

## Compiling Market and Other Financial Data on Smallholder Forestry in Leyte, the Philippines

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**Abstract** Data collection and maintenance of databases concerning smallholder forestry presents special problems in developing countries. This paper examines forestry data collection experiences in a series of research projects in Leyte, Philippines, supported by the Australian Centre for International Agricultural Research, and the prospects for developing forestry accounting networks. A variety of financial data have been collected in relation to seedling production, plantation performance and timber marketing. Seedling production cost and revenue data have been obtained through snapshot surveys conducted in 2002 and 2008, and repeated attempts have been made to estimate financial returns from growing the most popular tree species. Diverse sources have been identified for timber market information. On the supply side, these include government records of registered plantations, obtaining inventory data from barangay (community) leaders, and reporting information about timber available for harvest on community notice boards. On the demand side, official records of registered timber merchants have been accessed, a detailed survey of timber processors has been conducted, and estimates are being made of apparent per capita timber consumption by district. Experiences in the Philippines reinforce that the potential for forestry accounting networks is limited by the resource-constrained situations of developing countries, placing greater reliance on one-off surveys. Use of pre-existing local networks and institutional structures offers potential for routine collection of forestry data, such as through barangay (village) leaders in the Philippines.

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## Introduction

Information of various types is critical for forestry policy formulation and management of forest enterprises in any country or region, for example to plan promotion of timber planting and to identify priority forestry planting areas, species and systems. Information is also needed for enterprises involved in timber production, processing and marketing. Governments, the timber industry, research organizations and NGOs are involved in forestry data collection and processing. Information is compiled at the individual enterprise, regional and national level, and typically relates to aspects such as forest tenure, timber production, prices, profitability and timber trade.

The nature and extent of information which is compiled by government and research agencies differs between developed and developing countries, with the latter facing much greater constraints on routine data collection. In developing countries in South-east Asia which have heavy reliance on funding from organizations such as the World Bank and Asian Development Bank, along with donor countries, data collection is influenced by the need to provide evidence that aid and loan funding is being used effectively. This includes statistics on tree planting for environmental protection, and of measures adopted to control illegal logging.

In the Philippines, as in other developing countries, deforestation has taken place at a rapid rate in the last 50 years. The Philippines was for many years a major timber and furniture exporter, but due to a high rate of logging of native forests is now a net timber importer. Illegal logging and wildfires have damaged natural forests and plantations. Shifting cultivation in upland areas has led to severe land degradation. Natural disasters linked to deforestation, including floods and land and mud slides, have taken many lives.

Some industrial forestry plantations have been established, particularly in Mindanao. However, industrial scale forestry has proven relatively unsuccessful (Harrison and Herbohn 2003). Smallholder tree planting is widespread but takes place on a very small scale, typically as woodlot, agroforestry and fenceline plantings. In an attempt to settle farmers and prevent shifting agriculture, improve livelihoods, protect watersheds and supply timber for domestic markets, the national government has introduced various plantation forestry programs, most of which fall under the umbrella of Community Based Forest Management or CBFM (Harrison et al. 2004). Philippine smallholder plantation forestry typically involves growing exotic timber species, including *Gmelina arborea* (gmelina), *Swietenia macrophylla* (mahogany) and *Acacia mangium* (mangium), with relatively small areas planted to the longer rotation native species including dipterocarps, which have greater environmental benefits.

With minor exceptions logging in native forests has been outlawed in the Philippines, so the timber resource base relates to planted forestry. Based on DENR data, the total area of plantation forest on Leyte Island is about 35,000 ha (Cedamon et al. 2007a). Less than half can be considered productive forest; some plantations

have suffered high tree mortality while harvesting is not allowed in some areas. Most plantations are on forest land (elevated and sloping land with limited 'tax declaration' tenure), though some is on alienable and disposable (A&D) land (freehold land much of which is suitable for cropping). Most of the plantation area comes under various CBFM tenures.

Research projects in Leyte in the Philippines funded by the Australian Centre for International Agricultural Research (ACIAR) have included various data collection activities in relation to seedling production, forest inventory and yield modeling, timber enterprises, and socio-economic conditions of smallholder tree farmers.

