

# Current situation of teak farm forestry after Economic Tree Plantation Promotion Project in Northeast Thailand

Naoyuki Furuya<sup>1)\*</sup>, Arunee Pusudsavang<sup>2)</sup>, Iwao Noda<sup>3)</sup>, Woraphun Himmapan<sup>2)</sup>, Yasuhiro Yokota<sup>4)</sup>

<sup>1)</sup> Hokkaido Research Center, Forestry and Forest Products Research Institute, 7 Hitsujigaoka, Toyohira, Sapporo, Hokkaido 062-8516, Japan

<sup>2)</sup> Forestry Research and Development Bureau, Royal Forest Department, 61 Phaholyothin Rd., Chatuchak, Bangkok 10900, Thailand

<sup>3)</sup> Japan International Research Center for Agricultural Sciences, 1-1 Ohwashi, Tsukuba, Ibaraki 305-8686, Japan

<sup>4)</sup> Forestry and Forest Products Research Institute, 1 Matsunosato, Tsukuba, Ibaraki 305-8687, Japan

\* Corresponding author; e-mail: [nfuruya@affrc.go.jp](mailto:nfuruya@affrc.go.jp)

## Abstract

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Current situation of teak farm forests after the Economic Tree Plantation Promotion Project (1994-2002) were analyzed based on questionnaire surveys on teak farm forest owners in the northeast of Thailand. A low implementation rate of thinning was one of the key problems in management. Many respondents (59%) were satisfied with their tree plantations even in the northeast of Thailand. However, planters were still concerned about the market and the achievement of fair trade in this region. Planters also expected financial support for managing their forests. Not only technical assistance in the initial stage of tree planting but also continuous support in terms of socio-economic aspects was expected. The level of satisfaction with tree planting was directly related to the growth conditions of teak stands. It was suggested that site selection and research on suitable sites for teak tree planting were key tasks for the promotion of tree planting.

**Keywords:** farm forestry, Economic Tree Plantation Promotion Project, teak (*Tectona grandis*), Northeast Thailand, questionnaire survey

## Introduction

The Economic Tree Plantation Promotion Project was conducted from 1994 to 2002 in Thailand (Mahannop 2004). Most plantations were established during the initial period from 1994 to 1997 before the project budget was reduced due to the Asian economic crisis (Mahannop 2004). Subsidies were provided to the participants step by step over the initial 5 years for farm forest management. The Royal Forest Department (RFD) project evaluation report (2002) pointed out that many plantations were abandoned, but large areas of tree plantations were established all over the country through the project. The report also mentioned the importance of marketing and continuous care after the 5 years of assistance by the project. Many studies were conducted targeting factors that affect participation in tree planting around the year 2000 (e.g. Buaban 1999; Tangittam 1999; Rachadawannapong 2000; Saengpan 2003).

Natural teak forests are distributed from the north to the east of Thailand, and these have contributed to the national and local economy (Gajaseni and Jordan 1990). However, as a result of a decrease of teak resources from domestic natural forests and the resultant logging ban in

1989, teak log supply has been highly dependent on the import of logs and sawn wood from neighboring countries, such as Myanmar and Laos. Teak was first planted in 1906, and there is a long history of teak planting by the public sector (Kijkar 2001). Teak is one of the most popular tree species for planting in Thailand. However, the decrease of resources in surrounding countries is considered to lead to high demand for domestic teak wood from the plantations. Therefore, the establishment of a system for providing teak logs from plantations in a sustainable way is urgently required.

Northeast Thailand has a large human population (Alpha Research 2010). The economy depends more on agricultural production than in other regions. The main crops are rice, sugarcane, cassava, and maize. Northeast Thailand previously had large areas of forest (42.0% in 1961) on comparatively gentle terrain, but the forest area dropped through land conversion to agricultural land, and the forest area as a proportion of the total became the lowest among the regions of Thailand (12.5% in 1998) (RFD, 2008). Fluctuations in cash crop price and irregular weather cause instability of farmers' income in this region (Kasem and Thapa 2011). One option for farmers is to adopt teak

**Table 1.** Total planted areas (rai) of five popular tree species established by the Economic Tree Plantation Promotion Project during 1994-2001

