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# Development Issues

## *The controversy surrounding eucalypts in social forestry programs of Asia*

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Key to symbols used in tables

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| n.a. | Not applicable |
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# abstract

Social forestry emerged amidst important changes in thinking about the role of forestry in rural development and a growing need for fuelwood. In an attempt to alleviate the fuelwood crisis, the World Bank encouraged the planting of *Eucalyptus* species in its social forestry programs in the 1980s. Eucalypts were the chosen tree species for the majority of social forestry projects because they survive on difficult sites and out-perform indigenous species and most other exotics in height and girth increment, producing wood for poles, pulp and fuel more rapidly. But, despite the benefits that eucalypts can bring to developing countries, the introduction of the species in social forestry projects has not been without controversy.

This paper reviews two controversial social forestry projects—one in Karnataka, South India, and the other in Tung Kula Ronghai, North-east Thailand—based on *Eucalyptus* species that resulted in social protest. In doing so, this paper aims to determine why these projects failed to bring benefits to the communities involved and what it was that caused these communities to protest. In both cases, it was found that criticisms levelled against eucalypts were expressed in ecological terms. Eucalypts do have some adverse ecological impacts on soil nutrients, water hydrology, biodiversity and wildlife, but protests against the tree conceal the real reasons for anxieties about the planting of eucalypts—inappropriate use without due consideration for community needs. Both projects resulted in social concerns such as the loss of agricultural land for food production, reductions in rural employment, diversion of forest products from local markets to larger industrial users, and the transfer of public or common land to private corporations. The failure of eucalypts to meet the social objectives of social forestry policies were found to outweigh any of the technical and ecological criticisms against the tree and *Eucalyptus* became a symbol and rallying point of grass roots resistance to government meddling, poor project planning and management. Lessons to be learned from the failings of the Karnataka and Tung Kula Ronghai social forestry projects will be drawn and couched within the framework of ecologically sustainable development. Whilst both projects caused unnecessary hardship to those communities involved, much can be learnt from the failings of

## Abbreviations

| | |
|---|---|
| ADAB | Australian Development Assistance Bureau |
| ACIAR | Australian Centre for International Agricultural Research |
| CSIRO | Commonwealth Scientific & Industrial Research Organisation |
| DAE | Department of Agricultural Economics |
| DLD | Department of Land Development |
| ESD | Ecologically Sustainable Development |
| FAO | Food and Agriculture Organisation |
| LDD | Livestock Development Department |
| ODA | Overseas Development Administration |
| RFD | Royal Forest Department |
| RTG | Royal Thai Government |
| SIDA | Swedish International Development Agency |
| TATKRP | Thai-Australia Tung Kula Ronghai Program |
| TKR | Tung Kula Ronghai |
| URC | Upland Reforestation Component |

## Glossary of Thai terms

| | |
|---|---|
| Amphoe | District |
| Changwat | Province |
| Nai Amphoe | Government appointed District Officer |
| Rai | Unit area of land |
| Tambon | A group of villages |
| Tung | Plain, and a volumetric measure equivalent to about 10 kilograms of paddy |

## Thai equivalents

| | |
|---|---|
| A$1.00 | = Baht 20,000 |
| 1 *rai* | = 0.16 hectares |
| 1 t*ung* | = 10 kg paddy rice |

# the controversy surrounding eucalypts in social forestry

The term social forestry, often used interchangeably with community forestry, emerged in the middle of the 1970s amidst important changes in thinking about the role of forestry in rural development. The terms refer to a broad range of tree or forest related activities undertaken by rural landowners and community groups to provide products for their own use, and for generating local income (Gregerson 1988:24). Social forestry may also include governments or other groups planting trees on public lands to meet local community needs.

Social forestry was defined by the United Nations Food and Agriculture Organisation (FAO) in 1978, as 'any situation which intimately involves local people in a forestry activity'. The term initially embraced a spectrum of situations including woodlots in areas which were short of wood and other forest products for local needs; the growing of trees at the farm level to provide cash crops; the processing of forest products at the household, artisan or small industry level to generate income; and the activities of forest dwelling communities (FAO 1978).

In the 1970s social forestry was seen to comprise three main elements (FAO 1978). These were

- the provision of fuel and other goods such as poles, essential to meeting basic needs at the rural household and community level
- the provision of food and the environmental stability necessary for continued food production
- the generation of income and employment in the rural community.

The FAO stressed that social forestry must be an integral part of rural development and the basic precept that the central purpose of rural development is to help the poor become self-reliant (FAO 1978). Forestry for community development was to

be, therefore, forestry for the people and involving the people or, in the words of the FAO (1978), 'forestry which starts at the grass roots'. From its inception, community forestry was, by definition, participatory and directed towards rural needs—in particular the needs of the rural poor (Arnold 1992:3).

## Social forestry and the fuelwood crisis

Two of the main factors underlying the emergence of the concept of social forestry in the mid 1970s were concerns about the 'poor man's energy crisis' and 'desertification' (Weirsum 1994:5). To overcome these problems increased rates of reforestation were considered essential (see Spears 1983). Early initiatives tended to focus on those issues perceived to be of particular importance. Of these, the fuelwood shortage became byfar the most important as it had been estimated that wood provided roughly 20 per cent of all energy in Asia and Latin America, and that about 50 per cent of all energy in Africa was wood generated (Arnold 1992:7). Early analyses emphasised the huge numbers of people affected, the apparent 'gap' between demand for fuelwood and sustainable supplies—and a seemingly exponential growth in demand with population growth—and the growing burden placed on users of having to search ever further afield for fuelwood and of having to divert crop and animal residues needed for soil restoration or livestock feed to fuel use ( Eckholm 1975).

The fuelwood situation was also widely considered to be contributing to a third area of concern—declining productivity of food production systems and deterioration in land use. Deforestation and excessive removal of trees from many agricultural landscapes were increasingly seen to be critical components of this process, and demand for fuelwood was identified as being one of the main causes of deforestation. An extreme example was the accelerated reduction in tree cover in Sahelian countries during and after the prolonged period of drought in the 1970s, and in the Himalayas prior to disastrous flooding in the plains of South Asia in 1977. Cases such as these served to underline such thinking (Arnold 1992:2).

Many early social forestry projects therefore took shape as responses to an energy supply / demand problem but neglected other elements of social forestry stressed by the FAO (1978) such as: the provision of food, environmental stability, generation of income and employment. As a consequence, a very large part of the initial investment in community forestry was in the form of afforestation projects to increase fuelwood supplies. These perceived imperatives had the effect of limiting the early community forestry effort to the establishment of new plantations and fuelwood—only a rather narrow part of the spectrum of linkages between people and trees that had been identified initially.

## Eucalypts in social forestry projects

In an attempt to alleviate the fuelwood crisis, the World Bank started to encourage the planting of *Eucalyptus* species in its social forestry programs in the 1980s. Most of these projects were implemented in the Asia region in countries such as India, the Philippines, Pakistan and Nepal.

According to the Australian Centre for International Agricultural Research (ACIAR), more than 600 species of eucalypts are known, and new ones are still being identified (ACIAR 1992:1). The species is found in almost all of the major habitat types in their native Australia, and a few species occur as natives in Papua New Guinea, Indonesia and the Philippines (Davidson 1993:35). But, despite the proliferation of the species, only a few eucalypt species are used in social forestry projects worldwide. The most common species used for commercial and social forestry projects include: *E. grandis, E. camaldulensis, E. tereticornis, E. globulus, E. urophylla, E. viminalis, E. saligna, E. deglupta, E. exserta,* and then either *E. citriodora, E. paniculata or E. robusta* (Davidson 1993:36). Of these, the first four mentioned are by far the most important on a world basis and this paper only refers to two eucalypt species namely *Eucalyptus camaldulensis* and *Eucalyptus tereticornis*.

In the tropics and sub-tropics eucalypts are often judged to be faster growing than other hardwood species and the most likely to survive on difficult sites (FAO 1988:2). The species are believed to out-perform indigenous species and most other exotics in height and girth increment, producing wood for poles, pulp and fuel more rapidly. They are easy to cultivate, unpalatable to stock (and therefore easy to protect), tolerate sites of low inherent nutrient status (and so require little fertiliser), drought resistant, coppice readily, produce a superior short-length fibre for paper-making, make excellent charcoal, and useful for shelterbelts, erosion control, land reclamation and drainage. Moreover, eucalypts have many uses in social forestry as they can be used for firewood, poles, shelter and amenity planting export (Midgley and Pinyopusarerk 1995:1). Valuable non-wood forest products such as honey, tannins and essential leaf oils can also be derived from the tree.

As a group, eucalypts have proven themselves to be extremely successful in a large number of countries. They have been used, for example, as the basis of massive plantings in Brazil to supply charcoal to the steel industry and fibre for the pulp and paper industry. In the highlands of Bolivia, Peru, Ecuador and parts of Colombia, eucalypts are planted for fuelwood and erosion control. They have also been widely planted in Ethiopia and other parts of Africa and are a major feature of the landscape in southern China (Turnbull 1987:1).

## Eucalypts in Asia

Deforestation has been particularly severe in Asia and the Pacific. In a recently completed Forest Resource Assessment of tropical countries, the FAO (1993) estimated that the rate of deforestation in the region between 1981 and 1990 was 3.9 million ha per year, or 1.2 per cent yearly. In response to deforestation, the rate of fast-growing eucalypt plantation establishment has rapidly increased. During the period 1981–90 the area of forest plantations in the tropics is reported to have increased by an estimated 2.6 million ha yearly to reach a total gross area of 43.8 million ha. About 85 per cent of that area was established in just five countries: India, Indonesia, Brazil, Vietnam and Thailand (Ball 1993:16). About 40 per cent of all trees in plantations in the tropics are of Australian origin, and most of these are eucalypts (ACIAR 1992:1). Over four million ha of *Eucalyptus* plantations now exist in India, Thailand, Vietnam, and elsewhere in the Asia region (Table 1).

Despite the wide propagation of eucalypts in Asia, and the species ability to adapt to a wide variety of sites and supply fuelwood, the use of eucalypts in social forestry programs has not been without controversy. During the 1980s social protest arose, first in India and later elsewhere in the Asia region, over the alleged adverse effects of eucalypts on soil nutrient status, soil water relations, soil erosion and wildlife. The tree became the focus of attention in the local and international media with newspaper headlines such as: '*Eucalyptus*—Disastrous Tree for India', 'Indian Protest on *Eucalyptus* Plantings', 'Beware of the Gumnuts', World's Saviour or a Menace?', 'Overseas Prejudice against Australia's Eucalypt is Growing', 'Third World Maligns Killer Gums', and 'Critics Threaten Eucalypt Industry'.

In considering objections to the environmental and social effects of *Eucalyptus* plantations in Asia, it is important to identify whether objections are to the effects of *Eucalyptus* as a species, to the ecological effects of the plantation or whether complaints about the species are in fact concealing other socioeconomic grievances. This paper sets out to

- determine what these other grievances are by examining two controversial social forestry projects, one in Karnataka, India, and the other in Tung Kula Ronghai, North-East Thailand
- determine why the eucalypt became the subject of debate and regarded as the cause of social protest in countries such as India and Thailand
- draw upon these case studies to determine lessons to be learned which can improve the performance of future social forestry projects involving eucalypts and help improve the standard of social forestry project planning and design.

