RESOURCE ACCOUNTING FRAMEWORK FOR THE COMMUNITY-BASED FOREST MANAGEMENT SYSTEM OF THE PHILIPPINES: A CASE STUDY

By

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ABSTRACT

RESOURCE ACCOUNTING FRAMEWORK
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This study presents a natural resource accounting framework at the community level that captures non-marketed components and natural resource exploitation not captured by conventional accounts. The conceptual framework consists of a rural/community-households' economic system, a natural resource system simulation model, and a social accounting matrix (SAM). The empirical study was conducted in five communities bordering the Bicol National Park in Region V, Bicol Region, in the Philippines. Focus group discussions and face-to-face interviews of households elicited data on consumption and production activities. The household survey sampled 20% of households in the five communities. Empirical data consisted mostly of consumption and production activities, transformed to monetary terms, and structured in the SAM framework. Non-marketed outputs comprised 21.3% of total production. Forest resources represented 27.1% of the total production. Natural resources data in the SAM became the basis for developing the simulation model for evaluating resource sustainability. Current wood consumption would cause natural resources depreciation by 0.07% per year while the proposed harvest would cause depreciation by 4.21%. The developed framework

captures the rural economic system and is useful for policy evaluation and decision-making at the local level. The natural resource accounting structure supplements the national accounts by providing both marketed and non-marketed transactions at the community level. The natural resource modeled in the study focused on timber. Future study could incorporate sustainability models for other non-timber resources such as rattan, bamboo, medicinal plants.

To a friend I dearly love;
my thoughts of whom filled my mind as I wrote this manuscript.

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KEY TO ABBREVIATIONS

AWP - Annual Working Plan

BNP - Bicol National Park

CBFM, - Community-based forest management

CGE - Computable General Equilibrium Model

DENR - Department of Environment and Natural Resources

ENRAP - Environment and Natural Resources Accounting Project

FAO - Food and Agriculture Organization

FDES - Framework for the Development of Environmental Statistics

FGD - Focus Group Discussion

FLUP - Forest Livelihood and Utilization Plan

IRG - International Resources Group, Inc.

LSMS - Living Standards Measurement Studies

MVP - Marginal Value Product

MEB - Material/Energy Balance

MEW - Maximum Economic Welfare

NI - National Income

NDP - Net Domestic Product

NHE - New Household Economics

NRA - Natural Resources Accounting

NRMP - Natural Resource Management Program

OECD - Organization for Economic Cooperation and Development

PNSCB - Philippine National Statistical Coordination Board

SEEA - Satellite System for Integrated Environmental and Economic Accounting

SNA - System of National Accounts

UN - United Nations

UPLB - University of the Philippines Los Baños

WB - World Bank

WRI - World Resources Institutte

CHAPTER 1

INTRODUCTION

For several decades policy makers and economic planners have greatly relied on aggregate economic indices such as the Gross Domestic Product and National Income as indicators of a country's economic growth. The path to economic development has been viewed as an increasing rate of annual growth of these indices, following the trend of industrialized countries. Often, this path disregards effects on income distribution and quality of life both in the present and in the future. A closer examination of these indices, however, reveals inherent risks because the process of development depletes the environment and natural resources rapidly, possibly beyond recovery; yet depletion is not reflected in measures of growth. Thus, a variety of approaches have been developed recently in order to correct this deficiency (see Lutz and El Serafy, 1988; Abaza, 1992; Lutz, 1993; and Leefers and Castillo, 1998 for details of deficiency of these aggregate measures) and to derive genuine or sustainable income or growth indices, hopefully reflecting impacts on the environment and natural resources.

Several approaches include physical measures or information as indicators on the state of the environment and natural resources. But interpreting voluminous physical information with different units of measure related to economic policy making is complex and subject to varied interpretations. A newer option is to link these physical indicators with economic indicators that are embodied in national accounts, thus essentially labeled the "greening of the account." This requires putting values on

resources that are traditionally not valued in the market in order to be compatible with economic indicators. Planners are looking to revise such measures of growth as Gross Domestic Product, National Income and Depreciation so that they include indicators of resource sustainability (BEA, 1994). Revisions involve inclusion of depreciation or depletion of the environment and natural resources into the system of national accounts. Thus, the idea of "environment and natural resource accounting" was introduced as early as 1970s in accord with the concept of sustainable development. Since then, industrialized and developing countries have been developing concepts and methods of environmental and natural resource accounting. The biggest effort led to the addition in 1993 of the System of Environmental and Economic Accounts (SEEA), a satellite account instead of an integrated account, to the UN System of National Accounts (UN, 1993). SEEA is intended to be a standard for developing countries. Satellite accounts emphasizes the need to expand the analytical uses of the SNA for selected areas of concern such as environment and natural resources without disrupting the main function of the conventional or central account system. It provides for inclusion of additional information, additional concepts of valuation, cost and benefits of human economic activities, and linkages of physical data of the environmental and natural resources to the national accounts.

Natural resource accounts were meant to provide clues and early warnings of exploitation of natural capital for economic production; excessive exploitation raises concerns about sustainability (Peskin, 1993). Theys (1989) identified at least four objectives of natural resource accounting: (1) to diagnose the current state of the

environment; (2) to analyze the effects of environmental policies on economic performance and welfare; (3) to assess the value of resources that can be exploited for development; and (4) to identify possible options among the social, economic, and ecological objectives of development. Thus, these accounts provide vital information to economists and decision-makers for identifying areas of environmental and natural resource stress resulting from economic activities and assessing sustainability.

Still, most natural resource accounting systems developed in industrialized and developing countries are national in scope. The approach, particularly in developing countries, concentrated on designing accounts for specific sectors such as forestry, mining and agriculture (including fisheries); they emphasized environmental quality effects more than the natural resources that are inputs for economic activities. Jöbstl and Hogg (1997) recognized that these trends are influenced by a variety of cultural, historical, political, legal, and economic factors. Most accounting efforts, however, neglected to incorporate two important components: household production (see Becker, 1965 for definition) and rural economic activities. It was reasonable previously to accept these deficiencies, but the role of household production and consumption was increasing (Ruddel and Rodinelli, 1983). James (1996) cited the estimate by Hawrylyshyn (1976) that household production was typically one-third the size of GNP on average. By factoring unmarketed household production into national accounts, the International Resource Group et al. (1996) argued that the forestry sector aggregate account potentially increases by 30 percent. Thus, if household activities related to use of natural resources was ignored, the gross domestic product (GDP) would be biased.

Research Problem

Of particular importance are economic transactions of households in rural areas that occur outside organized markets, particularly in developing countries such as the Philippines. For instance, household-bound goods (production outputs directly consumed by households) are neither transacted in the market nor involve monetary transactions, and thus are not included in the calculation of aggregate national accounts. The national account system does not include these goods; thus, aggregate estimates of depreciation or appreciation at the national level can only be considered partial and incomplete. Accounts do not reflect real appreciation or depreciation of natural resources. Therefore, there is a need to incorporate accounts from rural household economic activities. By including these activities, national accounts can become more reflective and useful for policy and decision-making pertaining to sustainability of natural resources.

Household production activities for own-consumption are particularly large in communities subsisting or alternatively depending on forest resources. During the late 1980s it was estimated that 20% of the Philippine population lived in the mostly forested highlands, commonly referred to as uplands. Subsistence activities in these upland rural communities are more than those recorded in national accounts. Population increases potentially increased the use of non-timber resources, notably fuelwood. Further use increases may occur due to the government policy that delegated management of public forests to communities adjacent to or within these forests. These communities need to develop tools for effective management of forest resources. Decision-making at the local

level needs simple and vital sets of information that will help them come up with rational decisions in terms of efficiency, equity and sustainability of forest resources.

Thus far, efforts to develop accounting frameworks for rural economic activities that include natural resources exploitation are limited. Other than the long process it takes for accounts development, support for such work is minimal due to the current national-level emphasis. More so, natural resource accounting is a relatively new field; it became popular only with the advent of environmentalism. Such accounting endeavors have not been popular among many policy makers and international organizations, because they represent a more conservative "status quo" approach to economic growth.

It is likely that the framework and structure of the accounting system at the local level will be different from those at the national level, depending on the economic structure at the community (Taylor and Adelman, 1996). A number of other factors may influence development of accounts at the village level; several influencing factors that are relevant to this study are mentioned here:

- stakeholders' (within and outside the community) and community preferences and their household characteristics influence what activities and elements need to be included in the accounts;
- analysts' and decision-makers' degree of concern for substantive economic, ecological and social issues may define components of accounts;

- issues on tenure and property rights (i.e. community-based forest management), participation in management, and decision-making process define the structure of the accounting system;
- governance of the common property resources complicates analysis of resource sustainability; and
- valuation methods used in account systems limit types of non-market goods that can be included in the accounts.

All these issues potentially influence accounting frameworks at the community or village level. The main focus therefore is an accounting framework that will be useful for local and national decision-making in order to assess sustainability of resources. But linkages with the national level must be considered. At this stage the focus is on renewable resources in forest-dependent communities, and thus on natural resources as capital for economic production. Environmental concerns though important are beyond the scope of this study.

Other than usefulness for local decision-making, recent international developments on forestry emphasized the need for sustainable forest management. Examples include developing criteria and indicators for forest sustainability and "green certification" of forest products that aim to provide consumers with information on how forests are being managed (Bratkovich, undated; Kiekens, 1999). Forest certification and auditing are "emerging trends" in business transactions on products coming from natural resources. Therefore, in order to be competitive in international trade, community forests

must initiate efforts toward sustainable management and having their forest certified. Natural resource accounting and these other new mechanisms ensure that forests are sustainably managed. These are notable concerns that policy makers at the national level will need to address.

Research Objectives

In view of the above issues, two main questions are addressed in this study: Can an accounting system be workable at the local level and at the same time provide useful information for national level decision-making? And, can the accounts provide indicators of sustainability of the forest management system?

Other basic questions to ask are "What needs to be measured (including values) at the community level?" "How are these measured?" "What tools are helpful in developing measures?" All these questions are helpful guides in conceptualizing a framework for decision-making at all levels.

In the light of the above, the overall purpose of the research is to develop natural resource accounting and resource valuation framework for forest-based communities in the Philippines in order to assess resource sustainability under varying management

regimes. Included in framework development is the link of human production activities and consumption on the stock and flow of natural resources. Specific objectives are:

(1) To develop a physical and monetary accounting framework that captures community forest resources including those not accounted for at the national scale (i.e., natural resource accounting),

(2) To link the accounting framework with household and community forest production options (flows) and capital (timber) stocks (i.e., sustainability).

Organization of the Dissertation

Chapter 2, Literature Review, examines various account systems for environmental and natural resources that relate to framework development at the community level. The review covers how account systems and their components are identified, the choice of physical and monetary approaches, valuation methods and measurement. The usefulness of accounts for assessing sustainability of forest as capital in economic production is also presented.

Chapter 3, Conceptual Framework for Natural Resource Accounting at the Community Level, presents a conceptual natural resource accounting framework for rural community forest management using a concept of achieving well-being of household through satisfaction of consumption needs. The chapter includes conceptual procedures

and techniques for measuring and valuing consumption and production activities and for assessing sustainability of natural resources.

Chapter 4, Data Collection, Analysis Methods and the Accounting Structure, discusses the field procedure of data collection through surveys (i.e. face-to-face interview) and focus group discussions. The chapter includes synthesis of survey data obtained during the 1998 community survey, description of study areas, and summaries of demographic characteristics of households.

It is important to highlight the institutional context in rural areas where the study was conducted. Institutional context as defined by Appendini et al. (1999) refers to "dynamic institutional arragements which influence their access to different resources and services which are essential for their income generating strategies." The site in which this study was conducted was under a community-based forest management agreement between five communities and the government. The forest that these five communities encompass is a second growth forest that the government refers to as a "buffer forest."

Chapter 5, Results and Discussion, presents analysis of survey results, the structure of community-level accounts, and a simulation model for assessing resource sustainability. Major findings, strengths and weaknesses of the framework, and how this framework can be used for local-level decision-making are included. Linkages to national accounts are also noted.

In chapter 6, Summary, Conclusions and Policy Recommendations, several additional issues on natural resource accounting are discussed. Among them are politics of community forestry that affect accounting of resources, deforestation and associated land-use changes, small-scale timber harvesting, valuation of non-market resources, adjustment of national income for household consumption of non-market forest products, and estimation of the value and sustainability of forest products which are consumed directly by households. Also, policy recommendations and suggested areas of change and refinement of the framework for future work on institutionalizing accounts system are presented.

CHAPTER 2

LITERATURE REVIEW

This study develops an accounting framework applicable at the village level for management of community forests. The previous chapter noted the importance of household consumption and production activities in rural areas. A system of accounts for assessing the impact of rural economic activities on natural resources, therefore, must encompass household activities. This chapter reviews various account frameworks, techniques of valuation and sustainability assessment, and their usefulness for developing natural resource accounts at the community or village level.

Developing the Accounting System

The review of various accounting models developed in both industrialized and developing countries provides direction on what system would apply to the community, with an emphasis on household consumption and production. Criteria used in reviewing these models include:

- ability to capture local economic conditions (i.e., households as consumption and production centers),

- usability for evaluation, monitoring and decision-making (e.g., whether to apply purely physical or physical with monetary accounting), and
- simplicity of structure and distinct boundary of the accounts (i.e., whether it can be used by local decision-makers that include households, community leaders and local government units).

The discussion that follows explores various frameworks and structures of account systems in the context of rural communities. This provides a foundation for designing a relevant account system.

General Approaches to Natural Resource Accounting

Literature abounds with conceptual frameworks that attempt to incorporate (or capture) environmental and natural resources into the system of national accounts with the aim of revising measures of economic growth. However, they inadequately cover economic activities of households in rural areas. Commonly cited frameworks include the UN System of Integrated Environmental and Economic Accounting (SEEA), Peskin's Environment and Natural Resources Framework, Repetto's Accounting for Natural Resources Depreciation, Nordhaus and Tobin's Maximum Economic Welfare (MEW) framework developed for Japan, the French Patrimony Accounts, and the Framework for Development of Environmental Statistics (FDES) (Peskin, 1993; Vincent, 1997; UN, 1993). These account systems, applied to both industrialized and developing countries often include sectoral accounts such as forestry, mining, and agriculture aggregated at the

national scale (see example of Costa Rica, Solorzano et al., 1991). Other accounts focus on a landscape scale such as for watersheds and ecosystems (Xu et al., 1995; King et al., 1995). Thus, there is a need to develop an account system for rural household economic activities that can be included in national accounts.

Harrison (1993) looked at development of account systems in stages by categorizing accounting approaches into *stages of development*. The first stage was the accounting of environmental and natural resources based on the material-energy balance (MEB) concept, where environmental information is expressed in physical terms using an input-output structure. The second stage involves converting physical environmental information into stocks and flows called natural resource accounts (NRA), which are primarily physical but can be enhanced to include monetary accounts. The SEEA (a satellite system for the SNA) is the model for both physical and monetary accounts, because it contains stock and flow information. The third stage is transforming natural resource accounts from physical to monetary terms, thus, resembling the SNA.

Usability for decision and policy making is an important factor in developing the accounts, whether at the local or national level. The Organization for Economic Cooperation and Development (OECD, 1995) classifies most account systems into three *levels of use:* macro, sectoral, and micro levels. The *macro* level accounts are used mainly to adjust and calculate alternative national accounts aggregates, in order to reflect the depletion of natural resources and degradation of the environment to improve aggregate measures of general welfare. The *sectoral* accounts focus on more narrowly

defined field of application to particular environmental media and natural resources such as forests, water or energy, obviously for central planning and management-related purposes. The *micro* accounts focused more on the firm level because the pressure for green consumerism motivates firms to conduct environmental audits and certification (OECD, 1995). However, literature on micro-level accounting that includes environmental and natural resources are rather rare. Other landscape-level approaches, such as the watershed management unit or an ecosystem, are proposed obviously for management purposes (Xu et al., 1995).

Thus, macro- and sectoral-level frameworks are more common than micro-level or localized frameworks because of the drive to revise national aggregate measures of growth. Peskin (1993) categorized most macro-level account frameworks into four general approaches. First, accounting of environmental activities that are already reflected in conventional accounts such as assembly of pollution control expenditures (Statistics Canada, 1997) – those effects that are simply a result of all economic activities. Second, physical accounting of environmental and natural resources activities that are related to economic activities, such as pollution discharges by sector and stocks/flows of natural resources. Third, accounting for depreciation of renewable and non-renewable resources in order to adjust income estimates (e.g. NDP). Two examples of which are the Repetto approach for Indonesia (Repetto et al, 1989) and the Nordhaus-Tobin Measure of Economic Welfare (MEW) for Japan (Perman et al., 1996). Fourth, and the most ambitious, is a comprehensive accounting system – both physical and monetary – to expand the coverage of the conventional accounts in order to include environmental and

natural resources. The French system (Peskin and Lutz, 1993), the Peskin accounting system for the Chesapeake Bay (Grambsch et al., 1993), and the UN SEEA (UN, 1993) are examples of this fourth approach.

Sectoral accounts such as agriculture, forestry, mining and related industries are commonly developed in tandem with macro accounts by industrialized countries (Peskin and Lutz, 1990; BEA, 1994; BEA, 2000; BEA, 2000). Developing countries such as Indonesia, Mexico, Papua New Guinea, and the Philippines followed suit (WRI, 1991; DENR et al., 1996; Leefers and Castillo, 1998; Vincent, 1998). These were intended to monitor impacts of economic policies on resources, that is, to measure impacts of environmental regulations, emissions taxes, and pollution (Atkinson et al., 1997).

A number of studies demonstrate that local environmental and natural resource accounts incorporated into the SNA may significantly change the picture of national accounts (Friend, 1993; Hecht and Peskin, 1993; UN, 1993). Peskin et al. (1992) proposed a framework to include fuelwood consumption by the household sector into the national accounts using cases in Africa. The UN SEEA, on the other hand, proposed to incorporate household production via a satellite system (UN, 1993). In the Philippines, the Environmental and Natural Resource Accounting Project (ENRAP) project estimated this sector which proved to have a significant influence on GDP (DENR, 1991). However, community-level accounting studies that include household activities are scant in literature, because of equally scant support for such efforts. A lone study by Saxena and Agarwal (1997) developed accounts system for tree growers in India, but confined

their work in timber resources to fuelwood. The inadequacy of local-level accounting emphasized the need to extend the coverage of national accounts to include non-market activities in rural economies, particularly those that are household-bound (Hecht and Peskin, 1993).

Most account developers aim for simplicity of structure. However, developing accounts for economic transactions alone, that include non-market goods and services, proved to be complex (Peskin, 1993; UN, 1993; Vincent, 1998) and required considerable survey and data collection efforts. Some countries approached this incrementally by confining assessments to a limited number of important environmental media and natural resources (i.e., water, energy, sub-soil assets, or forests). Still these efforts faced difficult challenges in valuation (Hecht and Peskin, 1993; OECD, 1995; Darmstadter, 2000). These difficulties were reasons that no natural resources, specifically those that have no known or acceptable markets or monetary value, are integrated into the system of national accounts. Instead they are appended as satellite accounts (UN, 1993) or as augmented accounts (Nordhaus and Kokkelenberg, 1999). Satellite accounts imply that core national income and product accounts remains to reflect mainly market activities, but renewable and environmental resources serve as supplemental accounts to provide materials for policy makers. Augmented accounts on the other hand imply extending the national and income accounts to include natural resources and the environment, but not integrated into the core accounts.

These challenges suggest that accounting systems at the community level should focus incrementally first on economic-production activities, as well as the provision of adequate information for rational decisions by community planners. Decisions regarding exploitation of resources must be done rationally in the pursuit of sustainability, at the local level, since current community residents are not the only stakeholders of the forest.

Atkinson et al. (1997) suggested an alternative way of developing environmental and natural resource accounts using the social accounting matrix (SAM) structure for localized socioeconomic impact analysis. Its suitability for natural resource accounts lies in its usefulness for policy analysis – being a flexible framework. Taylor and Adelman (1996) reported work done on developing a village-level social accounting matrix that focused on agricultural commodities. They compared the usefulness of the social accounting matrix with the computable general equilibrium model (CGE) for defining a village economy. Taylor and Adelman (1996) specifically recommended use of the SAM for defining the structure of the village economy, but suggested use of CGE for defining equilibrium conditions.

Physical vs. Monetary Accounts

Units of measure in accounts considerably affect the usefulness of accounting information for policy analysis. Accounting approaches range from purely physical to monetary or from purely ecological to economic, but physical accounts are basic features of all systems. The foundational framework for these systems is the material/energy

balance (MEB) concept, developed in the late 1960s and early 1970s by Ayers and Kneese (1969). The Framework for the Development of Environmental Statistics (FDES) developed by the UN Statistical Office (Rapport and Friend, 1979; UN 1991; Friend, 1993) emphasized physical accounting as input for developing natural resource accounts. The more complex French environmental accounting system was conceived to assess the interaction between economic, ecological and social environments, but it was developed from a quantitative and qualitative account of the environment (Peskin and Lutz, 1990). Both recognized the necessity of developing an environmental information system in physical terms before developing an economic system of accounts for the environment and natural resources can be developed – the approach for most systems developed by industrialized countries.

Physical accounts are necessary but not sufficient for understanding economic relationships. To illustrate, Statistics Canada (1997) used the example of mineral accounts where aggregating tons of gold and silver (similar to the water-diamond paradox) would be less helpful for policy analysis purposes. The resulting aggregation will be meaningless considering that they are valued differently (Statistics Canada, 1997). Therefore, aggregate monetary accounting systems for environmental and natural resources face the dual challenge of transforming diverse physical information into a common unit of measure by assigning values to them and of remaining useful for policy analysis.

Some proponents of monetary accounting suggest use of a "*numeraire*" by using money value (Hueting et al., 1993). In order to accomplish this, weights and ratio to market commodities (Statistics Canada, 1997) for environmental services are recommended, and thus converting them to monetary accounts. However, meaningful interpretation for policy is still the main issue. Other authors recommended that natural resource accounting as simply physical accounting because of these conceptual and empirical challenges (UN, 1993; Vincent, 1998). Otherwise, simple satellite accounts to complement the monetary system of national accounts are recommended (UN, 1993). Peskin (1998), however, proposed to integrate depreciation of the environment and natural resource in the SNA, with a distinction made between physical and economic depreciation.

Thus, the satellite approach came about because some experts rejected the idea of making substantial changes in the conventional SNA (UN, 1993). The latter is used for other types of analysis, requiring monetary valuations such as short-term monetary and fiscal policies, that cannot be consistently done for all environmental services. The UN SEEA became a model of physical and monetary accounts, but as a satellite system to the SNA (UN, 1993). It was intended to describe the environmental-economic relations, monitor environmental changes caused by economic activities, and be useful in assessing environmental costs and benefits (Bartelmus et al., 1993).

Hence, monetary accounts including the environment and natural resources have much room for research. Linking those physical data to monetary values are steps that

need to be undertaken in order to link NRA to the SNA (UN, 1991) and to be useful for economic policy analysis and decision-making. Most international bodies recommended the idea of localized accounting to pilot test monetary accounts (UN, 1993; Peskin, 1993).

Conceptual Framework and Structure of Accounting

The structure of the account system at the community or village level must be useful for their needs. Theys (1994) suggested that perceived economic need influences the structure of accounts created. Therefore, a prerequisite to developing an account structure for the community is understanding the concept of rural well-being and its link to natural resources via their production activities. This requires careful modeling of community/village economic activities, specifically consumption and production as they relate to resource exploitation.

