

Potential Economic Impact of Improving Returns to Smallholder Tree Farmers in Leyte: A Cost Benefit Analysis of ACIAR Project ASEM/2003/052

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ABSTRACT

This paper presents the results of a cost-benefit analysis of the likely impact of research project ASEM/2003/052 *Improving financial returns to smallholder tree farmers in the Philippines* – funded by the Australian Centre for International Agricultural Research. Three main categories of project benefits are identified which coincide with short, medium and long-term outcomes, namely (1) increased returns to existing tree farmers from increased volume and higher quality of merchantable timber combined with higher stumpage prices flowing from improved market access (estimated to have a net present value of A\$ 1.9 M), (2) increased returns to existing tree farmers from subsequent tree rotations due to increased volume and higher quality of merchantable timber from better management and higher prices (estimated NPV of A\$ 1.22 M), and (3) expansion of the timber plantation area due to the higher returns available as a result of project outputs (estimated NPV of A\$ 7.79 M). These estimated net present values suggest that the research project is a highly rewarding investment in economic terms.

Keywords: registered tree farm, market access, discount rate, timber quality, stumpage price

INTRODUCTION

ACIAR project ASEM/2003/052 is designed to provide economic benefits to tree farmers on Leyte Island in the Philippines. The flow-on benefits of higher timber prices, leading to higher incomes of smallholders can potentially make a substantial improvement in rural livelihoods, especially relative to current low

earnings, with more than 50% of rural households below the poverty line (NSCB, 2003).

The previous ACIAR research project (ASEM/2000/088 – Redevelopment of a Timber Industry following Extensive Land Clearing), to which various papers in this issue relate, provided considerable information about smallholder forestry on Leyte Island. The current follow-on project has a sharper focus on tree farms, or smallholder timber plantations, many of which are registered with the Department of Environment and Natural Resources (DENR). In designing this new project, ACIAR requested an estimate of the research payoffs in economic terms, as a component of the information concerning the desirability of the investment in research activities. This paper outlines the cost-benefit analysis (CBA) approach adopted in that assessment, and the estimated project net present value of benefits over costs.

KEY ASSUMPTIONS AND SOURCES OF DATA FOR CBA

Three main categories of benefits of the research project have been identified, namely: (1) increased returns to tree farmers from increased volume and quality of merchantable timber combined with higher stumpage prices flowing from improved market access; (2) improved returns to existing tree farmers from subsequent rotations of tree farms from increased volume and quality of merchantable timber flowing from better management and higher stumpage prices; and (3) expansion of the area of tree farms planted due to higher returns available, and attributable to, project outputs. The following sections report an estimation of net present value for each of these project benefit categories.

No accurate data exist for many of the key variables determining payoff from forestry research in Leyte. Data were obtained from a number of sources including DENR staff in Region 8, an ICRAF project on Mindanao, data collected by Australian project researchers on a Philippines visit and data provided by staff in the College of Forestry and Natural Resources at Leyte State University (LSU). In addition, a number of assumptions have been made in undertaking the analysis of the benefits of improvements in timber prices based on previous project activities. These assumptions are outlined below.

Discount Rate and Time Periods

The *real* (net of inflation) discount rate chosen has a major impact on the estimated payoffs in CBA. Venn (1999) noted that during the 1970s and 1980s, discount rates of up to 24% were used for forestry investments in the Philippines. Uriate and Pinol (1996 cited in Venn, 1999) used an 18% discount rate, while DENR (1998) used rates between 12% and 18%. Harrison *et al.* (this issue) adopted a discount rate of 15% for financial evaluation of plantation-grown exotic and indigenous tree species. The above are *private* rates, from the viewpoint of

tree growers, and appropriate *social* rates would presumably be lower due to both a lower risk premium and recognition of non-market forestry benefits. Niskanen (1998) and Venn (1999) adopted a social discount rate for forestry of 12%, Venn also used rates of 9%, 15% and 18% in sensitivity analysis. A real discount rate of 5% is adopted as a standard by ACIAR from project impact assessment, but would appear too low for a social rate in the Philippines. For the analysis reported here, real social discount rates of 5%, 10% and 15% have been adopted, with 10% chosen as the benchmark level.