It will be argued that criticisms levelled against eucalypts, usually expressed in ecological terms, often conceal the real reasons for anxieties about the planting of eucalypts—inappropriate use without due consideration for community needs. Whilst

Table 1 **Areas planted with *Eucalyptus* species in the Asia region** (hectares)

| | |
|---|---|
| Bangladesh | 12, 000 |
| China | 670, 000 |
| India | 2 ,500, 000 |
| Indonesia | 80, 000 |
| Laos | 62, 500 |
| Malaysia | 8,000 |
| Myanmar | 40 ,000 |
| Nepal | 8 ,000 |
| Pakistan | 10 ,000 |
| Philippines | 10 ,000 |
| Sri Lanka | 29 ,000 |
| Thailand | 195 ,000 |
| Vietnam | 350 ,000 |

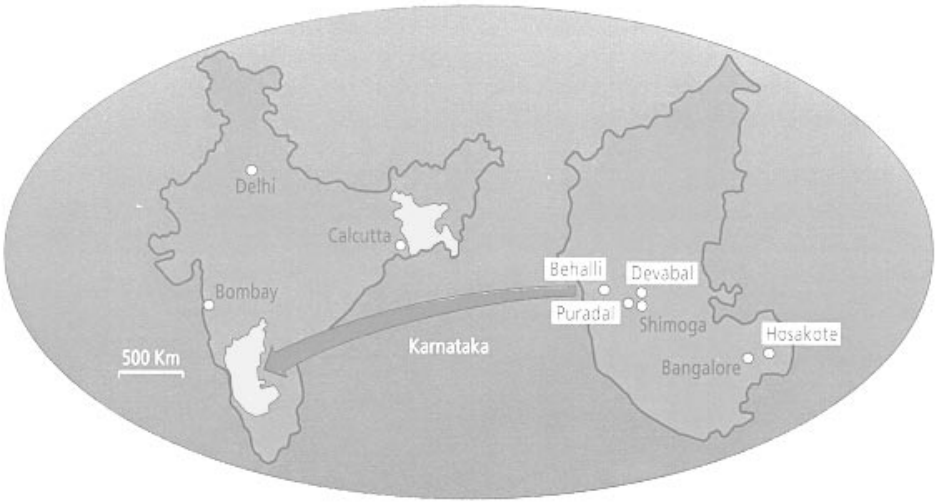
**Source** Midgley S & Pinyopusarerk K 1995. *The Role of Eucalypts in Local Development in the Emerging Economies of China, Vietnam and Thailand,* Joint Australian / Japanese Workshop, CSIRO Division of Forestry, Canberra

eucalypts do have some adverse ecological impacts, the failure of eucalypts to meet the social objectives of farm and community forestry policies outweigh any of the technical and ecological criticisms. Social concerns such as the loss of agricultural land for food production, reductions in rural employment, diversion of forest products from local markets to larger industrial users, and the transfer of public or common land to the state, have all led to further imbalances in the distribution of wealth in poor rural communities. In the Karnataka and Tung Kula Ronghai social forestry projects *Eucalyptus* became a symbol and a rallying point of grass roots resistance to government meddling, poor project planning and management.

## The eucalypt controversy in Karnataka, India

Most literature on the eucalypt debate stems from India where there has been an acrimonious debate on issues related to social forestry as a strategy for providing impoverished rural dwellers with fuelwood. This section will review the literature on the *Eucalyptus* debate surrounding a social forestry project in Karnataka, India in an attempt to determine why the project failed to bring benefits to the local community and what caused the local community to protest against the tree.

Figure 1 **Karnataka in Southern India**




**Source:** Calder I., 1994. *Eucalyptus, Water & Sustainability—A Summary Report*, ODA Forestry Series No.6, ODA, London.

## A short history of eucalypts in India

Eucalypts were first introduced to India in 1790 when a number of species were planted in the palace garden at Nandi Hills near Mysore (FAO 1979:80). Regular trials were started in 1843 when Captain Cotton of the Madras Engineers successfully introduced *Eucalyptus globulus* at Wellington in the Nilgiri hills to alleviate a fuel shortage in the area (Boland 1980:1). In addition, it is thought that eucalypts were introduced by the East India Company into several botanic gardens, near old British Hill Stations and around military cantonment areas for ornamental purposes (1980:1).

Among all the species so far tried in India, the Nandi provenance of *Eucalyptus tereticornis*, popularly known as Mysore hybrid or Mysore gum, has been the most widely used species for raising plantations in denuded and barren areas and also for replacing low-value natural crops. The species was first raised on a plantation scale in Karnataka state in 1952 when planted as roadside marker-trees in a *Casuarina equisetifolia* plantation (Boland 1980:1). When it was discovered that eucalypts performed better than *Casuarina*, news spread to other states and the establishment of large-scale eucalypt plantations to meet fuelwood, small timber and pulpwood needs in India commenced from about 1960 onwards (FAO 1979:80). By 1974, it was

estimated that eucalypts had been planted on an area of about 415, 000 ha of land. Around 129, 034 ha of this was planted in Karnataka state alone (1979:80).

## Eucalypts in social forestry

Eucalypts first became a component of India's social forestry program in the 1970s. With financial assistance from the World Bank, large tracts of forest lands, farms, and degraded land in the Indian States of Karnataka, Gujarat, Uttar Pradesh, Punjab and Haryana were planted with eucalypts (Turnbull 1987:1). The largest, and most controversial, social forestry scheme undertaken in India was at Karnataka, in southern India (Figure 1). This project encouraged local people to plant fast growing *E. tereticornis* to supply fuelwood, small timber and other wood products. It was hoped that planting introduced tree species would ease the fuelwood shortage and prevent the indiscriminate destruction of forests for fuelwood by the rural population, 90 per cent of whom were dependent on wood for cooking and heating (Turnbull 1987:1).

In 1983, when the project began, the estimated cost was 37 million pounds (approximately A$80 million). The World Bank was to provide 48 per cent of the funding, the British Overseas Development Administration 40 per cent, and the governments of India and Karnataka the remaining 12 per cent (Joyce 1988:54). The project had two main components—farm forestry, in which farmers planted seedlings subsidised by the Karnataka Forestry Department; and communal planting, in which trees would be planted on community land and government wasteland, on the foreshores of reservoirs, on canal banks and on roadsides (Joyce 1988:55). Farmers showed a great deal of enthusiasm for adopting *Eucalyptus* as a farm crop when the project first began, but their enthusiasm soon waned. Amongst growing concern over the ecological effects of eucalypts, small farmers dug trenches around their fields to isolate them from the adverse effects of neighbouring plantations of eucalypts and with the support of the local farmers union, they uprooted millions of seedlings planted on government land and in state-run nurseries, inserting tamarind and mango seeds in their place (Hall and Percy 1986:53).

## Some ecological concerns

Since the *Eucalyptus* controversy began, numerous accounts of the adverse ecological effects of *Eucalyptus* cultivation have emerged. The most scathing criticism of the social forestry project undertaken at Karnataka came from Vandana Shiva and Jayanta Bandyopadhyay of the Research Foundation for Science, Technology and Natural Resources, Dehra Dun. In a report entitled '*An Ecological Audit of Eucalyptus Cultivation*', Shiva and Bandyopadhyay argue that the spread of *Eucalyptus* on rainfed

land is 'nothing but an unscientific prescription for desertification' (Shiva and Bandyopadhyay 1987:68). They claimed that eucalypts deplete water supplies and do not regulate the flow of water as well as the native vegetation they may have replaced; deplete the soil of nutrients and produce toxins that kill neighbouring crops; compete aggressively with other vegetation; and displace indigenous species. A list of some of the ecological issues raised by Shiva and Bandyopadhyay in their report on *Eucalyptus* cultivation can be seen in Table 2.

Whilst some of the assertions raised by Shiva and Bandyopadhyay (1987) were not unfounded, most are emotionally charged and based on inadequate scientific data. Their assertions did, however, force the World Bank and ODA to reassess their social forestry program in Karnataka and solicit comprehensive scientific research on *Eucalyptus* cultivation.

Table 2 **Ecological assertions raised in the ecological audit of *Eucalyptus* cultivation.**

| Factor | Issues raised about eucalypts |
|---|---|
| Excessive water use | Lower water table thus having a negative impact on the hydrological water balance. |
| | Dry up streams feeding agricultural land. |
| Soil nutrient depletion | Detrimental effect on fertility and biological productivity of soil. |
| | Nutrient requirements of eucalypts for fast growth excessively high. |
| Soil erosion | Degrade the soil by reducing its fertility. |
| Allelopathy | Leaf extracts, decaying leaves and soil collected under *Eucalyptus* canopies inhibit seed germination and seedling growth of associated species. |
| Desertification | Complex multi-dimensional impacts of eucalypts on soil moisture and ground water, on the soil fertility, on other plant life and on soil fauna undermine potential of land for biological productivity. *Eucalyptus* cultivation therefore creates the threat of desertification. |

**Source:** Shiva and Bandyopadhyay 1987. *Ecological Audit of Eucalyptus Cultivation*, Research Foundation for Science and Ecology, Dehra Dun.

## World Bank and ODA response to growing criticism

In response to Shiva and Bandyopadyay's publication on the ecological effects of *Eucalyptus* cultivation in Karnataka, John Spears (1987:1), the senior forestry adviser in the Agriculture and Rural Development Department of the World Bank at the time of the Karnataka dispute, defended the Bank's role in the project and any future social forestry projects involving eucalypts by arguing that farmers have perceived the potential of the species for fast growth, quick production of poles and fuelwood (a critical issue for developing country farmers and village communities), its ability to coppice and to survive grazing (its leaves are unpalatable to livestock) and the fact that the species survives well on poor sites. He also argued that the species had obvious potential for rapidly contributing to increased rural incomes using poor quality agricultural wasteland that would otherwise remain unproductive. Thus, according to Spears (1987:1), criticism being levelled at the species was mainly due to 'inadequate investigation of the scientific and socioeconomic evidence relating to the advantages and disadvantages of *Eucalyptus* planting'. He did, however, admit that the tree may cause negative results if planted in the wrong place and that the key to its more effective use lay in greater awareness of its advantages and disadvantages, and better planning and supervision of projects which use *Eucalyptus* (Spears 1987:1).

The ODA also appeared to take stock of the socio-economic criticisms made of the Karnataka project. Ron Kemp, forestry adviser to the ODA and involved in the Karnataka project from the start, admitted that the original formulation of the project should have given more weight to the importance of livestock fodder and that, in turn, would have implications for the choice of species because *Eucalyptus* was not suitable for fodder (Joyce 1988:56).

However, as criticism mounted against *Eucalyptus* cultivation, numerous papers were published to provide detailed information on the biogeography and ecology of the more commonly planted eucalypts in an attempt to counteract the claims of critics (See Boland et al. 1980; Florence 1981; Pryor and Johnson 1981; Davidson 1985; Florence 1986; ACIAR1992). Given the space available, this paper can not review the wealth of material that has been published in response to criticism against *Eucalyptus* cultivation but it will review a number of significant publications put out by the FAO and the ODA to dispel rumours against *Eucalyptus* cultivation.

## FAO response to mouting criticism against eucalypts

The FAO reacted to growing concern over the alleged adverse effects of eucalypts by commissioning a study, funded by the Swedish International Development Agency (SIDA), entitled *The Ecological Effects of Eucalyptus* (1985), published as FAO Forestry Paper 59. This paper was later published as *The Eucalypt Dilemma* (1988) as the 1985 document, written by Poore and Fries, was found to be too technical for the non-

specialist. As the content of both reports is more or less the same, only Poore and Fries paper will be reviewed in the present study.