The household is the basic unit of economic activity in rural areas that functions as production and consumption center (Taylor and Adelman, 1996; Becker, 1965). Becker (1965) first modeled economics of household production and consumption activities, and became the foundation of New Home Economics (NHE).

In the rural context, household well-being is conceptualized as maximizing consumption from production outputs from farm, natural resources exploitation, and employment. According to Ruddel and Rodinelli (1983), production activities of most

households in rural areas consisted of several complementary activities, the most common of which were small-scale farming, fishing, animal husbandry, and collecting forest products. Households also interact with institutions outside of the village, and thus were important factors that define the rural economy. These activities and linkages influenced land-use (Cervigni, 1998), and thus affected the condition of natural resources under the control of the village.

Cervigni (1998) developed a computer-based model to predict the impact of these linkages on the stocks of secondary forests, agricultural and pasture lands in a village in Mexico. Endogenous variables of the model – that proved to influence human alteration of the environment –included farmers' objectives, opportunities for land use, land tenure policies, available technology, opportunities for salaried work outside the village, and government policies. Taylor and Adelman (1996) chose to apply the social accounting matrix (SAM) and the computable general equilibrium (CGE) model because of these inter-linkages among production activities and institutions within or outside the village. Hence, the SAM fits into the community/village-level economic structure for assessing impacts of rural policy. Framers of the UN SNA support the idea that SAM provides a flexible framework for socioeconomic analysis (UN, 1993). Atkinson et al. (1997) pointed out the usefulness of SAM for the linkages between the environment and the economy.

The SAM is a type of an input-output matrix. The more common applications of input-output matrix similar to SAM were on national level in order to assess impact of

certain sectors on a nation's economy (Miller and Blair, 1985). However, interests at the regional and community level economy have increased, particularly in the Philippines where local autonomy was emphasized. This has led to modifications of the input-output matrix in order to reflect peculiar characteristics. One notable difference was in the classification of account elements: in traditional input-output matrix, institutions or final consumers are treated as exogenous, while in village SAM certain institutions are treated as endogenous. The SAM has become a common tool useful for village economy assessment, particularly for developing countries (Taylor and Adelman, 1996).

The components of the SAM are structured by institutions (i.e., households, government, firms etc.), and the SAM is acknowledged to be flexible for any type of socioeconomic assessment (UN, 1993). A SAM can incorporate renewable resources as capital. Details on the origin and evolution of SAM can be traced to the work by Pyatt and Round (1977). This work further evolved with application to measurement of sustainability by Atkinson et al. (1997) and application to assessing a village economy by Taylor and Adelman (1996).

As a companion to the SAM, balance sheets that combine yearly opening and closing stocks of resources are recommended for renewable resources assessment (Repetto et al., 1989; delos Angeles, 1991; Peskin, 1993; UN, 1993; UN, 1993; Atkinson et al, 1997; Statistics Canada, 1997). Between these two stock records are factors that affect opening and closing stock such as harvest, damages and changes in values of stocks. The frequency and intensity of these changes, induced by human exploitation

determines the opening and closing stocks of each year. This type of account presentation and its link to consumption and production serves to evaluate the sustainability of resources. Hartwick (1990) and Mäler (1991) provided theoretical background for evaluating the optimal path of resource utilization for renewable and non-renewable resources over time, while Vincent (1998) developed the theoretical particulars for forest resources as they related to resource accounting. These theoretical discussions are the foundations to developing physical and monetary account structure that include consumption, production and stock and flow of resources. The next section presents literature on measurement and valuation of accounts.

Measurement and Valuation Methods

Incorporating rural household activities into the account system requires use of a common measure comparable with commodities already transacted in the market. Therefore, an essential undertaking in developing accounting systems that involve natural resources is to put all entries into the account using the same measure. Thus, one aspect of account system development was to develop measurement and valuation methods applicable to marketed and non-market-transacted goods; particularly those directly consumed by households in rural settings. These two concepts, measurement and valuation, prove to be essential and inseparable for this and other natural resources accounting studies.

Ideally, under a competitive situation (assumed Pareto-efficient markets), accounting of market transactions would suffice to reflect these natural resources exploitation activities. However, most rural communities in developing countries are not fully integrated into the exchange economy (Taylor and Adelman, 1996). These rural communities are largely subsistence-agriculture-based where households directly consume part or most of their production outputs. Thus, a considerable portion of their production is not reflected in the market. Hence, market values for most of these household outputs, Perman et al. (1996) pointed out, do not necessarily exist and thus should be obtained in some other way.

It is important to emphasize that the focus of valuation is on commodities and not on ecosystem functions of natural resources. For examples on forest ecosystem functions, Barbier (1994) summarized a number of valuation methods. The next sections reviewed literature on valuation techniques.

Choice of Valuation Techniques

A number of theoretical and empirical studies helped define suitable valuation methods for non-marketed goods. Schweitzer (1991), Mäler (1991), and Peskin (1992) provided overviews of valuation concepts as they relate to accounting. Several authors (Mäler, 1992; Shaw, 1992; Barbier, 1994; Perman et al. 1996; Bann, 1998) explored conceptual methods of valuation, and suggested methods of collecting this information.

Hufschmidt et al. (1983) classified valuation techniques into three categories: (1) use of direct market value, (2) use of market value of substitute (surrogate) or complementary goods, and (3) use of survey techniques to elicit valuation. The first two categories make use of the market price, while the third is based on a contingent market. Market prices, Bann (1998) noted, tend to underestimate true economic value because they do not account for consumer surplus. Market price also requires adjustment for any market or policy failure to reflect opportunity cost to society; the resulting value is the shadow price of the resource used. The third category is based on willingness-to-pay by an economic agent, a non-market valuation approach, where a hypothetical market is created.

The choice of which technique to use is dictated by what analysts will need. In the context of incorporating rural economic activities into national accounts, market price is most appropriate, because it provides methodological consistency with existing accounts. The third category implies a total economic value composed of potential market price and consumer surplus, which is not comparable with market values in conventional accounts. Hence, valuation techniques applicable for this study are confined to market valuation.

Bann (1998) listed six categories of market-based valuation techniques in literature with accompanying examples:

- market value - market prices, efficiency prices;
- related goods approach - barter exchange approach, direct substitute approach, and indirect substitution approach;

- cost-based evaluation - (indirect) opportunity cost approach, restoration cost, replacement cost, relocation cost, and preventive expenditure,
- indirect valuation techniques - travel cost method, hedonic pricing method, labor market approach, and market value of physical effects (the latter example include dose-response, damage functions, production function approach, human capital); and
- benefits transfer - using data generated from a study site to estimate values in another site.

Many published studies illustrate usage of these techniques specifically applied to village settings. Saxena and Agrawal (1997) used market value of commodities in an attempt to augment the financial accounts of a tree-growers' cooperative in India, and in order to include social, economic and environmental values. The SEEA employed a simple approach using cost data where the value of natural assets is the cost that is necessary to keep the natural capital intact (Bartelmus et al., 1993).

Both Mäler (1990) and Schweitzer (1992) favor use of indirect valuation based on productivity change over direct methods (such as those listed above) for developing countries. Such preferences are quite understandable because most environment and natural resource problems in developing countries pertain to use (Vincent, Crawford and Hoehn, 1990).

A number of studies focused on opportunity cost valuation. James (1996) used "time used" and market price of household activity to compare the opportunity cost and market price valuation methods for household production. For non-timber forest

commodities, Vincent (1998) proposed that the total value of household consumption of non-timber forest products is proportional to the opportunity cost of labor used in collecting these products: the wage rate times labor inputs. However, Vincent qualified that this proportionality holds only when forest earns no rent: that is, forest access is not restricted. Otherwise, the consumption value of timber is larger than the opportunity cost of labor. For other components of the forest, Vincent used shadow price defined as the value of the next best alternative use of the commodity (Vincent, 1998).

Opportunity cost (based on time-use) approaches do not necessarily apply for valuing all commodities. In some cases, opportunity cost approach is useful for production of goods for own consumption; such as in subsistence agriculture that has no market transactions (Peskin, 1995; and Vincent, 1998). As an example, for non-timber forest products, the total value of household consumption is considered proportional to the opportunity cost of labor used in collecting these products. However, the resulting value can only be exactly equal to the opportunity cost if the following conditions hold: (1) rent of the forest product is zero, (2) no excess capacity in production, and (3) no underemployment and free access to resources. If these conditions are not present the opportunity cost will not to equal market value (Peskin, 1995). Rural economic systems, in particular, are not characterized by these conditions. Hence, despite its shortcomings market prices are commonly used because they are observable.

The above samples of usage of valuation techniques provided a picture of the range of possible techniques applicable. The cost of data collection, purpose of study, and time involved determine what can be measured and valued, as well as the choice of

valuation techniques. Hence, this study covers only valuation of conventional goods or commodities using market values – for non-marketed commodities. Further, valuation method that will apply to household consumption and production depend on market transactions by households.

It is important to note that valuation difficulties arise for forest goods (and services) that involve variety of uses. Fuelwood is one case that has both marketed and non-market features. Fuelwood collected for household consumption in rural areas does not go through normal market channels (Peskin et al., 1993), and does not fully substitute as energy source; hence, its value would not be comparable to alternative marketed sources of energy. For instance, a ton of fuelwood will not have the same value as a ton of liquefied petroleum gas. This serves to illustrate the potential variations of interpretation of valuation results.

Data Collection Techniques

Data collection instruments must be parsimonious, yet cover goods not transacted in the market that require monetary measures in order to be comparable with marketed goods. Grootaert (1982) recommended that data sources for evaluating household well-being are standard household-level surveys that focus on measuring their welfare, while economic activities of households are based on budget surveys (Taylor and Adelman, 1996). Ruddel and Rodinelli (1983), however, argued that surveys, though useful for piecemeal studies, may have little value for evaluating resource systems because they do

not incorporate complementary household activities and functions such as those listed in the previous section. Thus, the need for complementary survey such as focus group discussions and interviews are implied.

The method of data collection adopted should be useful for those who will be using the account system. Therefore the types of value that are important, what is readily available at affordable cost, and ease of handling and analysis are important considerations in data collection (Bann, 1998). Three useful studies adequately covered data collection instruments helpful for this study. The Living Standard Measurement Studies (LSMS) of the World Bank used three different levels of survey instruments to assess welfare of households: household survey, community survey, and market survey – where price of vendors are surveyed (Grosh and Glewwe, 1995). Grosh and Glewwe (1995) explained component modules of these surveys. For time use data, Acharya (1982) recommended the use of recall, observation and diary keeping, details of which are explained in World Bank LSMS Working Paper no. 18. Finally, Taylor and Adelman (1996) used budget surveys to estimate a village social accounting matrix where households were asked about types of production, the uses of outputs, inputs used whether purchased and non-purchased, and their input prices.

Therefore, the data for the study will involve household surveys and community questionnaire in the form of focus group discussion, and secondary data on inventory of resources. These procedures are likely to encounter a number of difficulties such as data availability for stock of community resources, ability of respondents to recall information

about consumption and production activities, and precision of response depending on the rigidity of the questionnaire. Grootaert (1982) offered a number of suggestions for capturing data in these situations. The ideal is a compact survey that can capture the multi-dimensional requirements (production, consumption, demographics, environmental concerns) of the study. Dividing the survey into modules, prioritizing information needs, making use of screening questions (Grosh and Glewwe, 1995) and reducing the size of questionnaire by asking questions at the community level are very helpful recommendations (Grootaert, 1982). To that end, focus group discussions are a helpful tool for compacting household surveys, and the budget surveys format adopted by Taylor and Adelman (1996) are particularly useful in view of developing the social account matrix. Grosh and Glewwe (1995) described the data management procedures for survey data. These are important considerations in design of survey and data collection.

Sustainability and Local Resource Accounting

Exploitation of natural resources is the main issue in community forestry; hence, the question of sustainability naturally arises. Many dimensions emerged from discussions on sustainability that have relevance in defining local resource accounting. At the local level, the issue of what to sustain seems easy because these are normally tied to costs and benefits of local stakeholders (Saxena and Agrawal, 1997). However, at a higher level of decision making such as regional, national or global levels, this becomes

more difficult due to linkages between levels and complexity associated with broader systems.

Toman (1999) pointed out that at present, there is no consensus about what constituted sustainability and that such a consensus may be long in the future. Literature on this subject alone involved voluminous discussions on sustainability or sustainable development (Pezzey, 1992). It covered issues such as intergenerational equity and how to deal with uncertainty of preferences. Should analysts consider a finite or an infinite number of generations? What is the safe minimum standard? How can the level of resiliency of environmental systems be determined? There are arguments on whether to adopt strong or weak sustainability as related to substitutability of natural capital to man-made capital. Some would prefer to treat sustainability as a constraint in maximizing well-being or utility. There are also various issues on reliability of measures of sustainability and irreversibility; questions on insufficiency of traditional economic criteria of cost-benefit analysis, and discounting. The ultimate objective of all these discussions is to define policy prescriptions that will promote sustainability of resources.

Pezzey (1992) believed that arriving at a mathematical solution to complex sustainability issues is insurmountable. In order to minimize complexity of their models, most modelers ignore environmental amenities in determining sustainable economic growth (Pezzey, 1992). Instead, the focus is on maximizing consumption that best sustains well-being of present and future generations (Pezzey, 1992; Beckerman, 1994). A simple conceptual formulation presented by Pezzey (1992) maximizes U=U(C), typical

of most dynamic optimization models. In the traditional economic utilitarian approach, maximizing consumption over a time horizon subject to certain constraints sets the optimal path of growth. This maximization over time suggests introducing a utility discount rate, or the rate at which future utility is discounted to be comparable with the present utility levels. Atkinson et al., (1997) suggested (based on Solow) that a constant consumption path can be achieved by setting the discount rate equal to the marginal product of capital. In practical terms, the marginal product of capital should be equal to the growth rate or marginal productivity of the resource base. Those who propose a common numeraire for better interpretation suggested translating these productivity measures in monetary terms. Once translated, these changes in real value of assets (that is, the change in volume times a constant price) should not be negative.

Optimal control theory proved helpful in conceptualizing sustainability of resources. However, Pezzey (1992) argued that optimal control models that deal with renewable and non-renewable resources have intrinsic problems, particularly those that deal with more than two endogenous variables. Hence, most modelers resort to partial equilibrium and deal only with a single resource or system of resource (e.g. fisheries or forestry). The alternative to such difficulty is simulation modeling based on real data and pre-defined functional forms. This approach takes into consideration various phenomena and tests several assumptions, singly or even for multiple cases. Various tools applicable for these kinds of evaluation include structural path analysis (Defourny and Thorbecke, 1984), computable general equilibrium model (Taylor and Adelman, 1996), and process network theory applied by Alocilja et al., (Saama et al., 1990; Alocilja, 1990) for a study

on dairy cattle. All three approaches need intensive modeling and data, hence, simple simulation models that isolate the resource in question such as timber resources suffices for this study.

In summary, this chapter surveyed literature to cover three important goals of this study. First, the survey of accounting frameworks developed in industrialized and developing countries suggests developing a localized and flexible framework with the ability for incremental development. Account frameworks focused initially on household economic transactions, but with potential to include intangible uses in the future. The SAM should adequately capture village level economic activity and hence, be a useful structure for localized appraisal and decision-making needs. Thus, valuation of ecosystem services is relegated to future studies. Second, measurement and valuation of outputs of consumption and production activities should be compatible with accounting needs hence, the need to focus on market valuation. Valuation techniques dictate the data collection method employed. Third, assessing sustainability of household consumption and production activities and their impact on stock and flow of natural resources suggest use of simulation modeling but confined or limit this modeling to a limited number of resources. The next chapter develops the conceptual framework of local accounting system capturing the results of this review.

CHAPTER 3

CONCEPTUAL FRAMEWORK FOR NATURAL RESOURCE ACCOUNTING AT THE COMMUNITY LEVEL

The previous chapter explored literature in order to define an accounting framework applicable at the community/village level and useful for decision-making. This chapter develops the conceptual framework for the accounting system, as a basis for the empirical study presented in the next chapter. Development required defining the broader framework that covers linkages between economic agents and their impact on natural resources. Natural resource accounting, in the structure of the social accounting matrix (SAM), becomes the information system for these interactions. The SAM captures the state of the economy of one period, and provides indicators of the demand for natural resources. Two important processes covered by this broader framework are the community/household economic activities and natural resources processes. Therefore, two accompanying conceptual models supplement the SAM for analysts and decision-makers: a model of household/community production decisions as affected by internal and external interventions and a model of natural resources sustainability. Thus, the SAM, the principal focus of this research, is only one component of a broader model that integrates natural resources.

The first section emphasizes the need to define the economic structure and linkages in the community/village. This economic model incorporates internal and

external factors affecting household/community consumption and production decisions. The second section further discusses details of the household/community production decisions. A simple mathematical expression defines household consumption and production decisions, and serves as a basis for identifying elements of the accounts. The model also captures impacts of exogenous factors/interventions on economic activities in the community. These interventions come in the form of policy/decision options for sustaining productivity of timber resources. The third section outlines the Social accounting matrix that incorporates both marketed and non-marketed transactions of households and the community. The fourth section describes the conceptual framework for simulating timber resources stock and flow as affected by community economic activities recorded in the SAM. All three component frameworks of the broader rural economic framework interact dynamically over time, though the SAM is treated as static here.

Conceptual Framework of the Rural Economy

The natural resource accounts framework development begins with an overall understanding of rural community economics and household well-being in the context of rural agriculture. Interactions of households, mostly through consumption and production activities, with domestic and external factors define community/village economic activities. Endogenous household characteristics and exogenous factors such as institutions, government, and market forces dynamically influence consumption patterns and production activities. Household consumption patterns and production activities in turn affect the stock and flow of natural resources. By tracing these linkages and

outcomes of resources stock and flow, analysts identify various policy and decision-making options in order to sustain natural resources productivity. Therefore, the three major components of the overall accounting framework include (1) the SAM, the accounting framework, that portrays the community economy, (2) a natural resource sustainability model in the form of simulation, and (3) the community/household production (economic) decision model. Figure 1 shows the schematic relationships of these three components. The next sections discuss these component frameworks in turn.

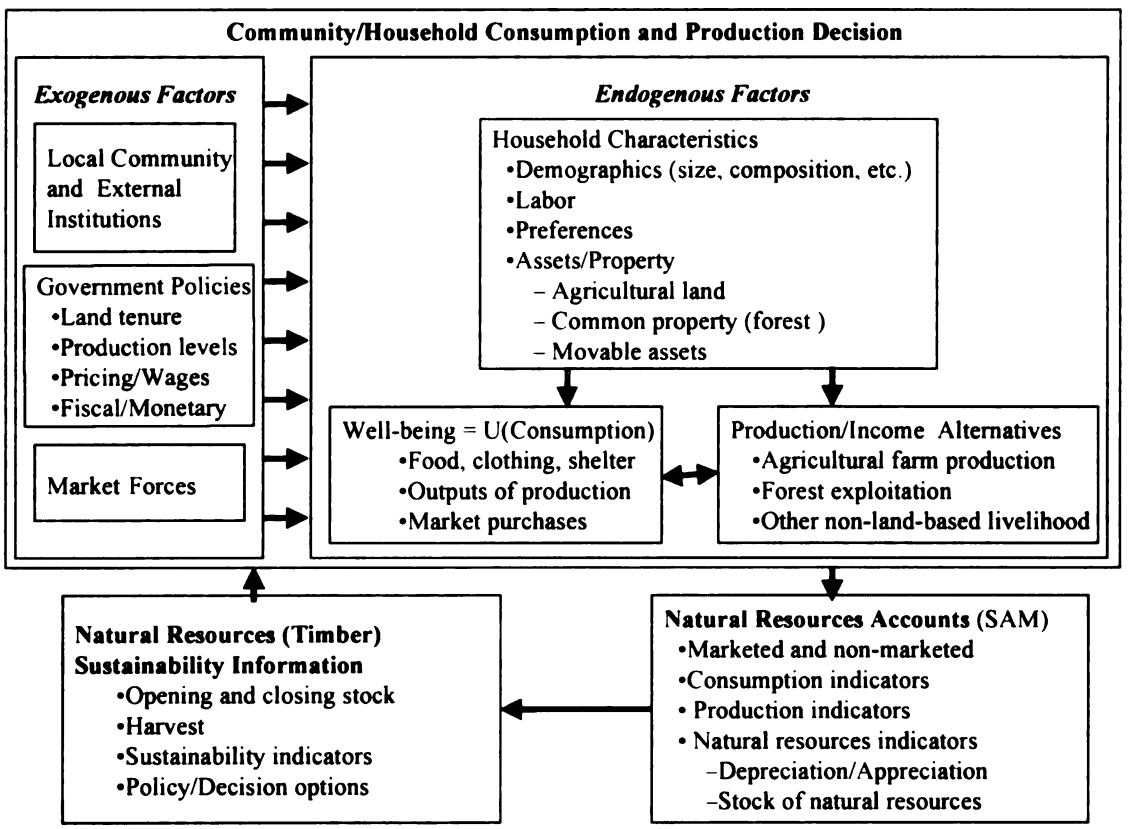

Figure 1. Schematic diagram of the overall framework encompassing an account system at the community level.

The Community/Household Consumption and Production Decision Model describes interactions or linkages of exogenous and endogenous factors that influence consumption patterns and production decisions:

- *Household demographics, preferences, assets or properties* such as agricultural land, housing, and movable assets influence household decisions on consumption and production activities;
- *Community institutions, market forces, and government policies* either constrain or promote consumption and production choices;
- *Consumption patterns* determine the intensity of production activities and vice versa; and
- *Production activities* shift from subsistence agriculture to natural or forest resources exploitation or to other livelihood activities such as wage employment within and outside of the community.

Natural Resources Accounts, using a SAM structure, record community economic activities at a point in time; it is a snapshot of economic activities in one year. It simply records production output, factors of production, destination of products, and investment/savings, in monetary terms. Sustainability of important factors of production or capital inputs such as natural resources remains to be determined. Assessing the sustainability of these resources requires constructing a dynamic model of natural resources stock and flow. This is the next component in the broader framework.

Natural Resources (Timber) Sustainability Model/Information simulates the stock and flow of resources as influenced by potential changes of consumption and production decisions by households over time. Model specifications include growth characteristics, harvest decisions (representing demand for natural resources), changes in stock and flow of resources, and indicators of sustainability. The outcome of the simulation provides a basis for intervention or policy options for both community decision-makers and national policy makers. The SAM helps assess potential impacts of those choices.

Community/Household Consumption and Production Decision Alternatives

Household consumption patterns and production activities in rural areas affect the flow and stock of natural resources. Internal characteristics and linkages with external factors, in turn, influence these consumption and production activities. Therefore, factors that influence household production and consumption activities directly or indirectly define the account. Internal characteristics and external factors relevant for this study are described below.

Internal Characteristics and Endogenous Factors

This includes household demographics, labor composition, household consumption and production preferences, and assets/properties. Brief descriptions of each component follow.

Household Demographics. Household size, age composition, level of education, gender ratio, family structure, religious affiliations, leadership, day-to-day management, and kinship relationships all influence the type and frequency of production activities and household consumption levels. In periods of scarcity or abundance, these demographic characteristics potentially influence decision-making and types of livelihood or production activities.

Household Labor Composition. Rural household heads are generally unskilled laborers besides having farming skills. Barbier and López (1998) hypothesized that off-farm or wage employment is directly proportional to size of landholding. The skill level determines the intensity or frequency of off-farm or wage employment. The level of education determines manpower capabilities. The male household head or husband traditionally conducts the decision-making, earning income, and production activities in rural households.

