Chapter 75
Huge Yields of Green Belts? Mega and Micro Plantation Forestry Cases from Indonesia, Ghana and Zimbabwe

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75.1 Forest Plantations for Protection and Production

Forests cover almost 4 billion ha (15 million mi^2), or 30% of the earth's area and the estimated net annual change in forest area worldwide in the period (2000–2005) is estimated at 7.9 million ha (30,500 mi^2) per year. Deforestation, mainly conversion of forests to agricultural land, continues at an alarmingly high rate especially in Africa and South America. At the same time, forests and trees are being planted for many purposes and at increasing rates. Forest plantations make up an estimated 3.8% of total forest area. The area of forest plantations has increased by about 2.8 million ha (10,800 mi^2) per year between 2000 and 2005. Productive forest plantations (primarily for wood and fibre) account 78% and protective forest plantations (for conservation of soil and water) 22% (FAO, 2005). In the developed countries, forests are currently expanding, mainly as a result of afforestation and reforestation. In contrast, however, it is deforestation and the processes of forest degradation that are still expanding in developing countries, and especially those in the tropical zone.

Large scale development of industrial forest plantations with fast-growing trees, especially on degraded lands, is regarded as likely to be essential in tropical forestry in the 21st century (Sayer, Vanclay, & Byron, 1997). There is also a global trend towards greater reliance on plantations as a source of industrial wood (FAO, 2001a). Forest plantations can supply large volumes of wood of uniform quality in a short period and, as has been claimed, may reduce the pressure on the remaining natural forests (Evans, 1992; Sayer et al., 1997). The growth and yield of exotic tree species, such as eucalyptus outside Australia, can be spectacular outside their natural range (Hillis & Brown, 1984). Popular exotic tree species are generally also very adaptable and have a wide range of utility, from sawn wood and processed wood products to a high calorific value fuelwood; they also have a variety of environmental and ornamental uses (Poore & Fries, 1985).

Several economical and environmental factors encourage the planting of trees, such as increasing productivity or reducing erosion. The social benefits gained from

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these efforts by local people include the creation of employment, the development of an infrastructure in remote areas, the use of land which has no agricultural value, and the integration of forest plantations with other land-uses (Evans, 1992; Niskanen & Saastamoinen, 1996). Despite the benefits already mentioned, plantation forestry in several tropical countries has been widely criticized for its alleged negative social and environmental impacts (Carrere, 1999; Kerski, 1995). The criticized negative environmental effects include a reduction in the biodiversity and long-term productivity (Evans, 1992). The *Eucalyptus* spp. have been also criticized for causing a variety of short- to long-term ills, including poisoning the soil, draining nutrients, failing to prevent soil erosion, repelling wildlife, and yielding no fodder or green manure (Kumar, 1991; Poore & Fries, 1985).

Globally associated with the expansion of pulp capacity is a huge increase in the area of industrial tree plantations, especially in South America, Asia and Southern Africa. Massive plantation schemes are planned in many countries in the world. National governments aim to establish 5.8 million ha (22400 mi^2) of industrial tree plantations in China, 5 million ha (19,300 mi^2) in Vietnam, and 5 million ha in Indonesia (19,300 mi^2), the(latter with the backing of the World Bank. In Laos, the Asian Development Bank has set a target of 500,000 ha (1,930 mi^2) of plantations by 2015. In Southern Africa Mozambique has plans to establish up to 7 million ha (27,000 mi^2) of plantations. In South America Brazil is currently the world leader in new pulp capacity; it already has large productive plantations. The rate of establishing plantations in Uruguay peaked in 1997 at almost 60,000 ha (230 mi^2) a year and is currently about 10,000 ha (40 mi^2) a year (Pulp Mill Watch, 2009). Concerns have risen about the impact of eucalyptus plantations on local residents and the environment and, in particular, land use questions. For example, the Finnish paper manufacturer Stora Enso had serious problems with landless farmers in Brazil in 2007 (YLE, 2007) and also in China in April 2009 (HS, 2009) because the company's eucalyptus plantations have reserved large areas which are also suitable for agriculture.

In summary, it is rather uncertain what the social and environmental impacts of tropical forest plantations are, especially on deforested areas. In this chapater the cases from Indonesia, Zimbabwe and Ghana are selected to provide additional information particularly on the impacts of forest plantations on peoples' livelihood.

