

# **IMPROVING THE TRIPLE BOTTOM LINE RETURNS FROM SMALLHOLDER TREE FARMS IN THE PHILIPPINES: A SYSTEMS APPROACH**

**John Herbohn, Steve Harrison, Jerry Vanclay, Eduardo Mangaoang, Nestor  
Gregorio, Edwin Cedamon, Iean Russell and Grant Wardell-Johnson**

Corresponding Author  
John Herbohn  
School of Natural and Rural Systems Management  
The University of Queensland  
Gatton, 4343, Australia

## **ABSTRACT**

This paper<sup>1</sup> outlines the application of Systems Thinking in investigating ways to improve the returns to smallholder tree farmers in the Philippines. The paper illustrates how a systems approach was used in the conceptualisation of the project and how systems thinking facilitated a shared understanding of the how each individual's research contributed to the broader project activities. Systems thinking has also been used in the design and implementation of various project activities. Three examples are provided. The first example illustrates how a systems diagram was developed which outlined the direct and indirect linkages between biophysical data on tree farms and various activities designed to increase returns. The second example illustrates how the suggested approach for improving the flow of information concerning tree registration, harvest and transportation regulations and approval mechanisms link with various project activities and have been informed by a series of action research workshops. The third example illustrates how systems thinking has also been applied to understand the factors affecting the production of high quality tree seedlings and to investigate the effect of policy interventions on improving the quality of seedlings available to smallholders.

Keywords: Small-scale forestry, community forestry, Bayesian belief networks

## **INTRODUCTION**

Most upland farmers in the southern Philippines have incomes below the poverty line (Emtage 2004). Timber production from smallholder tree farms provides a mechanism for income generation and capital accumulation. However, current returns to smallholder tree farmers are low, for a variety of reasons. Research conducted as part of a four-year project funded by the Australian Centre for International Agricultural Research suggests that tree farmers could receive much higher financial returns from their tree farms if they had better market access and knowledge of prices, produced greater volumes of timber per unit of cost, and could better produce timber of appropriate species, log size and quality as desired by the market. In order for smallholders to access markets directly they must first obtain log transport permits

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<sup>1</sup> This paper has also been recently presented at a conference organised by the IUFRO 3.08 Small-scale Forestry Research Group on the theme of "Improving the triple bottom line returns from small-scale forestry" held at Ormoc City, Philippines June 17-21, 2007.

## Improving the Triple Bottom line Returns from Small-scale Forestry

and sometimes harvest permits. To do this, they must first register their tree farms with the Department of Environment and Natural Resources (DENR). There are many institutional impediments restricting the ability of farmers to register trees, and hence these act as a barrier to them gaining access to markets, thus restricting timber sales to local markets, which are often thin and non-competitive. In addition, many smallholders lack information about how and where to market their trees, and lack knowledge of the current market value of their trees. For these reasons, they often accept the first, and often low, price offered for their timber, and often this is from a timber merchant who purchases the standing trees and undertakes to organise all the necessary felling and transport approvals. Smallholders also lack knowledge about what the market requirements are for timber and as result do not manage their tree farms to optimize the output of these desired products.

ACIAR<sup>2</sup> Project ASEM/2003/052 \_ Improving Financial Returns to Smallholder Tree Farmers in the Philippines \_ commenced on 1 January 2005 and runs to the end of 2007, with the potential for an extension of up to one year. The project is designed to improve the livelihoods of smallholder farmers in Leyte Province through investigating ways of improving financial returns from forestry, and promoting the adoption of these improved management methods.

Forest industry development for both economic and environmental reasons is a high priority for the Philippines, as indicated in the Revised Master Plan for Forest Development (Revised MPFD) issued by the DENR in 2003. In particular, the role of forests and forestry in poverty eradication and support of sustainable livelihood has been recognised in the Revised MPFD as being one of the important new developments in forestry in the Philippines.

Currently, the twin problems exist of shortage of timber hence reliance on imports from other provinces, and slow uptake of forestry in spite of availability of underutilized sloping lands. Forest industry development warrants high priority in Leyte Province. Tree planting is carried out for production forestry, limited harvest and conservation purposes, which are all considered important under the Revised MPFD. At the farm and community level, this generates a timber resource for on-farm use, sometimes provides a supplementary income, and creates opportunities for value-adding from log timber. At the wider community level, forestry expansion will provide environmental benefits, reduce pressure for logging of native forests and unnecessary cutting of mature coconut trees, and reduce reliance on timber imports from other regions or other countries.