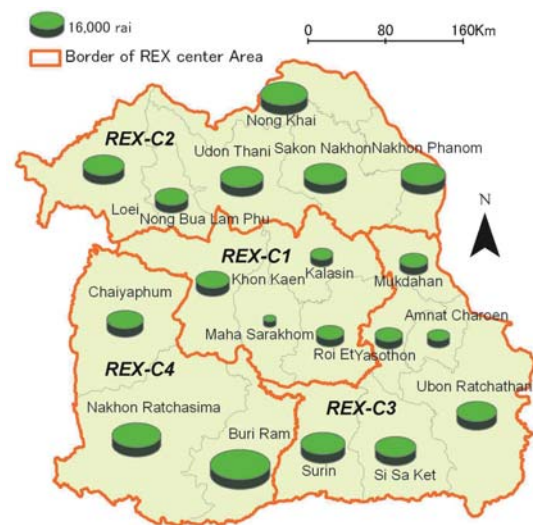
| Species                        | Central | North   | Northeast | South  | Total     | %    |
|--------------------------------|---------|---------|-----------|--------|-----------|------|
| <i>Tectona grandis</i>         | 103,014 | 492,784 | 377,307   | 5,284  | 978,389   | 45%  |
| <i>Azadirachta indica</i>      | 43,066  | 37,598  | 401,719   | 1,905  | 484,288   | 22%  |
| <i>Pterocarpus macrocarpus</i> | 13,038  | 6,233   | 448,680   | 161    | 468,112   | 21%  |
| <i>Azadirachta excelsa</i>     | 5,908   | 123     | 4,232     | 42,967 | 53,231    | 2%   |
| <i>Azizia xylocarpa</i>        | 523     | 165     | 41,682    | 40     | 42,410    | 2%   |
| Sub-total of 5 main species    | 165,549 | 536,903 | 1,273,620 | 50,357 | 2,026,430 | 92%  |
| Total                          | 219,851 | 545,763 | 1,352,495 | 75,578 | 2,193,687 | 100% |
| Percentage by region           | 10%     | 25%     | 62%       | 3%     | 100%      |      |

forest management on part of their land in order to stabilize the total long-term profitability of their land. Growth of teak forest in the northeast of the country is not always as good as that in the north, but there are suitable sites for teak planting where teak farm management can bring sufficient profits (Sukchan and Noda this issue). However, there is high competition among types of land use, such as cash crops, rubber, and eucalyptus plantation. Therefore, it is important to improve the socio-economic conditions surrounding teak forest management for developing and maintaining teak farm forests in this region.

Time has passed since the project's end, and new problems may have arisen. Therefore, the objective of our study is to determine the current situation of teak farm forest planters and their management, focusing on the northeast of Thailand where there is high competition among types of land use.

**Materials and method**

Firstly, regional characteristics of tree plantation were determined using a registration database of participants in the project from 1994 to 2001 constructed by RFD. The Reforestation and Extension Project in the Northeast of Thailand (REX) supported by Japan International Cooperative Agency (JICA) established four centers in different provinces of the region: REX-C1 in Maha Sarakam, REX-C2 in Udon Thani, REX-C3 in Yasothon, and REX-C4 in Nakhon Ratchasima. These centers played an important role for implementing the activities for promoting tree planting such as seedling production, forestry extension, training, demonstration plantation, and nursery technique development. Therefore, items were summarized at the level of province or REX center using information on the address of residence of planters and the location of plantation sites. The results were mapped using the software ArcGIS 9.3 (ESRI Inc.). Statistical analysis was performed with SPSS 15J software package (SPSS Inc.). Secondly, the results of a questionnaire survey conducted from 2005 to 2006 by the Department of Economics in the Research Bureau of the RFD were analyzed to understand the current status of planters, teak farm forest management, and the opinions of planters on