75.2 Case from Indonesia: Industrial Forest Plantations in West Kalimantan

In Indonesia the forest resources comprise about 112 million ha (432,000 mi^2) of land, of which 29 million ha (112,000 mi^2) are reserved for protection forest, 19 million ha (74,000 mi^2) for conservation forest and 64 million ha (247,000 mi^2) for production forest (Kartodihardjo, 1999). Indonesia has the second largest area of rainforest in the world after Brazil. It also has the seventh highest above-ground woody biomass in the world and is among the ten leading countries with the highest net loss of forest areas between 1990 and 2000 (FAO, 2001a).

Forest plantations are expected to be a major source of wood supply for forest-based industries in the next 10–20 years in Indonesia (Otsamo, 2001). Studies of the socioeconomic effects of plantation projects in Kalimantan, Indonesia have pointed out several social problems that may have arisen as a result of the forest plantation project. These include loss of agricultural land, the disappearance of traditional lifestyles, inequalities in job opportunities connected with the forest plantations, and even fighting between the villagers that was provoked by different attitudes towards the project (Lounela & Topatimasang, 2000). Gönner (2000) suggests that it is questionable whether economic development projects, as practiced by the government and by private companies, are actually improving the livelihoods of the aboriginal Dayak communities in rural Kalimantan, since the projects were meant to *replace* the traditional livelihood systems rather than to supplement them (Fig. 75.1).

The Indonesian case study area is located in the districts of Sanggau and Sintang in West Kalimantan (Indonesian Borneo), between 0°00′– 0°40′S and 110°30′–111°30′E at an altitude of 50–100 m (164–328 ft) above sea level (Fig. 75.2). The long term average annual rainfall in the area is 3,518 mm (138 in), but it is characterized by a distinct areal and annual variation. The soils are mainly deeply weathered heavy soils with low levels of organic matter. The population in the study area consists mainly of various indigenous Dayak groups, but Malay groups also make up a considerable proportion of the population. Traditional patterns of land use in the study area are characterized by the cultivation of upland rice in the swidden cycle, the production of tree crops for cash and consumption, and the harvesting of some products from primary forests (Potess, 1995).

Fig. 75.1 Indonesia. The rotation period for industrial tree plantations in Indonesia is only seven years. Fast growing trees, mainly Acacia mangium and Eucalyptus species, are planted for pulp and paper production

Fig. 75.2 The Indonesian case study area is located in the Sanggau and Sintang districts, West Kalimantan, Indonesia

Since 1996 an Indonesian-Finnish joint venture, PT Finnantara Intiga, has planted some 23,000 ha (56,833 acres) of fast-growing trees, mainly *Acacia mangium Wild* for industrial purposes in the area. There are 190 village sites with an estimated total population of 50,000 within the proposed gross plantation area of 300,000 ha (741,300 acres). Because all of the suitable areas for forest plantations (especially grasslands and secondary vegetation areas) are usually claimed by the local people, the land acquisition process for plantations has to be planned with care in close cooperation with the people (Potess, 1995). The company aims at securing the social sustainability of the scheme by providing cash incentives, an improved infrastructure (e.g., roads and bridges), clonal rubber plantations, work opportunities, and a share of the forest plantation for the community.

In our survey study the villagers volunteered a total of 92 negative and 108 positive comments expressing their opinions of the plantation scheme, and also made 86 suggestions about ways in which cooperation with the company could be improved (Tyynelä, Otsamo, & Otsamo, 2002). The most common negative comment was that the company did not employ enough people. At the same time, the employment provided by the company was also the most common positive comment. Opinions also differed about the company's land use policy. While some people acknowledged the use of unproductive land, others complained about the declining area of agricultural land. Facilities supported by the company were appreciated, but their provision was too frequently delayed. The land use model and the social approach of the company were mentioned in the majority of the comments.

Forest plantations did not provide a balanced range of benefits for all of the households. Connections with village headmen and the company leaders were among the most important reasons why households had varying chances of obtaining job opportunities in the plantations. In both case study villages, the wealthy households shared the best job opportunities amongst themselves because they had higher education, better skills, greater self-confidence and more resources for swift changes in their livelihood strategy than poor households had.