This paper outlines the application of Systems Thinking in investigating ways to improve the returns to smallholder tree farmers in the Philippines. The context of this project is first outlined, including a discussion of how the results of past research and consultations with key stakeholders have guided the development of the project. The results of a brainstorming session which developed a systems framework that guided the conceptualisation of the project are reported. The goal and objectives of the project which were articulated using the framework are then presented and the research strategy outlined. Three examples are then provided as to how a systems approach has been applied in the implementation of project research activities.

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<sup>2</sup> The authors would like to thank the Australian Centre for International Agricultural Research (ACIAR) for providing financial support for research into smallholder forestry since 2001. ACIAR has recently approved further support for a new four year project \_ ASEM/2006/091 Enhancing Tree Seedling Supply via Economic and Policy Changes in the Philippines Nursery Sector.

## PROJECT CONTEXT

Research in the current project follows on from that of ASEM/2000/088, which identified the social, economic and policy requirements for the facilitation of smallholder and community forestry in Leyte Province. Research undertaken as part of ASEM/2000/088 suggested that Leyte tree farmers could receive much higher financial returns from their tree farms if they had better market access and knowledge of prices, produced greater volumes of timber per unit of cost, and could better produce timber of appropriate species, log size and quality as desired by the market. In order for smallholders to access markets they must first obtain log transport permits and sometimes harvest permits. In order to do this, they must first register their tree farms with the DENR. There are many institutional impediments restricting the ability of farmers to register trees, which act as a barrier to them gaining access to markets, thus restricting timber sales to local markets, which are often thin and non-competitive. In addition, many smallholders lack information about how and where to market their trees, and lack knowledge of the current market value of their trees. For these reasons, they often accept the first, and often poor, price for their timber. Smallholders also lack knowledge about what the market requirements are for timber and as result do not manage their tree farms to optimise the output of these desired products. In many cases, the smallholders are achieving timber yields that represent only a fraction of the potential site productivity, often much lower than 50%. This failure to capture the potential productivity of the tree farms is due to a combination of factors including poor site preparation and early weed control, use of poor germplasm and poor silviculture practices involving a lack of thinning and pruning.

Low yields combined with poor market access means that financial returns to smallholder tree farmers are low. The environment that smallholder tree farmers are operating within is also complex \_ from a social, environmental, economic and political context. As such, there is no one 'magic bullet' that can improve financial or other returns from tree farms. In order to improve one or more of these triple bottom line returns, it is necessary to look at the smallholder tree farms in a broader context \_ there are many interacting factors that affect returns to smallholders growing trees.