Benefits accruing to existing tree farmers from the impact of both better management and higher prices are assumed to occur uniformly in each of the next 10 years – the average rotation length assumed for *gmelina* – and are discounted back to present value. A return in perpetuity has been used to calculate the benefits associated with better establishment and management of subsequent rotations and for the benefits of increased areas of tree farms.

Tree Species Selected for the Analysis

Tree farm¹ data obtained from DENR indicate that *Gmelina arborea* (*gmelina* or *yemane*) is the most widely planted species, hence growth and price data used in the CBA relate to this species. *Swietenia microphylla* (*mahogany*) is the next most common species planted.

Number, Size and Nature of Tree Farms in Leyte

According to the statistics provided by the DENR, in 2003 there were 523 tree farms registered in CENRO² Maasin and 207 in CENRO Tacloban compared with only 24 in CENRO Baybay and 42 in CENRO Albuera. The recorded aggregate area of tree farms in Maasin and Tacloban is 3,551 ha. The total area planted would be much larger; according to DENR and LSU staff, all four CENROs have a large number of tree farms within their boundaries despite the lower numbers registered with the DENR and it is reasonable to assume that the recorded tree farms represent less than 50% (and probably much less) of the total tree farm area. For the CBA, a conservative estimate of 50% has been used, resulting in an estimated aggregate area of existing tree farms over the four CENRO areas of 7,102 ha. There is a skewed size distribution of registered tree farm areas towards those of a larger size. This is consistent with owners of larger farms being wealthier and more educated and thus in a better position to understand the relevant regulations and pursue tree registration through the DENR. The number and total area of smaller tree farms is particularly difficult to estimate.

¹ The term 'tree farm' is used here to represent a planted area (e.g. plantation, strip planting, fenceline planting) within a farm, rather than the farm in totality.

² City Environment and Natural Resources Office.

Yield Estimates for the CBA

While growth models exist for key species including gmelina and mahogany, these have largely been developed based on data collected from well-managed industrial plantations and in some cases have been based on expected growth rather than actual growth. No reliable data exist on timber yields of tree farms. Current annual yields (mean annual increment, MAI) appear to be about 7.5 m³/ha or less for gmelina from smallholder tree farms (Bertomeu, 2006 Baynes, 2004). This is much less than estimates of the potential MAI of 20 to 30 m³/ha from well-managed plantations reported in the literature, e.g. by ERDS (1998).

Estimated Stumpage Prices

Little information exists on roundlog stumpage prices received by smallholders. Most are based on board feet (bf) prices of flitched timber. It is assumed that the current stumpage price is 4 PhP/bf (equivalent to A\$ 43.50/m³)³ which is the current price received for gmelina in Mindinao (Cramb, 2004, Bertomeu, 2006), which is slightly lower than the price reported by CENRO Maasin in Southern Leyte Province.

Impact of the ACIAR Research Project on Tree Yield and Stumpage Price Received by Existing Tree Farmers

In the analysis it has been assumed that improved management of existing plantations will result in an average increase in annual timber yield from 7.5 to 10 m³/ha and that this will be achieved on 5% of the total area of tree farms on Leyte. The estimate is reasonable given that staff will make at least one visit to approximately 500 tree farms and extension materials and advice will be provided directly to each of these smallholders. Further smallholders will be reached through radio segments and field days. In addition, a substantial proportion of the total area of registered tree farms is owned by a relatively small number of smallholders, and smallholders with larger tree farms will be targeted for more intensive extension and management advice.

