Impact of Forest Restoration on Poverty and Income Inequality: A case Study in Chiang Mai Province, Thailand

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Abstract

In this paper, we analyze a detailed household survey dataset to measure poverty and income inequality in Baan Mae Sa Mai - Mae Sa Noi, two villages in the Chiang Mai province, Thailand, where a sustained forest restoration program was undertaken. We found that the economic growth of villages has been improved, although average income per capita has small differences in the two villages, and households have low inequality. However, transportation remains a challenge since the village is scattered and difficult to access to transport goods.

Keywords: poverty, inequality, Gini index, FGT index, forest restoration

Introduction

The destruction of forests has an impact on the balance of ecosystems and biodiversity. The reduction of greenhouse gas emissions is a major issue. It has been included in the Environmental Strategy of the Thai Government since 2012 and in the 11th National Economic and Social Development Plan. Natural resources and the environment are sufficient to maintain ecological balance on the basis of community participation in care. Environmental protection can support economic development and improve the quality of life for people in the Thai society. Starting with the development and conservation of the natural resources and the environment is the first step. It is evident that ecosystems are the source of natural and environmental resources, both soil, forest water, and biodiversity that are essential to the survival of organisms. The ecosystem plays a role in the protection against soil erosion; it is a natural reservoir and it can be used for recreational purposes. In addition to being a source of natural and environmental resources, food and medicine for the community, etc., it allows for the accumulation of folk wisdom, i.e., the culture and traditions that have passed from the past to the present. It also provides many benefits both directly and indirectly to the economy. However, nowadays natural resources and the environment have deteriorated considerably

from being utilized to meet economic goals. This exploitation undermines the ecological balance and makes natural resources and the environment in many areas unrecoverable. There are ineffective uses of natural resources and conflicts in the use of land and forest resources.

In addition to helping to preserve natural regeneration, restoration of the forest and the natural environment expands the capital of the natural environment. It also improves the quality of life, leading to a fair and sustainable economic and social development. If society is aware of the importance of conservation of natural resources, it should be integrated with other fields of science, economically, socially and culturally (Aronson, Clewell, Blignaut, & Milton, 2006). Involvement of all sectors concerned with the ecosystem will create a common understanding of how to effectively cooperate in protecting, restoring, conserving and managing natural resources and the environment (Gesinee Charoencharoen et al., 2012).

Mae Sa Mai and Mae Sa Noi are two subdistricts in Pong Yang, Mae Rim district, Chiangmai Province. It is one of the large Hmong communities in the area of Suthep-Pui National Park. There is more than 200 years of settlement in this area. Later, the external culture and globalization has pushed the community to change and develop a more modern way of life. Opium plantation has been discouraged and replaced with other crops (such as lychees, cabbage, coffee) and livestock. These communities have opened to the outside world and have sent their children to study in the city. This has resulted in the loss of traditional local culture and community traditions, as well as the problems of soil erosion, landslides and decline of wildlife.

Later in 1998, Suthep-Pui National Park and the Forest Restoration Research Unit at the Faculty of Science, Chiang Mai University, initiated a project to perserve and restore natural and environmental ecosystems in the Mae Sa Mai - Mae Sa Noi community area. This project has been very successful in developing upstream forest restoration, as can be seen from the increased diversity of plant and animal species. It has stopped the deterioration of forest condition caused by forest invasion and destruction for farming by the community. People in the community are cooperative and play a great role in conserving and managing natural resources and the environment. Mae Sa community (Mae Sa Mai - Mae Sa Noi) has been recognized as a prototype community for forest restoration in the upstream area and as a successful example of tropical forest restoration in Asia. (Forest Restoration Research Unit Chiang Mai University, 2011)

However, the flow of globalization from outside has poured into the community. Popular tourist attractions, such as Moongjoo, have incited the community to modernize its development and focus on economic benefits. The lack of consideration of the impact on the economy, society as well as the environment, and the lack of planning and management to develop the community in the right direction may cause other problems. It is necessary to use natural and cultural resources within the community as a basis for development. However, these resources are limited to support economic growth. Thus, management within the community often faces the problem of conserving natural resources and the environment. Because of these problems, the balance between economic development, society and the environment is lost and it is not sustainable.

