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FOREST VILLAGES: AN AGROFORESTRY APPROACH TO REHABILITATING FOREST LAND DEGRADED BY SHIFTING CULTIVATION IN THAILAND

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ABSTRACT

The Forest Village scheme was introduced by the Forest Industries Organisation (FIO) of Thailand in 1967 as an attempt to stop further spread of the fast increasing shifting cultivation and deforestation in the country. The underlying principle of the scheme is to relate reforestation with social welfare of the people involved. It is essentially a modification of the traditional taungya method of plantation establishment.

The salient aspect of the scheme is to induce the shifting cultivators to settle down in villages where each family is given tenure over a plot of land to construct a house and develop a homegarden around it. The farmers are required to help establish and maintain forest plantations, in which they are permitted to raise agricultural crops during the first three years of its establishment. The farmers are also given free medical and educational facilities, and technical advice on crop and livestock husbandry. They can also earn cash rewards for successful plantation establishment.

Although the scheme has not achieved its full target in terms of area covered and number of families settled, it is proving to be a successful method of luring people away from destructive shifting cultivation. The approach is applicable to other countries and regions with similar land-use problems and socio-cultural background.

The paper also examines the constraints to the effective working of the scheme, provides some simple suggestions for improving its functioning and identifies some of the issues that can easily be tackled by research.

Key words: Thailand, Forest Villages, Shifting Cultivation, Agroforestry, Home garden, Reforestation.

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(Photo: P.K.R. Nair)

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(Photo: P.K.R. Nair)

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(Photo: P.K.R. Nair)