Household Preferences. Preferences translate to choices of production activities and levels of consumption. Likewise, skill level and demographic characteristics influence preferences and vice versa.

Household Assets or Properties. Inherited or acquired land generates income and wealth for rural farmers, if it is productive (Shields et al., 1993). Without these types of properties, households rely on small-scale income generating activities such as labor and wage employment (domestic helper, carpenter, masonry etc). Without these

opportunities, rural households resort to exploitation of natural resources in fisheries or forests. In this situation, open access or common pool resources substitute as important secondary sources of livelihood for rural households. Ownership status affects intensity of natural resource exploitation, and thus its stock and flow.

Therefore, household characteristics affect the stock and flow of resources directly and indirectly via production and consumption activities. Community or village level accounts ought to reflect these influences.

Household Well-being and Consumption

One approach to identify what goes into the SAM is to understand what constitutes household well-being, represented by its consumption. Satisfaction of basic food, clothing and shelter needs of households determine household well-being. These needs are met either by own-production or by purchase of market commodities using income from production or both. Therefore, rural households' well-being is directly or indirectly derived from consumption of outputs in agriculture (A), forest-related natural resources (F) and market purchases (M), simply summarized as follows:

Rural Household Economic Well-being: $f(C) = f(A_c, F_c, M_c)$ (1)

Where:

C = consumption as measure of well-being which includes:

A_c = agricultural goods consumed by households

F_c = forest goods consumed by households, and

M_c = market goods purchased and consumed by households.

Conceptually, conventional accounts reflect mostly the M_c component of household consumption plus hired labor and purchase of capital inputs, but ignore direct household consumption. This complete market orientation assumes that all food, clothing and shelter needs are marketed. It further assumes that market expenditures are equivalent to money income from production activities (that include natural resources exploitation). Equation (2) represents a mathematical expression of well-being formulated as market expenditures (Appendix A.1 presents more details):

Market Expenditures: $\Sigma P_{Mi}M_{ci} = \Sigma P_{Ai}(A_s) + \Sigma P_{Fi}(F_s) + \Sigma I_i - (wL + P_K K + c)$ (2)

where:

$\Sigma P_{Mi}M_{ci}$ = total market purchases/expenditures of households, where P_{Mi} = market price of purchased commodity i, and M_{ci} refers to market commodity i purchased for consumption needs;

$\Sigma P_{Ai}(A_s)$ = money income from sale of agricultural (A) commodity i where it is assumed that total agriculture output $A = A_s$, all output are marketed; P_{Ai} is the market price of agricultural commodity i and subscript *s* means sold or marketed;

$\Sigma P_{Fi}(F_s)$ = money income from sale of forest commodity i where it is assumed that total forest exploitation output $F = F_s$, all outputs marketed; P_{Fi} is market price of forest commodity i and subscript *s* means sold or marketed;

ΣI_i = total income from other production activities i;

$\Sigma P_{Ai}(A_s) + \Sigma P_{Fi}(F_s) + \Sigma I_i$ = total income of household from production activities, reflected in the market;

$wL + P_K K + c$ = total expenditures of household, where w, P_K, and c are wage rates of L, price of capital input K, and other costs of production activities, respectively.

Since, Market Expenditures = Net Household Income, then

$$\Sigma P_{Mi} M_{ci} + (wL + P_K K + c) = \Sigma P_{Ai}(A_s) + \Sigma P_{Fi}(F_s) + \Sigma I_i \quad (3)$$

An M_c equal to zero in Equation (2) and (3) implies that all production outputs are diverted to household consumption to meet essential consumption needs (In an economic sense, the opportunity cost of selling production output is greater than direct consumption). However, in most cases, M_c will not be zero because household production income must provide for essential expenses such as education, import of inputs and commodities from outside the community, and related needs available only at the market. Therefore, household consumption (representing well-being) includes both own-produced and market-purchased commodities. In this case the value of Equation (1) is greater than Equation (2)

$$f(C) = f(A_c, F_c, M_c) > \Sigma P_{Mi} M_{ci} \quad (4)$$

because some production outputs are directly consumed by households that do not enter the market. The right-hand-side of Equation (4) represents money income of households net of directly consumed production outputs, while the left-hand side includes market-purchased commodities and production outputs consumed by a household – hence, the

inequality. Therefore, the accounting system that assesses well-being should incorporate both marketed and non-marketed components of consumption.

The mathematical models above assume that:

- households satisfy welfare needs by substituting some market commodities with own produce, hence, there are commodities that do not enter the market;
- households have two major sources of livelihood: agriculture and forest exploitation, and may shift to other types of livelihood such as wages/employment in the event that those two are not sufficient or constrained; and
- households augment income from agriculture and forest exploitation with other non-land-based livelihood activities;

Elements of the accounts are guided by these formulations (Equations 1 to 4). The household-expenditure function reveals consumption needs linked to outputs of production activities. In rural communities, households resort to various production activities at different times, as influenced by endogenous and exogenous factors. The next section shows simple models of these production activities.

Household Production

The household is the consumption as well as production center. These households own and lease agricultural land from landowners, and seasonally gain livelihood from

fishery and other non-land-based activities; otherwise, they exploit natural resources in the forest. These alternative opportunities promote shifts of production activities depending on the constraints, benefits, and costs involved. A number of factors influence the choice and intensity of any production activity:

- consumption needs;
- demographic characteristics (e.g., household size);
- income opportunities from outside, translated as opportunity cost of production;
- external factors such as market forces, government policies on land tenure, institutions within and from outside that affect the community;
- pressures from other groups outside the community (e.g., environmentalists, political groups, local governing authorities); and
- weather conditions and potential natural risks.

At some times in household production, more effort goes to agriculture and at other times to the forest. If the opportunity cost of production in agriculture is high, a household will intensify production from the forest; otherwise, time will be devoted to non-land-based production activities. Equation (3) show Agricultural (A), Forest (F) and Other Livelihood (I) production options of households that show components for recording in the SAM:

$$A_i \text{ or } F_i \text{ or } I_i = f(L, K) \qquad (5)$$

Where i refers to a particular commodity production, and the factors of production that enters the SAM are:

$$L = L_H + L_{Fa}$$

$$K = A_K + F_K + M_K$$

$$L_H = L_A + L_F + L_I$$

And

$$A_K = A_A + A_F + A_I$$

$$F_K = F_A + F_F + F_I$$

$$M_K = M_A + M_F + M_I$$

L_H = summarizes hired labor employed in agricultural production, L_A, or hired labor for forest exploitation, L_F, and hired labor for other livelihood activities, L_I. If L_H is zero, L is simply family labor, L_{Fa}; not all labor types are employed in one production activity;

L_{Fa} = family labor employed in all production activities, not accounted in conventional accounts;

K = total capital inputs coming from agriculture, A_K, forest exploitation, F_K, and purchased from the market, M_K;

A_K = capital used in production may include A_A, A_F, A_I, or part of agricultural production output used as capital for agricultural production, forest exploitation, and for other livelihood, respectively;

F_K = capital used in production may include F_A, F_F, F_I, or part of forest exploitation output used as capital for agricultural production, forest exploitation, and for other livelihood, respectively; and

M_K = capital inputs purchased from the market, used for agriculture (M_A), forest exploitation (M_F), and other livelihood (M_I), considered imports to the community.

Equation (5) implies that factors of production employed by households are common factors, movable from one livelihood opportunity to the other. In the absence of empirical evidence, equations for L and K are suggested to be linear or portraying perfect substitutability between hired and family labor, and between capital for agriculture, forest, and other livelihoods, respectively. These kinds of relationships promote shifting of production activities. This relationship further emphasizes its relevance in valuation of production components that do not enter the market.

Not all outputs in agriculture (A) or forest exploitation (F) or other livelihood (I) are marketed; a portion is directly consumed by the household or reinvested as capital inputs. Production outputs are distributed as follows:

$$A = A_s + A_c + A_K \qquad (6)$$

$$F = F_s + F_c + F_K$$

$$I = I_s + I_c + I_K$$

Where, in all the expressions (Equation 6) above, the subscript *s*, *c*, K refer to marketed (sold), household-bound, and reinvested as capital input, respectively. The last two output destinations may not involve monetary transactions, but are needed to reflect household activities in economic accounts. Appendix A.2 provides simple measures of natural

resources in consumption and production, useful for comparing conventional accounts and the SAM developed in this study.

Finally, certain production constraints (or opportunities) force households to shift from one production activity to another. Appendix A.3 presents a simple mathematical relationship describing household decisions to shift from one production activity to another. The shifting and frequency of production create uncertainty on the outcome of resources, most especially open access or common pool resources such as forests, where exploitation can be uncontrolled. An accounting of natural resources exploitation that considers these shifts can aid decisions in terms of sustainability of consumption and production.

Consumption and production activities are endogenous factors that are affected by internal and external factors. These external factors influencing consumption and production decision are discussed next.

External (Exogenous) Factors

Exogenous factors either constrain or increase consumption and production activities. These external factors become instruments in regulating resource exploitation, and hence, useful (tools) for sustainability objectives. These include local institutions, government, and market forces.

Local Community and External Institutions. Property and tenurial relations, common property management, socio-cultural affiliations, political institutions, labor exchange arrangements and production relations influence income generating strategies and thus, level of activity in farms, forests or other livelihood (Appendini et al., 1999).

Government (Policies). Policies on land tenure and ownership, access to forest resources, regulation of production levels, rural credit, and landholding in rural communities directly and indirectly influence household activities.

Market forces (Rest of the World). Prices of consumer goods and production outputs, market wage rates, and input prices generally influence decision-making in terms of consumption and production activities, and value of natural resources.

In situations where consumption/exploitation of natural resources, particularly timber, is not sustainable, decision- and policy-makers use these exogenous factors to regulate or promote natural resources exploitation. Impacts of such intervention on the rural economy is recorded in the SAM, and further analyzed through multiplier analysis. Discussion on this extension of matrix component (multiplier analysis) is set aside for a later discussion. Hence, the SAM is necessary but not a sufficient instrument for assessing long-term rural well-being.

Natural Resource Accounts

Natural resource accounts provide appraisal and evaluation functions, and management decision-making functions. They are primarily useful at the local level, and as input for policy-making at the broader scale (i.e., regional and national levels). The appraisal and evaluation functions require those important variables, such as consumption and production accounts that affect the stock and flow of resources enter the account system. Thus, accounts must include how much of production outputs are marketed, directly consumed, and reinvested in own production. The account structure must clearly reflect these important variables.

The World Bank framework on social accounting matrix, or SAM (Pyatt and Round, 1985), closely captures the dynamics of these rural household activities, and aggregates accounts at the community level. The standard structure of a SAM includes production activities, factors of production (represented by L and K), institutions [represented by household and community expenditures on M_c, capital formation and human capital (representing capital)], and the rest of the world.

SAM Components Derived from Consumption and Production Functions

The number of account components depends on the purpose of SAM construction. Most socioeconomic studies attempt to evaluate distribution of benefits over categories of households, and in this study, on land ownership. An extension covered by this study evaluates the impact on natural resources. Figure 2 summarizes the model structure of the

SAM at the community level. The rows of the SAM contain receipt accounts of community production activities, factors of production, institutions, capital accounts, and the rest of the world. The column elements represent expenditures made by these accounts. The intersection of each row and column (sub-matrix) represents a "transaction" account, implying receipts or expenditures. Empty sub-matrices can mean two things: either there are no relevant transactions at the community level or there were no transactions recordable. The numbers in parentheses represent row and column (r, c) for labeling transactions. Transactions are described starting from the upper leftmost to the right and moving downward.

1. Production activities (1,1). At the village level, this consists of agricultural farming (A), forest exploitation (F), and other livelihood activities (I) that may include fishery, retail stores and others. Institutions purchase or directly consume outputs of production (A_c, A_s; F_c, F_s; I_c, I_s), recorded as transactions (1,3). Part of production goes to savings/investment [A_K, F_K, transactions (1,4)], whether it is man-made (m) or natural (n). The rest of outputs are exported (1,5). This sub-matrix ("transaction") also records inter-activity demand for outputs. However, in the case of the community/household, most production outputs are sold or exported outside of the village (1,5). Hence, only a few activities have input-output interactions.
2. Factors of production - accounts for family labor, hired labor, and capital used in production activity [f(L,K)]. Transactions (2,1), the intersection of Factors of Production Accounts and Production Activities, summarize payments to capital or capital value-added, and labor or labor value-added. Capital accounts include tangible and produced capital (man-made and natural).

Aggregate Monetary Values		Expenditures						
		1 Production Activities	2 Factors of Production	3 Institutions	4 Capital	5 Rest of the world	6 Deficit/ Surplus	7 Total
Receipts	1 Production Activities Agri Farming Forest Exploitation Wage Employment Fishery Retail Other livelihood CBFM	Input-output matrix of production activities (1,1)		Demand/ expenditures on commodities (1,3)	Investment/Savings on man-made, natural and human capital (1,4)	Export sales of production (1,5)		Total Production income/sales (1,7)
	2 Factors of Production Family Labor Hired Labor Capital Man-made Natural	Factor payments (2,1)						Total factor payment (2,7)
	3 Institutions Smallholder households Landless households Cooperative Government	Taxes returned as subsidy for production (3,1)	Factors income receipts by institutions (3,2)	Remittances from outside, transfers, taxes (3,3)		Factor income from outside (3,5)		Total income, remittances, gov't receipts (3,7)
	4 Capital Depreciation Appreciation Accumulation Human Capital	Capital inputs in production (4,1)		Saving of households (4,3)	Capital Depreciation, Accumulation (4,4)			Total capital savings (4,7)
	5 Rest of the world	Purchase of imported inputs (5,1)		Demand for imports (5,3)			Trade Deficit/Surplus (5,6)	Total imports (5,7)
	6 Deficit/Surplus							
	7 Total	Total payments for factors	Total payments to capital and labor	Total institutional expenditures	Total capital investment	Total exports	Total deficit/ surplus	Total Income/ Expenditures

Figure 2. Structure of the community Social Accounting Matrix.

3. Institutions - includes households as recipients of income from employing factors of production (2,1). From the mathematical model, transactions (3,2) records w_dL and rK, where w_d refers to domestic wage rate and *r* refers to value of capital. Other than receipts from employing factors of production, institutions receive remittances from external wage employment (w_xL), recorded in (3,5). Transfer payments/subsidies from government (3,3) adds to household receipts. Government taxes may provide subsidies for local production (3,1).

   On the expenditure side, this major account also records household purchase of production outputs or expenditures on locally produced market goods (1,3); household tax payments to government (3,2) and imports (5,3) of consumption goods.

   Insertion of direct use by household of own-production is one notable extension of the SAM for this major component. Thus, transaction (1,3) includes households as destinations of production outputs. Chapter 5 provides further explanations on this insertion.

   Institutions' factor income, receipt from remittances, and transfers or subsidies are allocated among consumption expenditures or demand for commodities (1,3), savings, and contribution to community cooperatives (4,3). Household savings (4,3) are further allocated to physical capital investment or human capital enhancement (4,4).

4. Capital - On the receipt side, this account records investment/savings (A_K, F_K), recorded as transaction (1,4). On the expenditure side, this account records depreciation and accumulation of both man-made and natural capital, labeled as transaction (4,4). Human capital, normally an independent account in other SAMs, is under this major category of capital. This major account also records expenditures on enhancement of human capital (i.e., manpower skill development), useful for evaluating manpower potentials of the community;

   Imputed value for the use of natural resources also appears as factor of production (in 4,1). Hence, inclusion of the natural resource accounts revises the standard SAM. Capital and other inputs purchased from outside are reflected as "Purchase of imported input" (5,1) from the Rest of the World.

5. Rest of the world (ROW) - includes purchase of imported inputs (M_K) for production activities (5,1) and expenditures on market commodities (M_c) for consumption (5,3); and

6. Receipts and Expenditure accounts must balance hence, the SAM is a square matrix. Each row total should equal corresponding column totals. However, in practical situations, they do not balance so that a Deficit/Surplus account is included. Thus, Deficit/Surplus and Totals are simply balancing accounts.

Therefore, this study introduces three innovations to the conventional SAM. First, SAM, traditionally used at the national (macro) scale, is applied to a rural community setting. Second, in principle, the community SAM in this study includes accounts of natural resources stocks and flows. Depreciation and depletion of natural capital becomes a novel entry into the SAM, not traditionally included in most SAM structure found in literature. This account provides indicators for community decision-makers on the status of natural resources when compared to investment in capital resources, and natural resources accumulation. Third, inclusion of direct household consumption of production outputs not traditionally included in conventional SAM. Hence, the overall structure and components of the SAM resembles conventional SAM, with modifications as described. However, the structure of the production sector is not the same with conventional or industry-type input-output matrix. In industry-type input output, government and business are distinct production activities. In this study, these accounts were treated as part of household production activities hence, the SAM creates a different form of aggregation.

Estimation of SAM entries, whether marketed or non-marketed, requires common measures and valuation, which is the focus of the next section.

Measurement, Valuation and Aggregation to the SAM

This study assumes that consumption needs and market transactions guide households in applying measures and values. That is, household decisions to directly

consume or market production outputs depend on money income needs. From an analyst's perspective, this implies a balanced budget. In principle, aggregated household expenditures should equal aggregated total receipts, mirroring the structure in the SAM. At the household level, the balanced budget or income-expenditure identity equation (a possible measure of well-being) will be:

$RH_j = EH_j$ (i.e., Receipts of Household j = Expenditures of Household j)

or

$$\Sigma P_{Ai}(A_s+A_c+A_K) +\Sigma P_{Fi}(F_s+F_c+F_K) +\Sigma I_i = w(L_A+L_F+L_I) +P_K K + c + \Sigma P_{Mi}M_{ci} \quad (6)$$

Therefore,

$\Sigma P_{Ai}(A_i)$ = total value of agriculture production, marketed and non-marketed

$\Sigma P_{Fi}(F_i)$ = total value of forest exploitation, , marketed and non-marketed

$\Sigma P_{Ai}(A_i - A_c - A_K) = \Sigma P_{Ai}(A_s)$, is the value of marketed component of agricultural production, equal to net income from agricultural production,

$\Sigma P_{Fi}(F_i - F_c - F_K) = \Sigma P_{Fi}(F_s)$, is the value of marketed component of forest production, or net income from forest exploitation.

Hence, non-market-transacted components:

$\Sigma P_{Ai}(A_c+A_K)$ = non-market-transacted component of agricultural production, and

$\Sigma P_{Fi}(F_c+F_K)$ = non-market-transacted component of forest exploitation.

These formulations suggest a basis for valuation of non-marketed components of household consumption and use of natural capital. Equation (6) clearly, delineates non-marketed components that do no appear in conventional accounts. In a later chapter, these are calculated in order to measure proportions that are not reflected in conventional

national accounts. Specifically, percentages of natural capital depreciation and non-marketed components are computed. Subscripts c and K represent outputs directly consumed, and used as capital inputs for production activities, respectively.

Thus, measurement and valuation depends on the consumption or production commodity in question. Measurement follows the mode of measurement and market transactions by households, and valuation is principally market-based. Appendix A.4 lists other valuation methods applied to forest resources.

Likewise, valuation of the non-marketed component will depend on the commodity and mode of transaction. Based on the expressions above, market transactions become the basis for measurement and valuation of production outputs, whether for household consumption or reinvested in production.

Physical outputs of all production activities are valued at market price P_{xi} [where: x = agriculture (A) or forest (F) output]. Hence, the total of household income and expenditures represents aggregated income and expenditures by the community or village, representing the grand total of Receipts and Expenditures in the SAM:

$$\sum_{j=1}^{N} RH_j = \sum_{j=1}^{N} EH_j \quad \text{for all j = 1,..., N}$$

Where:

RH_j = receipts of household j from production activities

EH_j = expenditures of household j for all its production activities

N = total number of households in the community

The aggregation to the SAM follows the above formulation where receipts of all households are aggregated for the whole community. To conform to the SAM structure, the sum of production activities and factors of production of households become the basis for aggregation to the whole community. The aggregation in the SAM in turn becomes the input for aggregation at the regional or national level. Thus, the structure and valuation provide possible linkage to national accounts.

In the process of construction of the SAM, the natural resources component of consumption and production activities were measured and valued. The next step in the framework development is to arrive at a model for assessing sustainability of natural resources consumption recorded in the SAM. The next section covers this component of framework development.

Measuring Sustainability of Natural Resources

The demand for natural resources by households and the community directly translates to levels of harvest or exploitation. Levels of harvest that exceed the growth rate potentially reduce the stock for future production, and the converse occurs with below-growth-rate harvest, and dominant product sustainability (Gale and Cordray, 1991) implies that harvest should not exceed growth considering other factors constant. Natural growth, harvest levels, and damages translate to physical depreciation or appreciation of resources over time. The SAM provides information at a point in time – one year. Information on stock and flow recorded and projected over time provides information on

sustainability of natural resources. A series of SAM models for several periods for the same region would provide a trend of natural resources exploitation. For planning purposes, analysts make projections in order to predict effects of varying levels of exploitation. Most literature suggests the idea of determining a steady state – using mathematical optimal control theory – of resource exploitation over time in order to assess sustainability (Pezzey, 1992). The general idea is to assume that households behave to maximize their welfare (consumption) in each period. Natural resources capital is introduced as constraint in the maximization function. The optimal decision criterion for sustainability of resources is that the resource extraction at each period t, such that the stock of resources is non-declining over the planning horizon. However, this approach is conceptual.

Simulation modeling provides an alternative tool for assessing sustainability. Its advantage lies in the use of empirical data obtained from inventories and surveys. The SAM provides the initial values to the simulation model. In order to conduct simulation, natural resources stock and flow and human exploitation are modeled in a dynamic fashion. Figure 3 summarizes a simulation model for assessing natural resources stock and flow.

The model starts with a beginning or opening stock of resources, timber in this study, and ends with a record of closing stock at year's end. Additions to opening stock come from natural growth of timber (from both existing stand and new growths) and forest expansion (through reforestation or afforestation). Reductions come from harvests (obtained from household/community demand), natural stand mortality and other natural occurrences including forest fire. The closing stock for the year becomes opening stock

of the next year. Additions less reductions produce net changes in stock. The net-change-in-stock records the depreciation or appreciation of the resource. Balance of addition and reduction over the years translate to sustainability of the resource base. A negative net-change-in-stock implies over-exploitation. In this latter case, policy or decision options suggest reduced consumption of natural resources, a shift of production activity to non-natural resource-based livelihood, import of natural-resource-based consumption output, price intervention, or government regulation (see Figure 1).