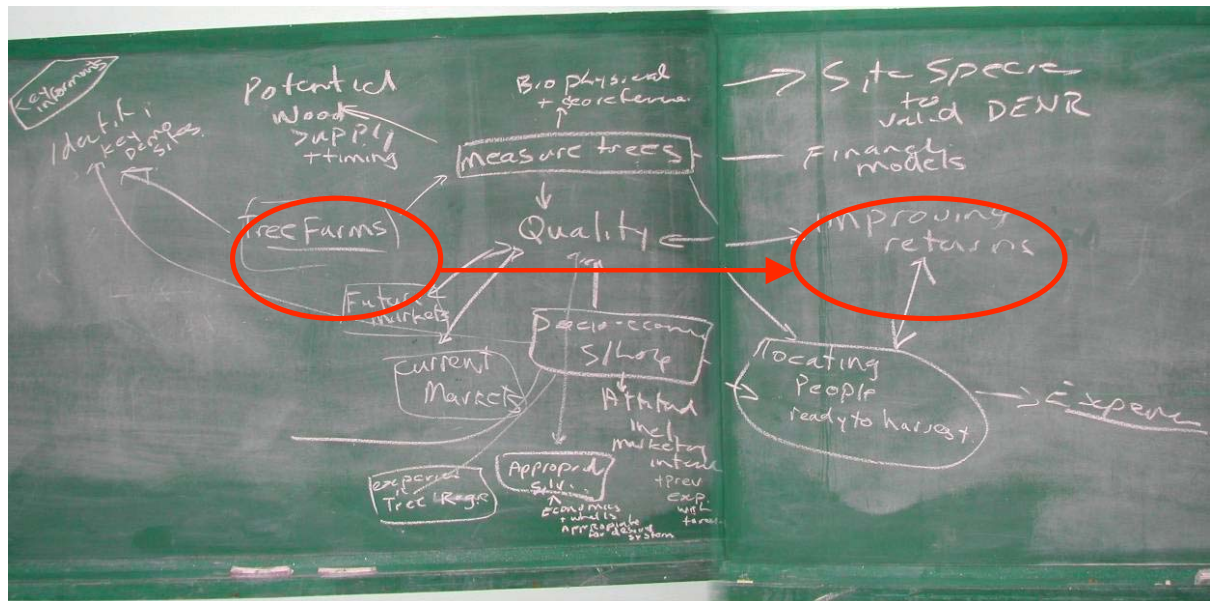
## USING SYSTEMS THINKING TO CONCEPTUALISE THE PROJECT

As discussed in Bosch *et al.* (2007), conceptualisation of the ACIAR smallholder tree farmer project occurred over a period of one week during a visit by researchers to the Philippines (to incorporate feedback on the initial project proposal following discussions with the funding body). During that week, a number of visits to smallholder tree farms and communities were undertaken, and discussions held with a variety of stakeholders including tree farmers, officers and researchers from the Department of Environment and Natural Resources (DENR) and Local Government Units (LGU). These discussions, combined with experiences from the precursor four year project (ASEM/2000/088), suggested that a complex range of interacting factors influence the lack of current uptake of smallholder forestry in Leyte. For example, it became apparent that a large number of tree farms existed that had been established about 10 years ago, with trees ready to be harvested, and smallholder farmers were asking where they could find a market for their trees.

Following the field visits, a workshop was held where researchers discussed the observations made over previous days and discussions tended to focus on separate studies that could be undertaken to address one or more of the issues identified. In an

## Improving the Triple Bottom line Returns from Small-scale Forestry

attempt to integrate the disparate discussions, a brainstorming session was held to create an overall influence diagram that connected the various aspects of possible research opportunities. Two observations were represented by boxes placed on a blackboard, namely, (i) the existence of a large number of tree farms and (ii) the need to improve current low returns to tree farmers. From this basis, researchers brainstormed the factors that influenced the current low returns and how these linked back to the existing smallholder tree farmers. The resulting influence diagram that was developed on a blackboard is shown in Figure 1. The initial starting points are contained in ovals and linked by arrows.



**Figure 1.** Influence diagram developed for planning the research project

The construction of the influence diagram provided a shared understanding to all of the researchers in the project of how their particular area of expertise contributed to the broader project objective of improving financial returns to smallholders. A key element that was recognised from field observations was that the most of the current tree farms have been poorly managed and most of the logs that will be produced will be of low quality \_ hence the location of 'quality' between 'tree farms' and 'improved returns'. Estimating (measuring) and improving the quality of logs from existing and future tree farms thus became one of the foci of project activities. In addition, the influence diagram recognises the importance of log quality on the types of markets that smallholders can currently access. In terms of identifying industry development strategies, it was also recognised that identifying the log quality required to access particular markets (e.g. export markets) was necessary in order to identify the type (quality) of silviculture that smallholders needed to implement to achieve, for instance straight, defect free logs of a certain length and diameter or fitches cut into certain dimensions by circular saws as opposed to chainsaws. Another key influence on the quality of logs produced was socio-economic factors such as household income, general education and specific training in forestry and how these factors may also affect the ability of the smallholders to access to markets. The influence diagram also recognises the importance of gathering data on the expected yields of timber from current tree farms, date which is importance to estimate potential wood supplies and

## Improving the Triple Bottom line Returns from Small-scale Forestry

timing; and to develop financial models, which in turn can be used to both predict financial returns from existing tree farms and to also model likely impacts of improved silviculture, access to markets etc.

### **PROJECT GOAL AND OBJECTIVES**

The goal of the smallholder forestry project is to increase financial returns to existing tree farmers and intending smallholder tree farmers. The research strategy is reflected in the following objectives.

- Objective 1: Assist DENR to overcome policy implementation constraints to tree registration and log transport currently restricting access to markets
- Objective 2: Assist smallholder tree growers to satisfy market requirements and improve productivity
- Objective 3: Identify and promote livelihood systems and policies which incorporate forestry and which recognise the socio-economic circumstances of smallholders

In that a systems approach was used in the conceptualisation of the project, this is an example of how systems-thinking can be applied at a broad 'project' scale. That is, the issues associated with increasing financial returns to smallholders have been conceptualized as being interrelated such that they cannot be addressed in isolation (as would be the case in a reductionist approach). At a finer or operational level, Systems Thinking is embedded in supply or value chain management which is the framework on which many of the activities in falling under Objective 2 are based. Also, a systems approach is embedded in the investigation of livelihood systems in Objective 3; this approach recognizes that forestry cannot be undertaken by (or recommended to) smallholders in isolation without consideration of the broader context (or livelihood system) of which it will form a part.