The forest company, which paid 1.21 US\$day^{-1} for workers (the exchange rate was 1 US\$=10000 Rupiah during the period of the study), was also the biggest employer in the area. However, the forest plantations provided job opportunities for villagers mainly in the first year of the rotation, while between the fourth and the sixth year there were no operational activities at all. The company has paid for villagers 6 US\$/ha (2.4 US\$/acre) as land rent for a 45-year period. In addition, after carrying out the logging the company will pay royalties for the wood harvested. The royalties amount to a value of 10% of the total harvest, which would be 15 US\$/ha (6.1 US\$/acre) if the harvested volume is 200 m^3/ha (112,000 gallons/acre).

Species diversity measurements in Indonesia were done in 10 land use types and 5 plant form classes. Total number of plant species was highest in natural forest (8.5 sp/m^2) followed by forest garden (8.1), rubber garden (8.0), secondary vegetation forest (6.8), and clonal rubber (6.7). It was lowest in *Imperata* grassland (2.7) followed by *Acacia mangium* plantations (4.1), wetland rice fields (4.4), pepper fields (5.3) and swidden fields (6.1). There were statistically significant differences between the land-use types for the total number of plant species ($p = 0.001$ confirmed by Mann-Whitney′s *U*-test). The total number of species in the *Imperata* grasslands differed significantly from all other land use forms ($p = 0.008$). There were also significant differences between the plots in the forest plantations on *Acacia mangium* sites and those in all of the other tree-based land use systems ($p < 0.05$). The total number of woody (trees and shrubs) species was highest in the natural forests, forest gardens and rubber gardens (Tyynelä, Otsamo, & Otsamo, 2003).

75.3 Case from Zimbabwe: Small Eucalyptus Plantations Seen as Green Belts

Zimbabwe is a landlocked country in the subtropical Southern Africa that also includes Angola, Malawi, Mozambique, Namibia, Tanzania and Zambia. Zimbabwe was among the ten countries in the world with the highest net loss of forest area between 1990 and 2000. It is currently moderately forested, with around 22% forest cover and an additional 44% of other wooded land. There are about 119,000 ha (294,049 acres) of commercial forest plantations and 18,000 ha (44,478 acres) of non-commercial forest plantations, while the current annual establishment of new plantations has been estimated at 2,200 ha (5,400 acres) (FAO, 2001b).

At the beginning of the 1990s there were some negative attitudes in rural Zimbabwe against the eucalyptus, for example, popular beliefs that associate eucalyptus with high water consumption, a bad effect on land and neighbouring crops, and an unpleasant “smell” associated with spirits (Virtanen, 1991). However, later, in the 1990s, important changes occurred, most notably more extensive plantings and higher levels of commercialisation of eucalyptus plantations (Remme, Campbell, Chikandiwa, & Nobane, 1997). Price and Campbell (1997) found that some 90% of the rural households owned at least one exotic tree, and that status attributed to wealth bore no relationship to tree holdings. Eucalyptus plantations have been mainly established to provide wood as a construction material and poles for a number of purposes, while fuel wood is a less important product of the plantations. However, more recently eucalyptus plantations have been established not only to satisfy the increasing demand for wood, but also to earn a profit for the landowners. According to Mandondo (1997), for people in Zimbabwe tree planting is an emotional and ethical investment that provides them with, for example, reverence, confidence and security enhancement (Fig. 75.3).

The case study area was situated in a heavily deforested area where the villagers themselves had established small *Eucalyptus camaldulensis* woodlots. The approximate center of the Murewa District in Northeast Zimbabwe is at Latitude 17°35′S and Longitude 31°45′E. The mean monthly temperature varies during the year between 18° and 23°C (64–73°F), and the mean annual rainfall is between 890 and 930 mm (35–36 in) (Brinn, 1987). The study area lies between 900 and 1400 m (980–1,530 yards) above sea level and the land was mainly used for the dryland cropping of maize and cattle grazing. Much of the original vegetation which was classified as *Brachystegia-Julbenardia* miombo woodland on granite (Timberlake, Nobanda, & Mapaure, 1993) has been cleared, and the soil has been cultivated. "Miombo" is colloquial term used to describe those central, southern and eastern African woodlands dominated by the genera *Brachystegia, Julbenardia* and/or *Isoberlinia*, three closely related genera from the legume family (Fabaceae, subfamily Caesalpiniooideae) (White, 1983).