This paper examines the problems faced in constructing and maintaining forestry data systems in the Philippines, with particular attention to Leyte, and explores measures which could be adopted to improve the supply of forestry information. Some of the requirements for a forestry information system are first examined. The organization of forestry in the Philippines, and in Leyte in particular, is then discussed. Current information sources and approaches for obtaining forestry information are reviewed. Constraints to the provision of forestry information, particularly in relation to individual forestry enterprises, are examined. Some suggestions are made as to how forestry information collection and dissemination could be improved.

### **Some Aspects of an 'Ideal' Information System**

Information services are vital for informing decision-making in relation to national forest policy and microeconomic planning and management in forest industries. This raises a question as to what are the components of an ideal socio-economic information system to support forestry planning and enterprise decision-making, and also whether there are particular forestry information needs specific to developing countries.

Ideally, macro-level information components would include up-to-date and sufficiently detailed information—about timber resources, harvesting, production of forest products, prices and costs in forest industries, marketing and trade—at national and regional levels. A national timber inventory—essentially of trees on farms in cases where industrial forestry is absent—would be useful for predicting future log turnoff and sustainable harvest. Information in the form of criteria and indicators of sustainable forest management would be desirable.

Information services are also critical at the enterprise level. As noted by Cedamon et al. (2007a) in relation to lack of timber market information in Leyte in the Philippines, market efficiency depends on availability of information for market participants. Detailed information at the individual enterprise level is also needed for planning forestry support measures. In this context, it would be desirable to have a long-term forestry accounting network such as exists in Baden-Württemberg, Germany (described by Brandl, this issue).

In any forestry information system, a government natural resource agency is likely to be the lead agency and primary data collector, but supported by other government agencies and research bodies. Increasingly, electronic databases will be

developed to integrate and store forestry information, and to allow regular updating of the information.

### Sources and Types of Forestry Data Available in Leyte

In the Philippines, the Department of Environment and Natural Resources (DENR), through its Forest Management Bureau (FMB), is the lead forestry agency. The DENR has its head office in Manila, and has a network of provincial environment and natural resource offices (PENROs) and district or community environment and natural resource offices (CENROs). The Department of Agriculture (DA) and Department of Agrarian Reform (DAR) as well as local (municipal) government units (LGUs) and various NGOs play a role in forestry support and administration, the latter particularly in relation to CBFM.

Official statistics for forestry are compiled mainly by the DENR and the National Statistics Office (NSO). Forestry-related data available from NSO include employment in forestry, forestry business and establishments, gross national product and gross value added from forestry to forest products trade. Most forestry data available from the Philippine Forestry Statistics are aggregated by administrative region. Data on the DENR Philippine Forestry Statistics both published on the DENR website and in print relate particularly to aggregate timber production and trade statistics and timber prices. As indicated by FAO (2002):

The Forest Management Bureau of the DENR is responsible for collection, compilation, processing and dissemination of forestry statistics. Within the Bureau, the Forestry Statistics Section maintains and regularly updates the forestry data bank, which consists of several databases ...

The primary mode of dissemination of forestry statistics is through the Philippine Forestry Statistics Yearbook (PFS). The PFS is a compendium of basic information on forest resources, forestry operations, forest utilisation, forest products trade and prices, forest revenues and other forestry-related information such as employment, gross value added, etc. The information is derived from both primary and secondary sources. The primary sources of data are the regional offices, which submit regular reports as by-products of their administrative and regulatory functions. In some instances, data are also obtained from one off studies and surveys. Secondary data such as trade and gross value added in forestry are sourced from other government agencies. ...

Table 1 reports the statistical series maintained by the FMB. The NSO is the official source of statistics on forest products trade (NSO 2004).

#### The Philippine Master Plan for Forestry Development

Another important information source is the Philippine Master Plan for Forestry Development. According to the FMB (2003),

