REHABILITATION OF DEGRADED TROPICAL FOREST LAND THROUGH AGROFORESTRY PRACTICES: A CASE STUDY IN THAILAND

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KHEMNARK, C. 1994. Rehabilitation of degraded tropical forest land through agroforestry practices: a case study in Thailand. For many years landless farmers have illegally encroached upon the dry evergreen forest at Sakaerat for upland agriculture. A land reform project which allocated land to landless farmers was established in the area in 1981. This study reports a two-year project to promote agroforestry practices by the establishment of demonstration plots of multipurpose trees interplanted with cassava or groundnuts. Survival and growth after two years is reported.

Key words: Agroforestry - Thailand - multipurpose tree species

KHEMNARK, C. 1994. Pemulihan tanah hutan tropika yang ternyahgred dengan amalan hutan tani: satu kajian kes di Thailand. Sejak bertahun-tahun, petani-petani yang tidak memiliki tanah telah mencerobohi hutan malar hijau yang kering di Sakaerat untuk pertanian tanah tinggi. Satu projek reformasi tanah yang menguntukkan tanah kepada petani yang tidak memiliki tanah telah diadakan di kawasan tersebut pada 1981. Kajian ini melaporkan projek dua tahun untuk menggalakkan amalan hutan tani dengan mewujudkan plot demonstrasi pokok-pokok pelbagai guna yang disalingi dengan tanaman ubi kayu atau kacang tanah. Survival dan pertumbuhan pokok-pokok tersebut selepas dua tahun dilaporkan.

Introduction

Forest degradation at Sakaerat followed a pattern which has been a general phenomenon in Thailand. Pressure to grow maize and cassava for export forces farmers to expand agricultural production. Because their occupation of cleared forest land is illegal the farmers do not have access to formal credit facilities; also because of the lack of land tenure there is little incentive for good agricultural practice. The farmers have to borrow from the traders to whom they sell their crops. Eventually the debt mounts so that the farmers are forced to sell their land to the traders. The farmer then works as a landless labourer and eventually finds new land by encroaching into the forest.

Causes of forest loss include

- Poverty of the landless farmers;
- Export promotion of agricultural crops, e.g. cassava, maize, rice;
- Weak law enforcement due to political pressure. Many political parties focus their campaign on promises to allocate land to the rural poor.

The Royal Thai Government established the Agricultural Land Reform Office (ALRO) in 1975 to deal with this problem. In 1981 the ALRO selected 560 hectares of degraded forest land for use as a land reform project.

Objectives of the land reform project:

- To provide stable agricultural land to landless farmers
- To resettle illegal occupants from the Sakaerat Biosphere Reserve
- To promote agroforestry practices

The area was divided into 140 plots each of about 3.2 ha, depending on topographic variations. Each plot was randomly assigned to a landless family drawn from either the illegal occupants of the land, landless farmers in the vicinity, or farmers moving from the Sakaerat Biosphere Reserve which had been established in 1977 (Srisawas *et al.* 1991). Figure 1 shows the project area in 1984. By 1993, a total of 400 people in 73 families had settled in the project area. The ALRO had approved the settlement of 44 families of which 23 were from the Sakaerat Biosphere Reserve and 21 were landless farmers. There were also 20 families who had occupied the land before the establishment of the project who requested to join the scheme. Each family was randomly allocated a housing area of 0.08 ha (0.5 rai) in the residential zone along the highway. The ALRO certificate 4-01 was distributed to each family. This certifies the family's inheritable right to use the land. The certificate can be used as collateral, but may not be sold.