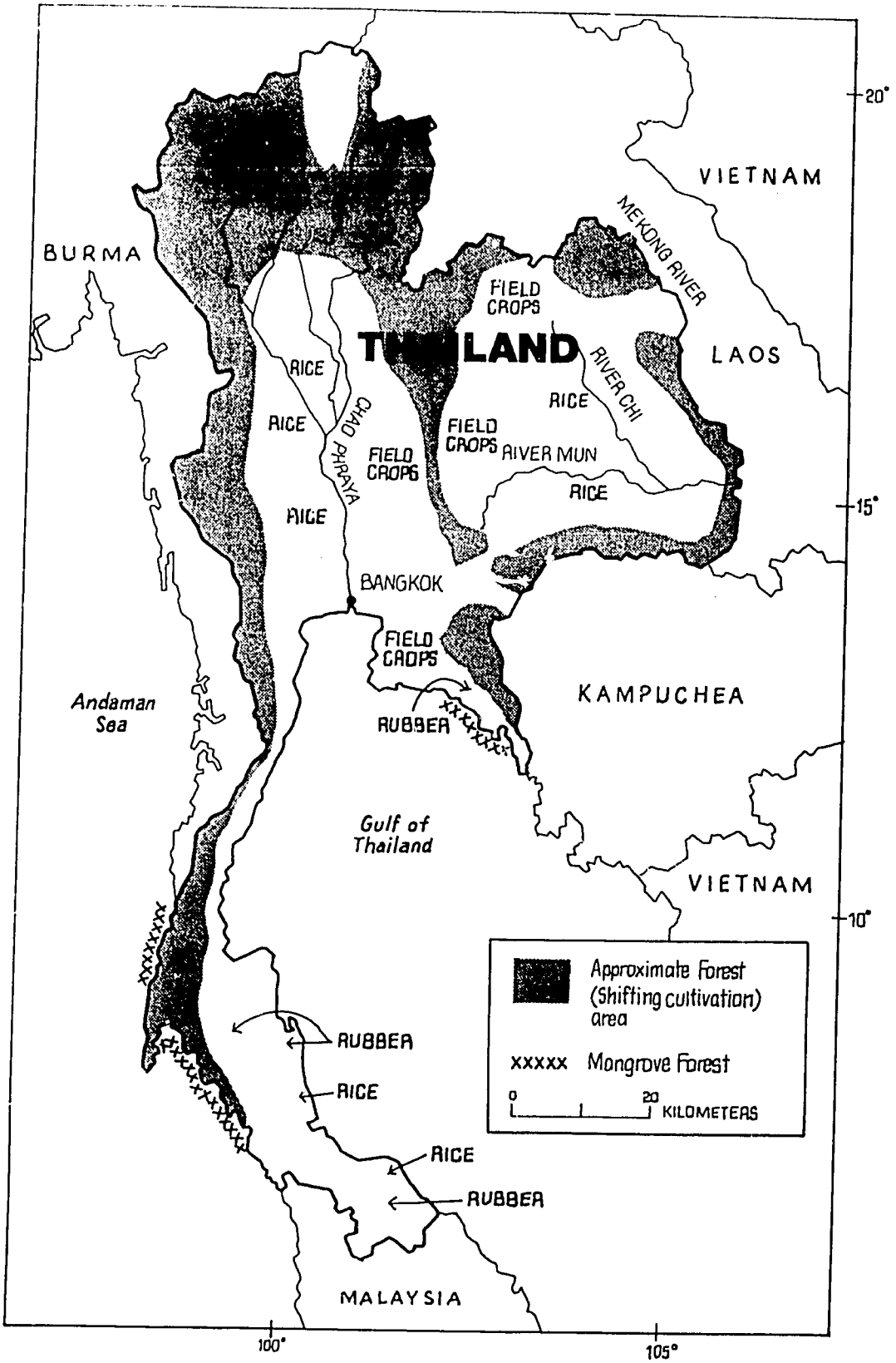

FIG. 1 : A ROUGH LAND-USE MAP OF THAILAND
(BOONKIRD, FERNANDES AND NAIR)

1. INTRODUCTION

The number of people engaged in shifting cultivation in Thailand is estimated to have risen from 300,000 to well over 700,000 in the past 15 years (8). This phenomenal increase has been caused mainly by migration both from the neighbouring Laos and Burma as well as within the country from the lowland agricultural lands into the forests. Consequently, the forests in the country are under severe pressure. Moreover, the length of the fallow periods in shifting cultivation cycles is drastically shortened, and as a result, the land is rendered unsuitable to sustain repeated croppings and hence abandoned. Subsequent regeneration of forest species is very slow and poor in such abandoned sites. Shifting cultivation is thus causing large-scale forest destruction and land degradation in Thailand. It has been estimated that the country had around 0.8 million ha of land under shifting cultivation in 1980, and that increasing encroachment into the forest was causing forest destruction in over 400,000 ha each year (4).

With a view to arresting deforestation and reclaiming the degraded forest areas, the Government introduced and encouraged the taungya plantation system (5). The results were, however, not satisfactory, primarily because the scheme had no provisions for the social welfare of the people involved (2).

In 1967, the Forest Industry Organization (FIO) launched the Forest Village system in the northern highlands, in an effort to rehabilitate the degraded forest land. It is essentially a modification of the taungya system, and its main objectives are:

- to attract shifting cultivators and landless people to establish

themselves in forest villages which offer improved facilities and greater stability than nomadic life;

- to encourage village people to establish taungya plantation in order to reforest areas degraded by shifting cultivation. This could also result in opportunities for long term forest employment (3).

The scheme, though originally designed for the hilly areas of Northern Thailand where shifting cultivation has been most common, now extends all over Thailand. In 1981 there were 26 forest villages spread over the country, and they undertook plantation establishment in a total of 4,000 ha annually.

Encouraged by the success of the FIO Forest Village system, the Royal Family of Thailand and the Royal Forest Department (RFD) have also recently set up forest villages similar to those developed by the FIO. The underlying approach in all of them is to promote rural development and sound land use by relating forestry work with social welfare for the people involved.

This paper examines the details of working of the FIO Forest Village system. Since the scheme encompasses the whole of the country, it is relevant to give a general account of the biophysical and land use aspects of the country in order to understand the system in the proper perspective.