In *The Ecological Effects of Eucalyptus* (1985), Poore and Fries concentrated on the effects on physical and biological features (on micro-and macroclimate, soils, water, and populations of wild animals and plants); and included substitution effects such as the reduction in area of other ecosystems replaced by eucalypts (Poore and Fries 1985:3). The study revealed that young eucalypt plantations do require a large quantity of water and that this can have an adverse effect on nearby crops and cause erosion. Eucalypts were also found to lead to rapid depletion of nutrients in the soil, if harvested on a short rotation, and to have a negative effect on wildlife and plant diversity. Whilst less conclusive, some evidence was also found to suggest that eucalypts produce toxins that inhibit the growth of other plant species. But, on a more positive note, eucalypts were found to provide protection against wind erosion if planted in shelterbelts, reduce eutrophication (algae blooms), and be beneficial to wildlife if planted on treeless land. Planting eucalypt species for fuelwood was also found to prevent further denudation of natural forests. This was particularly evident in Nepal, Addis Ababa, Lome and Antananarivo. A more detailed summary of the studies findings can be found in Table 3.

To minimise the adverse ecological effects of *Eucalyptus* cultivation, Poore and Fries (1985:43) recommended the following strategies.

- Leave nutrient-rich biomass on the site.
- Don't harvest root systems on most sites.
- Remove bark form tree trunks and retain on site wherever possible.
- Use conservative site preparation procedures which minimise disturbance and loss of nutrients and organic matter from slash, litter layers and surface soil.
- Use fertilisers efficiently.
- Use legumes (either inter-cropped or during a fallow period between rotations) to assist in the maintenance of soil organic matter and nitrogen economy.
- Make plantations more favourable habitats for animals and plants by leaving patches or corridors of indigenous vegetation.

The study did not deal in detail with the social and economic effects of eucalypt cultivation, although Poore and Fries (1985:53) strongly recommended that a study on social attitudes to the growing of eucalypts, and the social costs and benefits associated with it, be conducted to complement their study on the ecological impact of eucalypts. They also stressed that the eucalypt had been blamed for the failure of the social forestry program to meet unrealistic expectations (1985:1). Eucalypts had failed to bring immediate solutions to local wood and erosion problems because they were the wrong species on the wrong sites. Blame had therefore fallen on the tree rather than the real culprit—bad forestry practice.

Table 3 **FAO findings on the ecological effect of eucalypts**

| Issue | Positive findings | Negative findings |
|---|---|---|
| Water | Catchments under forest have a lower water yield than those under scrub or grassland; but they may regulate flow better, depending upon the nature of the ground cover. | In the humid tropics, young, rapidly growing eucalypt plantations consume more water, and regulate flow less well, than natural forests.<br>The strong surface roots of some eucalypts mean that they compete vigorously with ground vegetation and with neighbouring crops in situations where water is in short supply. |
| Erosion | Eucalypts planted as shelter belts can provide some protection against wind erosion. | Eucalypts are not good trees for erosion control especially under dry conditions as ground vegetation is suppressed by root competition. |
| Nutrients | In areas planted to eucalypts there is no evidence of changes in soil structure.<br>Eucalypts planted on nitrogen-rich peat have been shown to take up large quantities of nitrogen and could be used for reducing eutrophication (algae blooms). | The cropping of eucalypts on short rotation, especially if the whole biomass is taken, leads to rapid depletion of the reserve of nutrients in the soil. |
| Competition | The effects of reduced light are probably less than those caused by some other broad leaved trees or pines, because of the light shade cast by eucalypt foliage. | In dry conditions, ground vegetation is greatly reduced leaving the soil bare and prone to erosion.<br>Evidence suggests that some eucalypt species produce toxins that inhibit the growth of some annual herbs. |
| Wildlife | Limited plantings of eucalypts in treeless areas and the shelter that these provide can be beneficial to populations of wildlife. | Numbers and diversity of animals are less in exotic eucalypt plantations than in natural forest. |
| Displacement | | Eucalypt plantations largely displace original ecosystems. |

**Source:** Poore and Fries 1985. *The Ecological Effects of Eucalyptus*, FAO Forestry Paper No. 59, FAO, Rome, pp 54–55

Underlying the whole report was the message that local conditions should determine local decisions on eucalypt culture and that any adverse social and ecological effects could be mitigated by careful planning and local consultation (1985:52). Poore and Fries then conclude

> There is no universal answer, either favourable or unfavourable, to the planting of *Eucalyptus*...each case should be examined on its individual merits. We stress that *Eucalyptus* should not be planted, especially on a large scale, without careful and intelligent assessment of the social and economic circumstances...and an examination of the ecological circumstances and needs of the local people (1985:55).

### ODA response to mouting criticism against eucalypts

In 1994, the ODA also released a report entitled *Eucalyptus, Water and Sustainability* which revealed the findings of a comprehensive research programme on the hydrological impacts of eucalypts to increase understanding of the environmental impacts of eucalypts in India (Table 4). For this report, studies of the hydrology of eucalypt plantations, indigenous forest and an annual agricultural crop were initiated at four main sites in Karnataka. Three of these sites were in the low rainfall zone (800 mm per annum), at the Devabal and Puradal experimental plantations near Shimoga, and the Hosakote experimental plantations near Bangalore. The depth of the soils was also different, approximately three metres at Devabala and Puradal and greater than eight metres at the Hosakote site. The fourth site was at Behalli in the high rainfall zone (2000 mm per annum) on deep soils greater than eight metres (Calder 1994:5).

Findings from the study were more in favour of eucalypts than the FAO report and Calder (1994:1) states that the study did not show eucalypts to be the ‘villains’. Eucalypts were found to be preferable to barren and denuded land from a soil conservation perspective and to use no more water than indigenous dry forest at the Devabal and Puradal sites. But, the study did find that eucalypts used more water than indigenous dry deciduous forest in dry areas, and that water use in the dry zones, with soil depths greater than eight metres, was greater than rainfall levels.

To minimise any adverse ecological impacts caused by eucalypts plantations the study recommended that

- *Eucalyptus* plantations be rotated with agricultural crops, as it was thought that a five year period under an agricultural crop should allow the soil water reserves to be replenished after ten years of forestry
- eucalypts be grown as a ‘patchwork’ interspersed with annual agricultural crops in the dry zone to minimise the adverse effects on the water table
- a ‘patchwork’ design with irrigated areas of forestry be optimised. This would allow farmers to grow the same volume of timber, using irrigation, on one-

fifth to one-tenth of the usual land area leaving the rest for rainfed agriculture.

Whilst studies on the ecological effects of eucalypts by the FAO and ODA had confirmed some of the concerns raised by Shiva and Bandyopadhyay (1987), both stressed the need to examine the social-economic effects of *Eucalyptus* cultivation. It had begun to become clear that while most of the debate was being couched in

**ODA findings on the ecological impact of eucalypts**

| Issue | ODA findings |
|---|---|
| Hydrological impact of eucalypts | In the dry zone, the water use of young *Eucalyptus* plantation on medium depth soil (3m depth) was not greater than that of the indigenous dry deciduous forest. |
| | In dry zones, the annual water use of *Eucalyptus* and indigenous forest was equal to the annual rainfall (within the experimental measurement uncertainty of about 10 per cent) |
| | At all sites, the annual water use of forest was higher than that of annual agricultural crops (about 2 times higher than finger millet). |
| | At the dry zone deep soil (>8m depth) site, there are indications that the water use, over the three (dry) years of measurement, was greater than the rainfall. Model estimates of evaporation were 3400 mm as compared with 2100 mm rainfall for the three year period. |
| | At none of the sites was there any evidence of root abstraction from the water table. |
| Soil erosion (rain drop splash induced) | The net rainfall size spectra associated with such exotic species as *Pinus caribaea* or *Eucalyptus camaldulensis* make their planting preferable, from a soil conservation perspective, to *Tectona grandis* (teak) which has a characteristic net rainfall splash of potentially greater erosivity and which does not generally allow the development of protective understoreys over bare mineral soils. |
| Water use efficiency | At the Devabal and Puradal sites where the water use of eucalypt plantation has been compared with that from indigenous forest there is no evidence that *Eucalyptus* species use more water than the indigenous dry deciduous forest. They do however, use more water than a typical annual crop; about twice as much as *ragi*, a finger millet. |

**Source:** Calder 1994. *Eucalyptus, Water and Sustainability: a summary report*, ODA Forestry Series No. 6, ODA, London.

ecological terms, many of the underlying issues were social and economic in nature. Ostensibly the debate was about species choice, but in fact much of it centred on *Eucalyptus* as a symbol of popular disenchantment with many aspects of government development programs. The part of the debate that was about species choice was complicated by the fact that such choices are always embedded in complex interrelated decisions about other aspects of the tree growing practice. Thus, what was being debated in many cases was not the appropriateness of eucalypts *per se*, but the whole technology, style and management of *Eucalyptus* promotion.

### Some socioeconomic concerns

Shiva and Bandyopadhyay also raised a number of socioeconomic concerns in their report on *Eucalyptus* Cultivation (1987). First, they criticised the project for not addressing the problems of the poorest people in the community. Eucalypts had, they argued, allowed farmers with private landholdings to profit from the tree whilst the poor people in the community gained little as they lost access to communal lands being planted to eucalypts (1987: 24). The Karnataka project had failed to meet the fuelwood needs of the poor because industrial users, such as paper mills, would pay higher prices for timber than poor families could for fuelwood. Eucalypts planted to provide fuelwood to the local community had become a cash crop instead. Farmers in social forestry schemes began to plant trees that would produce the most industrial timber in the shortest time with the result that *Eucalyptus* became a lucrative crop for rich farmers who had land to set aside and who could afford to wait for the returns. Poor people, on the otherhand, saw few benefits and faced further hardships because *Eucalyptus* plantations had put farm labourers out of a job; for 'a crop of trees needs far less labour than a crop of grain' (1987:21).

Second, the authors argued that the tree had failed to meet the basic fuelwood needs of the poor as few farmers growing *Eucalyptus* on their own land were found to use its wood as domestic fuel. Shiva and Bandyopadhyay argued that this was because the economic returns on the sale of *Eucalyptus* wood were high and alternative sources of fuelwood were cheaper. Traditional fuel woods such as Honge were also thought to be more suitable for cooking as they required slow and controlled heat. *Eucalyptus*, on the otherhand, was said to burn too fast making it more expensive than other fuel woods since more wood was inevitably required to cook a meal (1987:21).

Third, Shiva and Bandyopadhyay argued that plantations of *Eucalyptus* had taken over what used to be public wastelands—one of the only remaining sources of fuelwood, fodder, organic fertiliser and other basic needs for poor people. This had contributed to a decline in physical health and nutritional status as land previously used to grow crops was planted to *Eucalyptus*. Cattle were also feeling the brunt of *Eucalyptus* planting's as traditional farm trees, besides being appropriate for domestic

energy requirements like cooking and lighting, had also been a rich source of fodder for cattle. *Eucalyptus*, on the other hand, was said to allow no undergrowth when planted in high densities, and the plantations themselves could not be grazed. Thus, the widespread planting of *Eucalyptus* on farmland and community lands succeeded in further depleting the already scant fodder resources of the area (1987:23).