In the study area members of all social classes had already established eucalyptus woodlots already in the 1980s. Of the 62 *Eucalyptus camaldulensis* woodlot owners,

Fig. 75.3 Zimbabwe. Small-scale eucalyptus woodlots owned by the local farmers are common in Southern Africa. Photo is from Mukuwisi woodland near Zimbabwe's capital city Harare

25 were classified as poor farmers, 23 as middle-class farmers, and 14 as well-to-do farmers. The wealthier farmers had established significantly larger woodlots than the poorer ones. The mean areas of the woodlots and their standard errors were 0.024 (0.005) ha (0.06 acres, s.e. 0.01) for poor farmers, 0.129 (0.03) ha (0.32 acres, s.e. 0.07) for middle-class farmers, and 0.281 (0.084) ha (0.69 acres, s.e. 0.21) for well-to-do farmers. The differences in the mean sizes for the *Eucalyptus camaldulensis* woodlots in the different farmer categories were found to be highly significant (Kruskal-Wallis test value of $p < 0.001$) (Tyynelä, 2001a).

The private woodlot owners in the study area in Zimbabwe normally used about 30% of the trees harvested themselves and sold 70% (Table 75.1). The farmers used eucalyptus trees for roofing and fencing poles, which were the two most important functions for the poles (Fig. 75.4). Wood from the trees was also used in the construction of cattle kraals, goat pens, and fowl runs. In addition, the eucalyptus leaves placed in boiling water were used as a medicine for influenza. In many cases the woodlots were used as grazing areas. The schools that had established woodlots needed an ample amount of eucalyptus wood for construction purposes: bathrooms; fencing poles for gardens and around the school; teachers' fowl runs; poles for clothes drying lines; and poles for goal posts for soccer, netball, and volleyball. Some schools were earning considerable amounts of money selling trees to the villagers. Low prices had, however, been promised to those villagers whose children had labored in the woodlots. The schools generally wanted to set a good example for the local people by planting and through proper management of the trees (Tyynelä, 2001a).

Table 75.1 Benefits of Eucalyptus camaldulensis woodlots under different ownership categories in Mukarakate, North-Eastern Zimbabwe (Tyynelä, 2001a)

Benefits obtained	Private owners	Schools	Co-operatives
Poles	70% sold, the remainder used mainly as multi-purpose building materials.	A lot of money may be earned from sales, school use is also important.	Specified amounts annually available free to members, sometimes also sold.
Firewood	Mostly for personal consumption.	Small amounts can be collected free of charge by the families of students.	Specified amounts annually available free to members, can also be sold.
Medicinal leaves	Commonly used as medicine for flu.	Can be collected after permission is granted.	Available for all members, for others by permission.
Grazing	Often used as a grazing area for part of the year.	Not allowed.	Members use old woodlots for cattle and goats.
Other benefits	Can be used as an investment for the future.	Demonstration and provides experience to students and community.	Large woodlot areas are seen aesthetically as a "green belt."

Fig. 75.4 Zimbabwe. When the woodlots are used as grazing areas trees can often suffer from damages made by grazing animals and especially goats. In this case the coppice stems may be in safe place high above the ground

There were significantly more tree species in the miombo woodlands than in the *Eucalyptus camaldulensis* woodlots. The tree species diversity indices have indicated higher species diversity for the miombo woodlands than for the eucalyptus woodlots in northeastern Zimbabwe. There are, however, no statistically significant differences between the eucalyptus woodlot plots and miombo woodland plots in terms of their grass cover percentages, the number of grass species, or the number of herbs. There were also more trees per hectare on the miombo woodlands than on the eucalyptus woodlots. The mean basal areas for the woodlands and woodlots were not, however, significantly different, since the heights and diameters of trees were greater on the eucalyptus woodlots, which thus compensated for the lower density (Tyynelä, 2001b).