2. GENERAL DESCRIPTION OF THE AREA

Figure 1 shows salient aspects of the geographic location and land use systems of Thailand.

FIG. 1

2.1. Geographic location

The Kingdom of Thailand is located on the Malay peninsula (5.45 - 20.30° N and 97.30 - 105.45° E). It has an area of around 514,000 km^2 and has four main geographic regions.

- The Northern region (16.96 million ha) comprises a range of fold mountains which extend along the western border through the peninsula to Malaysia. These mountains have an average elevation of 1600 m and are interspersed with fertile valleys through which flow the four tributaries of Thailand's major river - the Chao Phraya.
- The Northeastern region, which includes the Khorat plateau, covers around 16.86 million ha. The elevation of the plateau is around 200 m while the mountains to the west average between 800 - 1300 m. This region is characterised by saline soils and is quite dry and windy in the summer.
- The Central plain has a total area of 10.39 million ha and is the rice bowl of Thailand. In the north, three tributaries flow together into the Chao Phraya river and in the south is the fertile Chao Phraya Delta.
- The Southern region (7.07 million ha) is the peninsula which in the west is composed of mountains with an average elevation of 1000 - 1500 m. Most of the rivers and streams here flow eastwards into the Gulf of Thailand.

2.2. Biophysical environment

2.2.1. Climate

Thailand receives 90 percent of its annual rainfall from the southwest monsoon which lasts from May to September. During the period from

October to April, the southeastern Asiatic cyclonic storms bring irregular amounts of additional rain to the southern regions while most of the north and northeastern areas have a long dry season.

Annual rainfall is highest in the southern and western parts of the peninsula and in the southeastern region and ranges from 2000 - 4000 mm+. The central plain which lies in the rain shadow of the western mountains receives between 1000 - 1400 mm, while the northeast gets between 1000 - 2000 mm.

Temperatures are relatively steady throughout the year, averaging between 24° C and 30° C (75° F and 86° F). In the north, frost may occur at higher elevations in December, while in the south climate is moderated by the maritime influence. The cold dry winter air produces frequent morning fogs especially in the north.

2.2.2. Soils

(See UNESCO/FAO Soils Map of the World - sheet IX). The predominant soils are Acrisols with a Lithic phase i.e. the presence of continuous coherent or hard rock within 50 cm of the surface. In general, the soils are podsolized and have low base saturation and cation exchange capacity. Soils in the northeast are saline.

2.2.3. Vegetation

Thailand has a wide variety of vegetation types reflecting the wide range of ecological and climatic conditions. The major vegetation types include:

- Evergreen and semi-evergreen forests
- Dry and moist deciduous forests
- Dry dipterocarp forests

. Fresh water swamp forests

. Mangrove forests

. Savanna forests

. Bamboo forests

. Beach forests

. Coniferous forests

. Scrub formations

2.3. Land Use Systems

2.3.1. Agriculture

The alluvial soils of the inter montane basins of northern Thailand are very suitable for the cultivation of rice, tobacco, fruit trees and vegetables. In addition, maize, peanuts, beans, garlic and onions are also produced. On the upper slopes, tea is grown both by large estates and also by smallholders. The former produce tea for drinking, while the latter ferment the tea leaves to produce a product for chewing ("miang") (6). In addition, the Hmong Hill tribe cultivate opium (at elevations between 1000 - 1500 m) as a cash crop and maize as a subsistence crop. There is a UN-supported crop-substitution project to encourage these farmers to give up opium cultivation in favour of agricultural crops such as coffee, maize, beans, etc. and flowers such as tulips (8).

The fertile Chao Phraya Delta region of the central plain is intensively cultivated. The main crop is rice although sugarcane is also produced. The alluvial deposits of the streams on the southeastern part of the central plain are also used for rice cultivation while the higher well-drained areas are used for rubber plantations, fruit orchards, sugar cane, cassava and pineapples. In 1979, Thailand's rice production

was estimated at 15.6 million tonnes. Only 10 percent of the total rice area receives controlled irrigation. The alluvial deposits of the rivers Mun and Chi in the northeastern region, although not very fertile, are extensively used for rice. The production per unit area is low and increasing soil salinity is a problem. Streams flowing off the peninsula into the Gulf of Thailand often have built up deltas which are utilised for wet rice cultivation.