**Table 1** Statistical series reported by the forest management bureau

Type	Coverage
Production volume (m <sup>3</sup> )	Fuelwood, logs, lumber, plywood, veneer, non-timber forest products, blockboard
Forest charges (PhP)	Logs, non-timber forest products
Prices (PhP)	Logs (m <sup>3</sup> ), lumber (board feet), plywood, lawanit, fuelwood, rattan
Forest products imports (volume and value)	Woodchip, wood waste, wood charcoal, logs, lumber, plywood, veneer, fibreboard, particleboard, non-timber forest products, manufactured wood products, furniture, paper and paperboard, pulp and wastepaper
Forest products export (volume and value)	Woodchip, wood waste, logs, lumber, plywood, veneer, fibreboard, particleboard, non-timber, manufactured wood products, furniture, paper and paperboard, pulp and wastepaper
Licenses issued	Timber licenses, other licenses
Non-timber licenses issued	Rattan
Number of wood processing plants	Sawmills (active with and without timber concession), sawmills (existing with and without timber concession), veneer mills, plywood mills, blockboard manufacturing plants, particle board manufacturing plants
Economic indicators in forestry	GNP and GVA in forestry, GVA growth rate
Indicators of forestry education	Number of schools, course enrolment, number of forestry graduates
Watershed management information	Watershed forest reserves
Reforestation information	Reforested area
Community-based forest management information	Community-based forest management projects
Industrial forest management information	Industrial forest management agreements
Grazing management	Forestland grazing leases and agreements
Land area by status (ha)	Land classification by type

Source: FAO (2002)

In response to the rapidly declining conditions of the country's forest resources, the Philippine Government through the assistance of Asian Development Bank (ADB) and the Finnish International Development Agency (FINNIDA), formulated a 25-year Philippine Master Plan for Forestry Development (MPFD) in 1989-1990. The MPFD was accepted and approved by the Philippine Cabinet in June 1990. It consists of three umbrella programs and fifteen major programs designed to revitalize the Philippine Forestry Sector back to its former significant role in national development. Formulation of Regional forestry development plans ensued, and was followed by formulation of a medium term plan for 1993-1998, all of which were completed in 1992. The Department of Environment and Natural Resources (DENR) has the primary responsibility in implementing the MPFD. Of the 15 major programs of MPFD, domestic and international support were concentrated on two: a) the

**Table 2** Information available from the MPFD forest based-industries and forest product utilization sector

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Estimated national timber consumption
Wood demand projections for furniture and housing
Projected demand for various forest products including lumber, plywood, veneer, particle board, and fibre board
Trend in forestry plantation development by sectors

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People-Oriented Forestry Program (POFP) which evolved into Community-Based Forest Management (CBFM) Program and b) Biodiversity Conservation, which became the foundation of the Integrated Protected Area System (IPAS).

The plan, which was updated in 2003 (UNFAO and FMBDENR 2003), provides a comprehensive collection of forest industry data and sets out ambitious objectives for forestry expansion, though progress towards these objectives has been slow. It is noted that the MPFD is divided into various chapters and the chapter on ‘sectoral assessment’ provides figures on forests and forest industries. Furthermore, most of the data provided in the MPFD were sourced from the Philippine Forestry Statistics (PFS). Table 2 lists information available from the MPFD relevant to smallholder forestry which is not available from the PFS.

#### Tree Farm Registration and DENR Statistics on Registered Tree Farms

The Philippines operates a complex system of registration for smallholder tree farms (described by Calub 2005), which is designed mainly to prevent illegal timber logging and transport. Tree registration is not a key responsibility area or funded activity of the DENR, and tree growers are reluctant to register planted trees because of the time and cost impost of the registration process, most registering only when they wish to harvest trees for timber sale. The CENROs are responsible for tree farm registration, and maintain an inventory of registered tree farms. This inventory contains details for each tree farmer on: location of tree farm (lot reference number, barangay, municipality); area planted; number of trees by species and age; and timber volume parameters (diameter at breast height, merchantable height and total height) if trees are past sapling stage. Unfortunately, as noted by Cedamon et al. (2005), DENR tree registration data are unreliable, because often the tree farms or the tree farm owners listed in the database do not exist, some tree farms have low stocking compared to what was reported, and only a small proportion of farmers register their plantations.

#### Leyte Timber Supply and Demand Information Generated by ACIAR Research Projects

Information on timber supply and demand for Leyte Island has been compiled in a ‘tree farm’ research project funded by the Australian Centre for International

Agricultural Research, as part of the evaluation of benefits of improved timber inventory estimation and silvicultural management.

### *Tree Farm Measurements*

The ACIAR project carried out a *tree inventory* on Leyte Island in which probability-proportional-to-size (PPS) sampling was used to select seven municipalities and a total of 108 barangays. Arising from this work, a yield model was developed for smallholder gmelina plantations, as reported by Vanclay et al. (2008) and Vanclay (2009).