75.4 Case from Ghana: Agroforestry Planting in the Modified Taungya System

Ghana has a diverse and rich resource base, and as such, has one of the highest GDP per capita in Africa. Traditional land uses in this western Africa country include small and large scale farming, forestry, wood fuel, cattle grazing, tree plantations of exotic and indigenous species (cocoa, rubber, timber), and game/park reserves.

Most of Ghana's 238,500 km^2 (91.379 mi^2) is savannah (56%) or closed forest (35%). All the vegetation types in Ghana, except for those comprising the savannah, are considered tropical forests and play very important role in supporting the livelihood of 21 million Ghanaians, particularly, those in the rural communities. However, the combined effect of over-exploitation of forest resources, unsustainable farming practices, bush fire and mining activities have significantly reduced the forest area and degraded nearly 32% of the reserved forest and over 70% of forests outside reserves (Ministry, 1996).

The current deforestation rate in Ghana causes huge social, economic and environmental problems. Because of the heavy dependency on biomass, rural populations are obliged to overuse their forest resources and agricultural residue. Current agricultural practices, including pastoral farming and the cutting of biomass are among the fundamental causes of major environmental problems. Ghana lost 1.9 million ha (4.7 million acres) or 26% of its forest cover in the last 15 years. The most recent study of Africa's vegetation changes, estimated 3% per year deforestation rate for Ghana (IUCN, 2006). Continued forest loss threatens the existence of such indigenous tree species and associated biodiversity through habitat loss and the potential lack of gene flow as a result of fragmentation (Novick et al., 2003) and these also increase the processes of soil erosion affecting agricultural productivity on which the livelihoods of rural people depend (Abeney & Owusu, 1999). Sustaining the populations of the species and the value of the forest is a matter of increasing concern for not only Ghana but the entire West Africa regions.

For long time Ghanaian farmers have not been used to benefitting from tree planting at all. The Ghana Timber Resource Management Amendment Act 617 of 2002, for example, does not allow farmers to harvest timber even from their farmlands (Kalame, Nkem, Idinoba, & Kanninen, 2009). They are not adequately compensated for the damages caused to their crops when timber companies who have timber exploitation permits are harvesting timber (Nketiah, Ameyaw, & Owusu, 2005). This practice motivated farmers to destroy young naturally regenerating trees on their farmlands and discouraged them from planting trees. Most of the natural regeneration efforts by the government failed due to ill planning, uncoordinated efforts, a lack of resources, and a lack of incentives for farmers similar to the situation in Burkina Faso (Kalame et al., 2009).

Community-based forest rehabilitation and landscape restoration programs through the development of plantation and agroforestry systems using indigenous tree species is something new in Ghana (Ministry, 1994). In the past exotic tree species such as teak and *Cedrela* dominated the tree planting activities so that many of the indigenous tropical tree species were ignored and not deliberately incorporated into plantation or farming systems. As a result, there is very little or almost no literature or solid scientific data on the indigenous tree species in Ghana to guide their utilization and management in different land-use systems.

The taungya system was originally developed in colonial British India in the late 1800s. In taungya, plantation forest is established on government owned land by the local farmers. The government provides seedlings and tools as well as instructions and training. It started in Ghana in the 1960s, and much of the plantation establishment was planned through this system in those reserves that had poor stocking (FAO/UNEP, 1981). Under the traditional taungya arrangements, Ghanaian farmers had no rights to benefits accruing from the planted trees (Milton, 1994) and no decision making role in any aspect of forest management (Birikorang, Okai, Asens o-Okyere, Afrane, & Robinson, 2001). The Government of Ghana has now launched a new plantation development scheme due to weaknesses in the old system. That is called the modified taungya system (MTS) in which farmers are given parcels of degraded forest reserves to produce food crops and to help establish and maintain timber trees.

The International Tropical Timber Organization (ITTO) in cooperation with the Forest Research Institute of Ghana (FORIG) started a project on the rehabilitation of degraded forest lands through local community collaboration at 2001. It aimed at collaborative forest rehabilitation through the promotion of tree plantation development within and outside forest reserves. Twelve popular 12 indigenous and one exotic tree species were planted in a modified taungya system (MTS). The mixture of 13 priority tree species was determined in consultation with local farmers. Farmers were given land to grow annual agricultural crops along with forestry species during the early years of plantation establishment. Annual food crops such as cocoyam, plantain and vegetables were interplanted with tree species. After three years the cultivation of crops was normally stopped because of shade from the growing trees. The project achieved overwhelming support from the chiefs and the people. Local communities' perceptions of this project benefits are shown in Fig. 75.5. A total of 250 ha (618 acres) of forest plantations had been established in degraded forest areas through the MTS using a mixture of 13 different tree species (Blay et al., 2007).