In previous work, we assessed both the monetary and non-monetary value of the upstream environmental services as well as the value of ecosystem services from upstream reforestation. This has led to the creation of a new knowledge base for assessing the value of natural resources. But this previous research did not cover the measurement of socio-economic impacts from upstream forest restoration. In this paper, we aim to determine economic and social indicators to measure the economic impact of the upstream forest rehabilitation on the community, in order to establish appropriate guidelines for policy development to enhance the economic, social and quality of life.

Data and method

The primary data for this study were collected in mid 2016 from households in two villages, Baan Mae Sa Mai and Baan Mae Sa Noi, both located in Mae Rim, Chiang Mai, Thailand. An open questionnaire was designed and used to conduct interviews in 201 households. The target population was divided into two groups, Mae Sa Mai and Mae Sa Noi. The methods used to measure the poverty and income inequality include Lorenz curves and the associated Gini coefficients of relative poverty, as well as the three Foster-Greer-Thorbecke (FGT) measures of absolute poverty.

The FGT indices are a set of widely-used poverty indicators. They are defined as

$$FGT_{\alpha} = \sum_{i=1}^{H} \frac{\left[{}^{(z-y_i)}/_{z}\right]^{\alpha}}{N},$$

where z is poverty line, y_i is income of household i, H is number of households, and □ is a coefficient that determines the index: ∝=0, ∝=1 and ∝=2 correspond, respectively, to the *incidence* of poverty or Head-Count Index (HCI), the *depth* of poverty or Poverty Gap – (PG^1), and the *severity* of poverty or the Squared of Poverty gap (PG^2).

The next tool is the Lorenz curve, which is a common tool for comparing inequality of wealth or income between two or more groups. This curve shows the actual quantitative relationship between the percentage of income recipients and the percentage of the total income they received during a given year. The simplified formula for the Gini coefficient is

$$GINI = \sum_{i=1}^{N} 2\left(X_i - Y_i\right)\Delta X_i$$

where X_i is the cumulative percentage of population and Y_i is the cumulative percentage of income per capita under study. It is a ratio with values between 0 and 1. A zero Gini coefficient corresponds to a population in which everyone has the same income, while a coefficient equal to one corresponds to a situation in which one person holds all the income (perfect inequality). (Sabry S., 2009)

The last indices considered in this study are the quintile and decile ratios, which are standard indices to measure income equality. Each decile and quintile corresponds, respectively, to 10% and 20% of the total population. The quintile and decile ratios measure the average income of the richest group divided by the average income of the poorest group.

Results

This section presents the sample characteristics of the household data survey. We collected data from 105 households from Mae Sa Mai (52.2%) and 96 households from Mae Sa Noi (47.8%). As shown in Table 1, the gender distribution in the sample was female 17.9% and male 82.1%.

Table 1: Gender of sample characteristics.

Gender	Baan Mae Sa Mai		Baan Mae Sa Noi		N	%
	N	%	N	%		
Female	18	17.14	18	18.75	36	17.91
Male	87	82.86	78	81.25	165	82.09
Total	105	100.0	96	100.0	201	100.00

Table 2 shows the major categories of occupation: 58.21% of the households are engaged in agriculture, followed by hired laborers (20.90 %) and other sectors (21%).