### *Smallholder Tree Inventory Information Collected by Barangay Captains*

In the tree farm project, the barangay captains for the 108 selected Leyte Island barangays were requested to compile data of households and individuals who have planted trees. The detailed research methodology has been reported by Cedamon (2007) and Cedamon et al. (2007b). The reliability of the barangay-based inventory was confirmed by visiting tree farms, identifying tree species and counting tree numbers, and interviewing farmers to determine the year of planting. Based on the tree farm inventory, it was estimated that on average farming households on Leyte Island were growing 136 trees on their farm and an average of 10 households in every barangay had planted trees. Given Leyte Island consists of 1990 barangays, it was estimated that the island has approximately 19,900 smallholders growing 2.7 M trees.

### *The Whiteboard Trial of Forestry Demand and Supply Information*

An experiment was conducted in the ACIAR project in which details of tree farmers and timber purchasers were placed on  $1.2 \times 2.4$  m whiteboards in public view at the front of a CENR office, so as to facilitate communication between buyers and sellers. The demand data—including purchase prices reported by various timber merchants for a range of tree species and sawn timber dimensions—are particularly useful in that ‘going prices’ are made public information. The tree farm supply data—including grower’s names, tree registration numbers and species grown—are useful for timber buyers seeking logs from registered tree farms. The whiteboard trial was evaluated by Gerona et al. (2009) and found to meet requirements of the various stakeholder groups in the timber market, although the difficulty in updating the hand-written whiteboard details may lead to replacement by broadsheet printed data.

### *Leyte Timber Enterprise Survey Finding*

A survey of Leyte timber enterprises including lumber processors and lumber retailers was conducted in the ACIAR tree farm project. Data were collected on: timber procurement volume and buying prices; volume and selling prices of timber products sold by location, species and product type; managers’ views on

smallholder tree farms as a sources of timber resource; and managers' perceptions of future prospects for their enterprise and the overall Philippines timber industry (Cedamon et al. 2009). Customers were found to include building contractors, furniture makers, lumber retailers, government institutions and households.

### *Estimation of Apparent per Capita Consumption of Timber in Leyte*

Apparent consumption of wood by region—as an indicator of timber demand—can be estimated by adding the volume of imports to local production then subtracting exports (Gregory 1987). Cedamon et al. (2007a) obtained volume data on solid wood (log and lumber) production, imports and exports for the Philippines from 2005 Philippine Forestry Statistics, and population data from the website of the Philippine National Statistics Office ([www.census.gov.ph](http://www.census.gov.ph)). The total Philippines population for 2005 was estimated as 85.4 M, and the national apparent per capita consumption of solid wood for the year was 0.018 m<sup>3</sup> or 7.58 bdf. This information on apparent per capita timber consumption will provide estimates of timber demand for particular regions, which will then be used to examine the extent to which supply meets demand. The information on timber balance will then provide information for landholders for forestry planning.

### *Socio-Economic Survey Findings*

Socio-economic data were obtained from a sample of 81 smallholders who participated in the timber inventory survey. Data were collected on farm resources, production by enterprise type, forestry and agroforestry activities, and attitudes towards tree registration. Various reports on survey findings are provided in the end-of-project workshop proceedings edited by Harrison et al. (2009).

Timber supply and demand data obtained from the several research activities by ACIAR research projects on smallholder forestry are summarized in Table 3.

### *Plantation Profitability Information*

While no forestry accounting information is regularly collected from tree growers in the Philippines, various financial models have been developed of smallholder forestry plantations, including ERDS (1998), Venn et al. (2000), Aggangan (2000), Harrison et al. (2005) and Magcale-Macandog and Abucay (2007). Tree farmers appear to often accept low stumpage prices because buyers agree to meet the payments and paperwork requirements of the DENR for harvest and log transport approval. While smallholder forestry was strongly promoted in the 1990s, there appears to have been a decline in profitability since that time. For example, Pasicolan and Macandog (2007) observed that the belief that there is 'green gold in Gmelina growing' and consequent widespread tree planting in the 1980s led to great disappointment among tree growers in the southern Philippines a decade later.