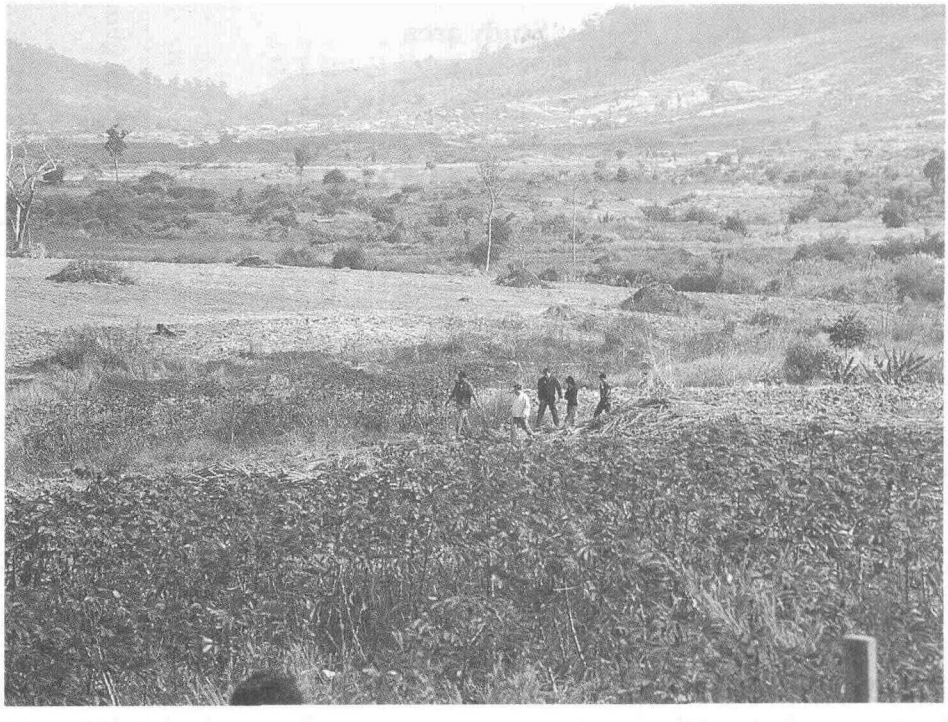

Figure 1. General view of the project area during its establishment in 1984

In the early stages the settlers faced water shortages because there were only two small reservoirs which dried out during the dry season. All the agricultural lands are rainfed. The Sakaerat Environmental Research Station distributed drinking water every three days. The ALRO developed roads into the farming area and built reservoirs with year-round capacity. In 1983 a private company promoted a high yield variety of cashew nut by providing seedlings at 12 baht (US$ 0.50) per seedling on credit.

Each family was allowed to grow cashews on half of their agricultural land, and the remainder of the land was planted with maize or cassava. Some farmers intercropped cashews with cassava for the first two years. The company guaranteed a buying price of 60-150 baht/kg, but unfortunately at first harvest after four years the cashew nuts offered very low yields due to low fertiliser inputs and improper management. Some farmers abandoned their fields or returned to cassava monoculture. No soil conservation measures were applied and consequently the cassava yield decreased due to erosion and loss of soil fertility. Weed competition became serious and more inputs of herbicide were needed. The farmers seemed to be once again without hope, although they now had access to the loan facilities of the Bank of Agriculture and Cooperatives. In 1986 the ALRO established a field office near the village, with five permanent officers.

An electricity supply runs through the village, causing some change in the lifestyle of the farmers; they now spend more money on household electrical goods.

Study area

Location

The project is located at the agricultural land reform village of Tambon Wang Nam Kheaw in Nakhon Ratchisima Province in northeast Thailand, about 350 m a.s.l., lat. 14 ° 15' N, long. 101 ° 50' E (Khemnark 1985). The land reform project covers an area of 560 ha or 3500 rais.

Climate

Climatic data from Sakaerat is presented in Table 1. The area experiences a tropical monsoonal climate with a distinct dry season between December and April.

Soils

The sandy to sandy loam soils are derived from sandstone, shale and andesite. Most of the soils are classified as Red-Yellow Podzolic, and fall into the Khao Yai and Tha Yang series. The top soil is around 15-20 cm deep and subsoils are between 60-80 cm thick. Scattered rock outcrops cause some difficulties for land preparation and other agricultural practices (Puriyakorn 1982).

Table 1. Climatic data at Sakaerat Environmental Research Station (1969-1985)

	J	F	M	A	M	J	J	A	S	O	N	D	Av.
Temp (°C)													
Mean	17.2	20.4	23.4	24.6	24.7	24.6	24.6	24.2	23.9	23.1	22.0	19.5	22.0
Mean max	29.8	32.9	34.7	35.1	34.0	32.7	32.5	31.8	31.2	29.7	27.9	27.5	31.6
Mean min	15.9	19.4	22.3	22.9	23.4	32.2	22.7	22.6	21.9	20.6	18.4	15.8	20.8
Relative humidity (%)													
(average)	89.4	83.6	80.0	82.7	87.4	87.1	87.4	88.7	93.5	95.1	93.7	92.2	88.4
Rainfall (mm)	10.1	17.4	68.8	102.0	152.5	110.8	116.0	121.3	284.7	202.5	57.6	8.3	1251.7
No. of days													
of rainfall	1.4	2.6	5.8	8.2	14.7	13.0	13.4	15.5	24.1	14.1	5.9	1.8	117.2

Source: Khemnark 1991.