Table 2: Categories of occupation

Categories of occupation	Baan Mae Sa Mai		Baan Mae Sa Noi		N	%
	N	%	N	%		
Agriculture	59	29.35	58	28.86	117	58.21
Hired laborers	26	12.94	16	7.96	42	20.90
Merchant	9	4.48	11	5.47	20	9.95
Government office	2	1.00	2	1.00	4	1.99
Other	9	4.48	9	4.48	18	8.96
Total	105	100.0	96	100.0	201	100.00

As shown in Figure 1, 33% of the household sample have average household income per month between 10,000 and 19,999 baht, followed by 5,000-9,999 baht (26%) and less than 5,000 baht (13%). The sources of household income are growing vegetables for sale (33.31%), commerce (20.74%) and wages (17.15%). These data confirm that agriculture is the main source in these areas, likely as a result of the forest restoration program.

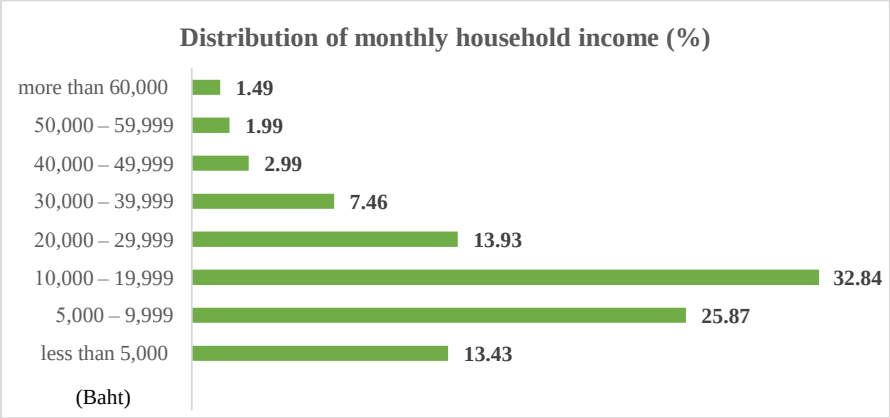

Figure 1: Distribution of monthly household income.

To analyze poverty and income distribution from household data survey, we disaggregated the 201household survey data into two villages to compare the economic situation in both areas. To highlight income distribution, we constructed the Lorenz curves for Mae Sa Mai and Mae Sa Noi. The results are reported in Table 3.

Table 3: Gini coefficients

Area	Gini index
Overall	0.48
Mae Sa Noi	0.45
Mae Sa Mai	0.50

Source: Calculated from the survey data.

In terms of income distribution, we may consider the Gini index. Income inequality is higher in Mae Sa Mai, closely followed by Mae Sa Noi, where those indices are 0.50 and 0.45, respectively.

To provide a more detailed picture of the income distribution, we constructed the Lorenz curves for household data for the whole sample and for each of the two villages. These curves show the actual quantitative relationship between the percentage of income recipients and the percentage of the total income they received during a given year. A low Gini coefficient indicates more equal income, while a high Gini coefficient indicates a more unequal distribution.