**Table 3** ACIAR research projects and types of data collected

ACIAR research project	Data collected or provided
Tree farm measurement	Per plot tree data, e.g. tree height, dbh, basal diameter, dominant height, crown radius, bark thickness; log data, e.g. diameter at small and big end of the log, log length, log grade; plot data, e.g. slope, vegetation, soil and topography
Barangay chairmen inventory of smallholder tree farms	Names and locations of tree farmers; number of trees planted by species, age, planting pattern, year of planting; land tenure where trees are planted
Socio-economic survey	Tree farmer profile, farm resources, production by enterprise type, forestry and agroforestry activities, and attitudes towards tree registration
Timber enterprises survey	Timber procurement volume and buying prices; volume and selling prices of timber products sold by location, species and product type; managers' views on smallholder tree farms as a sources of timber resource; and managers' perceptions of future prospects for their enterprise and the overall Philippines timber industry
Whiteboard trials	Harvestable tree farms by name of farmer, location, area of tree farm, age, species and standing volume; timber buying prices by product type or lumber dimension by lumber buyer or timber processor

### Electronic Data Processing of Forestry Information at DENR

In a comprehensive evaluation of forest and natural resource data and information flow in the Philippines, Bantayan and Arche (2003) observed that ‘The DENR and its attached agencies manage an extensive collection of spatial and statistical data’. They developed recommendations on establishment of a GIS-based database ‘guided by four major components, i.e., physical resources and infrastructure, biological, social and economic components’, with coding structures based on these four major components.

While an enormous amount of forestry data is collected at CENRO level, electronic processing and management of these data remains limited. For example, among the five CENROs in Leyte Island, as of 2008 only two had managed to enter tree registration onto a computer while the rest kept records in log books. While systematic reporting on forestry information is provided to DENR Regional VIII office in Tacloban City, these reports contain mainly summarized information at CENRO level. Various visits of the authors to these CENROs in the last 5 years revealed a shortage of computers and data encoders, and computers had only been installed in the last few years. This perhaps explains the limited electronic data processing at CENRO level.

### Constraints on Forestry Information Systems in Leyte

While a substantial amount of aggregated information on forestry is available in the Philippines, various factors work against detailed forestry reporting at the individual enterprise (tree farm) level. Timber millers are nervous to report their resource use.

Apart from this being a traditionally tight-lipped group in many countries, there is the additional concern in the Philippines that some of the resource has been illegally logged (especially for native species), and there is a fear of increased taxation and of prosecution. Although Leyte Island exports some timber to other islands in the Philippines, it also has substantial timber imports, much of the timber coming through Cebu, but some also direct from Mindanao. DENR officers have commented that timber coming from disputed territory in Mindanao where separatist movements exist is regarded as illegally logged timber. Experience in a series of timber processing enterprise surveys in ACIAR projects in Leyte has revealed that obtaining detailed information from these enterprises is a challenging task.

Obtaining enterprise data is made difficult by the very large number and small size of holdings. In Leyte there are no forestry enterprises which could be called large-scale or industrial, the industry being dominated by smallholder forestry in blocks, agroforestry systems (including underplanting in coconut plantations) and as fenceline plantings. As of year 2002, Leyte Province had a total of 136,209 farms, and Southern Leyte Province 39,377 farms, with total farm areas of 258,362 and 62,220 ha, respectively, farm sizes averaging about 2 ha (NSO 2004). Consequently the area planted to trees is often small. For tree inventory and socio-economic survey work in the ACIAR tree farmer project in Leyte, a minimum planted area of 0.1 ha was adopted (Herbohn et al. 2005).

In addition to their reluctance to register tree farms with the DENR, tree growers who do not have secure land tenure and have not applied for land titling are excluded from the tree registration process. Many farmers have tax declaration status, but often the annual tax payments are not made so a farmer who acquires such a property is required to pay all the back taxes to obtain title. Many farmers in upland areas are regarded as *kaingan* squatters, not recognized by government, and access to these areas is difficult because of poor roads and law and order problems.

The DENR tree registration system tends to place a focus on regulation rather than forestry planning and information use, and the tree registration database is not kept up-to-date. A high proportion of the timber harvested on farms does not enter formal markets—it tends to be used on-farm for house construction, extension or repair, or traded with neighbours. Keeping tree farm records up-to-date is made more difficult because on the harvest pattern over time; often only a few trees are cut at a time, e.g., to meet an emergency medical payment, pay school fees or help fund a wedding. Even on registered tree farms, these occasional tree harvesting activities are unlikely to be reported to the DENR.

