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TREE PLANTING AS A PROFITABLE ECOLOGICAL STRATEGY

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ABSTRACT

We discuss the possibility of afforestation schemes by the private sector in Thailand. Data extrapolated from India suggest that these should be financially extremely lucrative. They would also go a long way toward revegetating land that is lying unproductive. Implemented around protected areas, they would alleviate rural poverty to a very large extent, reducing pressure on these areas. The major problems in implementation in Thailand are the lack of experience in intensive forestry in the country, and financing for demonstration projects.

INTRODUCTION

With increasing deforestation, large tracts of land in Thailand lie barren without being put to productive use. In most instances, these lands have suffered heavy erosion, are no longer suitable for agriculture, and may be only marginally useful for grazing. Forestry statistics indicate that 31% of the country's area is neither agricultural nor forested; a significant proportion of this includes degraded land. Deterioration of Thailand's existing forest resources will continue, as long as there is demand for timber and charcoal. Total protective measures can never be implemented since there is a genuine need for these forest products. This problem now affects wildlife resources in parks and sanctuaries, as well as watersheds and timber resources.

Reforestation efforts by the Royal Forest Department (RFD) have been relatively modest, with approximately 357,200 ha having been planted by 1983 (RFD, 1984). Most of this reforestation has been done with valuable timber species such as teak which can be harvested only after 20 to 40 years, or exotics such as *Eucalyptus* (Myrtaceae), or else for watershed rehabilitation. The most productive approach to reforestation of degraded lands should involve the private sector, but private investment has so far been discouraged because teak and other 'high-profit' species generally used in plantation schemes give a return on the original investment only after an unacceptably long period of time. Recently, however, fast-growing casuarina plantations have sprung up near Bangkok, and these point the way to other possibilities for the future.

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It is worthwhile here to discuss some recent schemes in India which show that reforestation on really degraded land is not only feasible, but can also be commercially very attractive. We summarise the salient results from India below, and use these to project the economic feasibility of similar schemes in Thailand.

SUMMARY OF INDIAN DATA

Arguably, the most successful reforestation scheme in India is located at Auroville, an international community sponsored by UNESCO, about 6 km north of Pondicherry in Tamilnadu State. The area is coastal and receives about 125 cm of rain per year. The soil varies from sandy to pebbly, and extensive erosion has occurred in the past, creating ravines as deep as 25 m. Detailed descriptions of both the area and the precise nature of the work being carried out are given in Ali (in press).

The afforestation techniques practised at Auroville differ from conventional ones mainly in the extra effort put into land preparation and protection of the trees after planting. While precise details vary from site to site the following summarises the general technique. Firstly, the land is 'bunded' along the contours, with a 30-cm-high bund for every 30 cm contour. There are also bunds that connect the contours, dividing the area into 0.25 ha blocks. Next, live fencing is planted to keep out goats and cattle. Pits $40 \times 40 \times 40$ cm in dimensions are dug, and filled with finely sieved topsoil and manure. Seedlings about 4 months old are planted at the beginning of the rainy season, and weeding and mulching are done twice during the first year. During very dry spells the trees are watered. Casualties are replaced both in the second and third years. Table I gives a breakdown of the labour per year required by each operation, estimated from the India data, for Thai conditions.

The trees planted are not the conventional ones used by the Tamilnadu Forest Department, but are fast-growing varieties. Out of 106 species tried, 3 are particularly promising: *Acacia auriculiformis* (Leguminosae), which had measured growth rates of up to 35 m^3/ha/yr for 9-year old trees, *Khaya senegalensis* (Meliaceae), a fast-growing timber species which produced 23 m^3/ha/yr measured over 5 years, and *Albizia lebbeck* (Leguminosae) which produced an estimated biomass of 17 m^3/ha/yr for 10-year old trees. Other promising species include *Kigelia pinnata* (Bignoniaceae) and *Cassia siamea* (Leguminosae). Given the climatic similarities between peninsular India and Thailand, there is no reason that these trees should not grow equally well here: *A. auriculiformis* observed in Bangkok seem to grow faster than in India. However, we stress that indigenous species should be used to the maximum extent possible. For the economic analysis presented in Tables 2 and 3, we assume that a properly maintained plantation can produce 15 m^3/ha/yr of wood or 1500 poles/ha over 5 years, and 20 m^3/ha/yr over 10 years for light timber.

PRODUCE PRICES IN THAILAND

There is no market as such for firewood. Charcoal sells for 5 baht per kg in

Table 1. Parameters used in constructing economic model. M-D = man-days; quantities are in bahts.