2.3.2. Forestry

At the end of 1980, it was estimated that the natural forest area of Thailand amounted to 16.17 million ha or about 31 percent of the country's total area (4). This contrasts dramatically with a forest area of 57 percent in 1961 (1).

There are numerous types of forest types (see 2.2.3.). The main timber species from Thailand's natural forests are:

- *Tectona grandis*
- *Dipterocarpus alatus*
- *Shorea* spp.
- *Pterocarpus* spp.
- *Toona ciliata*
- *Instia palembanica*
- *Parashorea siellata*
- *Dalbergia cochinchinensis*

FAO estimated that in 1980, the annual value of all non-timber forest products from Thailand such as Dipterocarp oil, gum damar, bamboo pulp, edible bamboo shoots, canes, resin, honey, camphor, etc. was about US $ 30 million (4).

In addition to natural forests, there were around 0.43 million ha of successfully established hard and softwood plantations in 1983. The main hardwood species used include *Tectona grandis*, *Pterocarpus macrocarpus* and *Dipterocarpus* spp. Other species that have been successfully established are *Acacia catechu*, *Casuarina junghuhniana*, *Casuarina equisetifolia* and *Eucalyptus* spp. Softwood species used are *Pinus kesiya* and *Pinus merkusii*. Rubber is one of the main tree crops with 1.35 million ha planted in 1979.

2.3.3. Agroforestry

Various agroforestry systems/practices can be identified in Thailand:

- swidden/shifting cultivation for growing rice as the main crop with a variety of other food and cash crops (6, 7) -- in some areas, the woody vegetation of the long fallow period is deliberately managed for a variety of products, e.g. fruit, honey, fodder, resin, etc. (6)
- home gardens dominated by a wide variety of fruit trees;
- sericulture, where various species of silkworm moths are reared on the foliage of mulberry trees;
- aquaculture in mangrove forests;
- intercropping of coconut with cacao *(Theobroma cacao)*;
- grazing of cattle in coconut plantations;
- forest villages.

3. ORGANIZATION AND STRUCTURE OF THE FOREST VILLAGE SYSTEM

3.1. Organization

The FIO selects the degraded land where a forest village is to be set up for reforesting the land. The benefits and features of the

scheme are publicised widely within the locality through extensive media coverage and other extension methods. The services of the religious and other leaders are also solicited to disseminate such information and to allay any suspicion among the villagers. Families who come forward and agree to give up shifting cultivation in favour of settled land use are provided with a piece of land within the selected village unit for building a dwelling and setting up a homestead garden around it (see section 4.1. for details). Moreover, they are also permitted to grow crops between the young trees in the forest plantation that they will have to help in establishing according to the plan that would already have been prepared by the FIO.

The FIO has also set up "Development teams" having multidisciplinary expertise for each forest village. These teams provide agricultural, educational and medical services (see section 4.2.) to the people covered by the scheme. The objective is to encourage farmers to develop permanent bases in the forest village.

3. Components

3.2.1. Crops

Both subsistence and cash crops are grown. In the forest plantations, the major crops grown are dryland rice, maize *(Zea mays)*, sesame *(Sesamum indicum)*, sweet potatoes *(Ipomoea batatas)*, cassava *(Manihot esculenta)*, and water melons *(Citrulus lanatus)*. Tobacco *(Nicotiana tabacum)* and kenaf *(Hibiscus cannabinus)* are also grown in some areas.