Providing better access to markets is likely to increase stumpage prices and part of ACIAR project ASEM/2003/052 involves testing mechanisms for providing improved access of smallholders to formal markets. In the CBA it is assumed that a total of 30% of tree farmers will benefit from higher stumpage prices achieved through accessing more formal markets. The roundlog stumpage reported in the Philippines forest industry statistics was used as a proxy for the stumpage price that could be obtained if smallholders could access formal markets. As such, the benefit achieved by smallholders gaining access to formal markets is estimated conservatively as being the difference between estimates of current stumpage of 4 PhP/bf (\$43.50/m³) received by smallholders and the most recent (2002) roundlog

³ The 2005 exchange rate was A\$ 1 = 40 Philippines pesos (PhP) approximately.

stumpage (\$56.4/m³) which is reported for Leyte in the Philippines forest industry statistics compiled by the DENR. The stumpage price paid to smallholders appears to have been constant for a number of years, including 2002, and it is thus considered reasonable to use this in the analysis. The 5% of smallholders achieving increased yields through better management are included as part of the 30% receiving higher prices. In addition, it is assumed that the 5% of tree farmers who take up better management practices will receive a 25% increase in stumpage price due to improved log quality.

RESULTS OF THE CBA

Economic Benefits Arising for Existing Tree Farms

The current estimated total annual cash income from Leyte tree farms is \$2.4 M per annum. This is based on a stumpage price of 4 PhP/bf (SA 43.50/m³). This has been used as the baseline against which the figures reported in Table 1 have been calculated.

Table 1. Financial benefits expected to be realised by smallholders from project activities

Tree farm intervention	Net present value (A\$ M) ^a (discount rate of 10%)		
	(1) Immediate incremental benefits to existing tree farmers	(2) Incremental benefits to existing tree farmers from subsequent rotations	(3) Net Income generated by additional plantings of 500 ha per year for 10 years
Additional income from improved management of tree farms (5% of tree farmers affected)	0.474 (0.596 – 0.388)	0.670 (2.133 – 0.286)	Not estimated separately
Additional income from higher prices from better market access (30% of tree farmers affected)	1.410 (1.772 – 1.152)	0.549 (1.748 – 0.235)	Not estimated separately
Total benefit expected to be realised	1.884 2.368 – 1.528	1.219 3.881 – 0.521	7.794 (23.244 – 1.655)

a. Figures in parentheses are NPVs at discount rates of 5% and 15%.

An increase in productivity of existing tree farms of just 2.5 m³/ha would produce a net benefit of \$1,544,386 per annum additional revenue flowing to smallholders. The benefits of the project have been estimated based on an improvement in productivity to *only 5% of current area of tree farms* – which equates to \$77,219 additional cash to these smallholders per annum (NPV over 10 years = \$0.474 M).

Research by ICRAF in Mindinao suggests that saw millers would be willing to pay a stumpage price of between 1 and 2 PhP per board foot more for straight logs, which are 8 feet long and with a minimum 15-20 cm small-end diameter. A 1 PhP increase in stumpage is the equivalent to an increase in stumpage of 25% or about \$11/m³. Project activities directed at improving the quality of logs produced by smallholders are thus likely to result in 25% or greater improvements in stumpage paid to smallholders. If these improvements in market prices were obtained by all smallholders then this would equate to a potential annual increase in income to smallholder tree farmers of at least \$1,147,362. Assuming that *only 30% of tree farmers benefit and that the 1 peso increase in stumpage accrues only to the 5% of tree farms that adopt improved management*, this is still a benefit of \$229,472 per annum (NPV over 10 years = \$1.410 M).

Economic Benefits Arising to Current Tree Farmers from Improved Management to Subsequent Rotations

If existing tree farmers see the benefits of better management of their current tree farms through higher yield and prices, they will be encouraged to replant these tree farms when they are harvested and to then subsequently manage them better from the outset. This better management is likely to produce substantial gains in productivity. An improvement in productivity of existing tree farms to 15 m³/ha, combined with higher quality timber, will produce high economic benefits to smallholders. Improvement in productivity of subsequent rotations of existing tree farms has the potential to improve cashflows to smallholders by of the order of \$2.5 M per annum. Even if only the 5% of the smallholders who adopted better management of tree farms go on to better management of subsequent rotations, the estimated financial benefits will be in the order of \$173,743 per annum (NPV over subsequent rotations = \$0.670 M). Improvements in market prices translate to a potential benefit of about \$3.5 million per annum to smallholders. Assuming that *only 30% of tree farmers benefit from higher prices of subsequent rotations, and that the 1 peso increase in stumpage accrues only to the 5% of tree farms that adopt improved management*, this is still a benefit of \$142,328 per annum (NPV subsequent rotations = \$0.549 M).