### FAO report on socioeconomic attributes of trees and tree planting practices

Realising that there was a need to address the socio-economic effects of *Eucalyptus*, the FAO released a report on the socio-economic attributes of trees and tree planting practices in 1991 to complement the FAO commissioned study on the ecological effects of eucalypts by Poore and Fries (1985). In this report Raintree states that

> the [Karnataka] project documentation gave little information on the socio-economic context of species selection and in most cases failed to offer any systematic explanation whatsoever of the reasoning behind the choices made. In short, what the literature review revealed was the appalling casualness with which the whole question of species choice is approached by the majority of tree planting projects (1991:4).

He then went on to say that the project literature evinced little or no awareness that there were different kinds of tree users and that the purposes for which trees are planted might vary not only with the type of tree, but also with the type of user. The project documentation revealed that there was a general tendency to 'promote undifferentiated 'tree planting'—as if all trees were the same!' (1991:4).

He then concluded that the socioeconomic impact of trees like the *Eucalyptus* varied greatly from one situation to another. For while the commonly used species of the genus do indeed have attributes that permit them to be used in ways that may limit their suitability for certain categories of users (i.e crop idiotypes compatible with high-density, food and labour-displacing monocultures), there is nothing inherent in the species that compels them to be always used in these ways. The corollary to this, he states, 'is that simply changing the species will not necessarily solve the problems of an inappropriate tree growing practice' (1991:26).

Desegregating the issues in this way shows that the controversy was much more than a question of species choice. In fact, it was not just *Eucalyptus* that was being called into question, but the whole social forestry approach along with the economic development strategy in which woodlots on private farmland seemed to be the technology of choice. Thus according to Raintree, the crux of the controversy in India appeared to be

> the opportunity cost of social forestry programmes that were devoted, quite successfully, to helping the relatively better off segments of the population while failing to address the needs and opportunities of the poorest members of society—

the primary intended beneficiaries of the social forestry programme, as originally conceived by government planners (1991:26).

### The ecological, economic and social effects of eucalypts in Karnataka

The literature reviewed on the *Eucalyptus* controversy in Karnataka, India revealed the following ecological, economic and social aspects of *Eucalyptus* cultivation.

- *Eucalyptus* species can provide many benefits very quickly, ranging from industrial wood and fibre, to poles, posts, timber and fuelwood for household use, nectar, essential oils and tannin. Services such as windbreaks and shelter belts may also be provided by *Eucalyptus* species.
- There is sufficient evidence to verify Shiva's and Bandyopadhyay's claim that eucalypts do have some adverse environmental effects. These include impacts on soil water, soil nutrients and soil erosion; and impacts on wildlife and native plant diversity. However, it is thought that most of the adverse ecological effects of eucalypts can be minimised through proper plantation design and management.
- Eucalypts can provide some benefits to the natural environment if planted on treeless land as they can alleviate damage caused by wind erosion if planted as shelter belts, provide shelter for people, crops and cattle, and some indigenous wildlife. Eucalypts can also relieve pressures on natural forest for fuelwood and other wood products.
- The problems and conflicts formerly blamed on eucalypts arose more from the insensitive application of government afforestation policies and social injustice than the ecological effects of eucalypts.
- Problems arose over the planting of eucalypts on public or communal land because there was insufficient involvement of local communities in the planning, establishment and management of the plantations and a blatant disregard for local community needs.
- An ignorance of market forces by those implementing the project and an inequitable division of benefits derived from the trees meant that the poor ended up worse off, whilst the rich became richer.
- While literature on the *Eucalyptus* controversy in Karnataka, India revealed that most of the debate had been couched in ecological terms, the economic and social aspects of *Eucalyptus* cultivation were equally, if not more important.

## Social protest in Tung Kula Ronghai, North East Thailand

In an attempt to promote economic growth and modernisation, most of the forests that once covered Thai hilltops have been logged by private logging companies. The destruction of this resource has affected the flow of water, bringing shortages and drought to many areas (Permpongsacharoen 1992:83). At the same time, a government

policy to promote the cultivation of cash crops for export encouraged farmers to expand agricultural land into areas where trees had been cut down for timber production. More recently, tourism, golf courses and land speculation have taken over large areas of land. Some communities established more than 200 years ago have been bought up and forced to move further up the mountains to find land for growing crops, often creating the impression that they are the ones destroying the forest (1992:83).

In response to these environmental problems, and growing national and international pressure o ban logging and promote reforestation, the Thai Government set about planting eucalypt trees on so called 'public lands' in an effort to reach the goal of 40 per cent forest cover by 1985. This was largely done with assistance from a number of aid organisations including the World Bank and the Australian Development Assistance Bureau. The Thai Government also encouraged the private sector to reforest degraded forest reserve land by offering very low rental rates as well as subsidies and incentives (Puntasen 1993:157). These policies were to some extent successful as the Thai Government had reforested an estimated 500,000 *rai* with *Eucalyptus* by 1980, of which 200,000 *rai* was grown in the north east (1993:158). These impressive figures do not, however, reflect the well-being of the communities involved as land planted to *Eucalyptus* was, in general, previously used for grazing, particularly during the monsoon, and covered with regrowth—a valuable source of fuelwood. Those without title to this land and already living there 'illegally' faced two alternatives: move out, or stand up and fight.

An explosion of rural activism in opposition to eucalypt plantings, similar to that found in Karnataka India, resulted from this situation. Small farmers expressed their opposition to *Eucalyptus* plantings by petitioning Cabinet officials, arranging strategy meetings with other villagers, marching, rallying, blocking roads, ripping out seedlings, chopping down eucalypt trees, burning nurseries, planting fruit, rubber and forest trees in order to demonstrate their own conservationist awareness, explaining to newspapers the methods by which they had preserved their local forests for generations, speaking out at seminars, giving television interviews, and increasingly, taking their case directly to the central government (Lohmann 1991: 21).

This section focuses on a reforestation project in Tung Kula Ronghai, north east Thailand, to examine why such opposition was voiced against the planting of eucalypts in Thailand. In doing so, it will discuss the impact that the project has had on both the environment and the local people, and how this has led to community unrest and protest.

## Project history

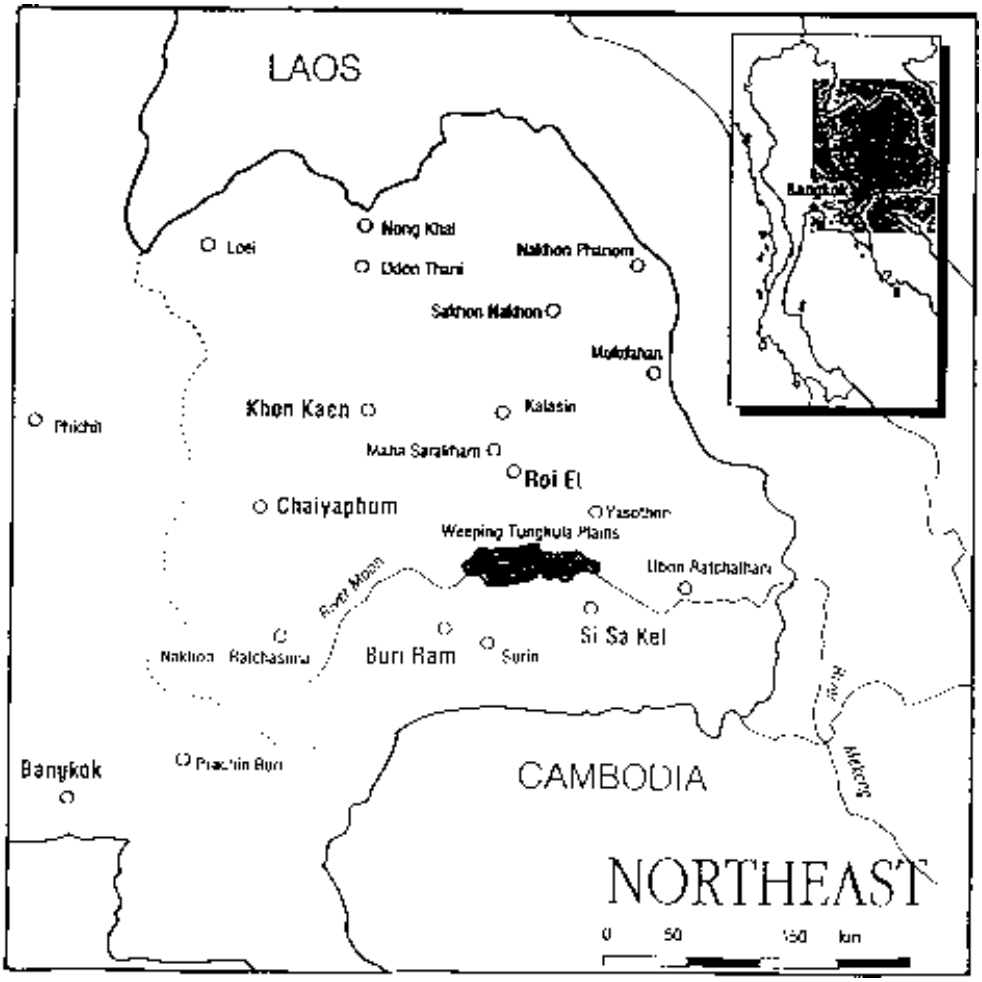
In 1976, the Royal Thai Government (RTG) asked the Australia Development Assistance Bureau (ADAB) to assist in the development of Tung Kula Ronghai (TKR) in north east Thailand (Figure 2). This area was in need of assistance because 'production and income in Tung Kula Ronghai were found to be inhibited by a difficult physical environment and lack of technical knowledge and other resources necessary to overcome the physical difficulties' (McGowan International June 1984:7). The main factors thought to be constraining development in the region included: climate and rainfall variability resulting in either drought or flooding; severe deforestation with less than two per cent of the Tung under forest; and salinity with only an estimated six per cent of the Tung Kula Ronghai lands salinity free. These factors were believed to be the cause of low rice yields and below average household incomes in the area (June 1984:2–6).

In light of the above, ADAB responded to the Thai Government's request for assistance with support for a three phase pilot project from 1979 to 1983. Assistance in Phases I and II came in the form of investigational activities aimed at the identification and assessment of options for future rural development (McGowan International June 1984:11). Phase III of Australian assistance (November 1982 to December 1983) was implemented for ADAB by McGowan International who conducted studies on soil fertility, soil salinity, shallow groundwater and land remodelling. They also constructed a training centre and assessed the need for, and planned the nature of, further Australian assistance. The original objectives of the project were developed during Phase III and based upon the work of officers of many Royal Thai Government agencies, resident Australian advisers and planners (June 1984:4). With the completion of Phase III in December 1983, it was decided that the main activities of the project were ready to be moved from test sites out onto farmers fields. Phase IV of the project was thus primarily directed towards bringing immediate benefits to the people of Tung Kula Ronghai (June 1984:11). This phase, which is the topic of discussion, began on 1 July 1984 and due to end in July 1989.

## Phase IV—project objectives

The 1984 Phase IV project document, prepared by McGowan International, states that: 'the overall goal of the Thai-Australia Tung Kula Ronghai project is to provide an equitable improvement in the standard of living of the rural population through improved net incomes, food supply and community participation' (June 1984:11). This was to be achieved in specific pilot areas which aimed to 'increase farmer productivity and benefits from rice, dry season crop and fish production in selected parts of Tung Kula Ronghai by improving physical resources, production technology and community involvement in the development process' (June 1984:11). The project also aimed to demonstrate the technical, economic and social feasibility of selected development initiatives, and to strengthen the capacity of Royal Thai Government

Figure 2 **Tung Kula Ronghai, North East Thailand**




**Source:** Ekachai S., 1990. *Behind the Smile: Voices of Thailand*, Thai Development Support Committee, Thailand.

agencies (June 1984:2). A number of additional technical proposals including water resource development and reforestation were also to be tested (June 1984:11).