	LOW PRICES	HIGH PRICES
BUNDING M-D/HA.	200	
FENCING M-D/HA.	0	
PIT PREP M-D/HA.	200	
PLANTING M-D/HA.	50	
WATERING M-D/HA.	0	
WEEDING M-D/HA.	20	
WATCH M-D/HA.	0	
AREA (ha)	10	
COST/M-D (BAHT)	70	
INTEREST RATES	17%	
COST/M3 TIMBER	1800	4100
COST/UNIT POLES	180	220
COST/M3 WOOD	774	774
LAND COST	0	

Saraburi and Bangkok. One ton of wood produces between 218 and 310 kg of charcoal. The mean yield for five different processes is 258 kg (ROSS & DONAVAN, 1984), having a market value of 1290 baht. Given that a cubic metre of wood weighs approximately 600 kg, the market value of charcoal produced would be 774 baht per m^3 of wood. Timber prices for species other than teak or dipterocarps range from 1800-4100 baht per m^3, and poles measuring 15 cm in diameter and 6 m high cost between 180-220 baht per pole.

Using the above prices, Tables 2 and 3 illustrate the expected economic feasibility of a 10-ha plantation in Thailand, assuming growth rates similar to those in India. Table 2 shows the expected income based on the minimum market prices for timber and poles in 1984, and Table 3 repeats the calculation using the maximum prices. No effort has been made to project inevitable price increases over the next decade, and so these figures represent very conservative estimates for the expected profit margins.

The first returns on investment would be realised in Year 5, at which time the plantation would be thinned from 2500 trees/ha to 625 trees/ha. These would then be sold as either poles or as charcoal; we have used poles as an example in the tables. Returns on investment might come in earlier than the fifth year if fruit trees are included in the planting scheme. The projected returns at Year 5 is between 1.5 and 3 times the original investment. Harvest in the 10th year would bring a return of up to 11.5 million baht on an original investment of about 650,000 baht, excluding land prices. The internal rate of return across the price range is between 62-74%, making it an extremely attractive investment.

Table 2. Cost-benefit projection (in bahts) assuming low prices, using parameters from Table 1.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
BUNDING	140000	14000	0	0	0	0	0	0	0	0	154000
LAND COST	0	0	0	0	0	0	0	0	0	0	0
FENCING	0	0	0	0	0	0	0	0	0	0	0
PIT PREP	140000	0	0	0	0	0	0	0	0	0	140000
PLANTING	35000	3500	0	0	0	0	0	0	0	0	38500
WATERING	0	0	0	0	0	0	0	0	0	0	0
WEEDING	14000	0	0	0	0	0	0	0	0	0	14000
WATCH	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	329000	17500	0	0	0	0	0	0	0	0	346500
INTEREST	0	55930	68413	80043	93651	0	0	0	0	0	298037
TOTAL COST	329000	73430	68413	80043	93651	0	0	0	0	0	644537
WOOD PRODUCTION	0	0	0	0	0	0	0	0	0	0	
POLE PRODUCTION	0	0	0	0	1500	0	0	0	0	0	
TIMBER PRODUCTION	0	0	0	0	0	0	0	0	0	20	
INCOME, WOOD	0	0	0	0	0	0	0	0	0	0	0
INCOME, POLES	0	0	0	0	2700000	0	0	0	0	0	2700000
INCOME, TIMBER	0	0	0	0	0	0	0	0	0	3600000	3600000
TOTAL INCOME	0	0	0	0	2700000	0	0	0	0	3600000	6300000
NET PROFIT	−329000	−73430	−68413	−80043	2606349	0	0	0	0	3600000	

Internal Rate of Return = 62.54%

Table 3. Cost-benefit projection (in bahts) assuming high prices, using parameters from Table 1.