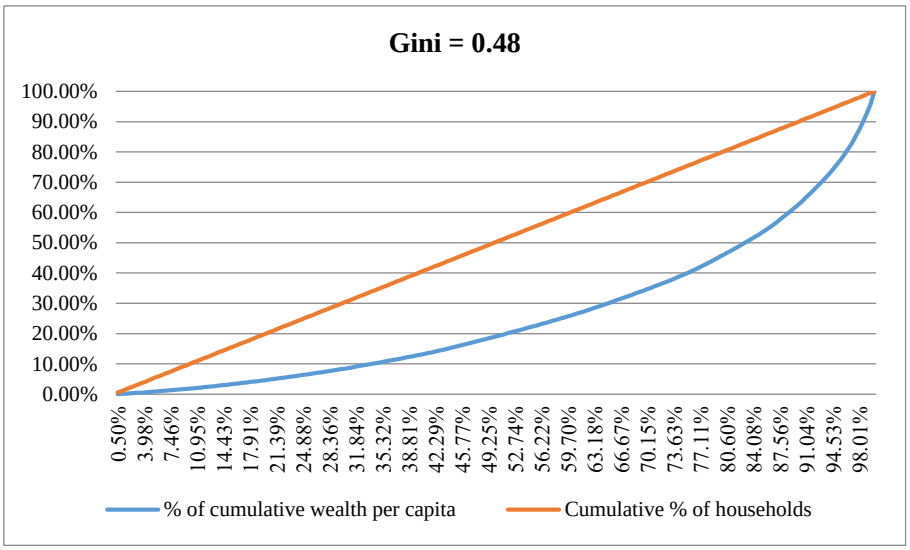

Figure 2-1 Lorenz curve for the overall sample

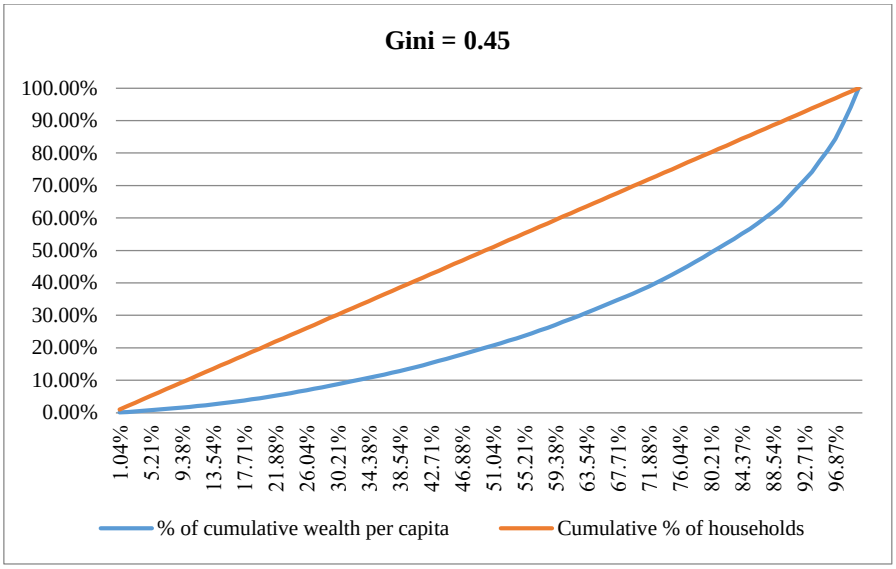

Figure 2-2 Lorenz curve for the Baan Mae Sa Noi village.

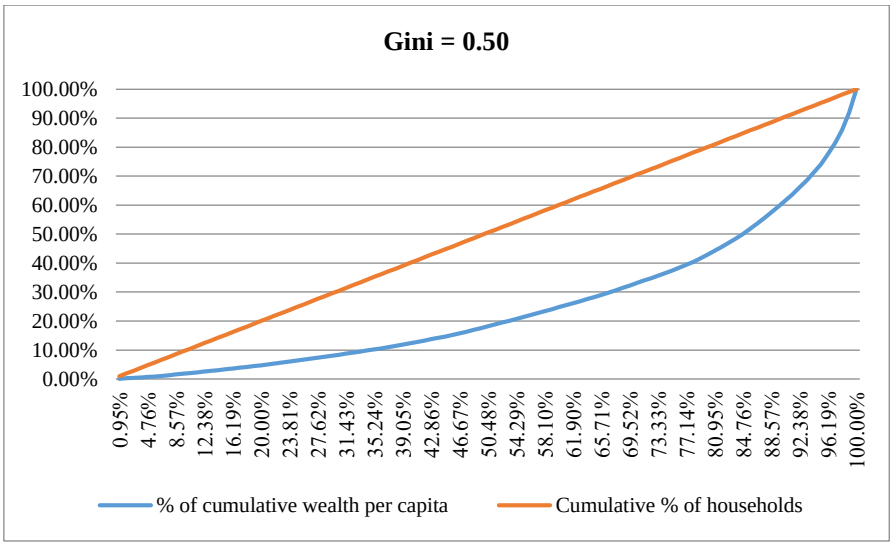

Figure 2-3 Lorenz curve for the Baan Mae Sa Mai village.