The project was made up of eight components consisting of: land remodelling, groundwater development, a water resources study, fisheries development, upland reforestation, research and extension, community development and technical assistance support (June 1984:2). The locations of these components are shown in Figure 3. It is beyond the scope of this paper to discuss and assess the project in its entirety. The upland reforestation component, which primarily led local communities to protest, is the focus of this section.

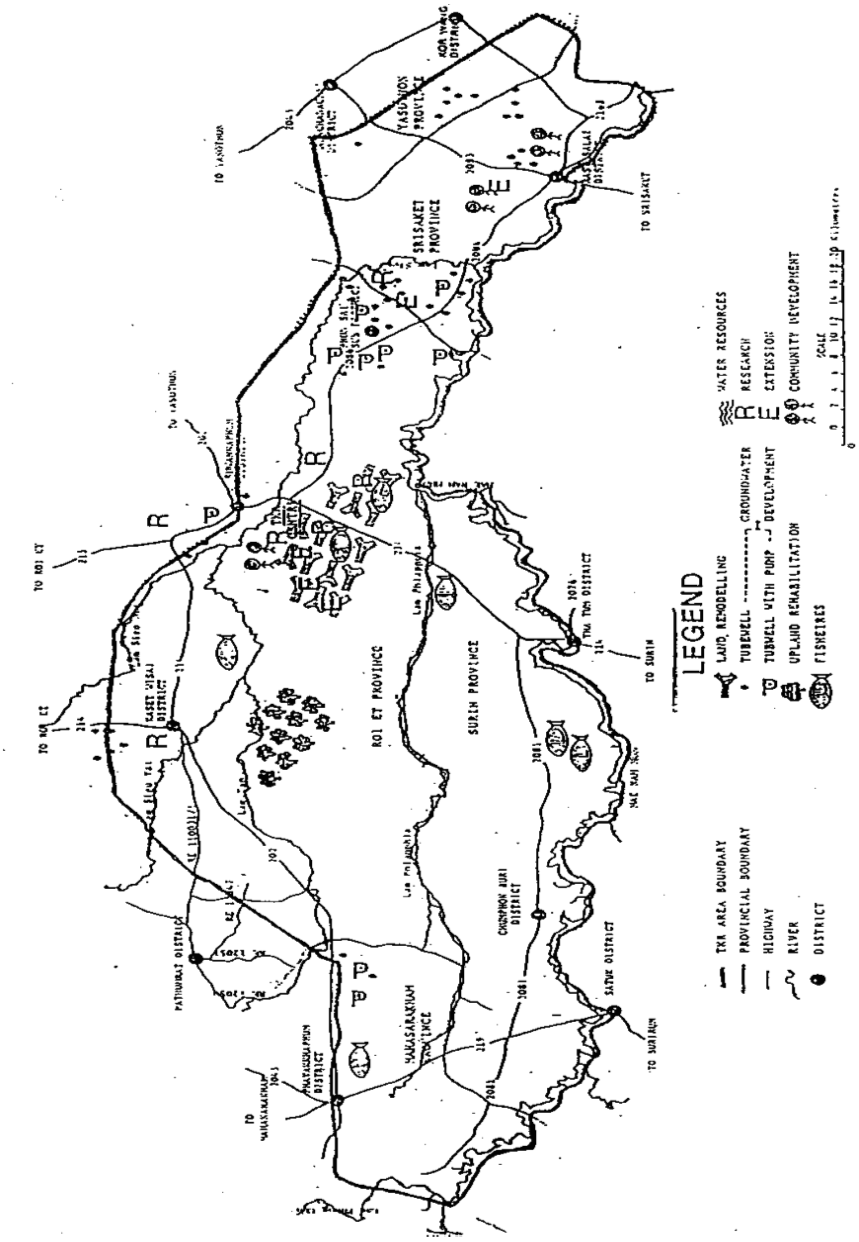
### The upland reforestation component

Studies conducted during Phases II and III of the Thai-Australia Tung Kula Ronghai project had shown that rice yields on salinised lowlands were about 35 per cent of those on unaffected lowlands (McGowan International June 1984:40). It was then postulated, in the 1984 *Phase IV Project Document Report*, that if trees were planted on upland areas they would draw upon water from the groundwater table thus causing it to fall, both on the uplands and the associated lowland. A lower groundwater table would mean that salt would not be brought to the upper layers of the soil and hence the rice yields would not be reduced (June 1984:40). See Figure 4. An initiative was therefore undertaken to test this hypothesis and quantify the extent to which revegetation would reduce salinity on nearby lowlands. The initiative also aimed to establish the most appropriate means of revegetating uplands and provide an assessment of other secondary benefits such as reduced soil erosion and economic production (McGowan International March 1984:19).

To achieve this objective, the *Phase IV Feasibility Analysis Report* suggested that a pilot upland area comprising about 10, 000 rai of public land, which was treeless and had saline soils in the adjacent rice fields, be reforested with *Eucalyptus* species, primarily *E. camaldulensis* (McGowan International March 1984:29). Locations chosen for reforestation can be seen in Figure 5. *E. camaldulensis* was chosen for the project because research undertaken at Charters Towers, North Queensland had shown it to be salt tolerant, fast growing and able to lower the water table considerably (McGowan International June 1984:12).

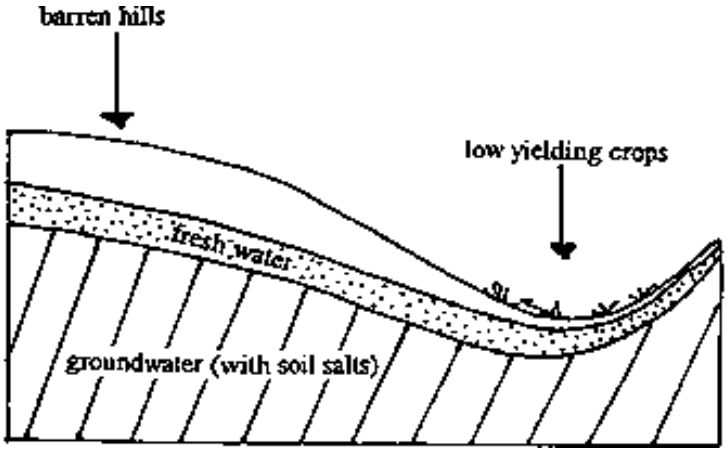
The plan to plant *Eucalyptus* species on the uplands was adopted in the *1984 Project Document* but slightly adapted to allow for pasture development amongst the trees. Pasture development was considered to be of importance because the upland areas were used for livestock grazing in the wet season. The project thus stipulated that trees were to be planted at a spacing of 2 X 8 metres so that pasture could be planted in amongst the trees (McGowan International June 1984:40).

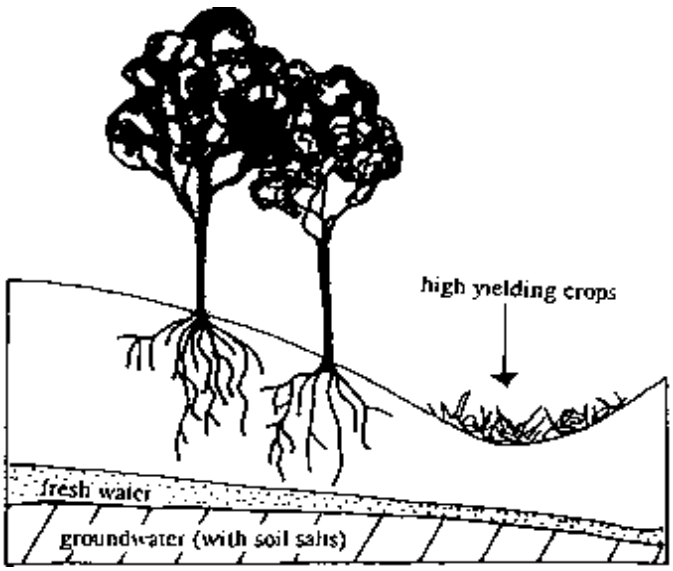
Figure 3 **Project components in Tung Kula Ronghai**




**Source**: McGowan International, June 1984. *Thai-Australian Tung Kula Ronghai Project Phase IV, Project Document*, ADAB, Canberra.

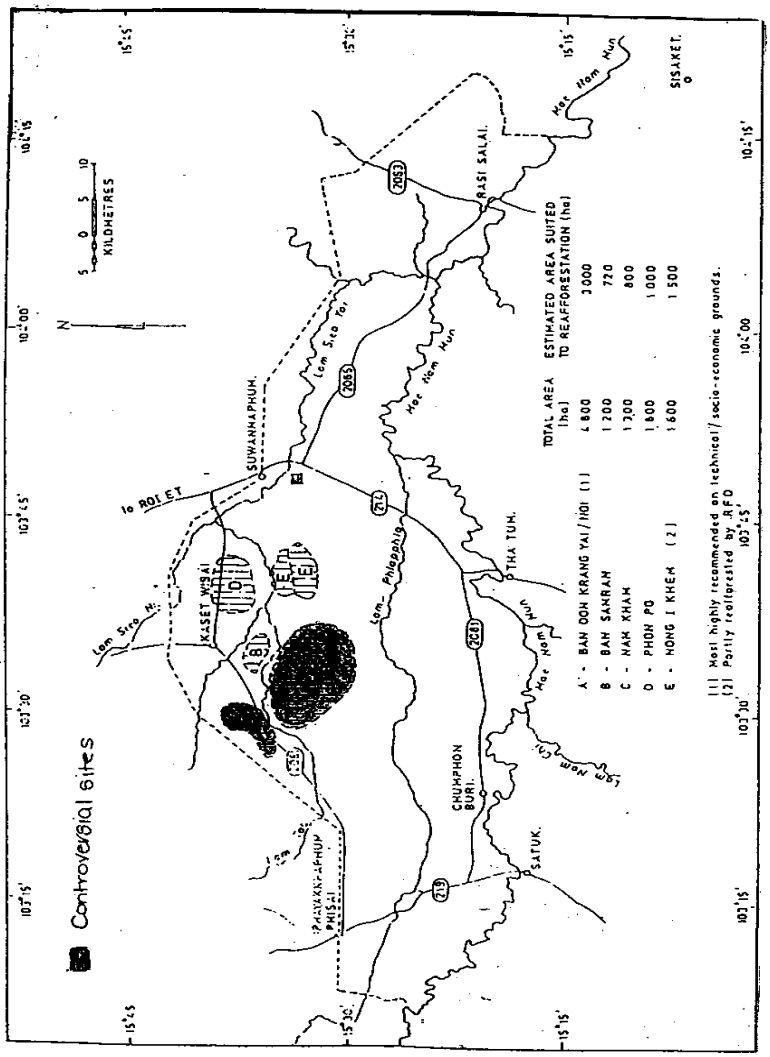
Figure 4 **Expected salinity development resulting from trees lowering water table**




**Source:** Author's drawing.

Figure 5 **Sites chosen for reforestation in Tung Kula Ronghai, North-east Thailand.**




**Source:** McGowan International, June 1984, *Thai-Australia Tung Kula Ronghai Project Phase IV, Project Document*, ADAB, Canberra.