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6	YEAR 7	YEAR 8	YEAR 9	YEAR 10	TOTAL
BUNDING	140000	14000	0	0	0	0	0	0	0	0	154000
LAND COST	0	0	0	0	0	0	0	0	0	0	0
FENCING	0	0	0	0	0	0	0	0	0	0	0
PIT PREP	140000	0	0	0	0	0	0	0	0	0	140000
PLANTING	35000	3500	0	0	0	0	0	0	0	0	38500
WATERING	0	0	0	0	0	0	0	0	0	0	0
WEEDING	14000	0	0	0	0	0	0	0	0	0	14000
WATCH	0	0	0	0	0	0	0	0	0	0	0
SUBTOTAL	329000	17500	0	0	0	0	0	0	0	0	346500
INTEREST	0	55930	68413	80043	93651	0	0	0	0	0	298037
TOTAL COST	329000	73430	68413	80043	93651	0	0	0	0	0	644537
WOOD PRODUCTION	0	0	0	0	0	0	0	0	0	0	
POLE PRODUCTION	0	0	0	0	1500	0	0	0	0	0	
TIMBER PRODUCTION	0	0	0	0	0	0	0	0	0	20	
INCOME, WOOD	0	0	0	0	0	0	0	0	0	0	0
INCOME, POLES	0	0	0	0	3300000	0	0	0	0	0	3300000
INCOME, TIMBER	0	0	0	0	0	0	0	0	0	8200000	8200000
TOTAL INCOME	0	0	0	0	3300000	0	0	0	0	8200000	11500000
NET PROFIT	−329000	−73430	−68413	−80043	3206349	0	0	0	0	8200000	

Internal Rate of Return = 73.70%

MAKING A START

In an effort to understand the practical 'on-the-ground' difficulties of implementing such a scheme as part of a rural development project, we visited a small village, Ban Sap Tai, located on the northwest boundary of Khao Yai National Park, Nakhon Ratchasima Province. Ban Sap Tai offers an ideal location for a demonstration project as it is virtually deforested, contains derelict land, has a history of illegal encroachment within Khao Yai Park and is the site of a new 'rural development for conservation' project being implemented by private organisations in cooperation with the Royal Forest Department.

Presently, all of the approximately 90 households in the village make their own charcoal, with much of the wood coming illegally from Khao Yai Park. Likewise, timber for the construction of houses and other structures has traditionally come from the park. Much of the land now under cultivation is located on steep slopes, and in the absence of soil conservation measures crop yields have declined by 40% over 30 years, according to one local estimate.

In April this year, we discussed the possibility of a plantation scheme with the village headman. He gave his full support, and is prepared to contribute 3 ha of his own holdings to a cooperative venture with other households. He expressed confidence in gaining village support. However, three major difficulties came to light which need to be addressed before embarking on the project.

The lack of expertise in Thailand for this sort of high-input forestry is one of the problems. Neither the RFD nor private organisations have the knowledge or experience to teach proper techniques to the villagers, and initially some outside help will have to be provided, on short-term contracts. Because of its past successes, Auroville appears to be the best place to recruit this expertise.

The second and most important difficulty is securing start-up funds. Total expenditures for the first 5 years of operations at Ban Sap Tai are estimated to be approximately 351,000 baht, involving mainly labour costs. Approximately 115,000 will be required in the first year. It is unrealistic to expect even the ultimate beneficiaries to contribute labour, because the benefits are not immediately tangible and because they are busy with their own agricultural fields at the same time. Village lending sources require annual repayment and are therefore not available for a venture of this kind. Thus institutions such as UNEP and USAID would need to get involved. Once the project is shown to be successful and highly profitable-local banks might be approached to extend the project into other areas.

The most important change in attitude that is required, however, will be to convert these poor farmers to a system requiring longer term planning and higher capital investment than the one they have been used to. Currently, no farmer in this area implements soil conservation measures on his fields, in spite in recognising that this leads to erosion and long-term reduction in crop yields. Only demonstration and education can achieve this.

This does not imply that 5 to 10 years must pass before the program can be expanded. The first year of operation is the most critical. It is during this time that intensive labour is required to ensure proper growth and low mortality. (In Auroville, average survival for the first year was over 90 per cent.) The plantation becomes essentially self-maintaining after the second year, the only labour involved being maintenance of firebreaks during the January to May dry season. Thus, traditional lending sources could be approached after two years, at which time the high-risk period has passed and the project is shown to be viable. The Population and Community Development Association, which coimplements the ongoing rural development program in Ban Sap Tai, has 16,000 other project villages throughout Thailand and could serve as an administrative vehicle for programme expansion.

The plantation scheme has potential for making a very significant impact on conservation. Introduced into villages which traditionally rely on timber from national parks and other protected areas, the scheme would not only lessen the need for continued poaching of timber but would also make a substantial contribution to village living standards. Village poverty is one of the basic causes for abuse of protected areas. In addition to the obvious benefits of replacing derelict land with tree cover, the soil conservation techniques employed can also point the way to similar practices on agricultural land, discouraging shifting cultivation which is prevalent in the area. In conclusion it hardly needs to be stated that the money-making possibilities of such a scheme falls right within the free-enterprise philosophy of the Thai people.

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