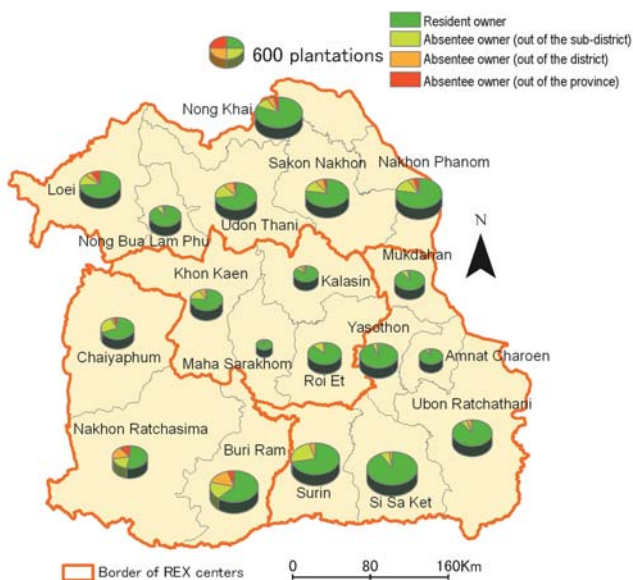
**Fig. 1.** Planted areas of teak in each province through the Economic Tree Plantation Promotion Project from 1997 to 2001

tree plantation. A total of 148 answers of teak planters in the northeast of Thailand were analyzed. Statistical analysis on questionnaire survey was performed with JMP 8 (SAS Institute Inc.). Lastly, the results of teak farm forest establishment through the project were discussed.

**Results and discussion**

**1. Regional characteristics of establishment of plantations in the northeast of Thailand**

Teak was one of the most planted tree species, occupying about 45% of the overall planted area. About half of teak plantations were established in the north of Thailand, but 39% of these were established in the northeast of Thailand (Table 1). It is observed that more tree plantations were established in the provinces associated with REX-C4 and REX-C2 than with REX-C3 and REX-C1 (Tukey's HSD,  $p < 0.05$ ) (Fig. 1). In addition, the average area of teak plantation was larger in the provinces associated with REX-C4 than with the other centers

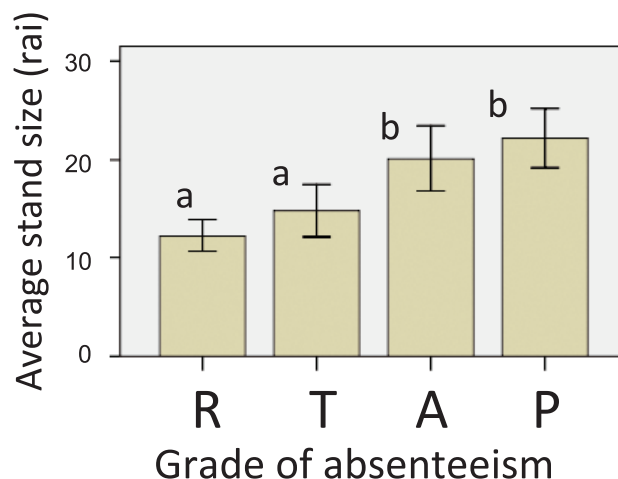


**Fig. 2.** Proportions of resident owners (group R) and absentee owners (out of their own sub-district (Tambon) (group T), out of their own district (Amphoe) (group A), and out of their own province (Changwat) (group P)) in each province through the Economic Tree Plantation Promotion Project from 1997 to 2001

(Tukey’s HSD,  $p < 0.05$ ). A previous study revealed that the grade of absenteeism of planters is one of the factors that affect the non-reforestation attitude after harvesting in Japan (Noda and Hayashi 2004). Thus, the grade of absenteeism of planters was calculated and summarized for each province. The percentage of absentee owners, who planted out of their own district and out of their own province, was high in provinces around big cities in the region, although most planters were resident owners in rural areas (Fig. 2). The average tree plantation area became larger according to the grade of absenteeism, such as for resident owners (group R) and absentee owners (out of their own sub-district (group T), out of their own district (group A), and out of their own province (group P)). The average sizes of teak stands of absentee owners P and A were larger than those of planters T and R (Tukey’s HSD,  $p < 0.05$ ) (Fig. 3).