### **RESEARCH STRATEGY**

The research strategy to address the project aim has three components. First, university-based researchers have collaborated with DENR officers and smallholders to identify and remedy impediments to timber market access. Many of the current problems with DENR regulations arise from the way in which these regulations are implemented, rather than the nature of the regulations per se. The focus of this work with DENR Region 8 has been to make the existing regulations work more effectively. This will (and has) resulted in immediate short-term benefits to tree farmers wishing to register trees and obtain permits to transport logs. It is anticipated that in the longer term, the project outputs will influence national level DENR policy and regulations.

The research first identified the reasons for the large differences in the rates of tree registration between Community Environment and Natural Resource (CENR) Offices and how higher rates of tree registration can be facilitated. Mechanisms were then developed and tested, to improve the flow of information about regulations affecting tree harvest and about transport approval mechanisms, from DENR to LGUs and smallholders. Subsequent presentations will outline these activities, especially related to the development and testing of the primer for tree registration, harvesting and log transport. In addition, a 'School of the Air' radio program on tree farming policies

## Improving the Triple Bottom line Returns from Small-scale Forestry

was broadcast, with formal enrolments of ‘students’ and with active participation of Department of Environment and Natural Resources personnel, municipal mayors, councillors and municipal agricultural officers. The effectiveness of that program is currently being assessed.

Second, research has been undertaken to assist smallholder tree growers to satisfy market requirements for timber and improve productivity. A core part of this research has been to identify the market requirements for timber in terms of tree species, type, quantity and quality of timber required by processors. A survey of timber processors on Leyte Island (including Biliran), in Samar and Cebu has been undertaken. The market potential from existing tree farms in Leyte Province has also been assessed. This assessment involves four interrelated activities: (i) an assessment of timber quality and likely yield per product class, (ii) further financial analysis including on mixed-species agroforestry systems (mixtures of trees and crops and mixtures of trees with non-wood products including abaca), (iii) modelling of timber supply and demand, and (iv) an investigation of the social and economic factors that affect the management of plantations and the types of outputs produced. The assessment of timber quality and yield has been completed. Data has been collected on 5664 trees from 532 plots established on 119 tree farms and socio-economic data have been collected from each of the tree farmers.

An extension program has been developed and trialed which aims to test mechanisms to improve the silviculture skills of farmers. As part of this program, ‘bus tours’ have been conducted, taking smallholder tree farmers to demonstration sites in order to deliver key information about silviculture. During 2005 and 2006, four pilot tours were undertaken and the lessons learnt from each tour were then used to improve the subsequent tour. The effectiveness of bus tours as extension activities is currently being assessed. The initial results indicate that these ‘tours’ provide an effective and cost-efficient means of delivering extension advice to smallholders. In addition, a pilot program involving cost-effective ways of linking buyers and sellers of timber has been conducted which involved the installing a large whiteboard outside a DENR office. One section provided details of smallholders and the woodlots (species, area, location and plot registration number) they had available. Another section provided details about processors such as timber species they wanted to purchase and purchase prices according to sawn timber dimensions. Initial reports have been positive and a follow-up assessment will be undertaken in 2007.

Third, a detailed analysis will be undertaken of livelihood strategies adopted by various types of smallholders and then recommendations made on appropriate farming systems that incorporate forestry and that recognize the socio-economic circumstances of smallholders. University researchers will collaborate with DENR to develop policy recommendations based on the findings from the various project activities.

### **SYSTEMS APPROACHES EMBEDDED IN THE RESEARCH STRATEGY**

In the following section three case studies are presented that illustrate how system thinking has been applied in the research strategy.