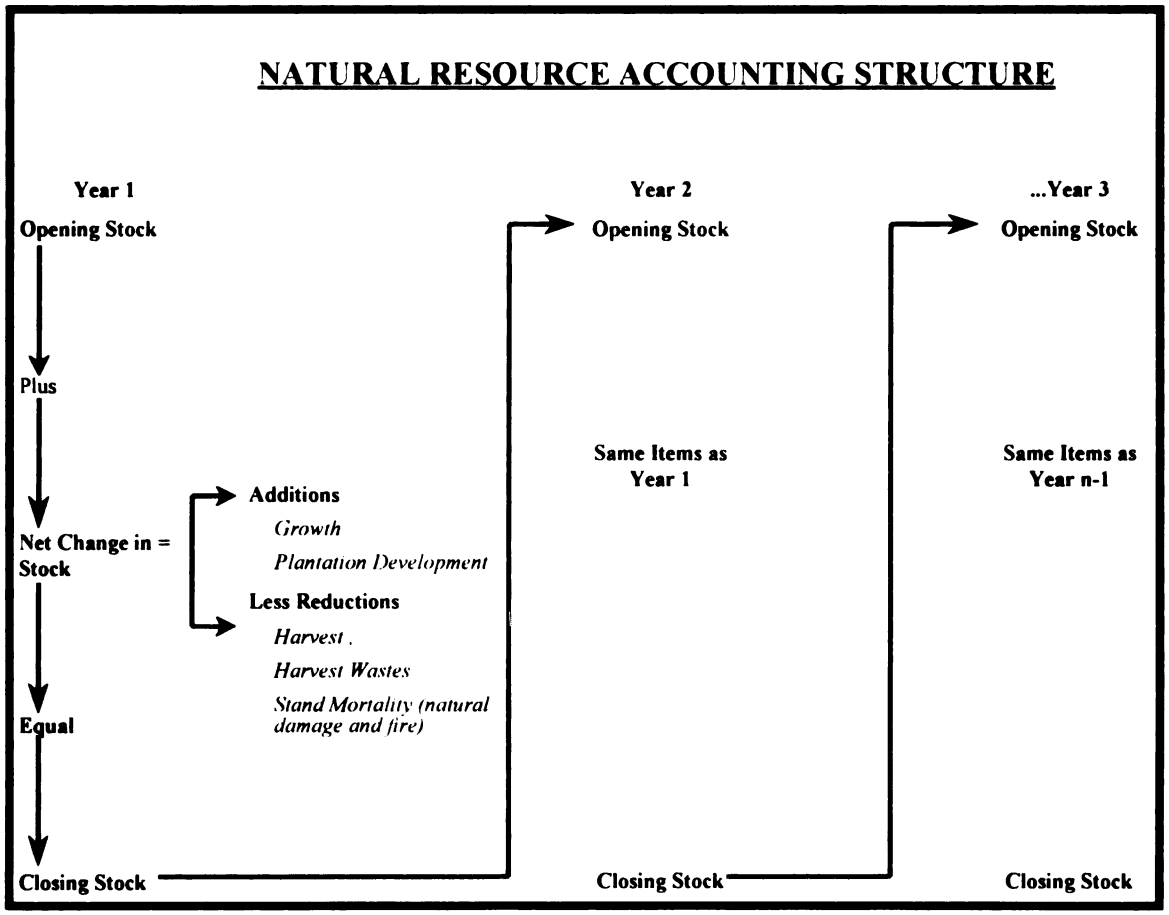

Figure 3. Simulation model for the stock and flow of natural resources (adopted from Repetto et al., 1989 and DENR, 1991).

In summary, this chapter lays the foundation for the empirical study by developing a conceptual framework for various aspects of account development at the

community level. The economic transactions of households at the community level become the basis for defining elements of the accounts. The accounts structured in the SAM format capture economic activities at the household level, whether marketed or non-marketed. Each account element is measured and valued based on household transactions in the market. The natural resource simulation model provides the link for assessing the impact of internal and external factors on the sustainability of natural resources over time.

Chapter 4 provides a procedure for constructing the SAM and multipliers helpful for analyzing impacts of exogenous (external) changes on household consumption and production and resource sustainability. The chapter also describes details of the data collection procedure that includes survey tools at the household and community level, in order to construct the SAM for this study. Chapter 5 present results of analysis and describes the simulation procedure to evaluate sustainability of community resources.

CHAPTER 4

DATA COLLECTION, ACCOUNTING STRUCTURE, AND LINKAGES TO RESOURCE SUSTAINABILITY

The previous chapter laid out the conceptual framework, the conceptual structure of the accounting system using the SAM, and the multi-period forest simulation model along with associated linkages. These served as a guide in the empirical study and data collection procedures described in this chapter. Further, data collection required significant effort due to interactions with members of the community, including local leaders and governing bodies, and this required multiple extended visits to different sites. Data accuracy and precision required checking and counter-checking for consistency that reflects the reality of a community. Surveys and interviews effectively generate information on consumption, production, and market activities of households, while focus group discussions generate a knowledge base on community institutions and external influential factors. Resource inventory is the other source of data needed to generate the stock and flow accounts of natural resources. The next section describes these data collection and measurement processes.

Data Collection Processes

The source of data for natural resource accounts using the SAM framework at the community level is of first importance. The basic unit for collecting data, discussed in Chapter 3, was the household, the final demand or consumption point and production

center. Building the SAM from household data to aggregate at the community level required surveying households' demographic characteristics, consumption patterns and production activities, and developing a knowledge base of community level institutions and external influences (e.g. market and government policies). The data collection process was a crucial component in account development.

Survey Process

The process of survey/interview involved three stages. The first stage, Community Familiarization, required interaction with community residents, local leaders, and governing organizations. The second stage, Focus Group Discussions (FGD), covered assessment of the economic structure and institutions in order to develop a knowledge base of economic and other production activities. The FGD was the venue for explaining the intent of the survey/interview and for creating an initial knowledge base on the community's economic structure and institutions. The third stage, Household Survey-Interview, involved interviews of sample households to obtain data on demographic characteristics, consumption, and production. The first stage involved simple and informal consultations and interactions with community residents. The next sections discuss details of the last two stages.

Focus Group Discussion or Survey. The process of determining what could and what could not be included in the household interviews required preliminary discussions and consultations with the community leaders through FGD. The group discussion

focused on understanding household consumption patterns, production activities, and household purchases (or expenditures). Therefore, a flexible structure of discussion was employed to appear less formal and varied for the five study communities. However, the group discussion centered on the following concerns of the study:

- On development of natural resource accounts: Draw feedback on the significance of simplified and community-based natural resource accounts;
- On conduct of household interviews: Solicit suggestions on the appropriateness and precision of draft questions pertaining to demographics, expenditure and consumption patterns, production activities, and marketing activities;
- On measurement and valuation of resources: Solicit information on more common products, both in agriculture and forests, sold or consumed, their units of measures, valuation methods employed, and periods of work and leisure; and
- On external influences: Draw out information on market, institutional and government policy influences on household and community activities.

Based on this four-point focus, the FGD involved a few steps:

- Initial community consultation and introduction of the research,
- Solicitation and screening of focus group participants,
- Scheduling of group discussion,

- Actual FGD, and
- Synthesis of discussion.

Other than meals and transportation expenses during meetings, no incentives were provided to focus group discussion and survey participants. Recommended participants to the FGD include community and people's organization officers. Table 1 shows the venue and number of participants in the FGD.

Table 1. Study site and number of participants of focus group discussions in 5 communities.

Focus Group	Venue	Number of Participants
San Pascual	San Pascual, Basud, Camarines Norte	12
Mercedes	Colasi, Mercedes, Camarines Norte	8
Tible	Tible, Sipocot, Camarines Sur	6

Comments on the interview questionnaire by FGD participants comprised the final stage of its technical revision. Discussions also included issues on appropriateness and structuring of questions so that they were not offensive or too technical for rural households. Auxiliary activities such as obtaining price levels and standard units of measures used in transactions within and outside the village were conducted toward the end of the survey process.

Household Survey. The household survey or interviews followed from the FGD. Considering the literacy level, a face-to-face interview was deemed more appropriate for rural households over other forms of survey. Interviewers were recruited who were well acquainted with the questionnaire and the rural community (or at least familiar with the

route of the survey). All interviewers were technical personnel of the Department of Environment and Natural Resources based in Camarines Norte and Camarines Sur. Some important considerations in household surveys are:

- Orient and train interviewers on how to handle and present the questionnaire so that it is not offensive to respondents, yet obtain the desired precision of answers;
- Focus the interview on residents and dependents of the household (family members independent of the household are not covered) to avoid underestimating or overestimating consumption and production information for the household;
- List of replacement (substitute) respondents must be handy for interviewers in case of unavailability of chosen sample respondent;
- A household respondent must be familiar with the consumption and production information, and this may not necessarily be the household head;
- Although an appointment time is not critical in rural households, advance notice of interview schedule must be passed on so that intended respondents are available; and
- Permission and cooperation of local leaders must be obtained before interviews can proceed.

The Survey Questionnaire

The synthesized outputs of focus group discussions were incorporated into the final survey questionnaire. The questionnaire consisted of four sections: consumption and household assets, production or livelihood activities, environmental awareness and leisure time, and household demographics. A number of steps were undertaken in order to develop the survey questionnaire:

- After review by the dissertation guidance committee, the questionnaire was presented to a group of technical personnel who had previous experience in questionnaire-based surveys;
- The questionnaire was introduced during focus group discussions as a screening process to determine the usefulness of each question;
- Questions were subsequently revised to focus only on consumption and livelihood or production activities;
- To test the duration of the questionnaire, a resident of a forest community inside the University of the Philippines Los Baños Forest Reserve was interviewed, and flaws in Filipino language were corrected in the process; and
- The questionnaire was pre-tested by five randomly selected members of each of the five communities in the study area. All pre-test respondents were excluded from the final household respondents. The final questionnaire incorporated modifications suggested by interviewers after the pre-testing.

The next sections provide brief descriptions of each questionnaire section. The final questionnaire (English Version) is in Appendix B.1. The actual questionnaire in the local language (*Tagalog*) consisted of 45 questions, a total of 25 pages and averages 1 to 1-1/2 hours of interview time. Some of the questions are "check/verification questions" that aid respondents in recalling consumption and expenditures over the preceding one year. These questions were useful in the process of data consolidation.

a. Household Consumption Questions

The basic needs (or consumption) component, was classified *a priori* into food, clothing, and shelter, and focused on dissecting a household's daily subsistence and other regular needs. This detailed approach obtained information on components of consumption activities that draw directly or indirectly from natural (forest) resources. The implicit proposition underlying this approach was that consumption by rural households was predominantly composed of non-traded goods that were not reflected in traditional national income accounts, thereby underestimating capital consumption, or depreciation.

b. Household Assets Questions

These questions elicited information on produced or non-produced (natural) household assets whether purchased from traditional markets or produced by households without passing through market channels. This complemented the actual

physical inventory or resource assessment that was conducted by community residents, and identified the destinations of outputs from various production activities. There was also an emphasis on getting data on expenditures for these assets, for purposes of determining total wealth.

c. Production Activities Questions

Livelihood or production activities consisted of two major types, agriculture and forestry, and other minor, non-land-based activities. Questions for eliciting information on these income-generating activities (agriculture, forestry, and other minor income-generating activities) were asked separately. From the point of view of the study, the intent was to describe the various patterns of production activities.

Questions on production activities included quantity of outputs, their prices, costs and returns, destination, and whether or not these are forest resources. Ancillary income generating activities (other than minor-income generating activities) which were assumed to cover for insufficiency of other livelihood sources were treated as the fourth "livelihood" activity.

d. Leisure and Environmental Awareness Questions

The questionnaire included three questions on health and sanitation to briefly evaluate household awareness of global environmental concerns such as water pollution and carbon dioxide emissions from forests.

Types of leisure and hours spent were included to determine number hours of work by households.

e. Demographic/Socio-economic Characteristics Questions

A table matrix summarized demographic and socio-economic questions for the household (See Appendix Table B.1 p 25). The table matrix included number of household occupants, family head, spouse, dependent children and extended family members and their age, sex, civil status, education, employment, and average monthly income.

Determining the Sample Size

Communities adjoining the Bicol National Park have a total land area of 5,201 hectares (Figure 5). The study area covered a cluster of 5 out of 10 communities surrounding the Bicol National Park. These five communities, all on the eastern side of the Park are:

Province	**Municipality**	**Community**	**Peoples' Organization**
Camarines Norte	Basud	1.San Pascual	CPEU, Inc.
	Mercedes	2. Pambuahn	MUFFIN
		3. Tarum	
		4. Colasi	
Camarines Sur	Sipocot	5. Tible	TIBKOI

Located in Region 5, Bicol Region, of the Philippines, all five communities were treated as an integrated community-based forest management project. Contracted to three different People's Organizations (POs) by the Community-based Forest Management (CBFM) Program coordinators, the project is treated administratively as one organization. Thus, in the context of the Bicol National Park all five were treated as a "super-community." Likewise in this study, the five communities were treated as one; hence, a single SAM was developed. Based on community chieftain records in 1998, the five communities consist of 1,493 households, and an estimated population of 9,430. Table 2 summarized total households by community, total population and land area of the five communities, including sample size for each community.

Households in these five communities shift activities from agriculture, forestry to fisheries. Households in interior communities such as San Pascual and Tible are predominantly coconut, rice and root crops farmers while coastal communities such as Pambuhan, Tarum and Colasi also diversify to fishing. Most of these activities are seasonal so that households resort to other livelihood activities such as carpentry, masonry, retail trading, and other artisanal activities such as broom-making and basket weaving using materials from non-timber products from the forest. The survey recorded 26 other livelihood activities (see Appendix C.8) based on surveyed households.

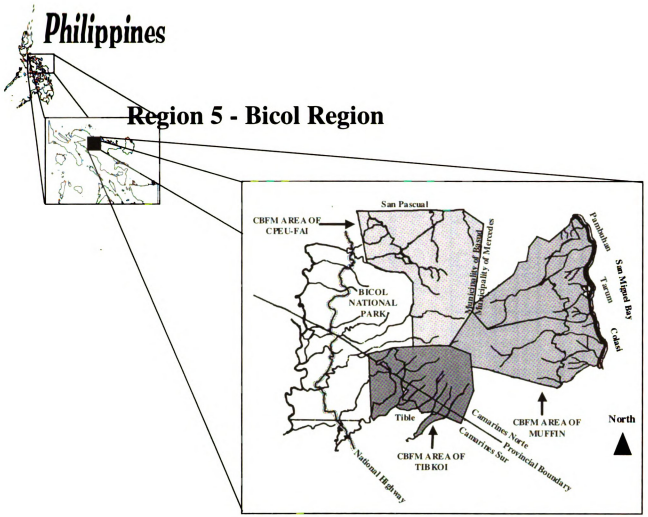

Figure 4. The study communities are located on the eastern side of the Bicol National Park in the Bicol Region.

Table 2. Summary of households (HH) in the five communities covered by the Community-based Forest Management Program at the Bicol National Park.

Barangay	San Pascual	Pambuhan	Tarum	Colasi	Tible	Total
Purok 1	33	84	30	74	71	292
Purok 2	52	57	75	50	24	258
Purok 3	40	144	70	53	23	330
Purok 4	24	101	44	36	27	232
Purok 5	48	71	29	83	11	242
Purok 6	46			21	23	90
Purok 7	31				10	41
Purok 8					8	8
Total HH	274	457	248	317	197	1493
20% Sample	55	91	50	63	39	299
Land Area (Ha)	2875	3653			1954	8482
Total Popn	1,189	4,332	1,081	1,449	1,379	9,430

The sampling frame was based on the listing of households obtained from community chieftains. These lists constituted the official list of residents and did not include groups of leftist rebels whose numbers and significance to the study remains to be determined.

The sample size was originally computed based on the conventional formula on sampling. However, the formula required specifying a variance that is unknown for the population of interest. One alternative to prove the sufficiency of sample is to determine the power of the test. However, this approach requires knowing population attributes such as the mean and standard deviation, which is unknown for the population under study. Therefore, a 10-15% sampling size from related socio-economic studies (Lopez-Gonzaga, 1994) was used. However, considering measurement errors (e.g., interviewer

bias, interpretation of questions etc.) the sample size was increased to 299 households, which was 20% of total households instead of 220 (based on 15% of the total household).

The sample was obtained using stratified proportional sampling, and using total households of the community for calculating proportions. This approach was deemed appropriate because the geographic distribution of five target communities suggests some differences in population characteristics and sizes. Income levels of residents of sub-communities (p*uroks*) at the center of the community (*barangay*) are comparatively higher that those in outlying areas. On the other hand, most sub-communities in outlying areas have consistently agriculture- or upland-forestry-based livelihood. This pattern was common in all five communities. Thus, instead of doing simple random sampling for all communities, proportional sampling was used.

Proportional sampling implies that groups of households in one sub-community have a different probability of inclusion relative to groups of households of another sub-community based on population, but each household within a sub-community has the same probability of inclusion. Thus, groups of households included in the sample represent a different number of households in the total population that comprise the five communities. Table 3 summarizes the number (expansion factor) that each household in the sample represents. The numbers in parenthesis are actual samples. In order to inflate to the five communities, the values obtained from 20% sample households (e.g. income from forest exploitation of sample of households in San Pascual) were multiplied by each sub-community expansion factor.

Table 3. Expansion factor and number of households (HH) – in parenthesis – sampled by community and purok.[a]

Barangay	San Pascual		Pambuhan		Tarum		Colasi		Tible	
Purok 1	6.60	(5)	4.42	(19)	5.00	(6)	4.93	(15)	4.73	(15)
Purok 2	5.20	(10)	5.70	(10)	4.69	(16)	5.00	(10)	4.80	(5)
Purok 3	4.44	(9)	5.33	(27)	5.00	(14)	4.82	(11)	4.60	(5)
Purok 4	4.80	(5)	5.05	(20)	7.33	(6)	5.14	(7)	5.40	(5)
Purok 5	4.80	(10)	5.07	(14)	3.63	(8)	4.88	(17)	5.50	(2)
Purok 6	3.83	(12)					5.25	(4)	5.75	(4)
Purok 7	7.75	(4)							5.00	(2)
Purok 8									4.00	
Total HH		(55)		(90)		(50)		(64)		(40)

[a] Barangay (a community) is the 2nd to the lowest in the hierarchical administrative classification of communities in the Philippines. "Purok" refers to a section in the community; the number of sections varies in each community.

Developing the Social Accounting Matrix (SAM) Structure

A SAM presents a community's balanced income and expenditures. Balancing them requires considerable knowledge of overall community economic structure and linkages as influenced or dictated by various institutions. Consequently, analysis of natural resource exploitation cannot be done in isolation, because livelihoods of households in rural areas are linked and in many cases complementary. Nonetheless, a SAM model can be constructed to demonstrate and estimate the magnitude of exploitation of natural resources relative to other production output. Hence, all production activities, whether natural resource-based or not, should be included. An appropriately structured SAM is useful for a number of economic assessments – this is discussed in Chapter 5.

SAM Development

To construct a community SAM, the household surveys first must be consolidated and aggregated. The data underwent encoding, cleaning, verification and consolidation before analysis was conducted. Various steps are described below.

In this study, the focus of impact assessment is on natural resources within one contiguous forest bounded by all five communities. A single SAM that covers all five communities seemed more appropriate and provided a consolidated picture of impact. Thus, consumption and production activities of 20% sample households (using stratified proportional sampling) from all sub-communities in five communities were inflated to create a single SAM. The values were inflated to the community level by multiplying this SAM for the 20% sample by each *purok* expansion factor (see Table 3). Activities of CBFM were not inflated, since these data were available from the three POs, covering their jurisdictions.

Consolidation of data follows the structure of the SAM and the objective of analysis. The SAM model, in summary, accounts for production activities, production factors used, institutional expenditures on outputs of production, capital accumulation/ depreciation, and domestic or external trade of output. The core production activity sub-matrix was categorized into agriculture farming, forest (natural resources) exploitation, and other livelihood. Thus, encoded household data were categorized into production, destination of output, inputs used, and consumption points. The resulting SAM model covers forest (natural resources) exploitation along with all other household consumption

and production activities, and it segregates household-bound and marketed components for all five communities. Other than providing a good picture of the community economy, the inclusion of these other components allows estimation of the overall ratio of natural resources in consumption and production, and estimation of SAM multipliers. Building an aggregate community SAM, in effect, consolidates all income (receipts) and expenditures over all households in each community.

Accounting for household- or market-bound commodities required an initial step of computing the ratios and proportions of natural resource consumption by households. This required careful structuring of the matrix so that household-bound commodities were reflected. The next section discusses details of the SAM.

The SAM Structure and Components

The conceptual framework explained in Chapter 3, presented a mathematical model of the SAM structure and institutional linkages. This chapter focuses on matching empirical data with components of the SAM, hence deals with calculation of entries in monetary values.

The SAM in this study (Figure 5) has similarities with the general structure of the village model by Taylor and Adelman (1996), except for entries in sub-accounts. Sub-accounts under production activities, one of the major accounts, include agriculture farming, forest exploitation, fishery, and other non-land-based livelihood activities. Factors of production include family labor, hired labor, purchased capital, and natural

capital. Institutions include small-landholder households, landless household, community cooperative or peoples' organization, and government. Capital entries include natural resource depreciation, appreciation, or accumulation and human capital. Rest of the world is treated similarly. These account categories become account centers or units in the SAM. The alphanumeric codes within the sub-matrix in the figure links to survey questions (see Appendix B.1 for the survey questionnaire). Hence, the SAM is distinguished from national and regional input-output models by its emphasis on rural households as production centers involving various types of activities. The latter models treat business sectors (i.e., manufacturing and services), government and households as distinct production activities. This modification in the community/village SAM gives emphasis to the socio-economic assessment needs.

Explicitly defining sub-accounts on natural resources emphasizes its value-added to production activities, and the impact of exploitation on its stock and flow (modeled in the next section) as represented by capital depreciation or accumulation accounts. In this manner, the influence of consumption and production activities on the sustainability of natural resources can be assessed. Hence, the matrix emphasizes natural capital depreciation or natural resources consumption and production (i.e., forest exploitation in tandem with agricultural production and other livelihood activities).

Aggregate Monetary Values		Expenditures						
		1 Production Activities	2 Factors of Production	3 Institutions	4 Capital	5 Rest of the world	6 Deficit/ Surplus	7 Total
Receipts	1 Production Activities Agri. Farming Forest Exploitation Wage Employment Fishery Retail Other livelihood CBFM	Production activities (Q9-Q10; Q11, Q15; Q16,Q19,Q22-Q26; Q29,Q32; Q33-		Household demand/ expenditures on commodities (Q1-Q7;Q36)	Investment/ Savings, Natural Capital, Human Capital (Q15,Q19,Q3	Export, sales of production (Q15,Q19,Q32)		Total Production income/sales
	2 Factors of Production Family Labor Hired Labor Capital Man-made Natural	Value added inproduction activities [Q13,Q14,Q17,Q18,						Total value added
	3 Institutions Smallholder households Landless households Cooperative Government	Taxes returned as subsidy (G)	Income/ Receipts of factors (Q13,Q14,Q17,Q18, Q30,Q31)	Remittances to households, transfers, taxes (Q37)		Remittances, factor income from outside (Q37)		Totals of remittances, hhold income, gov't receipts
	4 Capital Depreciation Appreciation Accumulation Human Capital	Capital inputs in production (Q15,Q19,Q32)		Saving of households (Q36)	Capital Depreciation (Q15,Q19,Q32)			Total capital saving
	6 Rest of the world	HH Purchase of other inputs [Q13,Q14,Q17,Q18,		Expenses of cooperative (Q1-Q7;Q36)			Trade Deficit/ Surplus	Total imports
	7 Total	Total payments	Total payments to capital and labor	Total institutional expenditures	Total physical capital investment	Total exports	Total Deficit/ Surplus	Total Income/ Expenditures

Figure 5. Components of the SAM and sources of information from survey questionnaire.

Measurement and Valuation of SAM Inputs

There are two fundamental issues to resolve in natural resource accounting involving the village or household economy: (1) varying units of measure for consumption commodities and production outputs, and (2) how to value non-traded or non-marketed commodities. Natural resource goods and services beyond these commodities are not addressed. This study describes approaches for the above issues that are applicable to the five communities under study. Application to other areas or communities was also envisioned in this approach.

In the community, units of measure of marketed commodities vary because of different forms of transactions. In order to resolve these variations, the most logical approach was to convert physical outputs into monetary units: using local currency, the Philippine peso. Use of monetary value (Pesos) provided a common unit for aggregating dissimilar products and activities, a fundamental requirement to be included in national income (and/or natural resource) accounting.