Species diversity measurements from the MTS system are not yet published. However, Damnyag (2009) has preliminary findings in an unpublished paper.

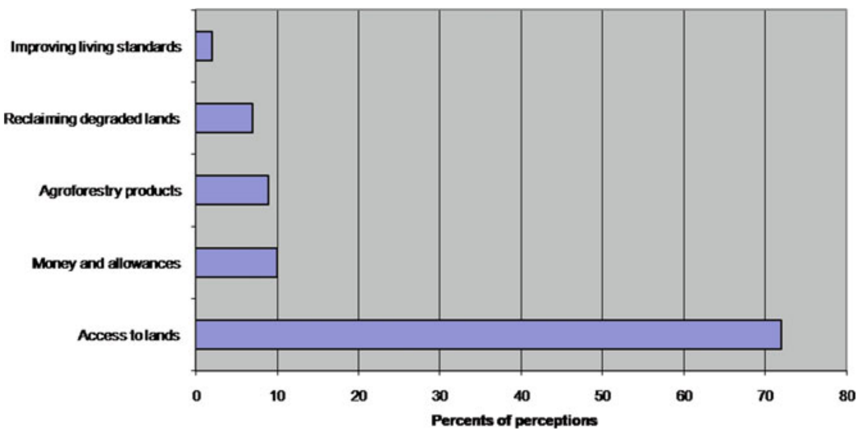

Fig. 75.5 Local communities' perceptions of tree plantation project benefits in Ghana (modified from Blay et al., 2007)

Fig. 75.6 Degraded forests (*left*) have smaller amount of trees and tree species than forest gardens (*right*) which include some planted trees. The photos are from dry semi deciduous area in Dormaa, Ghana

Table 75.2 Number of trees and tree species are compared in different forest types in Begoro (moist semi deciduous area) and Dormaa (dry semi deciduous area) in Ghana

Site, forest type	Number of trees/hectare	Number of tree species/hectare
Begoro, natural forest	230	34
Dormaa, natural forest	277	18
Begoro, forest garden	277	20
Dormaa, forest garden	211	14
Begoro, degraded forest	81	21
Dormaa, degraded forest	141	18

Modified from the unpublished manuscript of Damnyag (2009).

According to him there are generally more timber trees and species in the natural forests than degraded and forest gardens which include some planted forests (Fig. 75.6, Table 75.2). The results imply that forest benefits and tree species diversity are the highest in natural forests. However, forest gardens in the MTS seem to have more trees than degraded forests. Some valuable timber species like African mahogany were found in forest gardens but not in the other forest types. The average density of many important timber species is generally low in degraded forests. For example, African mahogany, is sometimes less than one commercial tree per 10 ha (24.7 acres) in the primary forests (Lamprecht 1989); it may even face extinction in the near future (Alder 1989).

75.5 Discussion and Conclusions

The objective of this study was to analyze how forest plantations impact on villagers' livelihoods in situations where the amount and importance of natural forests have been reduced in cases from Indonesia, Zimbabwe and Ghana. In Indonesia the results show that it is possible to include even large scale industrial forest plantations in village livelihoods without completely altering the traditional livelihood structure. The positive economic effects of forest plantations for the villagers have also been clear. This is an interesting result since in most cases large-scale plantation projects have been opposed on the basis of these arguments.

The results show that in Zimbabwe the villagers' established eucalyptus woodlots have provided important basic needs that complement other products obtainable from the remaining natural miombo woodland. However, although woodlots provided useful materials such as poles and building materials for their owners' own use, they have, nevertheless, provided only a very narrow range of the needs of the majority of farmers; Mukamuri (1995) makes the same point.