#### **Case Study 1: Linking Biophysical and Socio-economic Data**

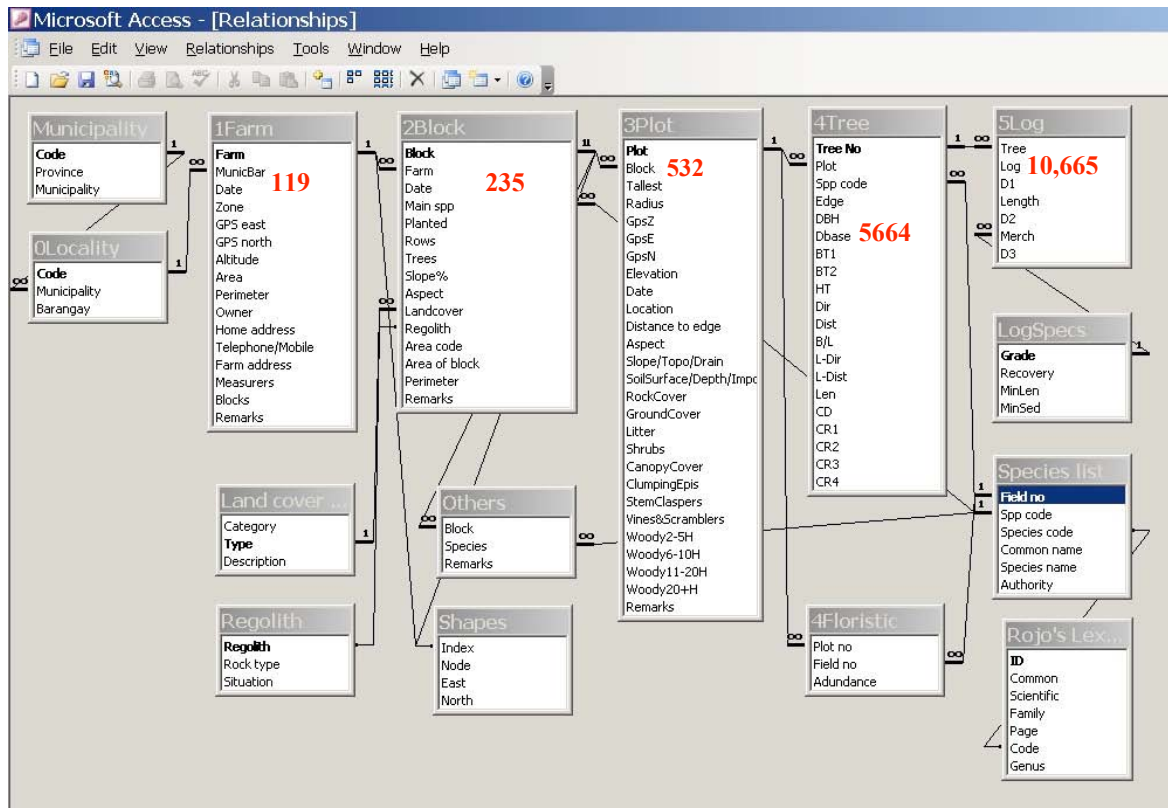
A key activity in the project has been the estimation of the yield of timber likely to come from existing tree farms. This data are being used to construct yield tables and

growth models for the common species grown by smallholders, including *Gmelina arborea*, *Swietenia microphylla* and *Acacia mangium*. The key biophysical information collected about site, plot, tree and log variables is summarised in Figure 2. Data on DBH and log length are used to construct yield tables for commonly grown species and to construct growth models. Typically this type of biophysical data is not used directly as input into socio-economic studies. Socio-economic studies involving the estimates of timber turnoff and market modelling do often draw on such biophysical data, it is usually from secondary sources and not collected as part of an integrated study. Drawing such data from secondary sources usually limits its application for the desired use.

By designing the project within a systems framework, it has been possible to identify how the biophysical physical data collected from the tree farms could be used as part of other interrelated activities within the project (Figure 3). Having this understanding at the outset of the project allowed sampling strategies to be designed that produced data suitable for use across a range of project activities. For instance, a group of researchers were responsible for collecting data from tree farms in order to develop yield tables and growth models of key species grown by smallholders. Typically, this would be where the use of such biophysical data would end. However, socio-economic project researchers outside the biophysical team also required these data to estimate the current timber inventory from smallholder tree farms on Leyte as part of their research to develop timber supply models. Stratified random sampling is the procedure typically used to identify plots from which to collect information on tree growth for yield tables and growth models. However, stratified random sampling would have been impractical for collection of data to estimate total timber inventories because of the need for collection of information across a suitably wide range of municipalities and barangays. As a consequence, a two-stage, probability proportional to size (PPS) sampling framework was used to select municipalities and then barangays from which tree farms were selected (as described in Herbohn *et al.* 2005). Information from surveys of timber processors and furniture manufacturers collected as part of other project activities will be used in developing demand-side models which in turn will feed into supply and demand and transshipment models.

Growth models based on the tree data, along with the supply and demand and transshipment models also drawing on the tree data, feed into the financial models developed to estimate the profitability of tree farms (with linkages as illustrated in Figure 3). The financial models then feed into activities associated with the development of improved livelihood systems incorporating tree farms. Data on crown diameters are not collected routinely during measurement of trees within inventory plots. However, such data were identified in the systems analysis as being required for modelling stocking rates and thinning regimes associated with potential agroforestry systems, and the biophysical teams included these measurements as part of their data collection activities.