Undertaking surveys to collect smallholder forestry data in Leyte has revealed some important difficulties that are likely to also be present in other developing countries. Due to official lists being incomplete and outdated, *snowball sampling* is required, in which respondents are asked to identify other potential respondents in their district. Data collection through surveys faces problems of obtaining survey approval from various gatekeepers in local government and barangays, and of language dialects (e.g., Cebuano is spoken in eastern Leyte and Waray Waray in the west). Record keeping by individual landholders concerning forestry is limited by lack of production volume, training in record keeping and computer access.

Notably, access to television and DVD players has been increasing, in part due to the popularity of videoke as a recreation activity, and merging of TV and computer technology may facilitate improved record keeping.

A general impression is that detailed reporting systems are often devised by governments in the Philippines, sometimes without consideration of whether they are practical to maintain, and with a focus on the mechanistic collection of data quantity rather than quality. Lack of funds, and perhaps lack of appreciation of the value of information and a disconnect between the data collection and its ultimate use, sometimes lead to weak statistical systems.

No regular collection of forestry accounting information at the individual enterprise level takes place in Leyte, or for that matter anywhere else in the Philippines. A number of constraints would make this particularly difficult. Government agencies lack funds for recurrent data collection. Some data collection activities take place as a result of donor funding—notably from Germany, Japan, Australia and Sweden—but this tends to be for projects of not more than 3–4 years duration.

### **Potential Measures for Improving Leyte Forestry Information Services**

What can be done to improve availability of Philippine forestry statistics, within budgetary and other constraints? In that much of the information reported on the DENR and NSO websites is highly aggregated, there appears scope for LGUs playing a greater role in recording forestry activities in their areas, and in making more local area statistics available. This would be appropriate given LGUs can be expected to play an increasing role in forest management in the future. For example, various observers have suggested the LGUs should carry more responsibility for tree registration (e.g., Herbohn et al. 2008, Mangaoang et al. 2009), because there are a larger number of these than CENROs and they are more accessible to smallholders.

One possibility for regular collection of local area data would be to seek annual reports at barangay (village) level. Cedamon (2007) confirmed that reasonably reliable data on tree ownership, species grown and age distributions, could be obtained from barangay captains. The possibility exists that at least a sample of barangay captains would be prepared to coordinate regular (say annual) compilation of details about the timber resource in their areas, against which yield models—such as that reported for Leyte smallholder forestry by Vanclay et al. 2008 and Vanclay 2009—could be applied to predict turnoff age and volume of timber harvested. Some logistical support and remuneration would probably be required to assist this reporting.

In that regular data collection is difficult, an alternative is to conduct surveys of tree farmers. Some of the one-off timber market data collection examples discussed by Cedamon et al. (2007c) provide pointers to how this could be done. Regular farm surveys are used in various countries to obtain current information on physical and financial variables. The socio-economic survey of Leyte smallholders conducted in the ACIAR Leyte tree farm project provides a model of how this survey work could be designed and conducted. The establishment of a central repository or clearing

house for forestry research findings of DENR *techno gabay* (extension) units, universities, the World Agroforestry Centre and other research groups would be a useful step in making these more widely available. The logical way to do this would be through linked web sites.

The whiteboard trial demonstrates a relatively low-cost and convenient information system for bringing timber purchasers and sellers together to expedite timber selling and harvesting. In that at least some of the CENROs have now adopted computer technology, an alternative would be to maintain an electronic database of timber stands and timber demands in the CENRO district. Updating would require that information can be captured for timber sales (which should be possible because sales require DENR permits) and on-farm use (which would be more difficult to monitor). Prices on offer could be obtained by telephone from timber merchants. The CENRO staff would then print of up-to-date information about tree farmers and timber buyers in paper form to place on a notice board.

### Concluding Comments

Comprehensive, reliable and up-to-date information is critical for policy formulation and enterprise decision-making. Data collection and processing can consume a large amount of resources. Particular problems exist for establishing and maintaining forestry information systems in developing countries in tropical south-east Asia, including the Philippines, due to lack of resources, the very small size of forest holdings, difficulty of accessing smallholders, and various other constraints.

For the Philippines, substantial information is available on the government forestry web site, particularly for aggregate statistics at the regional and national level. The Master Plan for Forestry Development, which was developed with assistance from the ADB and FINNIDA, provides an example of information collation in formulation of a national forest policy. Forestry information services in the Philippines appear to focus more on macro-level information, and there appears to be a lack of information at the forestry enterprise level. Inventory information on plantation forestry also appears lacking.