Economic Benefits Arising from Increased Planting

There are currently about 350,000 ha of non-forest land in Leyte Province, much of which is potentially available for agroforestry production. There are about

400,000 households in Leyte Province, although it is unclear what proportion of these are rural households with access to land for forestry. About 60% of smallholders surveyed from four rural communities as part of ASEM/200/088 were found to be interested in undertaking commercial forestry. Currently, there are over 700 registered tree farmers in the province, and many more can be expected to register trees (in anticipation of off-farm timber sale), particularly if stand registration and harvesting approval can be expedited. There appears to be great potential for the expansion of smallholder forestry, and this activity is likely to improve the livelihoods of the rural poor in the province.

Improved access by farmers to formal markets is likely to lead to an increase in establishment of new tree farms. A modest increase of 500 ha established per year over 10 years will potentially lead to increased income to smallholders with a present value of some \$7.8 million after allowances have been made for cash outflows and the opportunity cost of tree farms replacing agricultural activities. The per annum cash flows to smallholders associated with an additional 500 ha of tree farms is in the order of \$2.5 M.

DISCUSSION

The cost-benefit analysis reported here has a number of limitations. Importantly, estimates of direct benefits to smallholders only are reported, excluding any estimates of flow on impacts to other sectors of the community. For instance, an increase in the area of tree farms established would result in higher levels of sawmilling activities with consequent increases in employment and capital expenditure. These flow-on effects are not included because the aim of the analysis has been to assess the impacts on smallholders – which are the focus of the current ASEM/2003/052 project. Nevertheless, flow-on impacts are likely to occur and may be at least similar to the direct benefits to smallholders.

A number of additional economic benefits are likely to arise from the project which have not been quantified as part of the preceding analysis. An increased timber resource will be available for on-farm use, e.g. for house construction and repair, stakes to support crops, and fuelwood. Some of this timber would come from thinnings, rather than as an alternative to selling logs. Increased smallholder and community forestry will reduce the need to spend scarce cash on purchase of these items. A supplementary source of income will arise from sale of fuelwood and charcoal. Tree growing will allow a more diversified agricultural production base, greater creditworthiness, and greater income stability.

The benefits reported in Table 1 are based on *highly conservative estimates* of the total area of tree farms, timber prices and forestry uptake rates by smallholders. There is a high likelihood that the benefits realised will be much greater, although the high uncertainty associated with the rate of uptake of the project makes any definitive statement impossible.

Expansion of tree planting and higher timber prices will lead to welfare improvements from greater self-reliance with respect to timber and fuelwood and greater off-farm earnings from timber sale. Some improvements in housing standard may arise from increased availability of timber. The difficulty of obtaining permits for tree harvest and timber transport will be reduced for tree growers, including both reduced time requirements and reduced uncertainty in obtaining permits. Social harmony will be improved due to fewer prosecutions for infringing regulations. The increased activity of community organizations can lead to greater shared goals and social cohesion, and to creation of community development funds which can support asset purchase and infrastructure development. The beneficiaries from the project will mainly be smallholders, many of whom currently have incomes below the poverty line. There will probably be little gender impact, though there may be a reduction in effort needed to collect fuelwood (generally a task undertaken by females).

Benefits could arise from having more settled rural communities, particularly in sloping and upland areas, for which forestry is well suited. The practice of shifting cultivation would be reduced, there could be reduced insurgency activity, and cash income from forestry is sometimes used as a means of affording children's education.

Forestry expansion will provide environmental benefits through watershed protection and reduced siltation of marine habitats. Flood mitigation benefits will reduce loss of life and damage to crops and infrastructure from floods. Greater availability of fuelwood and charcoal will reduce reliance on gas as a fuel for cooking and water heating, with consequent lower CO₂ emissions. Further benefits are reduced pressure for logging of native forests (mostly illegal), and reduced felling of productive coconut palms for cocolumber (with associated erosion impact and encouragement of urban conversion of productive farmland).

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