The main crops in the home gardens are maize, cassava, pumpkins *(Cucurbita* spp.) and chilli pepper *(Capsicum frutescens)*. A large number of common agricultural crops are also grown. These include legumes such as beans *(Phaseolus* spp.), lablab bean *(Dolichos lablab)*,

soya bean *(Glycine max)* and winged bean *(Psophocarpus tetragonolobus)*; tuber crops such as sweet potato *(Ipomoea batatas)*, taro *(Colocasia antiquorum)*, and yams *(Dioscorea* spp.); cucurbitaceous crops such as cucumber *(Cucumis sativus)*, loofah *(Lufa acutangula)* and snake gourd *(Trichosanthes cucumeria)*; other vegetables such as egg plant *(Solanum melongena)*, and tomato *(Lycopersicon esculentum)*; minor millets such as Italian millet *(Setaria italica)* and finger millet *(Eleusine coracana)*; and spices and medicinal plants such as coriander *(Foeniculum vulgare)*, garlic *(Allium sativus)*, lemon grass *(Cymopogon citratus)*, mint *(Mentha arvensis)* and onion *(Allium cepa)*.

3.2.2. Trees

Teak *(Tectona grandis)*, which is native to Thailand, is the major FIO plantation species. In 1983, there were about 30,000 ha of FIO teak plantations. Other major plantation species include *Eucalyptus camaldulensis* (6,500 ha in 1983) and *Melia azedarach* (2,045 ha in 1983).

In addition to growing crops between the trees in the forest plantation the forest villagers also grow fruit trees e.g. *Parkia speciosa, P. javanica* and *Anacardium occidentale*. In some areas rubber trees *(Hevea brasiliensis)* are also grown between plantation trees and the proceeds from the latex sales are divided on a 70:30 basis between the forest villagers and the FIO. The 30 percent share retained by the FIO covers the cost of fertiliser and tools advanced to the forest villagers.

Other plant species maintained by the forest villagers in their home gardens (and their functions/uses) are listed in Table 1.

TABLE 1

3.2.3. Animals

Forest villagers keep a variety of domestic animals in the home gardens for food, ritual/religious sacrifices and prestige. Common animals include cows, pigs, chickens and ducks.

3.2.4. Management aspects

Degraded forest is cleared and burned and trees planted in holes (20 x 20 x 20 cm). Teak was originally grown at a spacing of 4 x 4 m on a 60 year rotation. Recently, however, a spacing of 2 x 8 m and 40 year rotation has been adopted.

Where soils are poor and dry, *Eucalyptus camaldulensis* (four-month-old seedlings) and *Melia azedarach* (1 year-old-plants) are planted at 2 x 8 m spacing. Eucalyptus plantations are grown on 10-15 year rotation for fuel or 20 year rotation for timber.

After planting the trees, the forest villager plants his crops in the interrows. Cropping occurs for the first three years and the villager then moves on to another area. It is the responsibility of the villager to weed and tend the trees while tending the agricultural crops.

Some villages have a herding cooperative for their cattle. The owners of cattle take turns to herd the village cattle within the plantations where grazing is permitted.

4. SYSTEM FUNCTIONING

4.1. Resource input and utilisation

Each family in the forest village is allocated 1.6 ha annually for clearing and planting with plantation trees and food/cash crops. In

addition, 0.16 ha is allocated for house building and home garden. Fig. 2 depicts a typical forest village scene with houses of the farmers in the midst of the individual home gardens. Cropping in the forest plantation occurs for upto 3 years and hence a villager can have upto 4.8 ha per year on which to grow his crops. Since the intended number of families per forest village is 100, upto 160 ha of land may be cleared and planted with trees and crops each year. In 1981, however, there was an average of nearly 59 families per forest village with each family cultivating 2.61 ha per year, i.e., a total of 153.63 ha annually per forest village.