**2. General status of teak planters**

General status of teak planters of farmers, non-farmers and all respondents were summarized in Table 2. The average age of respondents was 57 years old. Their main occupation was agriculture (66%). Half of the respondents were full-time farmers. Some ten percent of respondents were in private business and were officers. Most respondents had graduated from primary school and about 30% of respondents had graduated from college. This means that many highly educated people also joined the project. The average land holding size was 77 rai. On average, nearly half of that land (36 rai) was utilized for



**Fig. 3.** Differences of average sizes of teak stands according to the grade of absenteeism of teak forest owners. The error bars show the 95% confidence interval. The explanation on the grade of absenteeism was given in the caption of Fig. 2.

teak plantation. The average land use was 14 rai for cash crops, 12 rai for paddy fields, 4 rai for fruit gardens, and 10 rai for other land uses (n=94). The average monthly income and expenses were 20,618 baht and 13,948 baht, respectively. The average amount of debt was large, at around 430,000 baht. The average number of laborers in the family was 2.85 persons. Two types of planters, i.e. farmers and non-farmers, are included in the above-mentioned figures. Non-farmers generally include those with higher education (Chi square test,  $p < 0.05$ ), larger land holding, larger teak plantation, larger monthly income and expenses, larger debts, and smaller number of laborers in the family compared with farmers (Tukey’s HSD,  $p < 0.05$ ).

**3. Management of teak farm forests**

Sixty percent of respondents planted trees using family labor and 36% hired laborers from outside. Most plantations (80%) had been established on a flat area, reflecting the rather gentle terrain of the northeast of Thailand. Only 11.6% of plantations had been established on a slight slope to a mountainous area. Soil type was most commonly loamy sand (77%), followed by loamy clay (19%) and laterite (7%). Very narrow spacing, such as 2x4 m (40%), 2 x2 m (19%), or 2x3 m (15%), was adopted because more than 1,250 trees had to be planted to participate in the Economic Tree Plantation Project as a requirement of the initial phase. The proportion with a survival rate “higher than 70%” was 62%, “50 to 70%” was 25%, and “less than 50%” was 13%. 57% of respondents used some kind of

**Table 2.** General status of teak planters among farmers, non-farmers, and all respondents

| Item                                      | Farmers (n=98) | Non-farmers (n=50) | All respondents (n=148) |
|---|----------------|--------------------|-------------------------|
| Age                                       | 58.3           | 55.0               | 57.1                    |
| Average family labor (person)             | 3.02           | 2.46               | 2.85                    |
| Land use                                  |                |                    |                         |
| <i>Average land holding (rai)</i>         | 64.0           | 105.9              | 77.4                    |
| <i>Average paddy area (rai)</i>           | 13.9           | 8.9                | 12.3                    |
| <i>Average crop field area (rai)</i>      | 17.5           | 7.7                | 14.4                    |
| <i>Average orchard area (rai)</i>         | 2.7            | 5.7                | 3.7                     |
| <i>Average teak plantation area (rai)</i> | 21.1           | 68.8               | 36.4                    |
| <i>Average other land holding (rai)</i>   | 8.7            | 14.8               | 10.6                    |
| Average monthly income (Baht)             | 9882           | 41094              | 20620                   |
| Average monthly expense (Baht)            | 8612           | 23950              | 13947                   |
| Average debts (Baht)                      | 266146         | 824424             | 430638                  |
| Education level                           |                |                    |                         |
| Primary school                            | 75             | 7                  | 82                      |
| Secondary school                          | 15             | 4                  | 19                      |
| Vocational certificate                    | 3              | 5                  | 8                       |
| Bachelor's degree                         | 3              | 27                 | 30                      |
| Others                                    | 1              | 5                  | 6                       |

fertilizer on their teak plantations. Pruning was practiced in 87% of teak stands of respondents. Only 22% of respondents took preventive measures against damage by blight and insects. Thirty percent of respondents conducted thinning. The main objective of thinning was to accelerate the growth of the remaining trees (70%), following by selling wood (28%) and reducing tree density (23%). 54% of respondents recognized that their present tree stands were too dense (54%) or moderately dense (41%). The methodology of thinning was mostly low thinning (60%), simply related to the objective of thinning. 26% of respondents conducted high thinning and 16% of respondents conducted systematic thinning. Most of the thinned wood (67%) was used for household use because low thinning was mainly conducted. 22% of thinned wood was sold and 14% was utilized for private wood processing business. Only 5% of thinned trees were unutilized.