Imputation of value (based on local currency) was an approach taken for non-marketed commodities. Of particular importance are natural resources used as capital inputs in production and use of family labor as substitute for hired labor. Chapter 3 identified two standard approaches: shadow pricing and market price of substitutes. Peskin (1996) and Vincent (1998) recommended use of market value or opportunity cost of labor (still market price) to impute value for natural resources. In some instances,

employing the suggested opportunity cost approach tends to overvalue the resource. For instance, a household decision to produce own-fuelwood indicated that opportunity cost of hired labor is higher than its (fuelwood) production value. On the other hand, James (1996) recommended the use of market valuation for accounting purposes geared for policy analysis as opposed to opportunity cost based on labor wages. This study valued family labor as the residual value of production after deducting input costs.

For valuing timber, several studies supported the use of stumpage value (DENR, 1991; IRG et al., 1996). In the perspective of economic efficiency, stumpage valuation overestimates asset value because it disregards future tree growth and most likely included monopoly rents in a developing country setting (IRG et al., 1996). Calculation of the value of fuelwood, which has both a traded and a non-traded role, can be based on market value of delivered processed wood fuel less costs involved (equivalent to "stumpage"). Imputing value based on family labor used in wood fuel production may be used by conducting time and motion on fuelwood production. Thus, the SAM entries (including natural resources exploitation) were in monetary terms using market prices and imputing values of non-marketed commodities using market prices as a starting point.

Resources Sustainability and Community Well-being Interactions

Accounting for exploitation of natural resources is one focus of this study. Changes in household demographics, consumption, production, and external factors

affect the stock and flow of natural resources (timber) in the community and vice versa. Different levels of exploitation lead to different patterns of natural stock and flow. Exogenous controls may mitigate undesirable use levels or enhance desirable ones. Subsequently, controlling exogenous factors creates changes in various endogenous factors (i.e., production and consumption) and the well-being of households. All these interactions and changes can be reflected in the SAM. Thus, the SAM, *ceteris paribus*, becomes the information system at a point in time.

Assessing the linkage between resources sustainability and community well-being over time involved a two-stage procedure. The first stage required simulating the stock and flow of natural resources as affected by various options of exploitation, taking into account the goal to sustain well-being. The second stage was to assess the impact on well-being of controlling/changing exogenous variables, taking into account the goal of sustaining natural resources (timber) stock and flow. This second stage measures the impact of a unit change of exogenous variables on endogenous factors affecting household well-being (here described as consumption and production patterns). These processes or stages are described below.

Simulating Natural Resources Stock and Flow

The simulation procedure was designed to assess the sustainability of various options for harvesting timber resources, based on a sustainable harvest per year. The simulation model was also designed to evaluate the rate of appreciation and/or

depreciation (physical and monetary) of timber resources affected by community activities. This became the management tool for assessing the sustainability of forest resources as affected by various activities in community forestry.

The procedure required information on the initial stock and flow of resources. The survey of households and focus group discussions provided information on consumption and production activities. An assessment and inventory of resource stock (using the stand and stock table created by the POs as proxy) completed the other side of account development – the resource base. The summarized list of products extracted and sold or consumed became the master list of resources for inventory. Gathering this data required almost the same amount of time as household surveys.

The first step in the process was to define natural resource processes, and how human production activities affected these resources. These processes were translated into a simulation model that forecasts trends of resources, as driven by human economic activities. Ideally, the whole human-natural resource-system interaction should be modeled, but the resulting complex network and data needs far exceeded resources available for this study. Such a design will require enormous amount of data. Hence, the focus was on forest resources. Specifically, the focus was on timber resources, because no other inventory data were available for other forest resources. The source of stock and flow information for developing the timber resources simulation model were the stand and stock tables (see Appendix Tables B.1-3) from three POs developed for their 25-year planning period.

The basic model for the simulation was the conceptual framework adapted by Delos Angeles et al. (1995) for timber resources in the Philippines, similar to the reconciliation account of Canada (Statistics Canada, 1997). Its major components were opening stock, closing stock and net change in stock of various forest resources for every period. Opening stock plus net change in stock within the year yields the closing stock. The model incorporated resource characteristics such as growth rate, natural mortality, damage, and harvest options of the community on the periodic flow of resources. Thus, the measure of depreciation or appreciation could be negative or positive change in stock – an indicator of sustainability – for the 25-year project duration.

This approach was modeled using spreadsheet simulation in Microsoft Excel. The simplification required assumptions that other components of the forest system are not significantly affected by natural resources exploitation. An alternative graphical simulation model, using software such as STELLA (HPS, 1996) may take into account the complexity of the forest system by incorporating linkages with important natural resources such as soils. However, this approach would require further steps in modeling that are beyond the scope of this study.

Evaluating Exogenous Impacts on the SAM

The SAM is a snapshot or an account of receipts and expenditures at one point in time. It cannot provide concrete answers to questions of sustainability of resources and

well-being over time because most changes brought about by external factors appear only over a longer period, beyond the one-year data period of the SAM. A supplementary process that makes use of SAM information is to simulate impacts from changes in the SAM over the short term, by controlling exogenous variables. This makes use of the linkages between exogenous factors and the SAM represented by multipliers.

The procedure involves identifying controllable exogenous variables in order to satisfy sustainability objectives. Options include reducing consumption/production, shifting production, importing, changing prices, government regulation, or expanding the forest (see Figure 1). The desired goal is to sustain resources and maximize welfare. The option to choose depends on which linkage in the SAM will create the most desired impact. Thus, multiplier analysis involves evaluating which among the options will be effective in attaining those goals. Results of such analysis are discussed in the next chapter. This procedure makes use of the multiplier matrix of endogenous variables to assess impact of exogenous variables.

SAM Multiplier Matrix

The multiplier matrix is developed in two stages. In the first stage, the SAM elements are structured into endogenous and exogenous accounts. The latter, in this study, include Government and Rest of the World. Segregating these endogenous and exogenous accounts is critical in evaluating the impact of changes in the community economy and on natural resources. These model proceeds with two assumptions:

- Income and production changes as a result of exogenous introductions are strictly proportional (linear); and
- Mostly exogenous factors, such as government and market, trigger changes in the village economy by influencing production and consumption.

Then the base SAM is converted to a proportion matrix, or average-expenditure propensities (Taylor and Adelman, 1996), by dividing each value in the account matrix by expenditure totals (each element divided by its corresponding column totals). The exogenous share or average propensities for leakage (A_L) is separated from endogenous shares to produce a sub-matrix of endogenous share (A_E matrix). In effect, the SAM can be expressed as the product of A-matrix and endogenous incomes/expenditures. This implies that row and column sums must be equal – (or as Pyatt and Round, 1985 stated, injections must equal leakages).

In the second stage, the average expenditure multiplier (A_E) is converted to a Leontief-type multiplier derived from the mathematical relationship between income and expenditures as follows:

$Y_E = A_E \hat{Y}_E + x$

Where:

Y_E = vector of endogenous incomes or receipts;

A_E = vector of endogenous average expenditure propensities;

$\hat{Y}_E$ = vector of expenditure totals, referring to column totals in the account matrix;

and

x = exogenous income changes (introductions).

Since, in the SAM $Y_E = \hat{Y}_E$

Then,

$$Y_E = (I - A_E)^{-1}x$$

Or

$$M_E = (I - A_E)^{-1}$$

Where:

M_E = Leontief-type endogenous income multiplier

$\in A_E \leq 1$

Thus, accounting multiplier matrix, (M_E), originates from the average (expenditure) propensities (A_E) that measure the direct effects of exogenous introductions on endogenous accounts in the SAM. However, the multiplier impact is greater than the original exogenous change. Stone (1985) and Pyatt and Round (1985) decomposed the total effect to reveal three types of effects: direct, indirect and cross effects (or similarly called induced effects), decomposition of which is also presented in Defourny and Thorbecke (1984). Thus, any innovation or policy change (i.e. transfer of management of forest resources to the community) affects economic activity within the community, and thus impacts on resources. Linkages between consumption, production, and exogenous factors determine the impacts of these multipliers. Chapter 5 further elaborates on these impacts.

Secondary Sources of Information and Place of Study

In addition to the FGD, face-to-face survey, and gathering of resource information, auxiliary information was obtained from various sources. Reports of NRMP Community Base Forest Management Annual Working Plan (AWP), Forest Land Use Plan (FLUP), inventory and assessment of the community forestry. ENRAP Phase I and II provided regional and national estimates of resources. Various government institutions that manage community forestry, non-government organizations that assist the community in the 3-5 year build-up period, and the community organization itself were contacted for accounting validation. Household surveys were done in the five communities in Camarines Provinces namely Tible, San Pascual and Pambuhan, Tarum and Colasi. All these sites border the Bicol National Park in Region V. Finally, basic formulation of the accounting and simulation models were conducted at Michigan State University.

In summary, this chapter outlined the procedures for applying the conceptual framework for natural resources accounting at the community level. The data collection procedures included community interaction, focus group discussions, survey instrument design, and household survey. Construction of the SAM involved mostly aggregating survey responses of 20% households in five communities, and the rest were secondary data obtained from the three peoples' organizations (POs). Assessing sustainability of natural resources required developing a simulation model for natural resources

specifically timber. Finally, this chapter outlined the procedure for assessing the impacts of exogenous changes on the endogenous variables on the SAM by making use of the SAM multiplier matrix. Results of these procedures are discussed in the next chapter.

CHAPTER 5

RESULTS AND DISCUSSION

This chapter discusses the results of the SAM development, the simulation of natural resource exploitation (recorded in the SAM), and effects of exogenous interventions/injections on the elements of the SAM through a multiplier analysis. The first section describes the construction of the SAM that incorporated non-marketed production outputs and natural resources exploitation. The matrix format captures the economic structure and linkages of various actors in the community economic system. The second section describes the simulation modeling results of forest resources (timber) exploitation as affected by various levels of exploitation (harvest). The third section focused on evaluating the impact of changing exogenous factors on the SAM. Throughout the chapter, the discussion centers on aspects of account development and usefulness of the SAM for sustainability analysis.

Developing the Social Accounting Matrix

The initial direction of this research was to develop a SAM for each of the five communities that buffer a national park, and for possible replication in communities outside of the study area. However, in the process it became apparent that developing a separate SAM for each community would only increase the complexity of the analysis, but would not significantly change overall results and interpretations. Thus, all

information obtained from five communities was consolidated into one account matrix. The option to consolidate all five communities stems from two important justifications. First, the assessment focuses on the impact of forest exploitation activities on the overall second-growth forest that buffers the Bicol National Park rather than the jurisdiction of each community. A single account conveniently accomplishes this assessment, instead of evaluating several accounts derived for all five communities. Second, aggregating these five communities introduces more variation of livelihood activities. In this situation, it mirrors a number of production activities that are likely to occur in many other villages. Therefore, consolidating five villages as a "super-village" provides an advantage of evaluating impacts of various forms of production activities.

The social accounting matrix was developed by synthesizing community focus group discussions and household surveys. The schematic structure, shown in Figure 6, consisted of 26 component accounts grouped into five major accounts: production activities, factors of production, institutions, capital, and rest of the world (ROW). The resulting SAM consisted of 16 sub-matrices and six vectors. Each row or column label represents one account. Analysts interpret rows as income or receipts and the columns as expenditures of that particular account. The SAM is a square matrix following the concept that income should equal expenditures.

Figures inside the matrix are in monetary values based on nominal peso values in 1998 (US $1=PhP 41.29, average from September to December 1998, the time of the field study). If the study focused on comparison of income between periods, these values would require conversion into real values using a base year.

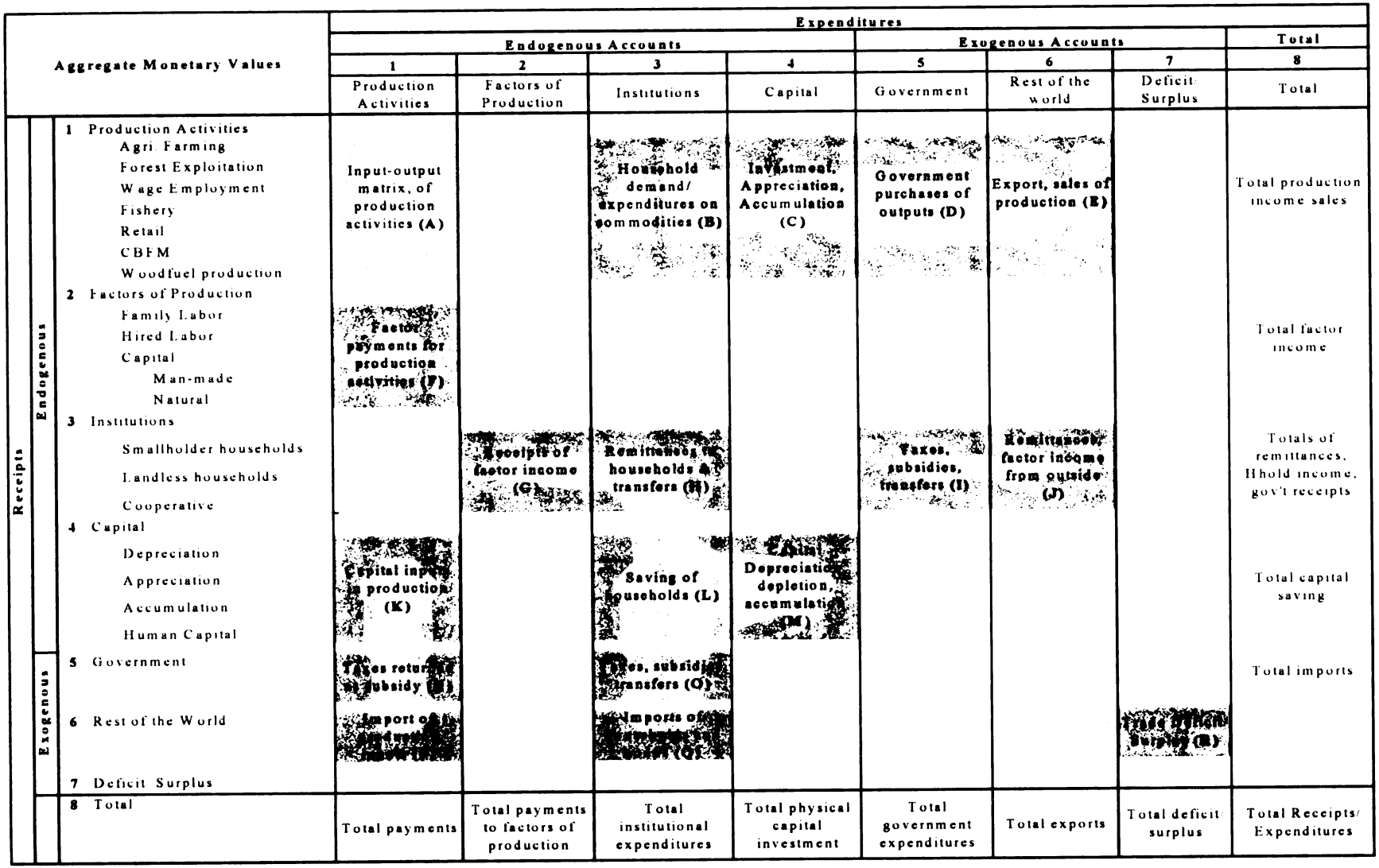

Figure 6. Schematic diagram of the SAM for five communities buffering the Bicol National Park.

The sections that follow describe and interpret entries of the accounts created. The first part describes each major account and underlying components and their linkages, and describes unique extensions of SAM construction introduced in this study. The second part discusses uses of the SAM. This includes evaluating how exogenous changes affect the system.

Components of the Social Accounting Matrix

Interpreting the outcome of the constructed SAM requires an understanding of each account component and how they all fit into certain categories. In traditional construction, the SAM is divided into two main groups: endogenous (within the community) and exogenous accounts (external factors affecting activities within the community). Endogenous accounts include Activities (or Production Activities), Factors of Production and Institutions (other than government). Normally, exogenous accounts include Capital, Government and Rest of the World (ROW). However, this study introduced a modification in this account: capital accounts included natural resource depreciation and accumulation, and were treated as endogenous, while government as an institution remained an exogenous account. Another unique extension introduced pertains to households (classified into small-landholders and landless) as production centers and institutional users of output. Distinctions were made between marketed production outputs and direct consumption of own-production. The rest of the accounts are balancing accounts, notably Deficit/Surplus and Total Receipts/Expenditures (Income and Expenditures Balance Sheet).

In the SAM structure, shown in Figure 6, endogenous accounts occupy the first rows and columns of the SAM. These grouping of endogenous accounts can be understood in terms of their interrelationships. The first focal point of the SAM is the sub-matrix of production activities as the communities' input-output matrix. Second, factor inputs define the technology used and sources of inputs (including labor, man-made and natural capital) of production. Third, destinations and recipients of output and factor income reveal demand and expenditures by various institutions.

Briefly, the SAM constructed from consolidated data derived mainly from household surveys have the following highlights:

- The total value of household/community production activities was P 71,651,622;
- P 12,618,383 or 17% of total output in all production activities were consumed by households, hence, not marketed;
- P 16,370,320 or 23% of total production was non-marketed.
- P 37,982,478 or 53% of total production output was locally used, and P33,669,144 or 47% was exported;
- The community imports P 43,962,754 which is equivalent to 61% of total production value; hence, the community has a commodity trade deficit of P10,293,610; less external remittances, the absolute trade deficit is P 3,557,209; and

- The total value of natural resources consumed was P 8,188,197 or 11.4% of total production value, and equivalent to 3.8% current natural resources stock, which then translate to 3.81% timber resources depreciation value.

Descriptions of each element in the SAM follow, where letters in parenthesis refer to the sub-matrix label in Figure 6 and details are shown as tables.

Production Activities (Sub-matrices A-E). Based on consolidated survey results, households in the five communities undertake two major income-generating activities (agriculture and forestry), and a number of other smaller livelihood activities that include wage employment, retail trading and fisheries (Table 4). These latter three were top income-earners in the community besides agriculture and forestry. In traditional input-output construction, wage employment is treated as factor of production. However, for purposes of evaluating production activity shifts, these types of activities (examples include carpentry, jeepney driver, church worker) were treated as significant income sources to emphasize the magnitude of their contribution to community welfare. Wood-based fuel production and community-based forest management (CBFM), a government-sponsored program, were distinguished to emphasize the role of non-traded consumption and impact of government programs, respectively, on natural resources. The total value of all production activities was P 71,651,622 distributed as inputs for other production activities, locally marketed, directly consumed by household, reinvested in other activities, and exported.

An entry in the sub-matrix can be interpreted in two ways. First, from the receipts side (row entry), the P512,000 (see Table 4) for example, is part of Forest Exploitation (row account) output used as input in Wood fuel production (column account). That same value from the expenditure side, can be treated as the purchase of (expenditures for) outputs from Forest Exploitation as input for wood fuel production. For CBFM, a sizeable amount of its output is used for a number of production activities. Blank cells imply no transaction between those accounts (e.g. no forest exploitation output used for agriculture farming).

Inclusion of production activities, or simply "Activities," does not require that all outputs enter the market but may include any major activity that involves economic costs, such as subsistence production and produces an output. Institutional recipients of outputs that do not produce outputs are treated differently. Small-scale activities with smaller impact, that would not significantly alter the SAM structure, were aggregated with similar activities (in traditional accounting this refers to an aggregation of smaller components and labeled, "not elsewhere classified" (n.e.c). If so desired, the number of activities can be disaggregated into smaller activities depending on the purpose or design for the SAM.

The "Activities" matrix is flexible enough to include activities relevant for policy analysis and decision-making. For instance, two such activities that concern the government are timber poaching or illegal logging and reforestation. The impact of these activities on natural resource stock and flow contributes to the impact of the rest. Other activities that concerns environmental protection may be added to the matrix (an emerging concern for current policies).

Table 4. SAM Production matrix (Sub-matrix A of the schematic diagram).

Aggregate Monetary Values			Expenditures							
			1							
			Production Activities							
			Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
Receipts	1	Production Activities								
		Agri. Farming						170,037		
		Forest Exploitation						461,522	512,000	
		Wage Employment								
		Retail Trading								
		Fisheries								
		Other sources								
		Wood-based fuel								
		CBFM	10,000	45,000				30,000		45,000

This Production or Activity sub-matrix is similar in form to conventional national accounts, but the latter cover major businesses that were non-existent (or nearly so) in the community surveyed. This is unique in a sense that in most accounting matrices, particularly national accounts, output of other sectors may be used by another sector as inputs thus, inter-industry input-output is very significant. Inter-activity input-output is minimal if the SAM is constructed from a household-production-center perspective. Most rural household production activities are primary producers, where backward linkages are minimal or nonexistent. Use of commercial fertilizers in agriculture, for instance, can be treated as inputs. However, these are not locally produced but imported; hence, fertilizer was treated as imported inputs in SAM construction. Thus, Production Activities was categorized based on production activities of households, and not on the type of distinct business occurring in the community.

The majority of household production outputs go directly to final consumption (Table 5 Sub-matrix B) or as export (Table 6, Sub-matrix D). Inter-household input-output transactions are less significant, and the survey did not capture such inter-household interactions. Focus group discussions and informal observations support the notion that little inter-household trade occurs. Thus, the SAM capture only agriculture and forestry-related outputs (mainly forestry livelihood and CBFM) used as inputs for "other livelihood activities" and wood fuel production.

The rest of production outputs were distributed among Institutions (Sub-matrix B), Capital (as investment - Sub-matrix C) and the Rest of the World accounts (Sub-

matrix E). Tables 5 and 6 summarize destinations of production outputs. The results of the survey revealed a number of other institutional recipients of production output. Thus, a final component called "Others" (in Sub-matrix B) aggregates all these various recipients. On the "Receipts" side of production, this account becomes the catch-all account for destinations other than market, government, people's organization and own-household. Listing such "institutions" is less important for the objectives of this study. Examples commonly observed in the survey include donations of output to relatives outside of the community and to neighbors and barter trading. This additional "institution" also captures formal and informal transactions by households and non-government organizations that provide financial or other assistance to communities. In the community surveyed, several groups provided aid to individual households or communities. Certain organizations specialized in housing assistance, social welfare programs, educational and infrastructure support, churches and civic organizations. Categorizing them as one group does not modify the effect on natural resources, which was the focus of analysis.

Factors of Production (Sub-matrix F). Factors of production, shown in Table 7, involved in those various production activities vary for each household. The simplest aggregation strategy was to classify these factors into labor and capital. They further divided into two subdivisions useful for analysis. Brief analysis of factor utilization showed that Agriculture farming had the largest usage of family labor with total value of P 32,084,862, or 90% total value of agricultural production, suggesting that production activities are predominantly family-type production activities.

Table 5. Destination of production outputs (Sub-matrix B of the schematic structure).