FIG. 2

In 1981 the average size of forest village families was 5.56 members. In addition to their annual responsibilities for establishing the forest plantation (on a minimum of 1.6 ha) and growing of crops in the plantation and home gardens, it was estimated that each forest village needed labour equal to 200 man days per year. This would be required for various plantation operations e.g. weeding, pruning, thinning, fire prevention, road and trail maintenance, etc. If a nursery was attached to the village an additional 50 man days per year would be required. Thus, depending on the number of families in the village, at least two members per family are guaranteed work on a continuous basis within the forest plantation. They are paid according to the prevailing minimum agricultural wage. Such labour is recruited exclusively from within the forest village.

4.2. Other facilities

In addition to providing land (4.1.), the FIO provides numerous other inputs and facilities. These include:

- provision of drinking water and electricity free of charge to

each house in the forest village;

- FIO medical team dispensing free medicines and advice to villagers on health, family planning, sanitation, etc.;
- forest village primary school in accordance with the Ministry of Education regulations, text books and uniforms being provided free of cost.
- Monetary incentives for successful establishment of forest plantation trees.

  . payment of a bonus of about US $ 60 for clearing, planting and two weedings of each hectare of allocated land;

  . a reward of about US $ 27 per ha if tree survival is 100 percent after harvesting of agricultural crops and third weeding. (This reward may be graded and related to percentage survival over 75 percent);

  . a bonus of US $ 75 for successfully tending 4.8 ha of forest plantation over 3 years payable at the end of the third year; if tending continues, the villager receives US $ 25 per ha per year for each successful 1.6 ha.

- Transport is provided for

  . taking workers to plantation site;

  . moving construction materials of forest villagers' houses;

  . taking forest villagers' agricultural produce to market.

- Advice on the market performance of various agricultural crops.

Table 2 provides a comparison of cost per hectare to FIO for establishing forest plantation with and without forest villages.

TABLE 2

4.3. Production

Data on the production and income from maize, cassava and kenaf grown in forest plantations in 1981 are given in Table 3.

TABLE 3

The soils especially in the dry northeastern region are generally poor. This tends to exaggerate the competitive interaction between the trees and crops. Thus, often, yields of dryland rice intercropped between the plantation trees tend to be the best in the first year. Yields decline markedly in successive years. Photographs of a teak + eucalyptus + rice plot during the first and second years of cropping, given as Fig. 3A and 3B respectively, illustrate this point.

FIG. 3A
FIG. 3B

Production of upland rice is typically of the order of 0.5 - 1.5 tonnes per hectare per year. Generally, the rice produced is used for home consumption although occasionally some of it may be sold to raise cash. This is also the case with pigs and chickens.

In 1981, the forest villagers earned an average of US $ 266 per family from the sale of agricultural crops grown in forest plantation and in their home gardens.

Added income from rewards, bonuses and daily wages from forest plantation operations gave a total income of US $ 693 per family per year (Table 4) or US $ 10.38 per person per month.

TABLE 4

Estimates of timber production from the plantations based on local experience are 75 m^3 per ha in a 40 year rotation of teak and 75 m^3 from a 15 year rotation of Eucalyptus.

5. SYSTEM EVALUATION

5.1. Rate of growth

The original target was to start with 2000 forest villages covering

32,000 ha (at the rate of 1.6 ha per family per year, and 100 families in each village), increasing progressively to 4,500 villages undertaking plantation establishment in 73,000 ha annually by the year 2000. However, by 1981, there were only 26 such villages, which undertook planting in a total of about 4,000 ha per year. Thus, the scheme has not been able to accomplish the target at expected levels.

5.2. Merits

1. The forest village system is proving to be a successful but slow method of ensuring the long-term improvement of national and export wood sources.
2. The rehabilitation of the country's forest resource is being achieved by people who would normally be engaged in the present destructive practice of shifting cultivation.
3. Opportunities are provided for landless people to form settled communities. Long term employment, raising food and cash crops, and better health and education facilities result in a higher standard of living for the forest villagers. This is especially important in the strategic border areas that are prone to the destabilising insurgency activities.