Vegetation

The original dry evergreen forest has been heavily invaded and cleared for agriculture during the last two decades (Srisawas *et al.* 1991). Remnants of natural vegetation include *Xylia kerii, Bombax anceps, Canarium subulatum, Gmelina arborea, Bauhinia monandra, Acacia rugata* and *A. comosa.*

The study

In 1986 a group of researchers went to follow up the activities of the farmers in the resettlement areas, and to study the potential of agroforestry practices. A two-year project began in 1987. A study area of 3.2 ha was selected for an agroforestry experiment.

The objectives of the study were
- To establish demonstration agroforesty plots
- To encourage villagers to participate in agroforestry practices

The village members, with advice from the researchers, selected the following multipurpose tree species:

Acacia mangium (exotic species)
Acacia auriculiformis (exotic species)
Azadirachta indica (native species)
Cassia siamea (native species)
Eucalyptus camaldulensis (exotic species)

Seedlings were grown in plastic bags by the Thai-Japanese Reafforestation Project and were planted two metres apart with 8 m between rows. Thus there were 100 seedlings in each 40 × 40 m plot. Cassava was planted as an intercrop during the first year. Figures 2-4 show the intercropping of cassava with *Acacia mangium* and *Eucalyptus camadulensis.* Twenty per cent of the net profit from the sale of the cassava was contributed to the village development fund.

In 1988 five additional plots were planted. Two were planted with *Acacia mangium* and *Cassia siamea* in the same spacing as the 1987 planting, but with an east-west alignment to reduce shading to the intercrop of groundnuts. The remaining three plots were planted with *Acacia mangium* and *Cassia siamea* along contour lines, and were intercropped with groundnuts. The *Azadirachta indica* plot planted in 1987 failed to grow, so it was replanted in 1988 with *Eucalyptus urophylla,* another exotic species.