Forestry accounting networks are probably unworkable in developing countries, including the Philippines. It is unlikely that any accounting network could operate effectively and have long-term existence. This leads to surveys—both one-off and repeated—being the choice of method for obtaining enterprise data, as for example undertaken in ACIAR-funded Philippine forestry projects.

### References

- Aggangan RT (2000) Tree farming in the Philippines: some issues and recommendations. In: Harrison SR, Herbohn JL (eds) Socio-economic evaluation of the potential for Australian tree species in the Philippines, ACIAR monograph 75. ACIAR, Canberra, pp 33–43
- Bantayan N, Arche V (2003) Evaluation of forestry and natural resources data and information in the Philippines. Regional Office for Asia and the Pacific, Food and Agriculture Organization, Bangkok

- Calub F (2005) DENR rules and regulations governing timber and timber products planted on private land. *Ann Trop Res* 27(1):91–96
- Cedamon E (2007) Reliability of barangay-based inventory of smallholder tree farms in Leyte Island. Master of Science Thesis, Leyte State University, Baybay City, Philippines
- Cedamon E, Baynes J, Bernaldez S (2005) Trials and tribulations in locating tree farmers and sites for research and extension activities. In: Suh J, Harrison S, Herbohn J, Mangaoang E, Vanclay J (eds) Improving financial returns to smallholder tree farmers in the Philippines, ACIAR smallholder forestry project ASEM/2003/052, Proceedings from the ACIAR project planning workshop held in Ormoc City, The Philippines, 15–17 Feb 2005, pp 111–120
- Cedamon E, Harrison S, Herbohn J (2007a) Timber market information on Leyte Island, the Philippines. *Ann Trop Res* 29(3):61–72
- Cedamon ED, Mangaoang EO, Harrison SR, Herbohn J (2007b) Evaluation of the reliability of village-based inventory of smallholder tree farms on Leyte Island, the Philippines. In: Harrison SR, Bosch A, Herbohn J (eds) Improving the triple bottom line returns from small-scale forestry, Proceedings from an international conference held in Ormoc, The Philippines, 18–21 June 2007, pp 79–88
- Cedamon J, Cedamon E, Harrison S, Gregorio N, Mangaoang E, Herbohn J (2007c) Survey of timber entrepreneurs in region 8 and Cebu, The Philippines: preliminary findings. In: Harrison S, Bosch A, Herbohn J (eds) Improving the triple bottom line returns from small-scale forestry, Proceedings from an international conference, Ormoc, The Philippines, 18–21 June 2007, pp 89–97
- Cedamon E, Cedamon J, Harrison S, Mangaoang E (2009) Timber entrepreneurs' attitudes and plans relevant to smallholder forestry. In: Harrison S, Bosch A, Herbohn J, Mangaoang E (eds) Improving financial returns to smallholder tree farmers in the Philippines, Proceedings from the end-of-project workshop held in Ormoc City, The Philippines, 11–12 Feb 2009. The University of Queensland, Brisbane, pp 129–144
- ERDS (Ecosystem Research and Development Service) (1998) Growth and yield and economic analysis of selected forest tree species, techno-transfer series bulletin No. 28, DENR, Davao City
- FAO (2002) National Forest Products Statistics Philippines. In: Ma Q, Broadhead J (eds) Overview of forest products statistics in the South and Southeast Asia. FAO Regional Office for Asia and the Pacific, Bangkok. <http://www.fao.org/docrep/005/ac778e/AC778E16.htm>. Accessed 28 Oct 2008
- FMB (Forest Management Bureau) (2003) Regional forestry master plan development, Department of Environment and Natural Resources. <http://www.forestry.denr.gov.ph/rfmp.htm>. Accessed 14 Mar 2010
- Gerona MA, Gravoso R, Pasa A, Mangaoang E (2009) Beyond the whiteboard: insights from disseminating timber marketing information in Southern Leyte. In: Harrison S, Bosch A, Herbohn J, Mangaoang E (eds) Improving financial returns to smallholder tree farmers in the Philippines, Proceedings from the end-of-project workshop held in Ormoc City, The Philippines, 11–12 Feb 2009. The University of Queensland, Brisbane, pp 227–231
- Gregory G (1987) Resource economics for foresters. Wiley, New York
- Harrison SR, Herbohn JL (2003) Strategies for forest industry redevelopment in Leyte. *Asia Pac J Environ Dev* 1(1):12–27
- Harrison S, Emtage N, Nasayao E (2004) Past and present forestry support programs in the Philippines and lessons for the future. *Small-Scale Forest Econ Manage Policy special issue on Community Forestry* 3(3):301–17
- Harrison SR, Venn TJ, Sales R, Mangaoang EO, Herbohn JL (2005) Estimated financial performance of exotic and indigenous tree species in smallholder plantations in Leyte Province. *Ann Trop Res* 27(1):67–79
- Harrison S, Bosch A, Herbohn J, Mangaoang E (2009), Improving financial returns to smallholder tree farmers in the Philippines, Proceedings from the end-of-project workshop held in Ormoc City, The Philippines. The University of Queensland, Brisbane, 11–12 Feb
- Herbohn J, Harrison S, Vanclay J, Wardell-Johnson G (2005) Designing a strategy to sample tree farms on Leyte. In: Suh J, Harrison S, Herbohn J, Mangaoang E, Vanclay J (eds) Improving financial returns to smallholder tree farmers in the Philippines, ACIAR smallholder forestry project ASEM/2003/052, Proceedings from the ACIAR project planning workshop held in Ormoc City, The Philippines, 15–17 Feb 2005, pp 203–210
- Herbohn J, Vanclay J, Harrison S, Gregorio N, Dargusch P, Mangaoang E, Smith C, Mercardo J (2008) ACIAR smallholder forestry and tree nursery research: briefing document, Prepared for the joint meeting of Forestry Project Stakeholders, Manila, 5 Sept