Aggregate Monetary Values			Expenditures					
			3					
			Institutions					
			Smallholder households Expenditures		Landless households Expenditures		Others Institutional Expenditures	
			Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organization	Others not specified
Receipts	1	Production Activities						
		Agri. Farming	-	8,402,474	-	126,187	-	1,922,834
		Forest Exploitation	-	357,797	-	35,895	-	685,545
		Wage Employment	3,748,374	-	1,329,013	-	-	-
		Retail Trading	3,058,580	-	13,422	-	-	-
		Fisheries	3,304,291	177,220	1,230,288	112,221	-	-
		Other sources	-	233,038	-	102,623	-	-
		Wood-based fuel		12,691,057	-	1,633,623	-	-
		CBFM	-	-	-	-	7,077,793	-

Table 6. Other destinations of outputs of production activities (Sub-matrix C, D & E of the schematic structure)

Aggregate Monetary Values			Expenditures							
			4				5	6	7	8
			Capital				Exogenous Factors			
			Investment	Natural Capital Depreciation	Natural Capital Accumulation	Human Capital	Government	Rest of the world	Deficit/ Surplus	Total Receipts
Receipts	1	Production Activities								
		Agri. Farming					-	24,753,529		35,375,061
		Forest Exploitation					-	4,852,961		6,905,719
		Wage Employment	-				-	-		5,077,387
		Retail Trading	-				-	-		3,072,002
		Fisheries	83,679				-	976,596		5,884,294
		Other sources	278,219				-	2,219,485		2,833,365
		Wood-based fuel	512,000				-			14,836,680
		CBFM	424,482		422,018			866,572		8,920,866

0

Table 7. Factors of production (Sub-matrix F of the schematic structure)

Aggregate Monetary Values			Expenditures							
			1							
			Production Activities							
			Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
Receipts	2	Factors of Production								
		Family Labor	32,084,862	3,373,600	4,887,030	2,515,736	5,057,984	1,683,488	-	-
		Other domestic inputs	1,238,880	161,959	72,661	14,574	17,146	12,745	-	6,094,678
		Hired Labor	965,436	26,175	111,111	-	3,080	2,080	-	391,994
		Capital								
		Man-made	30,727	4,085	-	-	458,273	-	-	-
		Natural	99,425	-	-	10,080	2,653	11,163	-	-

Labor was divided into hired and family labor. This separation proved useful in valuation of traded and non-traded commodities in the community. The value of family labor was not necessarily equal to the opportunity cost of wage labor, but was a residual value of production after deducting all input costs. This valuation approach uses the assumption that households resort to own-production instead of employing hired labor because the value of output is less than that of hired labor. Thus, there exists an inequality in value of family labor and hired labor. Market imperfections characterized the community thus, shadow prices such as family labor diverged from market wage rates.

Capital inputs were divided into man-made and natural capital. The natural capital component differs from the sub-account of natural capital in the account sub-matrix labeled "Capital" (K). This difference is explained later. Here it suffices to mention that natural capital inputs are explicitly market-transacted and produced natural capital used as factor inputs.

Other than labor and capital inputs, the household interview revealed a variety of other inputs in small amounts, thus they were lumped into an account labeled "Other domestic inputs" to differentiate inputs that were purchased from outside of the community. The Rest of the World account reflected values of the latter.

Component inputs or factors of production define the structure of production. It also typifies a technology employed by households. Obviously, production activities are not similar in component inputs. Some only have natural resources as input while others

have both man-made capital and natural capital inputs. In most cases, because production activities are by households, only family labor is involved. The sub-matrix that intersects Factors of Production by itself is a null matrix, because, logically, expenditures by factors of production for itself do not occur.

Institutions (Sub-matrices G-J). Table 8 presents the components of the Institution matrix, and its receipts or income for employing its factors of production (Sub-matrix G). In the process of data consolidation, a number of options for classifying institutions emerged. The disaggregation of institutions into components depends on the use of the SAM. The SAM could be used to assess the effect of landlessness, poverty, or lack of basic opportunities on natural resources sustainability. It is also flexible enough to consider environmental concerns. Hence, the purpose dictates the structure as well as content of survey questionnaires to acquire inputs for the matrix.

Table 8. Distribution of income from employing factors of production (Sub-matrix G of the schematic structure).

Aggregate Monetary Values			Expenditures				
			2				
			Factors of Production				
			Family Labor	Other Domestic Inputs	Hired Labor	Man-made Capital	Natural Capital
Receipts	3	Institutions					
		Smallholder household	42,168,103	650,361	1,090,270	352,334	110,060
		Landless households	7,434,597	867,605	17,612	140,751	13,261
		People's Organization	-	6,094,678	391,994	-	-
		Others not specified					

In this study, recipients of income from payments to factors of production are households, government and other relevant institutions within or outside a community. Thus, the Institutions account divides into households, people's organization, and government (this part labeled as sub-matrix I is discussed later). Households that compose the major consumption and production actors of communities further sub-divides into holders of small parcels of land (small-holders) and the landless. This classification explores the hypothesis that landholdings directly influence the decision for wage employment (e.g. carpentry or road construction) outside of the community or livelihood activities (e.g. white clay mining) other than agriculture and forestry. A comparison of the magnitude of incomes and expenditures partially supports this hypothesis.

A different component appears on the expenditure side for households. A distinction between market-purchased and direct-household consumption expenditures reflects subsistence- or own-production that do not enter conventional accounts. In this study, for instance, direct household consumption of own-production was P 12,618,383 (distributed among small-holder and landless households) or 17% of total production value. These additional components are not covered by traditional accounting approaches. The importance of this disaggregation is emphasized in a later section.

People's organization (PO) is not a typical entry in a SAM. It was included for two purposes. First, the government's community-forestry program recognizes the important role of non-government or people's organizations on natural resource conservation and economic development. Thus, the SAM includes these people's

organizations to evaluate their impact on natural resources and economic performance. Second, the PO appears in order to represent the institutional set-up of the community-based forest management concept. These POs serve as the rule-making institution for common property management, as a conduit for external support of forest management activities such as loans or financial assistance, and as the marketing arm for community outputs. This serves to emphasize that it is very important to develop accounts at the community level rather than simply aggregating all household production. Decisions do not originate solely from the household, but also from the community. This is particularly true when common pool resources exist that in most cases are strong points of political contention. Chapter 6 briefly expounds on this aspect.

Not all income or receipts of institutions derive from employing factors of production in community production activities. Households acquire income from wage employment outside of the community; thus, the SAM (Sub-matrix H and J) records these as remittances from external sources. In addition, government welfare programs include subsidies or transfers to a number of residents (Sub-matrix I). Table 9 (Sub-matrices H, I, J) presents various non-factor incomes from outside of the community.

Likewise, policy implications for production and consumption require inclusion of Government accounts under institutions to cover taxes, transfers and subsidies that goes into the production (recorded in sub-matrix N), and other institutions (recorded in sub-matrix H). In the SAM, analysts treat government as an exogenous factor that influences endogenous activities. Hence, for purposes of SAM analysis this was grouped together with Rest of the World accounts.

Table 9. Remittances, transfers and subsidies to (endogenous) institutions (Sub-matrix H, I, J).

Aggregate Monetary Values			Expenditures															
			3						4				5	6	7	8		
			Institutions						Capital				Exogenous Factors					
			Smallholder households Expenditures		Landless households Expenditures		Others Institutional											
			Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organization	Others not specified	Investment	Natural Capital Depreciation	Natural Capital Accumulation	Human Capital	Government	Rest of the world	Deficit/ Surplus	Total Receipts		
Receipts	3	Institutions																
		Smallholder households											175,008	1,951,762		46,497,897		
		Landless households											-	1,451,359		9,925,184		
		People's Organization					191,554					17,500		2,063,589		8,759,315		
		Others not specified	2,386,143		528									221,707		2,608,378		

Capital (Sub-matrix K,L,M). This major account divides into four important components: Savings/Investment, Natural Capital Depreciation, Natural Capital Accumulation, and Human Capital (Table 10). Conventional accounts normally ignore natural and human capitals. The Saving/Investment account may include household savings invested in production activities. Part of production activity outputs (sums up to P 1,298,379 in this study) goes to savings of households (sub-matrix M) and institutional demand for output (sub-matrix C, discussed earlier). These savings constitute the main investment capital for further production activities or for human capital enhancement (M).

The natural capital depreciation and accumulation reflect subtractions (harvest/exploitation and damages) and additions (growth and forest expansion), respectively, that result from resource use. Neither natural capital depreciation nor accumulation is a feature of standard national accounts or the SAM. In conventional SAMs, only a portion of natural resources appear as priced inputs (as priced factors of production) or outputs of production, and its depletion (P 8,188,197 in this study) does not appear as a capital consumption component. The conventional approach of accounting does not provide ways of knowing the sustainability of natural resources (timber) stock and flow. Thus, "Natural Resource Depreciation" and "Natural Resource Accumulation" were added to reflect natural capital consumption and outputs of reforestation activities or other resource replenishing activities. This is a way of internalizing natural resources value in the production costs of households and the community.

Table 10. Savings/Investment, natural capital depreciation and appreciation, and human capital (Sub-matrix K, L, M)

Aggregate Monetary Values			Expenditures							
			1							
			Production Activities							
			Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
Receipts	4	Capital								
		Investment/Savings								
		Natural Capital Depreciation		3,257,894					3,070,927	1,859,376
		Natural Capital Accumulation								422,018
		Human Capital								

Aggregate Monetary Values			Expenditures									
			3						4			
			Institutions						Capital			
			Smallholder households Expenditures		Landless households Expenditures		Others Institutional Expenditures					
			Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organization	Others not specified	Investment	Natural Capital Depreciation	Natural Capital Accumulation	Human Capital
Receipts	4	Capital										
		Investment/Savings	813,040		60,857		424,482					
		Natural Capital Depreciation										
		Natural Capital Accumulation										
		Human Capital					17,500					1,391,860

Natural capital accumulation reports community efforts to replenish natural resource extraction by reforestation or other related activities, and accumulation of stock from natural growth. Information obtained from resources inventories may be treated as supplemental (or satellite) account linked to this account. In the current SAM, this account element records only the reforestation investment by the CBFM project (P422,018). However, based on the stand and stock table for timber resources compiled by three people's organizations, a partial stock assessment is reported in Appendix B.2 (Tables 1-3)

The inclusion of these components provides help in evaluating the impact of community/household production activities on the stock and flow of natural resources. The section on assessing sustainability of natural resources further expounds on this impact evaluation.

Human capital is another feature newly explored in SAM development. In conventional SAMs, human capital is treated as an independent vector of account. However, no substantial change occurs if human capital becomes subsumed under Capital as a major account. This records household investment in human capital enhancement. At the community level, this information is vital in assessing expenditures on human capital enhancement. Part of the survey results included records of expenditures of household on education of children (P 1,391,860). In a like manner, the accounts record expenditures by POs on training and seminars conducted to improve people's organization management capabilities (P 17,500). Table 10 (Sub-matrix L and M) records savings of households and People's Organization as well as investments in human capital.

Government (Sub-matrix N, O). The sub-matrix N, the intersection of Government and Production Activities (Table 11) is a null matrix in the current SAM. Normally, the government receives taxes from production activities (sub-matrix N); however no such data were captured in the household survey, and the CBFM information do not contain explicit payment of taxes to the government. However, the POs record payments to the government in the form of license fees and forest charges from forest exploitation totaling P 1,047,985, recorded in sub-matrix O.

Rest of the World (Sub-matrices P,Q,and R). Table 11 (sub-matrix P) records imports of inputs for production activities and Table 12 (sub-matrix Q) record imports of consumption commodities by households. The five communities are not closed economies, and they are not self-sufficient. A substantial amount of imports and exports to urban centers occur. However, communities are not fully integrated to the market so that not all outputs of production enter the market; a portion is directly consumed. Exports of production outputs and purchase of inputs and consumption goods from outside of the community appear in this account. Any infusion of loans or capital investment other than government from external institutions also appears in this account.

The difference between the two accounts appear as *Deficit/Surplus*. At the current state, imports exceed exports [trade deficit of P 3,557,209, recorded in sub-matrix R] for all five communities. This condition suggests that most consumption commodities are normally purchased from the markets outside the five villages; other than those directly obtained from production output and consumed by household as substitute for traditionally purchased output.

Table 11. Government, Rest of the world (ROW) or imports of input and consumption commodities (Sub-matrices N and P).

Aggregate Monetary Values		Expenditures							
		1							
		Production Activities							
		Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
Receipts	5 Government								
	6 Rest of the world	945,731	37,007	6,585	531,611	345,159	462,331		107,800
	7 Deficit/Surplus								
	8 Total Expenditures	35,375,061	6,905,719	5,077,387	3,072,002	5,884,294	2,833,365	3,582,927	8,920,866

Table 12. Government, Rest of the world (ROW) imports of consumption commodities by institutions (Sub-matrices O, Q), and totals of expenditures.

Aggregate Monetary Values		Expenditures					
		3					
		Institutions					
		Smallholder households Expenditures		Landless households Expenditures		Others Institutional Expenditures	
		Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organization	Others not specified
Receipts	5 Government	-				1,047,985	
	6 Rest of the world	33,187,469		7,291,076			
	7 Deficit/Surplus						
	8 Total Expenditures	46,497,897	21,861,586	9,925,184	2,010,550	8,759,315	2,608,378

Deficit/Surplus (Vector 7). The survey-based social accounting matrix does not easily balance for a number of reasons. In most cases, expenditures recorded do not match with sources of income; exports and imports rarely balance. Thus, a deficit/surplus account was created. For instance, the community received subsidies in various forms: the initiation of the CBFM receives subsidy from the government (P 1,047,985); some households receive welfare financing (P 175,008). On the other hand, the community treats forest rent [calculated as natural depreciation in accounting sense, amounting to P88,188,197, recorded in (Sub-matrix 7,4)] from natural resource exploitation as part of net income. Thus, natural resource rent less government subsidy is treated as surplus. From the sustainability standpoint, the rent from natural resource exploitation should be treated as depreciation so that government subsidy and depreciation should add up as community deficit. The amount of natural resources depreciation should provide a signal on the amount of natural resource capital accumulation requirement for that particular accounting period. Without natural resources accumulation, the total amount of deficit is equal to government subsidy plus natural capital depreciation. The next chapter discusses the issue of sustainability of natural resources.

To aid in impact analysis, SAM entries are classified into endogenous and exogenous accounts. The latter include government and Rest of the World. Changes introduced by exogenous factors shape various endogenous accounts, as discussed in the next section.

Uses of the SAM

The SAM has two main uses or functions. First, it is used for evaluating the level of economic performance of the community – or economic profiling. This involves examining each activity's inputs, outputs and income distribution to members or institutions within the community. In rural settings, one outcome of this type of evaluation is a picture of the poverty situation and associated income distribution.

Second, the SAM helps in evaluating impacts of exogenous factors such as government and market forces on community economic activities, income distribution, and for this study, natural resources – economic impact assessment. As described in Chapter 3, the SAM provides a snapshot of linkages of various exogenous and endogenous factors affecting consumption and production activities of households. One or two accounts or elements in the matrix, in this case government and rest-of-the-world (ROW) accounts, represent these external factors affecting consumption and production. Any introduced changes of these factors affect natural resources stocks and flows. Hence, natural capital depreciation and accumulation accounts were included as new features of the SAM. Discussion of these SAM functions for the study area follows.

Economic Profiling Function of the SAM

The SAM serves to characterize and evaluate economic transactions of actors in the community. Evaluation takes on a number of forms. For purposes of this study,

evaluation focuses on the impact of consumption and production on natural resources. Four types of evaluation that relate to natural resources are considered: self-sufficiency in production, income distribution, level of integration with the market, and use of factors of production. Results of these evaluation approaches are discussed in turn.

First, one evaluates the level of dependence of households or institutions as economic actors on certain production activities. The evaluation outcome reports the degree of dependence of economic actors on a particular production activity or activities. Analysts can use either the base matrix or the average propensity matrix. For example, Table 13 presents measures of average production propensities or percent contribution of production activities to total production in five communities. Agricultural farming represents the largest activity, at 49%, followed by forest-related activities (i.e., CBFM, Forest exploitation, and wood-based fuel production). A narrative example of these evaluation types is presented in Appendix C.3.

Table 13. Proportion of various production activities to total production.

Production Activity	Values (Pesos)	Proportion
Agricultural Farming	35,375,061	49%
Forest Exploitation	6,905,719	10%
Wage Employment	5,077,387	7%
Retail Trading	3,072,002	4%
Fisheries	5,884,294	8%
Other sources	2,833,365	4%
Wood-based fuel	3,582,927	5%
CBFM	8,920,866	12%
Total	71,651,622	100%

A second economic profiling examines income distribution among different household groups (i.e. small-holders, landless, income groups, occupation groups, etc.) and how this impacts natural resources. In this study, the SAM structure aggregated households into small-holder and landless. Table 14 summarizes households sampled and percent of household with lands to cultivate or own agricultural land (small-holder households). Small-holders comprise 72% of total households. The proportion of household with landholdings is one determinant of natural resources exploitation. An example of evaluation is detailed in Appendix C.3.

The third evaluation approach identifies major sources of consumption: whether own-production, local-market-purchased, or if the community is a net importer of consumption goods. This type of evaluation determines whether the community is subsistence-type, partially or fully integrated into the market. Simply described, a fully integrated community suggests that consumption goods and production output are marketed; all commodities are transacted in the market, and hence possess market price. Furthermore, trade of production outputs, whether within or outside the community occurs with less significant transaction costs involved. This implies that a considerable portion of natural resource exploitation goes to the market, as shown in Table 15. One notable exception in the SAM for this study showed that 17.6% of total production is household bound, not reflected in the market, hence, not covered by national accounts. This further implies that the five communities are not fully integrated into the market. It is notable also that 21.3% of total production is unmarketed. This figure is close to the estimate made by James (1996), who claimed that direct household consumption is 1/3 of GNP.

Table 14. Land ownership in the 20% sample and estimate for the five communities.

Communities	20% Sample of Household by Community					Total Households (5 communities)	Smallhoder households	Landless households
	Total Households	Smallholder Household		Landless Households				
San Pascual	55	40	72.7%	15	27.3%	274	199	75
Pambuhan	88	60	68.2%	28	31.8%	457	312	145
Tarum	50	35	70.0%	15	30.0%	248	174	74
Colasi	64	40	62.5%	24	37.5%	317	198	119
Tible	40	40	100.0%	0	0.0%	197	197	0
Total	297	215	72.4%	82	27.6%	1493	1081	412

Table 15. Average propensities for expenditures on consumption for five communities

Average Expenditure Propensities		Expenditures					
		Smallholder households Expenditures		Landless households Expenditures		Others Institutional Expenditures	
		Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organizatin	Others not specified
Production	Agri. Farming		38.4%		6.3%		73.7%
	Forest Exploitation		1.6%		1.8%		26.3%
	Wage Employment	8.1%		13.4%			
	Retail Trading	6.6%		0.1%			
	Fisheries	7.1%	0.8%	12.4%	5.6%		
	Other sources		1.1%		5.1%		
	Wood-based fuel		58.1%		81.3%		
	CBFM					80.8%	
Institutions	Smallholder households						
	Landless households						
	People's Organization					2.2%	
	Others not specified	5.1%		0.0%			
Capital	Investment/Savings	1.7%		0.6%		4.8%	
	Human Capital					0.2%	
Others	Government					12.0%	
	Rest of the world	71.4%		73.5%			
	Total Expenditures	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

The fourth approach that directly links with natural resources is to evaluate component inputs or factors of production. This focuses on the combination of labor and capital, and whether it is domestic, imported, man-made or natural capital. Labor utilization in rural settings mixes family and hired labor for production activities. Evaluation revolves around how much family labor or hired labor goes into each production activity. Naturally, in rural agriculture, family labor is commonplace; hence, agriculture exhibited the greatest value of family labor. For forestry exploitation, the value of family labor would include of natural resources rent because use of natural capital is not treated as a cost; hence the residual value of production in terms of

percentage, including natural capital utilization would sum to 96% (48.85% + 47.18% from Forest Exploitation column in Table 16). In many cases forest production activities are mostly complementary production, employing mostly family labor, to augment income from agriculture. Hired labor is employed mostly in seasonal agricultural cropping. This has policy implications related to providing alternative livelihood activities.

Capital utilization, the focus is on how much natural capital goes into production; whether traded or non-traded. Of the total production value, 27% came from natural resources (see Table 13). The intensity of capital utilization reveals the kinds of inputs and factors commonly available or accessible to households in the community. Thus, the outcome provides policy directions related to providing access to natural capital.

Other options for evaluation related to factors of production revolve around the objective for constructing the SAM and constituent accounts involved. For instance to evaluate land as factor of production and its depreciation, the analyst should impute value on the land applying valuation techniques such as hedonic pricing, or other non-market valuation techniques.

All these types of evaluation help refine SAM construction where data inadequacies can be identified. An evaluation of economic performance of the community over time requires a different approach. The next section discusses these approaches as they relate to decision-making uses of the SAM.

Table 16. Proportion of factors of production to total production.

Proportions in Percent of Production Inputs			Expenditures							
			1							
			Production Activities							
			Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
Receipts		Family Labor	90.70%	48.85%	96.25%	81.89%	85.96%	59.42%		
		Other domestic inputs	3.50%	2.35%	1.43%	0.47%	0.29%	0.45%		68.32%
	2	Hired Labor	2.73%	0.38%	2.19%		0.05%	0.07%		4.39%
		Man-made capital	0.09%	0.06%			7.79%			
		Natural capital	0.28%			0.33%	0.05%	0.39%		
	4	Investment/Savings								
		Natural Capital Depreciation		47.18%					85.71%	20.84%
		Natural Capital Accumulation								4.73%
		Human Capital								
	5	Government								
	6	Rest of the world	2.67%	0.54%	0.13%	17.31%	5.87%	16.32%		1.21%

Policy and Management Decision-making Uses of the SAM.

The SAM constructed for the five communities, like other SAMs, presents production decisions made by households based on the opportunity set offered for one period – one year. It is a static matrix. This snapshot account does not readily reflect effects of external interventions, which could extend past the 1-year period. However, a series of SAM over time can exhibit the long-term trend of structural changes in the rural economy brought about by these interventions. Constructing a SAM multiplier matrix facilitates comparing between periods.

Prior to constructing the multiplier matrix, the SAM was divided into endogenous and exogenous accounts (Taylor and Adelman, 1996; Pyatt and Round, 1985). In generalized format:

$$Y = A_E \hat{Y} + x \qquad (1)$$

Where:

Y = vector of total income or receipts

$\hat{Y}$ = vector of total expenditures (representing column totals in the SAM)

A_E = square matrix of *endogenous* average expenditure propensities for each account

x = vector of *exogenous* injections (i.e. government, ROW, etc)

The $A_E \hat{Y}$ represents the endogenous component of the matrix. Since, Receipts equal Expenditures, therefore, $Y = \hat{Y}$

Hence, simplifying Y yields:

$$Y = (I - A_E)^{-1}x \quad (2)$$

So that,

$$M_E = (I - A_E)^{-1} \quad (3)$$

Where:

M_E = is matrix of Leontief-type multiplier for endogenous accounts

I = is an identity matrix

Based on the generalized form, a schematic presentation of the SAM constructed for the five communities is shown in Appendix C.1 Table 22. Using this schematic framework, the A_E, $(I - A_E)$, and M_E were computed. The A_E was computed by dividing each account element by its corresponding expenditures (column) total, and M_E is obtained by matrix inversion. Appendix C.1 Table 23 shows the A_E and Appendix C.1 Table 24 presents the M_E and exogenous multipliers (G_E). Table 17 provides a summary of endogenous, M_E, and exogenous multipliers, G_E. The next section provides interpretations of these multipliers.

Table 17. Summary of endogenous, M_E, and exogenous, G_E, multipliers.