5.3. Weaknesses/constraints

1. Enforcing the policy of forest reserves becomes difficult and expensive where forest land is still plentiful. Shifting cultivators are still able to operate illegally and it is difficult to induce them to settle in a forest village.
2. The initial years in a forest village can be hard and frictions can arise with other families in the village(5). This is often compounded by a cash flow problem since payments of rewards, bonuses,

etc. are not made till the end of the first year of participation.

3. Some forest villagers find the pay and other financial incentives low resulting in their deserting the forest village and seeking employment elsewhere.
4. Setting up large numbers of forest villages with free electricity, water, schools, medical facilities and other financial incentives requires a significant amount of capital expenditure.
5. Often funds are not available because of misunderstandings about the inclusion of social welfare expenditures in reforestation projects.
6. Some selfish politicians and unscrupulous businessmen undermine the concept of forest villages in order to ensure the availability of cheap labour force at their disposal.
7. Some reforestation sites are on steep slopes and the forest villagers find it difficult to cultivate and harvest their crops. Also, some soils are very poor and this results in minimal yields of agricultural crops.
8. There is a scarcity of capable managers (conversant with forestry, agriculture, administration and sociology) to take charge of forest villages.

5.4. Potential

The concept and philosophy of forest villages represent a sound approach to tackling the problems of shifting cultivation vis-a-vis land degradation. The benefits accrued from the scheme can, however, be enhanced by removing the observed bottlenecks and constraints as far as possible and improving the efficiency of working through appropriate technological interventions and social improvements. For example, providing forest villagers with improved varieties of seeds, appropriate types of fertilizers and sound advice on their proper use, credit facilities,

social facilities such as realistic rates of pay, bonuses and rewards, and so on, increasing the area of home gardens from the present rate of 0.16 ha per family to a more acceptable size, etc.

Todate the forest village system has proved to be a sustainable system although the growth of the system has been slow due to the various problems mentioned earlier. Suggested improvements in the system should assure the system's sustainability i.e. attracting shifting cultivators to settle down and help rehabilitate the degraded forest lands. This provides long term employment and better living standards and thus the shifting cultivators are prompted to stay within the ambit of the system. The system should be thought of as a multi-product enterprise rather than a system that provides supplementary income through forest land tenancy.

The forest village system has been tried successfully in various countries e.g. Kenya, Gabon, Uganda, India, Nigeria and Cambodia. Although it is more expensive than traditional taungya system it is particularly suitable for countries with a large natural forest resource and high numbers of shifting cultivators and other landless people. The system envisages the sustainable use of forest land for food production by landless people who would otherwise be engaged in forest destruction. Thus, it encompasses the concept of sound agroforestry approach to providing a viable alternative to resource-depleting and environmentally degrading shifting cultivation (9, 10). With appropriate technological back up and infrastructural improvement, the system can prove itself to be quite acceptable and adoptable under other situations with comparable land use problems and socio-cultural constraints.

5.5. Research needs

The foregoing analysis of the functioning of the system reveals that the major constraints to its effective functioning are both biological (technological) and socio-cultural. Whereas some of the socio-cultural problems are so intimately tied up with the general situation in the country and hence cannot easily be overcome, there are certain biological constraints that can be tackled effectively through research efforts. In fact it is a serious drawback of the scheme that research input has not been built into its operational framework so that the management techniques are based on the knowledge that was available at the time of project formulation. Moreover, no effective system exists for mitigating some of the simple problems through research-supported "mid-term corrections". Some of the issues that can be tackled through simple research are:

- the role of fast-growing nitrogen fixing multipurpose woody species in association with plantation trees;
- use of manures and fertilizers, at least to a limited scale, for ameliorating soil fertility decline that occurs after the first year of cropping;
- adjustment of planting patterns and management schedules of the plantation (forestry) species in relation to agricultural crops so as to facilitate profitable cultivation of agricultural species for as long a time as possible;
- use of appropriate varieties of crop species adapted to specific situations such as low light availability, soil reactions (acidity, salinity), soil conditions (poor drainage, low fertility), and so on;
- monitoring the visual interaction effects between the tree and the herbaceous components in order to devise appropriate ways to overcome some of the negative interaction effects to the extent possible even during the life of the project.

