regarding water quality the analysis of water and sediment samples didn't reveal any particular water contamination resulting from AI. Seasonality may have influenced this result as the study was conducted in the dry season during which there is low runoff of chemicals. Intensified agriculture practices particularly irrigation in the upper zone also creates water shortage in the middle and lower zones especially in the dry season. During this period, the upper zone farmers use more water from the stream to irrigate their intensified agriculture land. Some even build up water barrage or divert the streams to their farms which at the end prevent those in lower altitudes to have access to water. There are also problems related to flooding and siltation in the rainy season. Another major problem is water pollution resulting from the contamination by pesticides and fertilizers used in agriculture intensified lands located in upper zone. The

problem of water availability and pollution forms the two main conflict issues between the upper and lower zone villages in the watershed.

Conclusions

The major findings from the study indicate that land, labour and capital intensification strategies are used by farmers to grow mainly vegetables for commercial purpose throughout the year. The main strategies include multiple cropping, short fallows; wide use agrochemicals, irrigation systems, soil conservation techniques such as terracing and intensive use of labour. The proximate driver of agricultural intensification in the region is the promotion by the Royal Project which facilitates easy access to micro-credit, inputs and market. Restriction on land expansion by national park policy and increased household size are also key drivers. The wealth status and living standard of households have generally improved after engaging in agricultural intensification but it was found to be associated with the increased frequency of erosion, flooding and siltation as well as increased soil concentration in pesticide residues in the watershed. Water availability and contamination resulting from intensification activities are the main conflict issues between the upper zone farmers and lower zone villagers in the watershed. The findings of the study suggest a need for more environmentally sustainable intensification strategies to avoid the negative impacts.

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