## Improving the Triple Bottom line Returns from Small-scale Forestry



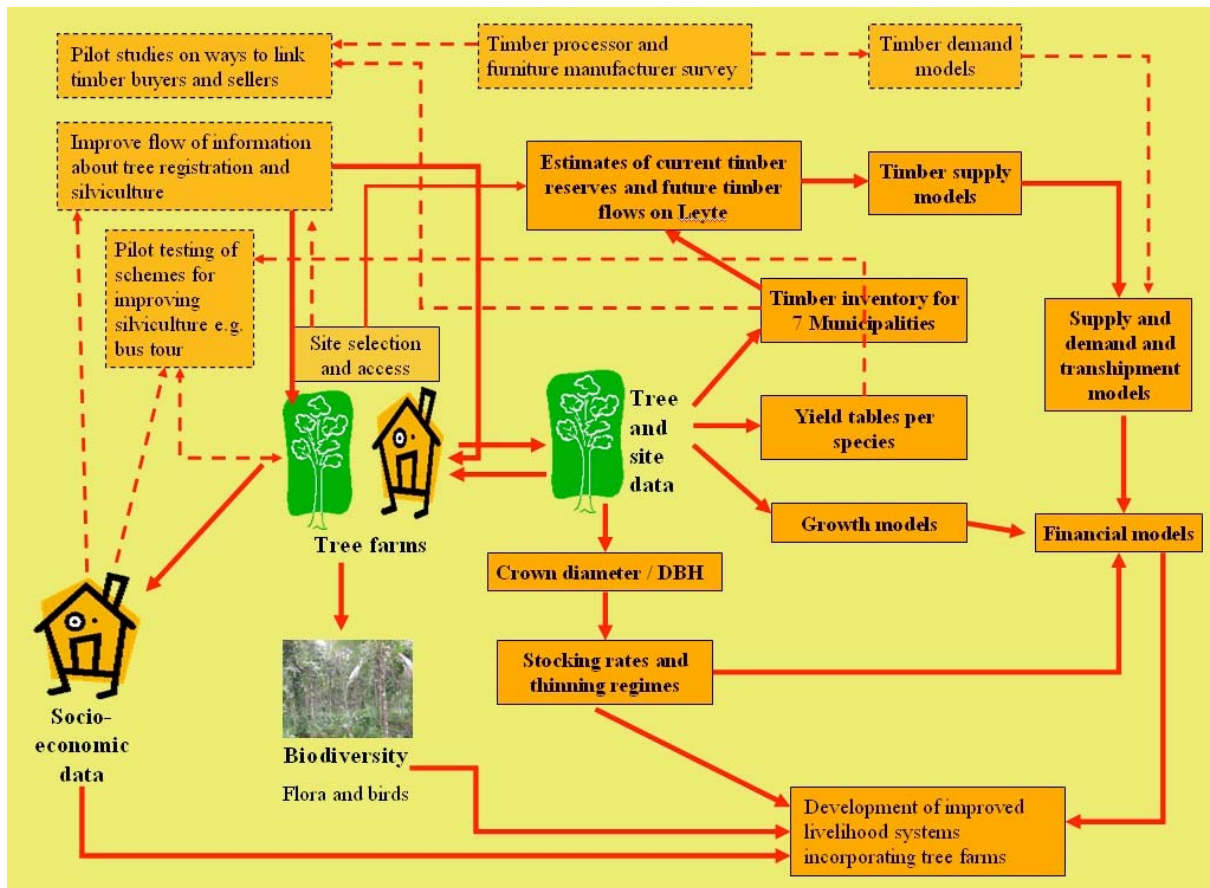
**Figure 2.** Screenshot of ACCESS database illustrating key site, plot, tree and log data collected from smallholder tree farms.

Biodiversity data collected at each tree farm, along with socio-economic data collected from the owners of the tree farms, will also be used in the development of improved livelihood systems. The ACCESS database illustrated in Figure 2 is currently being updated to include results from the socioeconomic survey of smallholder tree farmers, thus allowing researchers to link directly the socioeconomic and biophysical data.

The financial models can also be used to explore ways to improve financial returns to smallholders, including estimating the benefits of improved silviculture, flow of information about regulations affecting tree registration, log transport and harvesting (direct linkages not shown in Figure 2).



## Improving the Triple Bottom line Returns from Small-scale Forestry



**Figure 3.** Major linkages between biophysical and socio-economic research activities in the project. Not all linkages are shown.

The following two sections are based on material from Bosch *et al.* 2007.