To accommodate this pasture development the upland reforestation component was divided into three sub-components: forestry, soil conservation and pastures. These were to be the responsibility of Royal Forest Department (RFD), the Department of Land Development (DLD) and the Livestock Development Department (LDD) respectively. The Livestock Development Department was responsible for land clearing and embankment for the contour area. The Royal Forest Department was then to plant the trees and the Department of Land Development was to establish pasture between the trees (McGowan International June 1984:2).

The actual planting of the trees was to be carried out by villagers who were to be paid daily wages by the Royal Forest Department. Villagers were also paid to keep stock out of underaged plantations and maintain fences (McGowan International 1984:41). When the trees reached maturity, McGowan International stipulated that small areas could be harvested. Wood from these trees would then be made available to Tambon Councils after small royalties were paid (McGowan International 1984:42).

### The socioeconomic study

Before discussing the Phase IV upland reforestation component, findings from a socioeconomic study of villages under the reforestation program in Tung Kula Ronghai, prepared by the Department of Agricultural Economics (DAE), Faculty of Agriculture, Khon Kaen University, will be discussed. This study was primarily undertaken to assess the attitude towards, and acceptance of, the reforestation and pasture improvement program by local villagers in the project area (DAE 1985:4). As shall be shown, the study is significant because it revealed widely held community beliefs and deeply felt concerns about the project. But concerns raised were largely ignored by McGowan International and the Royal Forest Department with disastrous consequences.

**Firewood and livestock concerns.** The first significant finding was that there was a desperate need for firewood among the villagers in Tung Kula Ronghai. This need, the study argues, ‘may not be very crucial at present but in the very near future it will be’ (1985:108). Farmers were already spending a lot of time, energy, and money obtaining the firewood and charcoal they needed to survive. Because such a need for firewood existed in the area it is not surprising that the study found that 28.6 per cent of those villages questioned about their understanding of the primary objectives of the project thought that it was to provide firewood, whereas only 1.2 per cent said that they thought it was to solve the salinity problem in the low lying paddy fields (1985:118). These figures were thought to reflect the fact that the Royal Forest

Department reportedly hinted that 'if Tambon councils and farmers co-operated then they *might* (my emphasis), in reciprocate, benefit from the project in terms of fuelwood' (1985:118). This is despite it being mentioned in the original *1984 Project Document* that when the trees reached maturity they *would* be harvested and the wood *would* be made available to Tambon Councils (McGowan International 1984:42).

The second significant finding was that many villagers feared that reforestation would affect the previously available firewood supply obtainable from so-called 'unproductive forest' and bushes on public lands. It was thought that the government would not allow them to collect fuelwood and fodder from this land once eucalypts were planted on it. This was particularly evident in Don Krang Noi where the project was mainly situated. The great majority of farmers in this area were opposed to the project because of concerns about fuelwood and the Department of Agricultural Economics warned that 'the disagreement of almost one-fourth of farmers in Don Krang Noi should not be overlooked' (1985:116).

Many farmers in the project area also disagreed with the location of the project because of concerns over reductions of grazing area for buffaloes and cattle during the wet season. A reduction in grazing area would force them to expend extra labour cutting grass and carrying it back home in order to feed their livestock (1985:116). The Department of Agricultural Economics emphasised that this was not a matter to be overlooked as livestock were of considerable importance to the people in the project area as it was the second source of income for most after rice. They therefore state that 'it is crucial...to establish agro-forestry in the project area by growing pasture in between the row of the trees. As a matter of fact, keeping the pastureland in such a way is a measure to gain the co-operation from farmers in forest management' (1985: 139). The short-term mutual benefits in terms of arrangement for grazing land and fuelwood supply were also thought to give villagers more incentive to preserve the forest (1985:141).

**Community participation.** The final significant finding was that villagers had not been adequately informed about the reforestation project. They therefore suggested that the utilisation of forest products, in particular, should be 'spelt out clearly' as some farmers were expecting to benefit from the use of firewood or wood products whilst others thought the forest was untouchable because it belonged to the government (1985:136). To avoid such confusion and to minimise the negative social impacts expected from loss of grazing land and fuelwood, the study argues that 'villagers and village organisations should play an important role in the project' and that 'villagers should be very well informed and organised' (1985:141). Moreover,

community participation was considered to be of importance because it was thought to ensure the long term existence of the reforested area. Those implementing the project were therefore urged to encourage the local organisation of farmers and to allow them a place in decision-making and planning along with the Tambon councils or village committees (1985:141).

**Disaster strikes!**

Disaster was evident in the first Quarterly Progress Report, released in March 1985, as the first three sites selected for reforestation by the Royal Forest Department were not amongst those originally selected for solving the salinity problem—two of the first three were on a sand sheet, whilst the third was on a sand ridge. These three plantings were, therefore, in defiance of the upland reforestation project objectives which sought to test the postulate developed in Phases II and III 'that if trees were planted on upland areas they may draw water from the groundwater table thus causing it to fall, both on the uplands and the associated lowland. A lower groundwater table would mean that salt would not be brought to the upper layers of the soil and hence the rice yields would not be reduced' (McGowan International June 1984:40). McGowan International acknowledged the fact that these plantings were supposed to take place on saline lands but believed that the obstacles to carrying out the original salinity objective were insurmountable. They state that 'although this is not the original intention of the reforestation plan, there is little which can be done at this stage to alter the areas allocated' (McGowan International March 1985:1). To make matters worse, pasture development, given much importance in the social economic study, had failed due to poor site preparation.

Evidence of village resistance can also be found in the first quarterly report as McGowan International state that

> A large unknown factor seems to be the attitude of the villagers. There is the feeling that generally there was no good rapport between villagers and the RFD and that the villagers only reluctantly agree to the reforestation plans. The RFD claims that the land for reforestation is not private but Crown land. This may be true in a purely legal sense but the villagers may not be of the same opinion (March 1985:10).

This quote would seem to indicate that land tenure was already an issue of concern to the villagers and that problems over ownership of the trees would be bound to arise.

By September 1985, further problems in relation to site selection began to emerge. On several of the sites identified in 1982 for soil conservation works, eucalypts had already been planted in a 4 X 4 metre grid. This meant that, not only were soil conservation works futile on the sites, but also that they were no longer suitable for

pasture establishment as an 8 X 2 metre planting grid was needed to allow pasture to grow between the trees. Alternative sites identified by the Royal Forest Department were also suspect as they contained regrowth which was acknowledged to be an existing firewood source (McGowan International September 1985:4). Moreover, by December 1985, it became evident that eucalypts had been planted on many of the areas selected in Phase III for pasture establishment. In response to this McGowan International state that

> with most of these areas no longer available, the 1987, 1988 and 1989 programs are not yet prepared. Options are few and it may be necessary to consider developing either regrowth areas, areas already planted by RFD which are unthrifty and not sown to pasture, or even areas outside the Tung which the RTG wants to develop to forest and grazing land (December 1985:4).

Little consideration was given to the impact these plans would have on the local communities involved even though it was clear that the development of regrowth areas would cause farmers to lose a primary source of firewood.

Against the recommendations of the social economic report mentioned above, the Royal Forest Department cleared regrowth in Don Krang Noi and Nong Khem, and had planted 4,000 *rai* (640 ha) of eucalypt forest on these two sites by September 1986 (McGowan International December 1986: 11). They then selected another 700 rai at Don Krang Noi for reforestation in 1987 and a further 900 *rai* at Nam Kham which was covered with rather dense scrub and isolated stands of trees before being cleared to make way for eucalypts (December 1986:12).

Growing community resistance to the project came to a head at the Nam Kham site in March 1987 over the proposed planting of 900 *rai* to eucalypts which, as mentioned earlier, was covered with dense scrub and isolated stands of trees. McGowan International, in consultation with the *Nai Amphoes* (Government appointed District Officers), attempted to resolve the dispute by suggesting that only native trees (*Dipterocarps* and *Cassia*) be planted at the site as many of the villagers had claimed that they were against the *Eucalyptus* plantings (McGowan International March 1987:42). Obviously under pressure to meet the projects objective to reforest 10,000 *rai* with *E. camaldulensis*, McGowan International state that: 'If Nam Kham cannot be reforested an area near Phon Po will be the alternative site, or perhaps...Phon Sai even though this is not as suitable from the salinity point of view' (March 1987:42). This is in spite of the fact that the project originally set out to solve the salinity problem—or was it?

By June 1987 local resistance to reforestation at the Nam Kham site had escalated preventing the upland component from reaching its tree planting target of 2,000 *rai*. McGowan International this time correctly attributed the problem to the clearing of secondary scrub, a source of firewood and mushrooms, in order to plant eucalypts

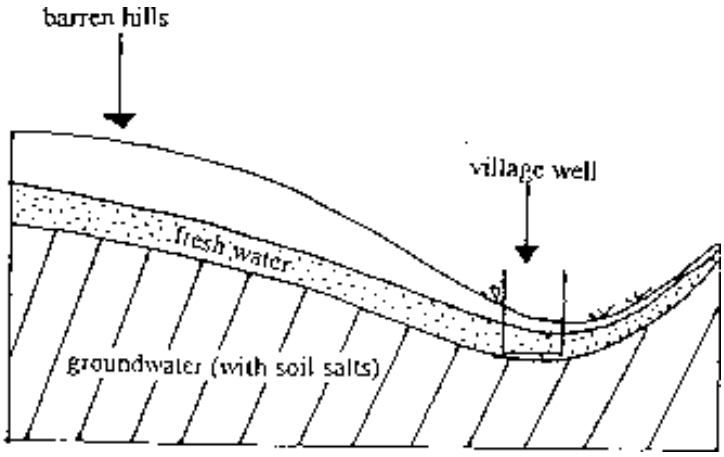
(McGowan International June 1987:1). A moratorium was declared for some months at Nam Kham but McGowan International soon managed to get provincial approval to continue, though not with *Eucalyptus*. They were also forced to move to an open site that did not involve any clearing. This would seem to indicate that McGowan International were more concerned with meeting their tree planting objective than community concerns and this is all too evident in the following extract where McGowan International state

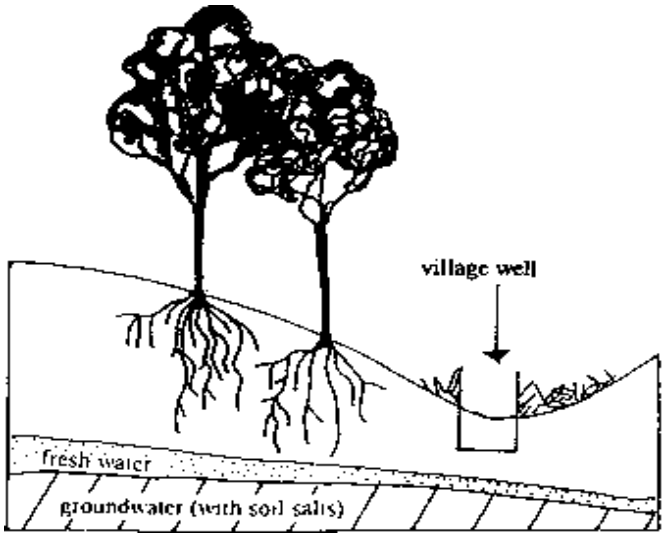
> we must move to an open site which does not involve any clearing. This is an example of matters going wrong even when correct procedures are followed at the Tambon council. The target of 2,000 rai will [however] be assured by moving to alternative sites (June 1987:1).