In Ghana the Forestry Commission was earlier the only owner of plantations established through taungya system; it received benefits from tree crops. As a result, farmers tended to neglect the tree crops and to abuse the system. In addition to these reasons, the rapid depletion and degradation of the forest resources has led to reintroduction of the modified taungya system (Blay et al., 2007). This MTS is expected to lead to increased revenue and other benefits to farmers and landowning communities. These are in line with the objectives of the 2001 Ghana Poverty Reduction Strategy. It seems that access to fertile land through MTS was the most important benefit in tree planting project according to local people. In the pilot areas the project managers documented a visible reduction in new farm clearings within and outside the forest reserves in 2004 compared to 2001 (Blay et al., 2007).

In all three countries, forest plantations have smaller three species diversities than the natural forests, but when established on degraded areas, such as the grasslands in Indonesia or grazing areas in Zimbabwe, they cannot be accused of reducing species diversity. Also preliminary results from Ghana showed that forest gardens in the modified taungya system have more trees than degraded forest and included valuable timber species. In Indonesia, the number of plant species was lower in *Acacia mangium* plantations than in any other land use type except on *Imperata* grasslands. The findings might suggest that if it is planted to any other land use type it would result in a decrease in the number of species. However, when exotic plantations replace non-forest communities they will create a forest environment which may be a good thing; although this is unlikely to favor the species that are characteristic of non-forest communities. According to Poore and Fries (1985), plantations of exotics will be poorer in terms of species richness and contain different species from those found originally in the natural forest which they have replaced.

In conclusion, the scale of the plantations has meant that forest plantations have generally had a range of different social impacts in the three case countries (Table 75.3). In Zimbabwe, all ownership types have the resources necessary to improve the management of woodlots, while in Indonesia and Ghana this has not been a problem since management has been undertaken by the forest company or research institute. This finding has also meant that farmers in Indonesia and Ghana had become more dependent on the company or other donors, whereas in Zimbabwe there have been fewer risks to take and less dependence on the forest plantations.

Table 75.3 Three different forest plantation types and their main social impacts. Cases from modified taungya system in Ghana, small-scale eucalyptus woodlots in Mukarakate, Zimbabwe, and large scale industrial forest plantations in West Kalimantan, Indonesia

Impacts on	Modified taungya system in Ghana		Eucalyptus woodlots in Zimbabwe		Industrial forest plantations in Indonesia	
Cash	Provide crops and tree seedlings for selling	+	Minor impacts, important for some owners	+	Important cash earnings from job opportunities and royalties	+++
Products for own use	Crops at the beginning, NWFP later	++	Provide building material, poles and firewood for owners	+++	None	0
Employment	Offer jobs at establishment and harvest time	+	Minor impacts, although some extra labour is needed at establishment	+	The most important employer in the plantation scheme area	++
Land-use	Access to land seen as the most important benefit	+++	Normally established in private fields or gardens, might reduce communal grazing areas	–	Reduce agricultural areas, but using grasslands may increase productivity	--/+
Risks	Risk of wild fire incursion in tree plantation in dry semi deciduous zones	–	Minor risks as trees are used locally and woodlot management is done by the owners themselves	0	Potentially high risks if changes in the company's policy occur	--
Infrastructure	Donor funded schemes may develop feeder roads and bridges	+	None	0	Forest plantation scheme develops infrastructure, e.g., roads and bridges	++
Environment	Tree gardens increase species diversity	+	Bigger woodlots seen as "green belt"	+	Reforesting grasslands might have positive effects on species diversity	+
Security	Reclaiming degraded lands seen as benefit and expected share from sale of trees	+	Seen also as investments for future and as grazing areas for cattle	+	Land-use model and incentives might also increase incomes and rice yields	+

+++ highly positive, ++ positive, + some positive impacts, 0 no impact, – some negative impacts, -- negative, --- highly negative

Despite their positive economic effects, forest plantations reduce the areas that can be used for other types of livelihood, particularly in Indonesia.

The present findings support the point made, for example, by the Australian Centre for International Agricultural Research (ACIAR, 1992) that the social and ecological effects of planting exotic trees in small woodlots may be very different from those produced by extensive plantations. Forest plantation can also be part of agroforestry system leading to valuable forest garden with many indigenous timber trees as in the case of Ghana. Therefore, one should be cautious and not make generalizations without specifying the scale and the context of the forest plantations.

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