Narrow spacing was selected because of the requirements for being approved as a tree plantation by the project in order to receive subsidies (more than 1,250 seedlings/ha had to be planted at the initial stage (625 seedlings/ha after a revision in 1999)). Therefore, it was necessary to conduct thinning, but the implementation rate was low, at only 30%. More than half of respondents felt that their teak plantations were too dense. Many respondents conducted low thinning to help the remaining trees to grow and used the thinned wood in their house. However, some conducted high thinning to sell wood that had reached a merchantable size. More people would conduct low thinning if they could sell small thinned wood. However, at present, postponement of thinning was delaying the growth in diameter of trees and also delaying the time until the trees reach a merchantable size. Daring to

make the decision to conduct thinning will be necessary to avoid this vicious circle.

#### 4. Planter's opinions on teak farm forest management

Planters evaluated the growth of their teak stands as good (21%), moderate (62%), or bad (17%). Many respondents (59%) were satisfied with their tree plantations, followed by moderately satisfied (29%) and unsatisfied (12%). The main purpose of tree planting was to obtain a subsidy from the government (74%) and the second was to sell trees (67%). Many respondents also gave reasons of improving the environment (59%) and using the wood for household use (56%). 32% of respondents planted trees for their own wood processing business, that is, they were to use the planted trees as raw material. Planters experienced the following difficulties: lack of money (73%), soil with low fertility (43%), occurrence of damage by blight and insects (31%), occurrence of wild fire (30%), slow growth (28%), and regulations of the RFD (22%). Types of support expected from the government were for marketing and fair trade (71%), followed by financial support (64%) and soft loans (50%), and then technical and knowledge enhancement such as consultation with the people in charge (44%), training in wood processing (33%), technical knowledge (32%), water supply (31%), and training and materials for silvicultural techniques (30%). Half of the respondents had hopes to carry out additional planting, but the other half did not because of a shortage or lack of land that could be additionally allocated to tree planting.

Respondents felt difficulties not in terms of technical or silvicultural aspects but rather from a lack of funds. They expected support from the government in terms of socio-

**Table 3.** Cross-tabulation table between the degree of satisfaction with tree planting and certain variables

| Variable                             | $\chi^2$ value | Probability | Category       | Satisfaction with tree planting |                  |                 |
|--------------------------------------|----------------|-------------|----------------|---------------------------------|------------------|-----------------|
|                                      |                |             |                | Satisfied                       | Med./Unsatisfied | All respondents |
| Growth conditions of trees           | 19.606         | <0.001**    | Good           | 28                              | 2                | 30              |
|                                      |                |             | Medium         | 40                              | 43               | 83              |
|                                      |                |             | Bad            | 10                              | 11               | 21              |
| Slow and stunted growth is a problem | 4.273          | 0.0387**    | Yes            | 15                              | 18               | 33              |
|                                      |                |             | No             | 55                              | 28               | 83              |
| Do you want to plant more trees?     | 13.128         | 0.0003**    | Yes            | 49                              | 17               | 66              |
|                                      |                |             | No             | 28                              | 37               | 65              |
| Farmer/Non-farmer                    | 0.156          | 0.6931      | Farmer         | 52                              | 38               | 90              |
|                                      |                |             | Non-farmer     | 30                              | 19               | 49              |
| Land-holding class                   | 1.647          | 0.4388      | >80rai         | 13                              | 14               | 27              |
|                                      |                |             | 30-80rai       | 26                              | 15               | 41              |
|                                      |                |             | <=30rai        | 14                              | 9                | 23              |
| Age class                            | 0.011          | 0.9173      | >56 years old  | 40                              | 27               | 67              |
|                                      |                |             | <=56 years old | 40                              | 28               | 68              |
| Income class                         | 0.429          | 0.5126      | >10000B        | 24                              | 21               | 45              |
|                                      |                |             | <=10000B       | 44                              | 30               | 74              |

economic aspects such as marketing, fair trade, financial assistance, and soft loans. Technical assistance may be necessary for implementing thinning, but assistance in terms of socio-economic aspects was strongly needed under the current situation when teak stands have already been established. Many planters complained about the regulations or procedures for harvesting and transporting teak while in the field, but not many respondents specifically mentioned difficulties with the regulations in our questionnaire survey. At any rate, RFD should positively strengthen assistance from the above-mentioned viewpoints. Private Forest Plantation Cooperative can also play an important role. Therefore, the strengthening of the role of PFPC is also a very important issue for the RFD.