McGowan International clearly underestimated local opposition as work did not progress at Nam Kham after 50 *rai* was cleared and further protests broke out over the clearing of secondary scrub (McGowan International June 1987:9). The June 1987 quarterly report provides further understanding of the conflict at Nam Kham as it reveals that 3,000 *rai* of *E. camaldulensis* had already been planted at the site, which had not only lowered the water table, but also dried up the village wells (see Figure 6 for a diagram showing how planting trees on the upland areas resulted in village wells drying up). McGowan International did not, however, feel that this was a cause of the protests at the Nam Kham site. Rather they attributed the protests to 'the bad press concerning the competitiveness and allelopathic effects of *Eucalyptus*' which had, they said, 'filtered down to village level' (June 1987:9). McGowan International then negotiated another development plan whereby only 1,014 *rai* would be set aside for the project. Of this, 500 rai was open and 514 rai supported secondary forest. However, the Royal Forest Department, set about clearing the secondary forest when the agreement was to develop the open area thus provoking yet further protests. McGowan International then persuaded the people to agree to plant 500 *rai* of forest in open lands with the tropical legume *Stylosanthes hamata*, and another 514 *rai* of *Stylosanthes hamata* on its own in the regrowth area. But, the forest species was not to be *Eucalyptus* (June 1987:9). Development had barely got off the ground before more objections were raised causing it to cease. McGowan International then finally admitted defeat as they agreed to a resolution whereby a village volunteer operation was established and assisted by the Royal Forest Department who were to provide seedlings and whatever consultation and help the villagers wanted (McGowan International September 1987:16).

Village protests did not, however, cease in the other major public land site where regrowth had also been cleared to make way for eucalypts—Don Krang Noi. This protest was attributed to a 'squatter problem' which was preventing work from being done on the site (McGowan International June 1987:9). In further reports little more is said about the so called 'squatter' problem at Don Krang Noi except that the site

Figure 6 **The adverse impact of trees lowering the water table on village wells**




**Source:** Author's drawing

was developed unprotected because the Department of Land Development soil conservation budget arrived too late to be of any use (June 1987:9). This reportedly resulted in 'large scale erosion during the monsoon' which was said to be aggravated by 'a knotty squatter problem which took months to resolve'(McGowan International September 1987:15).

**Project outcomes**

Despite community resistance to the upland reforestation component, the *Project Completion Report*, released in October 1989, reveals that McGowan International came close to meeting their tree planting objective as 8,010 *rai* were planted in the project area of a planned 10,000 rai. Another 6,360 rai were planted in Tung Kula Ronghai from nurseries established by the Thai-Australia Tung Kula Ronghai project, but outside the area designated for salinity control (McGowan International October 1989:12). Despite this apparent success, the Livestock Development Department, failed to establish the 10,000 *rai* pasture objective set out in the *1984 Project Document*, as only 2,000 *rai* of pasture had been successfully planted to the tropical legume *Stylosanthes hamata* (October 1989:XXV). Moreover, the prime purpose of reducing groundwater pressure, believed to be the cause of burgeoning secondary salinisation, was so successful in lowering the water table in some cases that village water supplies dried up. This 'adverse effect', was of little concern to McGowan International as they state that: 'In any event, the upland reforestation component (URC) is combating erosion and the forests are going some way towards restoring the environment' (October 1989:23). For this reason McGowan International stated that these new forests were to remain undisturbed so that the objective of reducing salinity by means of the trees pumping up salty water could be achieved' (October 1989:23). The forests were to be left 'untouched' and 'unharvested'.

However, these statements come into question when McGowan International discuss the economic benefits expected from the plantings once harvested. Yields of wood (in cubic metres per *rai*) based on estimates from various Thai-Australia Tung Kula Ronghai project plantings established for several years were expected to be 10 cubic metres per *rai*, and valued at 700 baht per cubic metre. This valuation was based on constant farm gate prices paid by a local pulp company in the region (McGowan International October 1989:IX). The inclusion of this information in the *Project Completion Report* then raises the question: were the eucalypts planted to solve the salinity problem and to improve the environment, or were they planted for economic returns? And, if they were planted for economic returns, to whom does the wood from these plantations belong—the Royal Forest Department or local villagers? In other words, who will benefits if the trees are harvested? The original *Project Document*

*1984* stipulated that wood from the trees would go to Tambon Councils, but the Royal Forest Department now claim that the communal lands, and the trees on them, are the property of the Thailand Finance Ministry and the Royal Forestry Department. Local villagers recently protested against the Royal Forestry Department claim at the Roi Et Provincial Office of the Thai Ministry of Agriculture in 1996. Regrettably, their battle for the land and trees on it is far from over.

To sum up, the upland reforestation component, which aimed to increase paddy yields through reduced salinity and thus increased net farm income, failed to achieve the overall goal of the Thai-Australia Tung Kula Ronghai project which was to 'provide an equitable improvement in the standard of living of the rural population through improved net incomes, food supply and community participation' (McGowan International June 1989:11). In fact, quite the opposite seems to have occurred as local communities faced further hardship as communal land, once used for grazing and a source of fuelwood, was lost to *Eucalyptus* plantations. Moreover, landless poor were evicted from 'public lands', village wells dried up, rice yields decreased and communal land was lost to the Thai Government and multi-national pulp industries.

As these problems escalated, so too did community resentment towards further *Eucalyptus* plantings. This is not to say, however, that the communities involved were protesting against eucalypts *per se*. They were protesting against the resumption of 'public' lands which were valuable sources of fuelwood and fodder reserves, Royal Forest Department claims to the land and the eucalypt trees on it, and the eviction of the so called 'squatters' who had previously occupied public land. It can, however, be argued that social protest against the project could have been avoided if McGowan International had actively pursued community involvement in the project, clarified land and tree tenure arrangements and heeded community concerns expressed in the socioeconomic study released by the Department of Agricultural Economics in December 1985. Their failure to do so, and the resulting mismanagement of the project, highlights the need for community involvement in further forest-based development projects. It is crucial that organisations involved in similar projects listen to community concerns and accommodate these in project planning and implementation, encourage more community participation in development projects, and consult, inform and involve communities in the project.

## The ecological, social and economic aspects of exotic eucalypts

As the area of eucalypts planted on land increases world wide, effective use of the tree in social forestry becomes increasingly important. This section draws some parallels between the Karnataka and Tung Kula Ronghai social forestry projects to determine what it was that caused the local communities involved to protest.

### Environmental aspects

In both the Karnataka and Tung Kula Ronghai social forestry projects, there was sufficient evidence to suggest that eucalypts have adverse ecological effects when planted as an exotic. This has since been confirmed by studies conducted by the FAO (1985) and ODA (1994). The environmental effects of eucalypts include adverse impacts on water, nutrients, erosion, wildlife and biodiversity. But eucalypts were also found to have some beneficial effects on the natural environment as they can minimise wind erosion when planted in shelterbelts, and provide shelter for people, crops, cattle and some indigenous wildlife if planted on treeless land. Moreover, the adverse ecological effects of *Eucalyptus* cultivation can be minimised through proper plantation design and management. This may involve

- planting fewer trees per unit area or thinning existing plantations to reduce the water consumption needed by eucalypts in areas where water is scarce or demanded by other sectors
- leaving the foliage and bark of eucalypts on the plantation floor after harvesting the wood to minimise the impact of *Eucalyptus* plantations on soil nutrients
- allowing much wider spacing between trees to allow ground cover and crops to develop amongst the trees
- conducting comprehensive research before undertaking a project to determine whether or not eucalypts will have an adverse impact on soil nutrients, water hydrology, wildlife and biodiversity.

It should, however, be noted that even though the ecological impact of eucalypts can be minimised, the biodiversity of eucalypt plantations cannot be compared with that of intact natural forests of most types and, although eucalypt plantations (and other monocultures such as rice, maize, ragi or teak) have more diverse populations of fauna and flora than many types of degraded lands, they should not replace healthy and undisturbed natural forests. If eucalypts are to be planted, then they should be planted in multi-species systems along with native tree species and vegetation wherever feasible.

### Social and economic aspects

In addition to the ecological aspects of *Eucalyptus* cultivation mentioned above, the following socioeconomic aspects can be determined from the Karnataka and Tung Kula Ronghai case studies.

**Ignorance of socioeconomic realities.** The first finding to be drawn from the Karnataka and Tung Kula Ronghai projects is that the economic and social effects of eucalypts can not be disentangled from political decisions affecting the forest sector and, in particular, the supply of wood to industry. In a paper entitled *'People's Dependence on Forests and Trees*', Arnold points out that as forest products such as fuelwood, fodder and fruits become progressively commoditised, and with the growing dependence of farm households on income to meet at least part of their needs, the distinction between production for subsistence or sale has progressively less meaning (Arnold 1992:22). A producer will therefore sell what is surplus to his or her subsistence needs, but will sell a commodity such as fuelwood needed in the household if the opportunity cost of doing so is advantageous—hence the widespread phenomenon of households being short of fuelwood selling wood (1992:22).

The Karnataka project clearly illustrates the dangers of promoting tree growing as though it is outside the forces of the market system, and the failure to match projected production to market possibilities or link producers to markets. The Karnataka social forestry project was developed as though it was effectively isolated from economic influences. It assumed farmers plant trees to meet subsistence needs but do not buy or sell fuelwood in the market place. Local communities were mistakenly believed to be divorced from, and immune to, market forces. As a result, the Karnataka social forestry project had several undesirable social consequences. The most significant consequence was that well-to-do farmers profited from such schemes, while landless people were negatively affected because they lost access to free fuelwood resources and the opportunity to be employed as agricultural labourers.

In Tung Kula Ronghai trees were also planted without any due regard for market forces. The trees were supposedly planted with the objective of solving the salinity problem, but those implementing the project failed to clarify other vital issues such as: Who owns the trees? Will they be cut down? Who will profit from the trees if they are cut down? If the trees are cut down will they to go to industry or to the local community in need of fuelwood? Failure to address these questions in the context of market forces has resulted in the present situation where local communities are fighting with the Royal Forest Department over the ownership of the trees and who is to benefit from them now that they have matured and are worth a considerable amount on the market.

**The politics of land tenure.** Social protest in Karnataka and Tung Kula Ronghai was more the result of common property resources being converted into state controlled resources than the perceived adverse ecological effects of *Eucalyptus* cultivation.

Farmers will not lightly cede rights to land and livelihood, and in both cases they cited the environmental disbenefits of *Eucalyptus* to crusade against the governments plantation policy. The battle was not about *Eucalyptus* however. It was about power. Both plantation programs became political issues, and as such were about people, power and persuasion.

The Karnataka social forestry woodlot program, for instance, inadvertently shifted use of communal land from products for local use to higher valued wood products for sale outside the community. This resulted in the benefits being transferred from those who previously used the common land, to those who gained from the income accruing to, and spent by, the community as a whole. Land planted to eucalypts was also land diverted from the production of essential foods resulting in food shortages. The eucalypt therefore became a symbol of discontent as land formerly used to grow crops and graze cattle was planted to eucalypts and any benefits reaped from the eucalypt plantation went to those who owned the land. The landless, on the other hand, lost access to grazing land and free fuelwood.