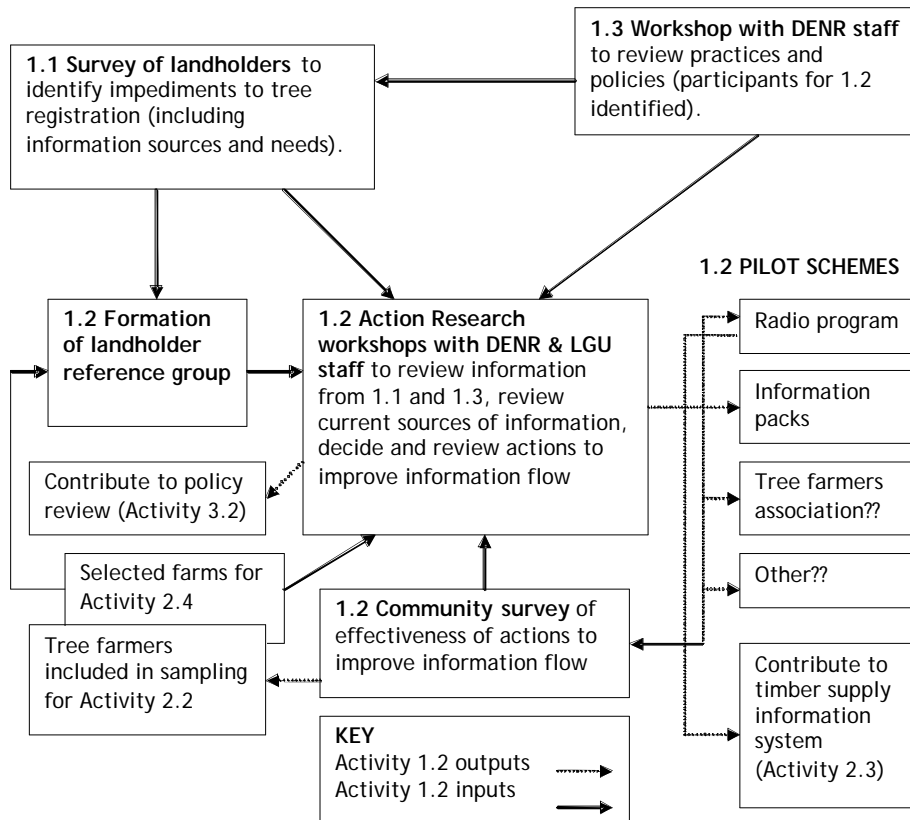
### Case Study 2: Improving the Flow of Information for Forestry Regulation

In conceptualising the smallholder tree farm project it became apparent that tree registration and log transport regulations enforced by DENR appear to be restricting access of smallholder tree farmers to timber markets. Rather than the regulation per se, this barrier seems to be the result of how regulations are enforced by DENR, and the lack of understanding of the regulations by smallholders. If the individuals with the greatest influence on the flow of information are directly involved in recognising the existing problems and formulating solutions to these problems, there is greater likelihood that strategies will lead to sustainable changes. In order to achieve these changes, the motivations and actions of the various stakeholder groups must be examined in the light of the institutional arrangements governing them. It is also essential that the strategies devised for improving information flow link closely with other project activities so that the changes occur at three levels (i.e. farm households/community, DENR staff operations, and policy). A systems approach is therefore an implicit component.

Figure 4 shows the relationship between various project activities and the action research workshops which lie at the core of the suggested approach for improving the flow of information concerning tree registration, harvest and transportation approval mechanisms. The action research workshops provided opportunities to (i) monitor and report via information bulletins, what the tree farmers involved in the project

## Improving the Triple Bottom line Returns from Small-scale Forestry

demonstration plots are required to do to get tree registration and (ii) to report and compare this information across the project. The steps involved in bringing the action research teams to life are to (i) confirm the aim with key stakeholders, (ii) secure sponsors' commitment, (iii) identify the participants, (iv) design and schedule regular workshops, including a training workshop, (v) secure the necessary resources for the project activities, (vi) conduct workshops and implement activities to improve information flow, and (vii) reflect on achievements and implement changes.