Aggregate Monetary Values			Expenditures: Endogenous: 1: Production Activities							
			Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
Receipts: Endo.	1	Production Activities	1 441	1 243	1 422	1 333	1 376	1 546	1 178	2 277
	2	Factors of Production	1 351	0 719	1 367	1 121	1 274	1 018	0 103	1 654
	3	Institutions	1 408	0 749	1 425	1 169	1 328	1 062	0 107	1 698
	4	Capital	0 076	0 519	0 061	0 041	0 045	0 130	0 931	0 826
Exo.		Exogenous Factors								
		Government	0 010	0 006	0 006	0 003	0 003	0 004	0 001	0 143
	5	Rest of the World	0 955	0 498	0 967	0 979	0 977	0 890	0 071	0 386
		Deficit/Surplus	0 034	0 496	0 027	0 018	0 020	0 106	0 928	0 471
		Sub-total	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000

Aggregate Monetary Values			Expenditures: Endogenous: 2: Factors of Production					3: Institutions					
								Smallholder households Expenditures		Landless households Expenditures		Others Institutional Expenditures	
			Family Labor	Other Domestic Inputs	Hired Labor	Man-made Capital	Natural Capital	Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organizatin	Others not specified
Receipts: Endo.	1	Production Activities	0 396	1 650	0 809	0 392	0 397	0 400	1 382	0 373	1 266	1 965	1 389
	2	Factors of Production	1 350	2 201	1 628	1 350	1 350	0 351	1 068	0 348	0 475	1 413	1 185
	3	Institutions	1 409	2 258	1 693	1 401	1 411	1 417	1 113	1 363	0 495	2 475	2 235
	4	Capital	0 046	0 753	0 280	0 043	0 047	0 050	0 266	0 024	0 652	0 931	0 193
Exo.		Exogenous Factors											
		Government	0 002	0 195	0 065	0 002	0 002	0 002	0 008	0 001	0 003	0 243	0 009
	5	Rest of the World	0 978	0 468	0 810	0 979	0 977	0 976	0 759	0 989	0 358	0 340	0 835
		Deficit/Surplus	0 020	0 337	0 125	0 019	0 021	0 022	0 233	0 009	0 639	0 417	0 156
		Sub-total	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000	1 000

Table 17. Summary of endogenous, M_E, and exogenous, G_E, multipliers...continued

Aggregate Monetary Values				Expenditures						
				Endogenous				Exogenous		
				4				5		
				Capital				Exogenous Factors		
				Investment	Natural Capital Depreciation	Natural Capital Accumulation	Human Capital	Government	Rest of the world	Deficit/ Surplus
Receipts	Endo.	1	Production Activities	1.629	-	2.277	1.965	-	-	-
		2	Factors of Production	0.881	-	1.654	1.413	-	-	-
		3	Institutions	0.910	-	1.698	2.475	-	-	-
		4	Capital	1.668	1.000	1.826	81.466			
	Exo.	5	Exogenous Factors							
			Government	0.048	-	0.143	0.243			
			Rest of the World	0.408	-	0.386	0.340			
			Deficit/Surplus	0.544	1.000	0.471	0.417			
			Sub-total	1.000	1.000	1.000	1.000	-	-	

Interpretation of the Matrix Multipliers, M_E

Exogenous accounts in the SAM link the community to various external factors (see Figure 1) that change over time. Market prices of exports or imports affect household production; savings/investment and government actions in the form of policy change, institutional arrangements or regulation affect opportunity set for consumption and/or production; external remittances or donations increase incomes of households. Thus, any income effect changes household expenditure/consumption decisions, and subsequently production decisions.

Conceptually, various linkages can explain the effects. Exogenous impacts are transmitted to production activities, factors of production, whether natural or man-made, then to receipts by institutions from value added in production. Part of the income by institutions is spent on consumption goods or expenditures by institutions such as small-holder or landless households that are either imported or domestically purchased; thus, part of the production impacts leaks to outside of the community.

A change introduced by exogenous factors can be positive or negative (Pyatt and Round, 1985). For each one unit (peso) of exogenous introductions into any account, say the upper leftmost row and column (Table 15), means that the ultimate amount for agriculture production will be increased (decreased) by P 1.441, an increase (decrease) of P 0.441 of such production. The total value of agriculture production including the values of inputs is:

$$1*M = 1.441+ 1.351 + 1.408 + 0.076 = 4.28$$

In a similar way, restriction on forest exploitation (row 1, column 2) can be expressed as:

$$-1*M = -1.243 - 0.719 - 0.749 - 0.519 = -3.23$$

A 1-unit value reduction in forest exploitation will ultimately reduce overall forestry production activity by P -3.23 including reduction in the employment of factors of production previously used for such purposes. An application of this type of analysis related to external intervention relative to sustaining natural resources is discussed in a later section.

It is important at this point to place qualifying interpretations of the multipliers. First, the increases/decreases of values initiated by the original introduction occur because of direct, indirect, and induced effects as the reactions go around the linkages of various accounts; they are not instantaneous impacts. Decomposition of such effects were discussed by a number of studies but not covered by this study.

Second, it is important to note that these multipliers assume that prices are fixed, and income elasticity is unity, even with the introduction of exogenous changes. It is likely that prices may change as a result of exogenous changes. Changes in prices may

motivate households to shift production activities. Therefore, prices determine the opportunity set workable for households. Any exogenous policy intervention should look at where the multiplier effects start and how they affect endogenous accounts. For instance, the CBFM seem to be isolated from other sectors of the community because of its limited linkage. This has implications on income distribution pattern of the CBFM program on the community. This type of analysis is possible by decomposing the M_E so that indirect and induced effects are determined.

Alternative approaches emerged from examining the SAM. One approach looks at the value of family labor for each production activity. The higher absolute value of family labor would suggest greater emphasis on that particular production activity in the next period. In Table 16, wage employment provided the highest value of family labor followed by agriculture. Besides agriculture production, the next best supplemental activity for households will be forest exploitation, other than wage employment. It must be noted that family labor in forestry, in reality, includes rent value of natural resources used in production. Households do not calculate rent of natural resources because they treat it as free factor of production.

Another alternative approach is to regress family labor with total production, hired labor, domestic and imported inputs, and capital inputs. This can be done for relevant production activities such as agriculture, forestry, retail trading, fisheries and others. The parameter to assess will be the size of coefficient of 'total production' variable. The 'total production' with the highest coefficient will be the most likely

production activity that farmers would shift to or concentrate in addition to other production activities. Obviously, forest production activity will be part of that opportunity set that households undertake. Thus, natural resource depreciation is always an account to look closely in any rural production accounts.

In summary, components of the SAM can be tailored to the need of actors for such information. The types of evaluation will depend on the focus of decision making. Thus, analysts develop the SAM based on situational needs. Entries in the SAM, are consolidated and measured in monetary terms. Values are based on actual transactions.

Sustainability of Natural Resources Recorded in the SAM

The third component of framework development (objective #2 of this study) involved establishing a link between natural resources recorded in the SAM and the stock and flow of timber resources; this provides a picture of sustainability of timber resources used in economic activities. Information from the SAM is used to simulate changes in timber resources stock and flow over time – a basis for examining resource depletion/accumulation.

Ideally, the SAM pictures a general equilibrium in the village that equates supply and demand or production sustains consumption. If this equality holds over time, the community is self-sufficient in production. A corollary would be that the combination of man-made and natural capital sustains the consumption by households. Natural resources

accumulation constantly equals or exceeds depreciation; hence, the community is maintaining its natural resource productivity. Consequently, its consumption pattern for natural resources is sustainable. However, communities are not closed economies because certain consumption needs are not available within, and households export to markets outside the community. The combination of exogenous and endogenous factors influence exploitation of natural resources, beyond the minimum needed within the community.

Proof of sustainability of natural resources lies on the stock and flow patterns as affected by changes of various exogenous and endogenous factors. The next section presents results of modeling natural resources stock and flow helpful for impact assessment.

Modeling Natural Resource Exploitation

Identifying indicators of sustainability requires modeling interactions of human exploitation (recorded in the SAM) and the natural resources system. Two aspects important in the development of a model of natural resources exploitation are the magnitude of demand (and its rate of increase) and the stock and flow of resources over time. The SAM indicates current levels of consumption (treated as demand). Modeling based on a resource assessment or inventory provides information on the stock of resources.

The forest resources are part of renewable, dynamic system with its varied uses and products exploited by the community. Forests are depletable beyond a certain threshold of exploitation (and impacts are seen only over a longer period). Those who exploit resources and decision-makers at the community level do not know this threshold. Thus, a rational decision considering incomplete information is to simulate natural resource conditions over time as it is affected by human exploitation.

The objective of modeling was to simulate the impact of resource exploitation by the community, specifically for timber resources. A variety of tools could be used to create and run the simulation. A simple approach briefly presented in Chapter 3 was spreadsheet simulation using Microsoft Excel. The approach confines simulation to timber resources using the framework applied by delos Angeles et al. (1995) for the Philippine second growth forests. Harvesting, natural damages and random fire occurrences reduce the beginning stock, measured in cubic-meters, of timber over a 25-year period.

The simulation evaluated three harvesting (exploitation) scenarios based on current demand by the community. The first harvest scenario considered a harvest of 74 hectares per year proposed by the CBFM. The second harvest scenario harvested based on current growth per year. The third harvest scenario, otherwise called the local minimum wood requirement (reflected in the SAM), harvested 2,652 cubic meters per year (16 hectares harvested per year). Figure 7 shows the stock trend based on these harvest scenarios. This Figure 7 scenarios assume a single fire occurrence over 25 years,

(at the 21st year) that causes a 5.2% loss (damage) to the existing stand (based on national average reported by AIFM for the Philippines - AIFM, 1996).

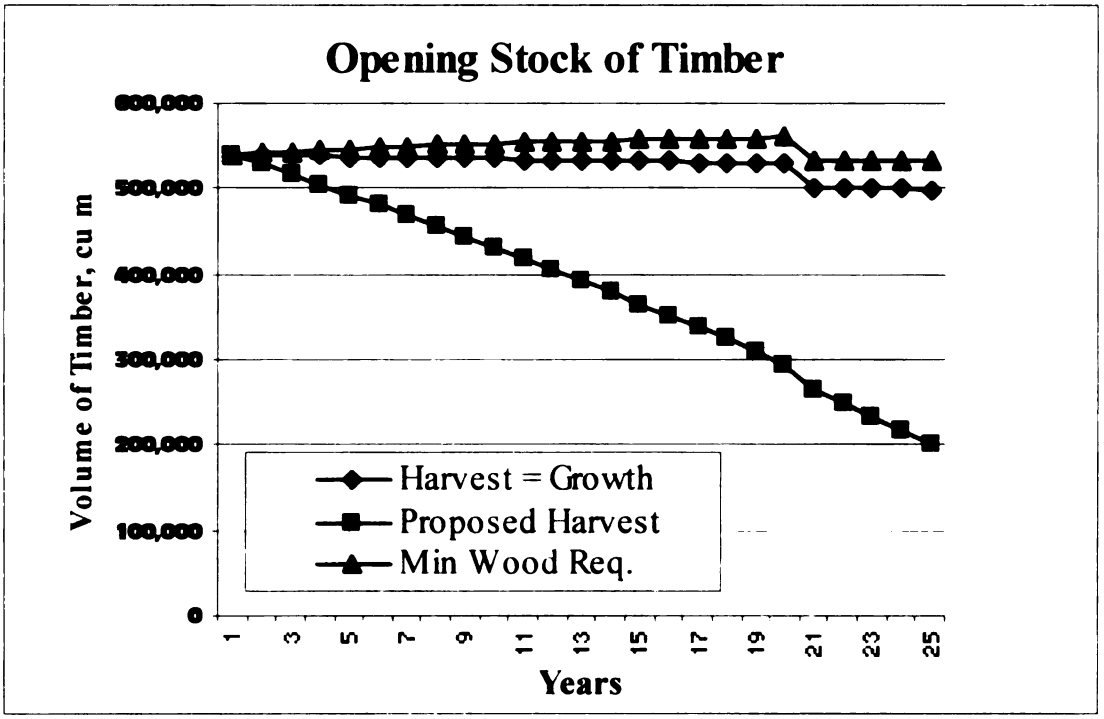

Figure 7. Simulation of the effect of three harvest scenarios on natural resources stock.

Appendix C.5 Table 31 summarizes series of simulation with varying number of fire occurrences. Appendix C.5 Table 32 summarizes a series of simulations to determine the level of harvest that will make the ending stock of timber to be not significantly different from the beginning stock – a procedure to evaluate maintaining the productive stand. The sustainable harvest at varying fire occurrences was 12 hectares per year, with an average of 165 cu m harvest per hectare (average of harvest per hectare by three POs) producing 1968 cubic meters. It is worth noting that the minimum wood requirement required a harvest of 16 hectares per year. The policy implications means that harvest must be regulated or wood consumption must be reduced. The impact of this change on the community can be analyzed using SAM multipliers (discussed later). This

further implies that households may choose to recover lost income by switching to other livelihood sources.

In the analysis of the five communities' proposed harvest, timber will be declining at a rapid rate, exceeding the growth rate of existing stands and new growths. Pending more detailed analysis this indicates that timber resources will be declining continuously unless (1) the communities decide to reduce harvest to the level of the in-growth, or (2) the government regulates natural resources exploitation through policy actions such as regulation or changing land tenure agreements, or (3) the communities institute arrangements through group contracting to control timber exploitation (Figure 1 provides alternatives for external interventions on community economic activities). Impacts of these approaches on the SAM are discussed in the next section.

Evaluating SAM Changes Using Multipliers

The section on interpreting multipliers demonstrated the usefulness of SAM multipliers in evaluating impacts of exogenous intervention on the community economic system. Two types of exogenous interventions are examined: regulating timber exploitation activities so that it is sustainable and promoting shifts to other production activities.

The SAM records the value of exploitation of timber resources (as proxy for natural resources). This value was transformed to a volume measure for use in natural resources simulation. Different demand scenarios were simulated. If the outcome of the simulation for a demand scenario proves unsustainable, as the case of the CBFM proposed harvest, a recommended policy option is to reduce harvest by government regulation and promote shifts to other activities. Returning to the SAM multiplier analysis, an analyst can evaluate the impact of such reduction on levels of production and income distribution. An illustrative example, below, suffices to demonstrate the use of multiplier matrix.

The wood requirement of the community was 2,535 cubic meters of timber equivalent to 16 ($\approx$ 15.34) hectares harvested of the second growth forest. Previous analysis showed that such a harvest level causes the stock to decline by 0.07% average annually over a 25-year period. A rational decision would be government regulation or self-regulation by monitoring and controlling community exploitation, or to encourage use of other non-timber products for consumption. Nonetheless, harvest of timber should be reduced to 2,209 cubic meters, equivalent to 12 hectares of second growth forest. The total value of timber harvest reduction is P2,349,446. This value, if intervention would be introduced, corresponds to a reducing total production of the community. Using multiplier analysis, the actual value reduction considering direct, indirect and induced effects amounts to P 10,675,060.

Since the underlying objective is to sustain the well-being of households/ community, the reduction in income from one production activity must be translated to increase in other activities. Thus, the subsequent SAM analysis can illustrate increases in production in other sectors of the household/community economy to offset declines in forest exploitation. Table 18 shows a possible scenario resulting from shifts in production activities. This shows proportionate increases in all other activities with the decline in forest production (assuming minimal constraint in production shifts).

Table 18. Change in production distribution resulting from external intervention.

Production Activity	Values (Pesos)	Projected Production (Pesos)	Difference	Inc/Dec	% Chage
Agricultural Farming	35,375,061	41,568,111	6,193,050	Increase	18%
Forest Exploitation	6,905,719	3,651,683	(3,254,036)	Decrease	47%
Wage Employment	5,077,387	5,966,276	888,889	Increase	18%
Retail Trading	3,072,002	3,609,812	537,810	Increase	18%
Fisheries	5,884,294	6,914,447	1,030,153	Increase	18%
Other sources	2,833,365	3,329,397	496,032	Increase	18%
Wood-based fuel	3,582,927	1,894,620	(1,688,307)	Decrease	47%
CBFM	8,920,866	4,717,275	(4,203,590)	Decrease	47%
Total	71,651,622	71,651,622			

This process completes the linkage of SAM, simulation of natural resources, and multiplier analysis. This completes a framework of natural resource accounts at the community level. Alternative policy options to reduce harvest of timber resources include:

Institutional arrangements may include:

- Active management and control spearheaded by the PO;
- Community reforestation to expand or accumulate natural capital; and
- Self-regulation or institute internal protection measures.

Government-supported measures or intervention:

- Regulate harvest by reducing the annual allowable cut;
- Provide incentives for reforestation or forest expansion;
- Provide security of tenure for common-property management; and
- Provide incentive for shifting to other livelihood activities.

Market measures include:

- Reduce price of timber/wood substitutes for construction, energy, and other uses; and
- Increased prices of agricultural or non-timber forest products to promote shifts to non-timber based livelihood.

These measures can be evaluated by quantifying and monetizing their effects in order to be comparable with other measures. A cost-benefit analysis framework would fit into this evaluation process.

In summary, this chapter presented results of the development of the SAM, multipliers and simulation of natural resources. Development of the SAM framework useful for decision- and policy-making involved three aspects. The first aspect concerns determining the most appropriate structure of accounts that captures economic activities in the community. Identifying and structuring of account elements are dependent on the goals of SAM development, economic conditions, and available data. It is important to transform data into monetary units so that account elements are comparable, and for

potentially linking to national accounts. The resulting SAM provides various options for socio-economic assessment and natural resources accounting.

The second aspect concerns linking SAM to natural resources exploitation such as timber resources. The SAM records the order of magnitude of timber resources exploitation for one period – it is a static framework. Comparing this exploitation with the stock and flow of timber presents a dynamic picture of the sustainability of the latter. Dynamic information is rarely available; thus, analysts resort to modeling natural resources. Hence, a simulation model can be developed to capture the link between community production activities natural resource stock and flow. In this study, a spreadsheet simulation was used to model harvest demand and natural stock and flow. At current/proposed harvest rates, timber stocks will be declining and will not be sustainable.

The third aspect concerns evaluating the impact of external intervention in order to sustain natural resource stock and flow. This required conducting a SAM multiplier analysis. The process involved segregating endogenous and exogenous accounts in the SAM and deriving the average expenditure propensities. From these averages a Leontief-type multiplier was developed. A multiplier measures the impact of a 1-unit increase in exogenous intervention on the endogenous accounts of the SAM.

The SAM, simulation and multiplier analysis all compose the overall framework of natural resource accounting at the community level that is helpful not only for

economic profiling but decision-making as well. A number of other concerns were observed in the process of developing the accounting framework at the community level. These concerns are further discussed in the next chapter. Further, the next chapter summarizes this whole study and provides further avenues for improving accounting framework development.

CHAPTER 6

SUMMARY, CONCLUSION AND POLICY IMPLICATIONS

This study consisted of three parts. The first part, Chapters 1 and 2, outlined the research problem and objectives and reviewed literature on natural resource accounting. The second part, Chapters 3 and 4, described the conceptual basis and empirical methods for developing a framework for community-based natural resource accounting focusing primarily on household activities. This included developing a method of data collection. The third part included Chapter 5, which presented data analysis and results, and Chapter 6 which summarizes results and provides policy recommendations.

Summary

The objectives of this study are to develop natural resources accounting framework applicable at the community or village level and to link this accounting system to sustainability of stock and flow of natural resources. The first objective focused on incorporating natural resources exploitation into an accounts system in rural communities, with the intent to link to a broader system of national accounts. The underlying reason was to correct measures of economic growth that ignores the contribution of natural resources. The second objective focused on decision-makers at the local level and policy makers at the broader scale – how to deal with information on impacts of production and consumption on natural resources.

The focus on rural households and communities emphasized the fact that this sector of the economy subsists or depends on natural resources other than their agriculture production. This study developed an account framework at the local level (village or community) that captures both marketed and non-market-transacted consumption and production output of households, particularly those related to natural resources.

Account framework development began with a review of a number of accounting systems developed for industrialized and developing countries, with the end in view of defining an account system useful at the community level. Most of the frameworks reviewed were macro in scale involving aggregates at the national level, and they were not linked to local accounts. Several frameworks incorporated both environmental and natural resource accounts, but sparsely covered household transactions or activities. Typically, household transactions include both market and non-market goods. However, this study focused only on natural resource commodities, and did not include non-market goods. Measurement and valuation of these goods remains a target for future work.

The conceptual framework, discussed in Chapter 3, introduced the Social Accounting Matrix in order to capture household consumption and production activities in rural communities. The SAM records income and expenditures from production activities. Factors of production involve mostly family labor and indigenous capital such as non-produced natural resources capital. However, internal and external factors influence these economic activities. These internal factors include household

characteristics (mostly household demographics, labor composition, and assets), consumption patterns, and production capacities. External factors include government and market forces that influence household consumption and production activities. For instance, government policies and regulations on use of natural resources can reduce or expand production activities, while market forces such as price levels and costs of commodity transactions affect household decisions to trade or directly consume output. Hence, these influencing factors determine the magnitude of resources transacted in the market and thus, recorded in conventional accounts. The SAM provides a snapshot of these transactions that can aid policy and decision makers in introducing interventions necessary to improve well-being in the community. A temporally extended analysis that determines the impact of consumption and production patterns resulting from activity linkages provides a picture of natural resource sustainability.

Developing the SAM required collecting income, consumption and production data at the household level in the community (Chapter 4). The study covered a cluster of 5 out of 10 communities surrounding the Bicol National Park. All consolidated, the five communities comprised 1,493 households. A sample of 20% of households was obtained using stratified-proportional sampling. All information from the 20% sample from each sub-community within a community was expanded and consolidated to one SAM covering all communities sampled.

The survey method consisted of three stages: community entry and initial interactions, focus group discussion, and finally the household survey using a

questionnaire designed for face-to-face interviews. The first two stages served to conceptually diagram the economic structure of the community and refine the structure of the survey questionnaire. The third stage was the main source of income, consumption and production data recorded in the SAM.

Obtaining auxiliary information such as stock of natural resources in second-growth forest required other methods of collection. Information on the stock and flow of natural resources required resource inventory and growth-and-yield modeling that required the same amount of effort as the survey. Hence, the stand and stock tables developed by three POs of the community-based management program of the DENR were used as proxies for modeling natural resources sustainability. Future studies related to SAM development could expand to incorporate a resources inventory including non-timber resources. Thus far, the timber resource model suffices for this study.

Chapter 5 summarized results of the SAM development. Questionnaire responses required careful encoding, structured storage, cleaning, and consolidation. The consolidated survey recorded fifty-one different livelihood activities. Eight were agriculture related, twelve were forestry activities and the rest of the 31 non-land-based activities were categorized into fisheries, retail trading and wage employment. The SAM model aggregated these 51 livelihood activities into six major production activities namely: agriculture, forestry, wage employment, retail trading, fisheries, wood fuel and community-based forest management (CBFM). The Production Activities sub-matrix disaggregated forest activities such as fuelwood production and CBFM activities for

purposes of evaluating the impact of these activities on natural resources. The SAM also classified households into landholders and landless in order to determine income distribution issues as well as its significance in evaluating natural resource exploitation.

The constructed SAM in this study resembled a conventional SAM except that the former explicitly identifies natural capital accounts and household-bound production outputs, and mainly based on household information. Natural capital depreciation and accumulation accounts appeared as components of the Capital accounts, while household-bound output accounts went into, but were distinguished from, household expenditures on production outputs. The inclusion of natural resource depreciation/accumulation and household-bound production outputs embodies two purposes. One purpose was the need to determine the proportion of natural resource exploitation that remains unrecorded in conventional accounts. The other purpose was to evaluate the impact of household-bound production and consumption on sustainability of natural resources.

The addition of natural resources, not traditionally marketed, into the SAM must conform to measurement standards and valuation. Hence, all natural resources added to the SAM were converted into monetary terms using market values (Chapter 4).