Similarly in Tung Kula Ronghai farmers initially co-operated with the Royal Forest Department as they had been led to believe that they would, in reciprocate, benefit from the project in terms of fuelwood. But, as the project progressed it became clear that farmers were not going to benefit from the project in terms of fuelwood and that the valuable communal land once used for grazing and collecting fuelwood would inadvertently become the property of the state once eucalypts were planted on it. Again, the eucalypt became a symbol of popular discontent against government intervention and a rallying point for social protest.

The above two cases show that if land tenure is unclear, no program can be implemented successfully. If a government faces difficulties in releasing the ownership of land, a long term lease arrangement with proper benefit share schemes could be an alternative. Otherwise, the use of communal land in fair management and benefit sharing schemes is worth considering.

**Project planning.** Both projects appeared to suffer from considerable confusion and lack of clarity about their nature and purpose. The Karnataka project encouraged local people to plant fast growing *E. tereticornis* to supply fuelwood, small timber and other wood products. Planting eucalypts, it was hoped, would ease the fuelwood shortage and prevent the indiscriminate destruction of forests for fuelwood by the rural population, 90 per cent of whom were dependent on wood for cooking and heating. But, as the project progressed eucalypts planted to supply fuelwood and other wood products to the Karnataka community began to be planted by wealthy farmers for industry.

Similarly, in the Tung Kula Ronghai upland reforestation project, there was much confusion over the project's objectives. The upland reforestation project initially aimed to plant eucalypts on upland areas to draw water from the groundwater table and to grow pasture amongst the trees. The planting of trees on the upland areas was expected to solve the salinity problem and increase rice yields. But, the first *Quarterly Progress Report* (March 1985) revealed that the first three sites selected for reforestation were not amongst those originally identified for salinity development**.** Then, as the project progressed, regrowth was cleared to make way for eucalypts and pasture failed to grow amongst the trees. If trees were to draw down the water table and increase rice yields, why then was regrowth cleared to make way for eucalypts? And why were the eucalypts not planted on land originally identified for salinity development?

**Consultation.** Fourthly, project managers from the Tung Kula Ronghai or Karnataka project failed to adequately consult local communities to determine their needs. In both projects, local needs and aspirations were identified by project planners and others from outside rather than the local people themselves. As a result project planners were not concerned with outputs from existing forests, or with the food and fodder dimensions. Moreover, both of these cases illustrate that the choice of a tree species is most likely to be wrong for a community when a project starts out with firm preconceptions about the kind of tree that is needed without first consulting the community.

In Karnataka, it was assumed that the community had a need for fuelwood. But, the Karnataka community also had a need for fodder, food, and employment opportunities. These needs were not identified or accommodated in the project documentation because those managing the project had failed to ask the community what they needed. As a result, the project was planned in such a way that it placed even more pressure on existing fuelwood and food sources.

Similarly, in Tung Kula Ronghai, those implementing the upland reforestation project failed to consult the local community about their needs and their perceptions of the project, resulting in unforeseen and regrettable social consequences. When Khon Kaen University interviewed the local community about the upland reforestation project, the community stressed a need for firewood and fodder. Moreover, most of the villages questioned about their understanding of the primary objectives of the project rightly thought that it was to provide firewood, and many farmers in the project area disagreed with the location of the project because of concerns over reductions of grazing area for buffaloes and cattle during the wet season. A reduction in grazing area would force them to expend extra labour cutting and transporting grass to feed their livestock. Thus amongst their primary concerns and needs were fuelwood and fodder—neither of which were adequately addressed in the project planning and implementation.

Moreover, the project managers failed to inform the community about the salinity objective. Because they lacked adequate information, farmers in the area did not fully understand how eucalypts would solve the salinity problem and increase rice yields in the lowland areas. The consequences of not consulting the Tung Kula Ronghai community were far-reaching as the planting of eucalypts placed more pressure on existing fodder and fuelwood sources and the Tung Kula Ronghai community is still, to this day, burdened with project objectives and designs which were developed without the benefit of their involvement.

In light of the above, project planners should involve the local people by asking questions such as: What are the community's socioeconomic and ecological problems? What do the local people need and why? How can these problems be addressed? For whom, when and where should the program be implemented? These basic questions should be answered by the local people themselves and local communities should gradually become wholly responsible for program implementation as this will give them a sense of ownership and empowerment.

**Community participation.** Finally, the Karnataka and Tung Kula Ronghai projects highlight the importance of community participation in decision making. If the Karnataka and Tung Kula Ronghai communities had been allowed to participate in decision making, project planners would have become more aware of other community needs and the community would have been able to ensure that these needs were also accommodated in the projects initial objectives and carried out through its implementation. The communities would not have felt so disempowered if they had chosen the tree species, participated in the project design and had a clear sense of ownership over the project's outcomes.

In the Karnataka project, local communities were given little opportunity to participate in the project planning or implementation. As a result, villagers were forced to protest to get project planners to listen to their grievances. Similarly, in Tung Kula Ronghai, the local community had little opportunity to participate in decision making or to state their grievances despite the recommendation from Khon Kaen University that the villagers be informed and well involved in the reforestation project to avoid confusion over the project's objectives.

It is only just being realised that there is much to gain from allowing local communities to participate in decision making. For instance, drawing on the experience of those who have worked on facilitating community development in the last 20 odd years, the World Bank found that allowing local communities and other stakeholders to participate in managing forestry and conservation projects can help to improve forest productivity, alleviate poverty, increase environmental sustainability, and make rules governing forest access more enforceable (World Bank 1996:220). In light of the above,

it is strongly recommended that local communities be able to participate in project planning and implementation.

## Towards sustainable development

Both the Karnataka and Tung Kula Ronghai projects highlight the dangers of focusing on a single perceived community need and failing to acknowledge the complex linkages between social, economic and ecological systems.

In Karnataka, for instance, too much emphasis was placed on the perceived community need for fuelwood before it was discovered that the need for fuelwood was just one of the community needs. The community was also in need of food and fodder and neither of these needs could be met by eucalypts. An emphasis on fuelwood therefore had the effect of concentrating the community forestry effort on a narrow part of the spectrum of linkages between people and trees and tree products that had been identified initially—namely to the establishment of new plantations and to fuelwood. Whilst eucalypts have many benefits, including fast growth and the ability to coppice, their harvest is largely limited to wood products such as fuelwood, poles, pulpwood and timber; although honey and oils are also produced in some instances. Their services include protection of crops and of the soil, but their fast growth often leads to competition with adjacent crops and the elimination of the undergrowth covering the soil—an effect compounded by the practice in many countries of collecting the litter beneath the trees (Ball 1993:21). Eucalypts are not, therefore suitable for addressing fodder and food shortages.

Similarly, in Tung Kula Ronghai, too much emphasis was placed on the perceived community need for increased rice yields. As a result, other crucial and scarce community resources such as fuelwood and fodder were ignored as the objective of solving the salinity problem was pursued. As valuable grazing land in the upland areas was planted to eucalypts with the aim to solve salinity, the local community lost access to land in the upland areas which was a critical source of fodder during the wet season. Similarly, as regrowth areas were cleared to make way for eucalypts the local community lost a valuable source of fuelwood. Thus, as eucalypts were planted on land previously used for collecting fuelwood and fodder, the Tung Kula Ronghai project inadvertently caused more hardship to an already impoverished community and did little to meet their needs.

Village wells drying up as a result of eucalypts lowering the water table was also the result of addressing one need rather than a multiple of needs. Protest occurred because project planners had only focused on one objective—that of solving the salinity problem—but in doing so failed to consider the impact this could have on village

water supplies. Solving one problem by creating another does little to improve social welfare. Therefore, by focusing on solving the salinity problem, the Tung Kula Ronghai community inadvertently suffered from fuelwood, fodder and water shortages.

Sustainable development requires an understanding of social, economic and ecological systems, and the complex linkages between these systems. It demands recognition of the fact that the production and use of tree products at the village level is, in practice, embedded in complex resource and social systems, within which most of the factors that affect our ability to intervene with forestry solutions are of a non-forestry nature. They are primarily human factors, connected with the ways in which local communities organise the use of their land and other resources. They require situation-specific approaches and are unlikely to be successfully tackled by generalised solutions or approaches that address only a single element of the situation.

If projects are to address the complex resource and social systems that exist in a given community, there is much to be said for establishing multi-species systems, such as home gardens, which can supply fodder, fruit, poles and fuelwood rather than trees, such as eucalypts, in monocultures which are unable to meet a range of community needs. Multi-species systems which include indigenous tree species, are also more likely to contribute to a sound mixed subsistence/cash crop household economy, attract wildlife, and enhance biodiversity than tree monocropping using exotic tree species. And such a system is more likely, in the long term, to be sustainable from a social, economic and environmental point of view.

## Lessons to be learned

It is undeniable that the Karnataka and Tung Kula Ronghai social forestry projects caused unnecessary hardship to the communities involved. But, some salient lessons can be learned from the shortcomings of these two projects, and it is hoped that these lessons will improve the design and performance of future social forestry projects. Lessons to be learned are placed within the ESD framework as they highlight the need to recognise complex linkages between social, economic and ecological systems and to accomodate these linkages in project planning and implementation. These lessons are not limited to social forestry projects which use eucalypts as the main tree species—the major issues raised can be applied to any social forestry project that involves complex resource and social systems.

### Environmental lessons

- Plant fewer trees per unit area or thin existing plantations to reduce the water consumption needed by eucalypts in areas where water is scare or demanded by other sectors.
- Leave the foliage and bark of eucalypts on the plantation floor after harvesting the wood to minimise the impact of *Eucalyptus* plantations on soil nutrients.
- Allow much wider spacing between trees to allow ground cover and crops to develop in amongst the trees.
- Conduct comprehensive research before undertaking a project to determine whether or not eucalypts will have an adverse impact on soil nutrients, water hydrology, wildlife and biodiversity.
- Avoid clearing native forest or regrowth to make way for *Eucalyptus* plantations
- Plant eucalypts in multi-species systems with indigenous tree species and vegetation to minimise any adverse impact on biodiversity and wildlife.

**Socioeconomic lessons**

- The introduction of a eucalypt species should be done only with the concurrence of the local community involved.
- Tree planting should not be planned in isolation of market forces and care should be taken to ensure that there is a clear understanding of tree and land tenure.
- Efforts should be made to secure land tenure for local communities in a given project area. If this is not feasible, then tree and land tenure should be clearly defined.
- Community needs in a given project area should be determined and projects that address a number of these needs rather than a single need identified by project managers should be designed.
- Particular attention should be paid to the needs of landless people, whose former access to the areas selected for reforestation could be curtailed by the planting program.
- Clear project objectives which are not in isolation of market forces, political motivations and community needs should be determined. Project objectives should also be dynamic and flexible in nature.
- Local communities should be consulted and informed both before a project begins and during the actual implementation of the project.
- Local communities should participate in decision making and project implementation to ensure its success.

Lessons learned from the failings of the Karnataka and Tung Kula Ronghai social forestry projects can contribute much to a better understanding of the scope and potential of social forestry. Both projects focused on a rather narrow part of the

spectrum of linkages between people and trees and tree products that had been identified—namely the establishment of new plantations. In doing so, they neglected to address the other elements of social forestry stressed by the FAO in 1978—the provision of food and the environmental stability necessary for continued food production; and the generation of income and employment in the rural community. For social forestry to be effective, it must address the complex resource and social systems in a given community and analysis of the failings of the Karnataka and Tung Kula Ronghai social forestry projects highlight the need to address these complex systems. By paying sufficient attention to the important lessons learned from these projects it is hoped that similar controversies can be avoided or minimised in future social forestry projects.

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