**Figure 4.** Relationship between activities concerning the development of strategies for improving information flow about tree registration, harvest and transportation regulations and approval mechanisms (1.1, 1.2 and 1.3 refer to specific project objectives)

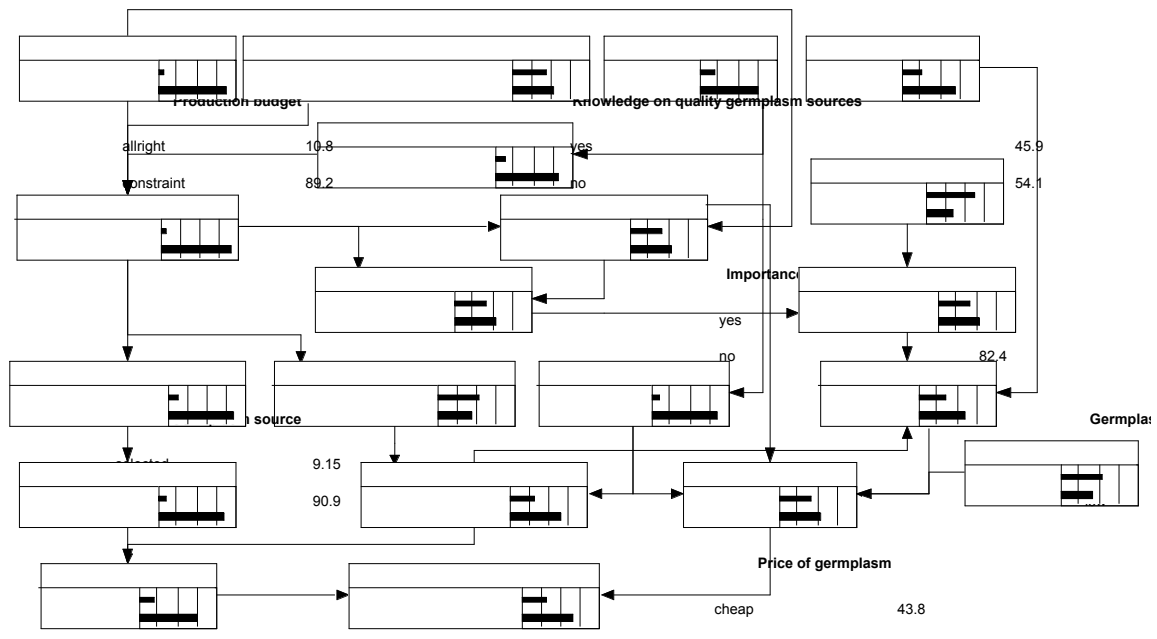
### Case study 3: Making Sense of the Tree Nursery Sector in Leyte

Systems Thinking has also been applied to understand the factors affecting the production of high quality tree seedlings and to investigate the impact that a variety of policy interventions may have on improving the quality of seedlings available to smallholders.

To conceptualise the nursery sector, an influence diagram was constructed for each of the nursery sub-sectors (private, community and government) using a Bayesian Belief Network (BBN). The data to construct the model (Figure 5) were obtained from a combination of quantitative and qualitative methods. For example, surveys were used to collect responses from nursery operators in Leyte and Southern Leyte Provinces, and the *nominal group technique*, as well as individual discussions, was used to collect expert opinion. This model has provided a good example of a dynamic systems model which can be used to explore the likely impacts of a range of policy

## Improving the Triple Bottom line Returns from Small-scale Forestry

interventions on a particular industry or sector. Unlike the process used with a BBN in case study 3 where a range of stakeholders constructed a model using the BBN as a participatory tool, this model was constructed by researchers using data obtained from a range of stakeholders from surveys and other social research methods, including focus group discussions and the nominal group technique. The model has subsequently been used to identify which factors have the greatest influence on key outcomes such as seedling quality, nursery sustainability and nursery efficiency. In addition, it has been used to explore the likely impact of various policy interventions such as developing training programs for nursery operators.



**Figure 5.** Nursery efficiency BBN for individual nursery group  
Source: Gregorio 2006

## CONCLUDING COMMENTS

The environment that smallholder tree farmers are operating within is complex \_ from a social, environmental, economic and political context. As such, there is no one 'magic bullet' that can improve financial or other returns from tree farms. In order to improve one or more of these triple bottom line returns, it is necessary to look at the smallholder tree farms in a broader context \_ there are many interacting factors that affect returns to smallholders growing trees. This paper has illustrated how a systems framework has been used to conceive and plan a research project addressing the problem of how financial returns can be increased to smallholders. The systems framework has also proved an effective means to integrate research activities of various researchers from disciplines from the social and physical sciences that are involved in the research. Importantly, the process of developing and then articulating the systems framework has been useful in giving team members a shared understanding of the scope of the project and how their activities fit into the bigger picture. The three case studies presented in the paper clearly illustrate the utility of this type of approach in coordinating and integrating research projects involving researchers from diverse field.

## ACKNOWLEDGMENTS

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