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Table 1: Plant species other than the common agricultural species found in forest villagers' homegardens and their functions/uses

Species	Functions/Uses
Areca catechu	masticatory nut
Artocarpus spp.	fruit, vegetable
Bambusa spp.	construction, mats, furniture
Calamus spp.	furniture, baskets, mats
Citrus spp.	fruit
Cocos nucifera	food, oil, thatching, fuel
Dendrocalamus spp.	construction, mats. furniture
Desmodium pulchellum	insent repellent
Imperata cylindrica	roofing grass
Magnifera indica	fruit, shade
Moghania strobilifera	insect repellent
Morus spp.	sericulture, fuel
Musa spp.	fruit, mulch
Psidium guajava	fruit
Saccharum spp.	food
Thyrsostachys spp.	construction, furniture, mats

Table 2: Cost (US $ per hectare) of establishing FIO forest plantation in Thailand with and without the Forest Village scheme[1]

	Without Forest Village		With Forest Village	
	Teak	Non-teak	Teak	Non-teak
First Year				
Labour	205.60	235.05	71.20	82.07
Administrative cost	287.28	287.28	287.28	287.28
Fixed cost (house, machinery, etc.)	74.00	74.00	74.00	74.00
[2]Stump or seedling and re-planting charges[3]	19.57	32.61	17.93	29.89
Forest village expense	-	-	168.29	168.29
Total	586.45	628.94	618.70	641.53
Second Year				
Labour and/or Reward	74.46	95.92	74.46	95.92
Stump/seedling	3.26	8.15	1.63	4.08
Total	77.72	104.07	76.09	100.00
Third Year				
Labour and/or Reward	56.79	68.86	56.79	68.86
Stump/seedling	1.63	4.08	0.82	2.04
Total	58.42	72.94	57.61	70.90
Fourth and Fifth Years				
Maintenance & protection per year	52.45	52.45	52.45	52.45
Total for 2 years	104.90	104.90	104.90	104.90

[1] Daily wage rate per labourer = ฿ 38; 1 US $ = ฿ 23

[2] Cost per teak stump = US $ 0.03; cost per non-teak seedling = US $ 0.04

[3] Replanting at the rate of 20% in "Without Forest Village" and 10% in "With Forest Village".

	Without Forest Village		With Forest Village	
	Teak	Non-teak	Teak	Non-teak
Sixth to Tenth Years				
[4] Maintenance & protection per year	20.65	20.65	20.65	20.65
Total for 5 years	103.25	103.25	103.25	103.25
GRAND TOTAL FOR TEN YEARS	930.74	1,014.10	960.55	1,020.58

[4] Thinning cost is not included as the output from thinning will cover the expenses involved.

Table 3: Area and total value of produce of the three agricultural crops grown in the forest village scheme in Thailand in 1981

Crop	Area of cultivation in plantation (ha)	Income (US $)
Maize	1,661	163,568
Cassava	1,782	75,874
Kenaf	380	49,348

Table 4: Income from the FIO forest village scheme in different regions of Thailand*

Region	No. of villages	Mean No. of families per village	Mean Area (ha) cultivated per village	Mean Area (ha) cultivated per family	MEAN INCOME (US $) FOR 1981					
					PER VILLAGE					Income per family
					From agricultural crops	Reward	Bonus	Daily	Total	
North	16	60.94	109.03	1.79	15,493	5,618	1,767	24,865	47,743	783.44
Northeast	6	64.67	315.05	4.87	20,888	2,948	1,696	19,634	45,166	698.41
South	4	41.75	98.87	2.15	8,246	4,526	652	21,489	34,913	321.54
Weighted means	-	58.85	153.63	2.56	15,623	4,909	1,697	23,139	41,868	692.76

* In 1981 there were a total of 1530 families cultivating a total of 3994 ha in different regions of Thailand.