As we can see from Figures 2-1 to 2-3, the Lorenz curves of both villages differ only slightly.

Table 4 FGT indices.

Income	Incidence	Depth	Intensity
Overall	15.42%	0.039	0.015
Mae Sa Noi	14.58%	0.043	0.017
Mae Sa Mai	16.19%	0.035	0.014

Source: Calculated from the survey data.

Table 4 further reports the three FGT indices. The FGT indices of absolute poverty were employed to measure the inequality of economic well-being. Those FGT measures include the incidence of poverty (percentage of the population that is poor), the depth of poverty (average percentage gap of poor household's income below the poverty line), and the intensity of poverty (square of the depth). The poverty line calculated by the office of the national

economics and social development board in 2015 is 2,609 baht per person per month, which translates to 31,308 baht per person per year (Office of the National Economic and Social Development Board, 2015). The results show that the percentage of poor population in Mae Sa Mai is slightly higher than it is in Mae Sa Noi, which is consistent with the comparison of the Gini indices. In contrast, Mae Sa Noi had a higher ratio of depth and intensity of poverty than Mae Sa Mai, but the difference is small. However, it is clear that the incidence, depth, and intensity of poverty of these villages are low.

To provide a general overall picture of income equality, the decile and quintile ratios were employed to compare the proportion of the movement of different quintile (see Table 5).

Table 5: Poverty and income distribution.

Area	Income per capita all households	Rank Income	Decile Ratio	Rank Decile	Quintile Ratio	Rank Quintile
Mae Sa Mai	113,854.77	2	20.76	2	12.16	2
Mae Sa Noi	115,586.92	1	20.20	1	11.24	1
Total sample	114,720.85					

Source: Calculated from the survey data.

[1] We use "1" for the best or highest rank. For rank income, 1st is the highest rank, which corresponds to highest income and on rank decile and quintile, 1st is the best situation of income distribution.

Table 5 shows the poverty and income distributions of the household sample. The quintile ratio gives a general overall picture of income equality by comparing the average income of the top 20% of the population to that of the bottom. The decile ratio gives a more specific contrast between the rich and the poor by comparing the average income of the top 10% of the population to that of the bottom. The results show that Mae Sa Noi has a better situation than Mae Sa Mai since income per capita and decile and quintile ratios differ slightly; those income were 115,586.92 and 113,854.77, respectively. The decile ratio is around 20 and the quintile ratio is about 10. If these villages have significantly less inequality, this may be a positive impact from the sustained program of forest restoration. Rehabilitation of the forest will generate income for the community. Farmers can increase productivity from their crops while reducing the cost of chemicals. They can use the wood for everyday usage and collect food in the forest.

Conclusions

The sustained program of forest restoration results in long-term economic impacts by improving productivity of forestry, the natural environment, agriculture and other business activity. It increases economic value by restoring and maintaining fish and wildlife, improving water quality, reducing flood risk and increasing recreation opportunities. This economic activity has created both other community-based partners and business opportunities, directly supports jobs and generates income.

As a result, the major categories of occupation are engaged in agriculture. Household sample have average household income per month between 10,000 and 19,999 baht, 33% and the main sources of income are growing vegetables for sale (33.31%). In term of poverty and income distribution, the Gini index was employed to measure the inequality of income; the overall ratio was 0.48. In term of the inequality of economic well-being, the FGT indices were employed to measure the absolute poverty. The results show low inequality in both villages. This fact was also confirmed by the decile and quintile ratios. This low inequality and economic well-being are positive consequences of the sustained program of forest restoration.

Even though these areas are suitable for agriculture and animal pasture, they are scattered and not easily accessible. Then, transportation is still a challenge; steep slopes also make it difficult to take products to market or even to bring goods into the villages.

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