- Magcale-Macandog DB, Abucay ER (2007) Predicting the long-term profitability, economic feasibility and sustainability of smallholder hedgerow agroforestry systems using the WANULCAS model. In: Harrison SR, Bosch A, Herbohn J (eds) Improving the triple bottom line returns from small-scale forestry, Proceedings from an international conference held in Ormoc, The Philippines, 18–21 June 2007, pp 229–234
- Mangaoang E, Harrison S, Herbohn J (2009) Trialling localization arrangements and other reforms of tree registration in Southern Leyte Province. In: Harrison S, Bosch A, Herbohn J, Mangaoang E (eds) Improving financial returns to smallholder tree farmers in the Philippines, Proceedings from the end-of-project workshop held in Ormoc City, The Philippines, 11–12 Feb 2009. The University of Queensland, Brisbane, pp 153–160
- NSO (National Statistics Office) (2004) A review of the agriculture sector in eastern visayas, special release no. 126, NSO, Manila. <http://www.census.gov.ph/data/sectordata/sr04126tx.html>. Accessed 28 Oct 2008
- Pasicolan PN, Macandog DM (2007) Gmelina boom, farmer's doom: tree grower's risks, coping strategies and options. In: Harrison SR, Bosch A, Herbohn J (eds) Improving the triple bottom line returns from small-scale forestry, Proceedings from an international conference held in Ormoc, The Philippines, 18–21 June 2007, pp 313–318
- UNFAO and FMBDENR (2003) Sustainable forest management, poverty alleviation and food security in upland communities in the Philippines: revised master plan for forestry. UNFAO Project PHI/01/010 Final Draft Report. Quezon City, DENR. <http://www.forestry.denr.gov.ph/MPFD.htm>. Accessed 26 Feb 2004
- Vanclay J (2009) A robust growth model for smallholder tree plantations. In: Harrison S, Bosch A, Herbohn J, Mangaoang E (eds) Improving financial returns to smallholder tree farmers in the Philippines, Proceedings from the end-of-project workshop held in Ormoc City, The Philippines, 11–12 Feb 2009. The University of Queensland, Brisbane, pp 41–48
- Vanclay JK, Baynes J, Cedamon E (2008) Site index equation for smallholder plantations of *Gmelina arborea* in Leyte Province, the Philippines. *Small-scale Forestry* 7(1):87–93
- Venn T, Herbohn JL, Harrison SR (2000) Relative financial performance of Australian and traditional timber species in the Philippines. In: Harrison SR, Herbohn JL (eds) Socio-economic evaluation of the potential for Australian tree species in the Philippines. Australian Centre for International Agricultural Research, Canberra, pp 93–110