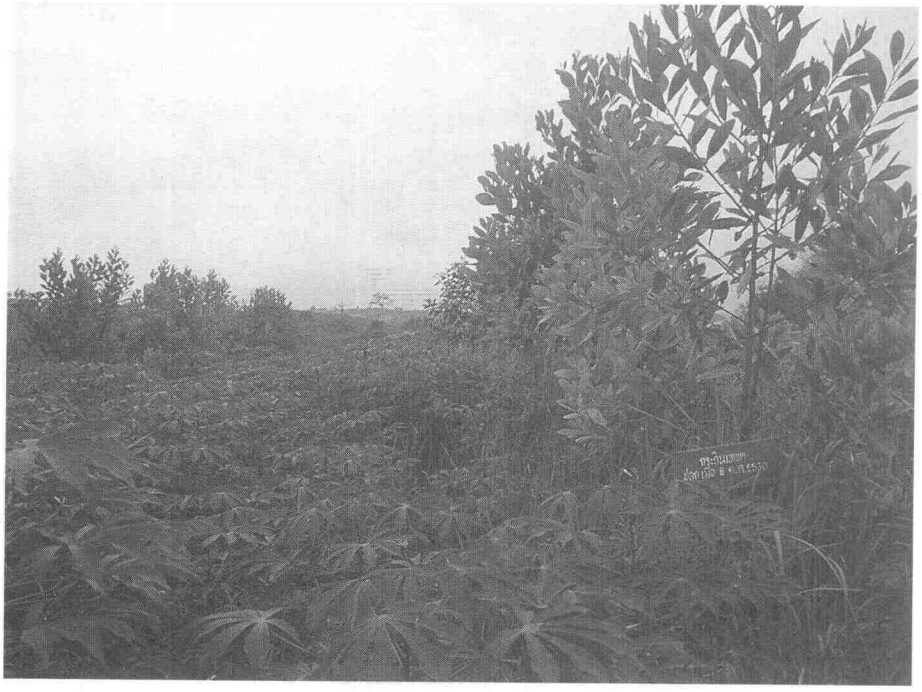

Figure 2. Second year growth of *Acacia mangium* and cassava

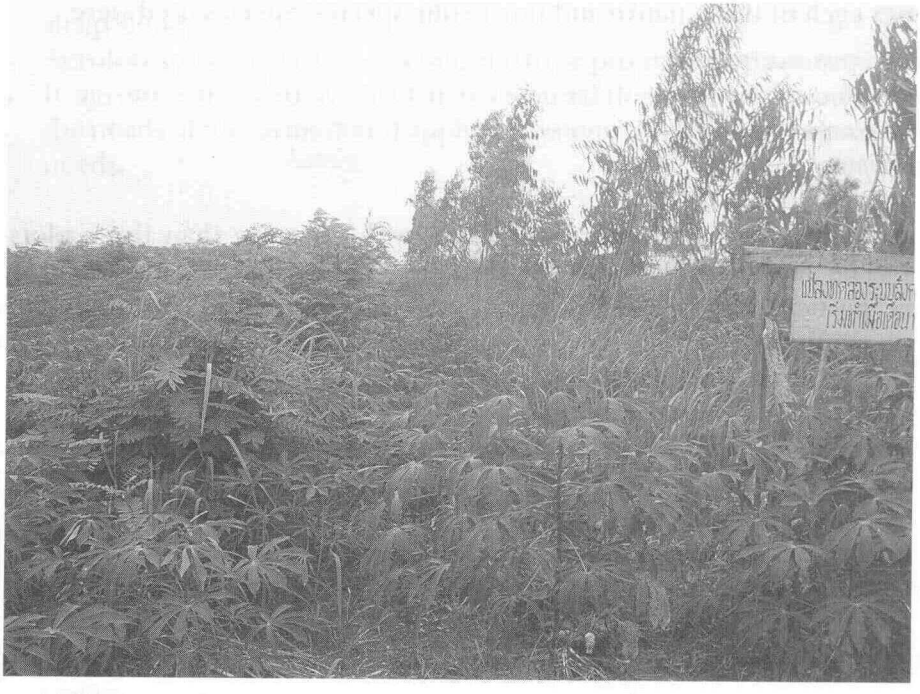

Figure 3. Second year growth of *Eucalyptus camaldulensis* and cassava

Figure 4. *Acacia mangium* and cassava plot after two years

In 1989 an additional experiment of four 40 × 40 m plots was planted, using 100 seedlings each of three native and one exotic species. Species used were

Pterocarpus macrocarpus
Dalbergia cochinchinesis
Dipterocarpus turbinatus
Eucalyptus urophylla

Plots were grown by volunteer farmers, with no more than three plots per farmer. The farmers grew intercrops of their choice (cassava and maize). All farmers participating in the growing of intercrops agreed to contribute 20% of their net profits to the village development fund. Roadside plantings were carried out by the villagers and school children with the assistance of foresters from the Thai-Japanese Reafforestation Project.

In the first year cassava yield was 1667 kg/rai at an average price at the farm gate of 500 baht/t (US$20 per t). The maize yield was very low: only 58 kg in two plots. This sold at the farm gate at 2.75 baht/kg. No fertiliser had been applied. The results after two years are shown in Table 2.

Fires are common during the dry season. Fire intensity depends on agricultural practices; careless burning of litter in the fields may cause fire damage to adjacent fields and forest. Fire spread into the experimental area in February 1990, causing death and arrested growth in some plots. Species such as *Eucalyptus camaldulensis, Cassia siamea, Acacia mangium* and *A. auriculiformis* are relatively fire tolerant.

Table 2. Survival and growth of tree species planted in demonstration plots

Species	Survival %	Average ht. (cm)	Average DBH (cm)
Acacia mangium	55	573.62	5.74
A.auriculiformis	84	556.23	5.28
Eucalyptus camaldulensis	92	817.71	6.62
Cassia siamea	91	379.81	3.21

The landless farmers became more confident after acquiring rights to land, and they were eager to improve their cultivation practices. They are gradually accepting agroforestry practices and are willing to introduce them to their farms in future. Of the original 73 families, 53 remained after seven years. Average income and family assets have increased. Greater capital and labour inputs allow farmers to access new technology (Khemnark 1991).

The agroforestry experiment showed that the most suitable tree species for the area are *Eucalyptus camaldulensis, Cassia siamea* and *Acacia auriculiformis. E. camaldulensis* coppices well after being cut to ground level, and may be harvested for poles, fuelwood, chip wood or construction timber after five years.

Some recommendations are

- Trees in agroforestry plots should be planted in an east-west direction;
- One or two rows of trees should be planted along the farm roadsides;
- Boundary planting should be done on the edges of farm plots and areas of steep slope;
- Agroforestry practice should continue to be promoted to farmers in this area;
- If agroforestry is to succeed it is essential that extension workers identify the needs of the farmers and apply the system which is most relevant to these needs.

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