### 5. Factors related to the degree of satisfaction with tree planting

The degree of satisfaction with tree planting can be a good indicator of the evaluations of teak planting by the respondents. Therefore, factors related to the degree of satisfaction with tree planting were investigated using Chi square test. The status of respondents, such as land-holding type, age, education level, farmer/non-farmer, and income, was not found to be related to the degree of satisfaction. In fact, the level of satisfaction was simply related to the growth of teak stands (Table 3). Satisfied planters were more likely to pursue additional planting. This also shows that the degree of satisfaction is a good indicator of the true feelings of respondents.

Many respondents evaluated the growth of their teak stands as moderate and were satisfied with tree planting. Half of the respondents still hoped to plant additional trees. Therefore, the overall evaluation of teak planting by the

respondents who had maintained their tree plantations was not bad. The degree of satisfaction with tree planting was directly related to the growth performance of teak stands. Teak farm forest owners were satisfied when their teak stands showed good growth and vice versa. Plantation sites were not carefully selected in the initial phase of the promotion project. Research on suitable sites for teak plantation should be conducted, and information should also be provided to people in an easily understandable way.

### Acknowledgements

We would like to express our deepest gratitude to the Private Plantation Division of RFD for providing documents and information on the Economic Tree Plantation Promotion Project. This study was supported by a joint research project 2006–2010 under RFD and JIRCAS.

### References

- Alpha Research Co., Ltd. (2010) Pocket Thailand in Figures 12<sup>th</sup> edition 2010, Nonthaburi, Thailand
- Buaban C (1999) Factors Affecting Economic Tree Plantation Project in Changwat Nakhorn Rachasima (in Thai). Master thesis, Kasetsart Kasetsart University Bangkok
- Kasem S, Thapa GB (2011) Crop diversification in Thailand : Status, determinants, and effects on income and use of inputs. Land use policy 28:618-628
- Kijkar S (2001) Timber plantation development in Thailand. *In*: Proceeding of the International Conference on Timber Plantation Development. FAO, Manila, Philippines

- Mahannop N (2004) The development of forest plantations in Thailand. *In*: Enters T and Durst PB (eds) What does it take? The role of incentives in forest plantation development in Asia and the Pacific. RAP PUBLICATION 2004/27. Food and Agriculture Organization of the United Nations, Bangkok
- Noda I, Hayashi M (2004) Characteristic differences of Non-Reforested Lands Compared with Reforested Lands in Kumamoto, Kyushu. *Bulletin of FFPRI* 3(1):29-32
- Rachadawannapong S (2000) Participation of farmers in Economic Tree Plantation Extension Project at Amphoe Chon Daen, Changwat Phetchabun (in Thai). Master thesis Kasetsart University Bangkok
- Royal Forest Department (RFD) (2002) Evaluation report of the Economic Tree Plantation Promotion Project 1994-2000 (in Thai). RFD, Bangkok
- Royal Forest Department (RFD) (2008) Forestry statistics of Thailand (in Thai). Royal Forest Department, Bangkok
- Saengpan C (2003) Factors Affecting the Membership being of Lop Buri Private Forest Plantation Cooperative Limited, Lop Buri Province (in Thai). Master thesis Kasetsart University Bangkok
- Tangittam P (1999) Factors Affecting the Participation in Economic Tree Plantation Promotion Program in Changwat Phisanulok (in Thai). Master thesis Kasetsart University Bangkok
- Yokota Y, Komaki T, Noda I, Furuya N, Pusudsavang A, Himmapan W, Tedsorn N, Vacharangkura T (2009) Current condition and problems of teak plantation of small farmers in the Northeast Thailand (in Japanese). *Kanto J For Res* 60:25-28