The SAM structure, with its components identified, its elements measured and valued uniformly, allows a number of evaluation functions. Broadly, these functions are economic profiling and impact evaluation. *Economic profiling* focused on such issues as

production-activity dependence, income distribution among types of households (i.e., among small-holders and landless – the latter comprise 25% of total population in 5 communities) and for dominant sources of consumption goods (i.e. import dependence, market-purchased, man-made or natural). In addition, profiling can be used to evaluate if the community is subsistence-type or integrated into the market, and types of capital inputs used; whether it is man-made or natural capital. The snapshot model of the SAM is well suited to these evaluation needs. The structure of the SAM largely determines the form of evaluation.

The *impact evaluation* makes use of the direct and indirect linkages between consumption, production activities and capital resources (man-made or natural), to predict the outcomes of the latter over a longer planning horizon. These linkages transmit changes to all account elements. These changes are determined through a multiplier analysis by converting the SAM into multiplier matrix. Any introduction or changes in exogenous (external) factors are assessed for their economic impacts on communities through these multipliers.

Undertaking impact evaluation required simulating timber stock and flow. The focus for this study was on timber resources in order to demonstrate the usefulness of the SAM framework for these types of impact evaluation. Evaluation for other resources is constrained by unavailability of stock and flow information that can be obtained only through growth and yield modeling, inventory or sampling.

The timber stock and flow model adopted from the delos Angeles et al (1991) framework evaluates yearly opening and closing stocks of timber as they are affected by natural and man-made harvests and reductions. The net change in stock, closing, and opening stocks at every period provides a picture of the sustainability of timber resources over the long-term planning horizon.

Results of the simulation, considering random (hence stochastic) fire and natural mortality, showed that the proposed harvest volume every year by the POs rapidly depletes timber resources over the 25-year planning model. On the other hand, the sustainable harvest suggests harvesting equivalent to the average annual growth of the existing stand, resulting to positive net growth. Therefore, policy intervention requires regulating harvest per hectare or reducing area harvested per year. The report of the simulation results provides local-level decision-makers some potential impact information on current exploitation of natural resources.

In the long-run, the impact of exploitation by the community on natural resources depends on its rate of harvest and natural resource regeneration capacity. Three harvest options were evaluated: (1) harvest based on total wood requirement, (2) harvest based on preferred (proposed) harvest of 74 hectares per year, and (3) harvest based on current annual growth. If harvest (option 2) exceeds current annual growth, the rate of depreciation of natural resources is 4.21% in each period. If the harvest equals current annual growth, the rate of depreciation is 0.32%. If harvest depends on current wood requirement, the stock of timber resources still shows annual depreciation of 0.07%. The

resulting depreciation despite harvest at or below annual growth can be attributed to fire damage (5.2% damage to existing timber stock) that occurred at the 21st year, natural mortality and harvest damages introduced in the simulation. Therefore, critical indicators of sustainability of natural resources include harvest levels, non-harvest reduction factors such as natural mortality, forest fire, and current annual growth or growth and yield of existing stock. Thus, other than the level of harvest, forest fire is a dominant factor in the depreciation of timber stock.

Results from analysis of SAM showed that 21.3% of community output was non-market transacted and natural resource depreciation at current wood production/ consumption was 0.07% annual average over 25 years. However, a proposed harvest of 74 hectares annually would cause a 4.21% annual average depreciation over the same period. Production activities in five communities consisted of 27.09% natural resources while non-marketed consumption consisted of 5.79% forest (natural) resources.

In the simple spreadsheet simulation, only the timber component of natural resources was modeled, making an assumption that all other system resources remains constant. In real world situation, this is not the case. Thus, a simulation model that takes other forest system resources and linkages is proposed.

Conclusion

In conclusion, the Social Accounting Matrix framework captured economic transactions (consumption and production activities) in rural communities including both

man-made (produced) and natural (non-produced) capital. Incorporating account elements for natural resource depreciation/accumulation and non-marketed outputs distinctly shows, and allows evaluation of, impacts of economic activities on the stock and flow of natural resources. In addition, the use of simulation and multiplier analysis provides a way of linking natural resources accounts with socio-economic evaluation. Thus, the accounting framework is useful for decision-making at the community level.

The SAM brought out three important issues. First, it showed that at least 21.3% of consumption and production are non-market-transacted; either directly consumed by household otherwise absorbed in destinations other than markets. Second, the current level of exploitation of natural resources reduces existing stock of natural resources. Increasing current level of exploitation will progressively increase the rate of depreciation. Third, because of the nature of access to resources (land tenure), rural households shift from one production activity to another, thus, exploitation of natural resources is dynamically linked with other livelihood activities.

The constructed SAM is a flexible framework. It can accommodate other activities that may occur in the future or those not captured by the survey. The number of activities can be expanded, disaggregated, or further fine-tuned in order to suit decision-making and policy needs. The matrix can be revised to include activities relevant for policy analysis. For example, future activities such as community reforestation can be added to the list of activities. Another activity that concerns government is timber poaching or illegal logging activities. Other activities related to environmental concerns,

such as establishment of eco-tourism sites, within the Bicol National Park may be incorporated into the SAM with minor modifications. It may entail adding another row or column, or even a major account on environmental concerns. The simulation model can incorporate linkage accounts that pertain to potential soil erosion and off-site sedimentation.

What the SAM accomplished that other account systems did not, was the option to internalize the value of natural resources into the production technology of the household. The value of exploitation of natural resources was added as a cost via depreciation value. This approach effectively incorporates values of natural capital into the account system. Hence, the issue of treating the natural resource accounts as a satellite account at the community level is no longer necessary. The next step in the process is to link community accounts into regional or national accounts. This may require additional work of developing an aggregate linkage accounts with regional and national level.

This initial attempt at developing a SAM at the village level certainly has room for expansion. At this early stage, it is already evident that the matrix has a number of evaluative uses for natural resources and for demographic and social questions.

Policy Implications

At the outset, natural resource accounts attempt to resolve deficiencies of commonly used measures of growth such as GDP and National Income by including

natural resources into conventional accounts. Such efforts are not straightforward additions because the issue of commonality of measures and valuation. Conventional accounts include only market-transacted economic outputs, whereas a large part of natural resources exploitation does not enter traditional markets. Natural resource exploitation in rural communities remains unrecorded despite the growing dependence of a considerable portion of developing country population on such resources. Following that reasoning, equally large household production outputs are directly consumed that does not enter mainstream economic transactions. Aggregate natural resource accounting systems do not capture these rural economic transactions. Thus, a framework of natural accounting at the community level is recommended.

This study arrived at a simple framework that relates or links household-bound production outputs with mainstream economic accounts. The framework emanated from a concept of household well-being that maximizes consumption of outputs from various production activities and market transactions. Market-transactions of household partially represent total consumption because household-bound goods are not reflected. In many cases, household market transactions depended upon money income from various production activities, taking into account that part of own-production are consumed at the household level. Accordingly, natural resource exploitation reflected in conventional accounts is incomplete, as this study showed.

The accounting framework makes use of the SAM structure in order to reflect natural resources as factors of production employed by rural households or the

community. The SAM proved useful for a number of evaluation needs relating to natural resource exploitation, whether static or dynamic. The level of dependence, income-effect, level of market integration, and intensity of factor use can all be assessed from the SAM. Understanding all the capabilities makes the SAM a flexible tool for accommodating policy analysis needs. Thus, the SAM structure has important policy considerations.

Policy considerations emanating from the SAM can be divided into three classes: monitoring and evaluation, resource sustainability, and formulating policy or market interventions.

The SAM analysis showed that conventional accounts potentially record only 78% of actual production that uses natural resources. What are the implications of these? The simplest interpretation means that rural communities, as expected, are not fully integrated into the market system. As such, subsistence production is considerable, and communities rely substantially on natural resources to substitute for commodities that they are unable to purchase in the market because of income constraints. The SAM becomes a useful alternative account system that provides clues and early warning of effects on natural resources exploitation.

Policy interventions become crucial if overexploitation is evident. Alternative courses of action revolve around sustaining the resource base in the face of continued exploitation. A number of policy-related questions that can guide courses of action follow:

- If viewed as useful, who will develop the SAM?

  If the SAM would be useful at the community level, decision-makers at the community must devise a plan for data collection and construction of the SAM. The frequency of collection, steps involved, type of data, number and type of sampling to employ will depend on the analysis required by the community. Implementing these activities depends on the motivation for doing so. Unless members of the community see the importance of natural resource accounting, the SAM remains simply a theoretical construct.

  The framework provides a mechanism for communities to know the status of their resources. A yearly accounting will provide information on the trend of various indicators such as harvest, consumption, household-bound goods, and those that integrate into the market. If the community stakeholders are convinced about the issue of sustainability, critical indicators will be important to them. The SAM can be structured in a way that community decision-makers can readily extract information about the indicators of resource sustainability.

- Is the SAM helpful in identifying market and policy failures at the community level?

The SAM provides a static picture of the economic situation in the community. In order to evaluate trends of economic performance, such a matrix must be renewed at pre-determined intervals. The interval may be dictated by implementation of certain projects or programs, so the SAM could be constructed at the start and end of program implementation. Ideally, yearly data collection provides adequate decision-making information to monitoring progress of community programs.

Disaggregating account elements in the SAM (i.e., factors of production and their sources – natural, man-made, or imports – capital accounts, and institutional recipients and such as households or income groups) would provide clues on the policy or market failures. In the factors of production accounts, propensity to use family labor or natural capital from open-access resources demonstrate inequality of market wage rates and rents for use of natural capital, respectively. In capital accounts, high propensity to use natural capital versus man-made capital exhibits propensity to capture natural resources rent. A high degree of dependence by landless households on natural resources would suggest the same. These situations can be shown in the SAM depending on how it is structured.

- Will households shift to market commodities if it increased their income or if prices of market commodities were subsidized?

The answer to this question depends upon how the community would respond to the market, the opportunity costs that households face, and the price trend of natural resource over time. An increasing demand price for natural resources will increase exploitation, possibly beyond recovery as prices rise.

It was shown in the SAM that higher income households have relatively higher proportion of market purchases. If this is statistically significant remains to be analyzed.

- Does land tenure or ownership have an impact on the exploitation of natural resources?

  This question arises because of the transfer of management of second-growth forest to community organizations. The SAM reported that landless households, relative to small-holder households, have higher natural resource consumption not transacted in the market. This suggests a lack of opportunities for landless households, giving them more incentive to access public lands for "free resources." Transfer of management as common pool resource potentially encourages self-regulation of these "free access."

- How can non-marketed natural resource exploitation be incorporated into broader accounts such as the regional or national accounts? If it is possible to

incorporate, should the conventional accounts be revised upward as a result of inclusion of household-bound production outputs?

Rural communities' exploitation of natural resources is systematically ignored in regional and national accounts. These accounts reflect mostly transactions by business establishments such as logging companies, mills and integrators, and government forestry activities. SAMs developed for rural communities could be incorporated in a number of ways. One approach would create a separate rural community sector in the listing of establishments. Another approach is to disaggregate forestry accounts and include rural household natural resources exploitation activities or household production activities.

These policy-related questions could be subject of subsequent studies related to SAM development at the community level. They could not be covered by this study due to some limitations listed in the next section.

Limitations

The survey conducted only partially contributed to the development of a full SAM because it was confined to households. SAM construction often includes transactions by other institutions (e.g., NGOs, churches etc.) government employment and linkages between communities. According to Taylor and Adelman (1996), these data need required extension of data collection to a minimum of one year.

In natural resources modeling or simulation, efforts were focused on timber resources. As explained in Chapter 4, assessment of non-timber forest resources requires considerable amount of time – more than possible with the survey conducted. Further, lacking empirical data on fire damages, natural mortality, growth and yield functions, a method referred to as "data transfer" was employed. It simply means that research results from areas other than the study sites were used as parameters in the simulation. These parameters may not reflect real conditions of the research site so caution must be exercised in viewing the depletion results. But the overexploitation concern has been raised.

The SAM, like other input-output models, has several inherent limitations. First, relationships among production, factors and income distribution are linear – proportionate relationships. This construction does not take into consideration dynamic changes in price and income elasticities. Second, the SAM is a static framework. All exogenous injections cycle through the rounds of impact based on the original base matrix, assuming no changes over time. Third, the resulting matrix of multipliers is what developers called "accounting multipliers" as opposed to fixed price multipliers. The difference between the two lies in the assumption for the former that income elasticity is constant – the multiplier was derived from average propensities for expenditure rather than the marginal propensities for expenditures.

Finally, the household survey instrument, despite its length, could not cover time and motion studies in order to calculate household time and labor used for their

production activities. The bulk of the household survey focused on consumption, production and demographic characteristics. Thus, continuance of similar types of studies needs to re-evaluate the structure of the questionnaire. Hence, this study recommends a number of revisions for future studies.

Recommendations for Future Studies

Based on the experiences of conducting this study, the following suggestions target improvement of future studies:

1. Expand SAM construction by incorporating activities of institutions other than household production and consumption. This will include government institutions, details of small- and medium- scale industries, and more details on external transactions of the community;
2. Continue the study in the same area by including a resources assessment or inventory;
3. Focus more on linkages between communities, i.e., inter-community trade;
4. Examine the need to disaggregate a number of livelihood or production activities;
5. Consider extending the multiplier analysis based on marginal propensities for expenditures;
6. Transform the SAM analysis into a dynamic model by conducting a computable general equilibrium analysis,
7. Enhance resource modeling by including other non-timber resources exploited by the community; and

8. Consider some refinements in the simulation by incorporating precise data on fire damage and natural mortality.

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GLOSSARY

Accumulation Accounts - this are flow accounts that record the acquisition and disposal of financial and non-financial assets and liabilities by institutional units through transactions and as a result of other events. Include capital accounts, financial accounts and changes in volume of assets accounts and revaluation accounts (UN, 1993).

Balance Sheets - show the value of stocks of assets and liabilities held by institutional units or sectors at the beginning and end of the accounting period (un, 1993)

Current Accounts - this account record the production of goods and services, the generation of incomes by production, the subsequent distribution and redistribution of incomes among institutional units, and the use of incomes for purposes of consumption or saving (UN, 1993).

Current cost accounting - best approximation of opportunity cost accounting. Assets and goods used in production are valued in their actual or estimated current market prices at the time the production takes place. Also described as replacement cost accounting (UN, 1993).

Distribution and Use of Income Accounts - (see SNA, 1993) - consist of articulated set of accounts showing how incomes are: Generated by production; Distributed to institutional units with claims on the value added created by production Redistributed among institutional units, mainly by government units through social security contributions and benefits and taxes; Eventually used by households, government units or non-profit institutions serving households (NPISHs) for purposes of final consumption and saving.

Economy - is a general equilibrium system in which interdependent economic activities involving countless transactions between different institutional units are carried out simultaneously. Feedbacks are continually taking place from one type of economic activity to another. (SNA, 1993).

Full cost accounting - is life-cycle costing. Life-cycle costing is a method in which both private and social costs are identified with the product, process or activity throughout its commercial life, from raw material acquisition to disposal (Adopted from: Martin Spitze, Robert Pojasek, Francis Robertaccio, Judith Nelson. Accounting and Capital Budgeting for Pollution Prevention, 1993.) Ref: United Nations Conference on Trade and Development, 1994. Accounting for Sustainable Forestry Management: A Case Study. United Nations Publication. UN Geneva pp 7.

Gross domestic product (GDP) is the value of final goods and services produced in the economy (Note: defensive expenditures for environmental degradation or pollution are not reflected in the GDP).

Gross value added - the value of output less the value of intermediate consumption and is a measure of the contribution to GDP made by an individual producer, industry or sector. GVA is carried forward into the Distribution of Income Accounts.

Historic cost accounting - requires goods or assets used in production to be valued by the expenditures actually incurred to acquire those goods or assets, however far back in the past those expenditures took place.

Imputed value or cost - when goods or services are retained for own use, no transactions with other units takes place. In order to record the goods or services in the accounts, internal transactions have to be imputed whereby producers allocate the goods or services for their own consumption or capital formation and valued have to be estimated for them. The purpose of imputation is to capture in the accounts major flows of goods and services actually taking place in the economy that would otherwise be omitted.

Opportunity cost , that is, the cost of using, or using up, some existing asset or good in the particular process of production is measured by the amount of benefits that could have been secured by using the asset or good in alternative ways. It is calculated with reference to the opportunities foregone at the time that asset or resource is used, as distinct from the costs incurred as tome time in the past to acquire the asset.

Production Accounts - this account records the activity of producing goods and services as defined within the system. Its balancing items is gross value added.

System of National Accounts - consist of a coherent, consistent and integrated set of macroeconomic accounts, balance sheets and tables based on a set of internationally agreed concepts, definitions, classifications and accounting rules. It provides an accounting framework within which economic data can be compiled and presented in a format that is designed for purposes of economic analysis, decision-making and policy-making. The SNA records flows and stocks (SNA, 1993)

APPENDIX A

Appendix to Chapter 3

Appendix A: Appendix to Chapter 3

A.1. The Household Market Expenditures (Purchase) Function

This section elaborates on the market expenditures equation (Equation 2) described in the first section of Chapter 3 where:

$$\Sigma P_{Mi} M_{ci} = \Sigma P_{Ai}(A_s) + \Sigma P_{Fi}(F_s) + \Sigma I_i - (wL + P_K K + c)$$

Total agriculture (A) and forest (F) production can be represented as follows:

$$A = A_c + A_s + A_K$$

$$F = F_c + F_s + F_K$$

Therefore,

$$A_s = A - A_c - A_K$$

$$F_s = F - F_c - F_K$$

Hence, market expenditures equation above can be expanded as follows:

$$\Sigma P_{Mi} M_{ci} = \Sigma P_{Ai}(A_i - A_c - A_K) + \Sigma P_{Fi}(F_i - F_c - F_K) + \Sigma I_i - [w(L_A + L_F + L_I) + P_K K + c]$$

Where:

P_{Mi} = price of market good i consumed by household

M_{ci} = market good i purchased

P_{Ai} = price of agricultural product i produced

P_{Fi} = price of forest product i extracted/produced/harvested

P_K = price of capital goods purchased for production activities

Agriculture or forest production and consumption consist of various commodities so that A_c, F_c, A_K, and F_K actually composed of several commodities *i*. In which case,

A_c and F_c = A_{ci} and F_{ci} = Agricultural good *i* and Forest good i consumed, respectively

A_K and F_K = A_{Ki} and F_{Ki} = Agricultural good *i* and Forest good *i* used as capital, respectively

A and F = A_i and F_i = total output of agricultural commodity *i* and forest good *i* extracted/produced/harvested, respectively.

Likewise, labor and capital consist of various categories so that:

L = L_A, L_F, L_I = L_H, hired labor used for agriculture, forest and other livelihood activities

K = A_K, F_K, and M_K = capital goods produced/purchased used in production from agriculture, forest, or market purchased, respectively

w = wage rate for labor

I = other livelihood or sources of income

i = represents specific commodity

c = other costs of production activities, or purchased inputs of production, and may include savings needs

This expansion of Equation (2) in chapter 3 provides the basis of valuation of various uses of outputs in of production.

A.2. Measurement of Natural Resources, and Non-Marketed Consumption

This section discusses simple procedures to measure production outputs and their various destinations.

Measurement of Natural Resources Directly Consumed by Households

Equation (6) in Chapter 3 presented output of each production activity. The proportion of natural resource consumption compared with rate of resources extraction partly addresses the rate of depreciation of resources. To assist in this, a three-step procedure segregates production activities, market and non-market transacted outputs, and isolates natural resources used.

1. Ratio of Production Activity to Total Production. The ratio of monetary values of each production activity to total production value reveals the intensity (y) of each production activity:

$$y_n = \frac{\sum_{i=1}^{a} P_{ni}(n_i)}{RH_h}$$

where:

i = 1,...a, commodity

n = agriculture (A), forestry (F) , or other livelihood activities (I)

h = hth household

So that $y_A + y_F + y_I = 1$

These ratios are useful coefficients for determining intensity of agricultural, forestry or other livelihood activities. Any changes introduced by external factors potentially shifts intensity of production activity.

2. Production outputs retained by household for consumption and invested in own-production or other production activities compose the non-marketed component of production. These values (using market price) divided by the value of total production estimates the ratio of non-marketed outputs to production:

$$r_n = \frac{\sum_{i=1}^{a} P_{ni}(n_{ci} + n_K + n_I)}{RH_h}$$ ratio of non-market-transacted production output to total household production.

where:

i = 1,...a, commodity

n = agriculture (A), forestry (F) , or other livelihood activities (I)

h = hth household

RH_j = total value of production of household h

However, $r_a + r_f + r_l < 1$, where r represents ratio of non-marketed production output to total production, and the subscript *a, f, and l* represent agriculture forestry and other livelihood outputs, respectively. Thus, $1 - (r_a + r_f + r_l)$ represents the ratio of marketed component of production.

3. Ratios of natural resources sold and directly consumed completes the accounting of natural resource exploitation.

The ratio of natural resources consumed or used for other production activities (calculated using this three-step process) to total consumption and intensity of production activity partially explains the state of natural resources and its sustainability over time.

A.3. Mathematical Model of Household Decision to Shift Production Activities

Predicting the pattern of production activity shifts between three production options - agriculture, forestry, and non-land based production - provide alternative approaches to estimation of natural resource use over time. The income-expenditure identity equation, that represents the decision function for the household to shift production, provides the framework in this approach. Under a condition of inequality of the expenditure-receipts function (Equation 3 of Chapter 3):

$$\Sigma P_{Mi} M_{ci} + (wL + P_K K + c) = \Sigma P_{Ai}(A_s) + \Sigma P_{Fi}(F_s) + \Sigma I_i$$

From the Receipt side:

The value of marginal product (MVP) of inputs of production alternatives provides logical basis for making production choices. VMP is simply translated as the value of a marginal unit of the output by employing a particular input. The

value of marginal product (MVP) from Agriculture, Forestry or other production activities:

$$VMP_n = P_{n1}(n_1)$$

where *n* refers to agricultural (A), forestry (F) or other production activities (I). The right-hand-side refers to per unit value of output by employing a particular input in a production activity.

Three different conditions mays arise so that household decisions under three different conditions are:

- VMP_A and $VMP_I < VMP_F$, household will shift resources to forest exploitation
- VMP_A and $VMP_F < VMP_I$, household will shift resources to other livelihood activities
- VMP_I and $VMP_F < VMP_A$, household will shift resources to agricultural production.

The three conditions show that differences in marginal value product determine the choice and intensity of a production activity. However, the household conducts production activities so that the identity equation holds, thus, they may have primary and secondary production activities to meet minimum basic needs. Hence, a minimum combination of production activity exists, i.e. agriculture and forest, forest and other livelihood or agriculture and other livelihood.

Under perfect market conditions $VMP = P_I$. Therefore, if $P_A < P_F$, households will shift to forest production.

From the Expenditure side:

Households decision options may be:

- Substitute for hired labor with family labor,
- Substitute for purchased market goods with own production (i.e., pharmacological products with medicinal plants),
- Substitute for purchased capital goods with substitute capital from production activities (i.e., housing materials such as metal roofs with indigenous materials harvested from forest), and
- Substitute for other purchased cost by exploiting "free goods" (i.e., use river water for laundry instead of purchasing piped water).

APPENDIX B

Appendix to Chapter 4

APPENDIX B. APPENDIX TO CHAPTER 4

B.1 Survey Questionnaire (Translated from Tagalog)

NATURAL RESOURCE ACCOUNTING FRAMEWORK FOR THE COMMUNITY-BASED FOREST RESOURCE MANAGEMENT (CBFM) SYSTEM OF THE PHILIPPINES

SURVEY QUESTIONNAIRE

Dear _____,

I am Gem Castillo, a student of Michigan State University in the United States. You were chosen by the researcher to answer thisquestionaire. I am presently conducting a study on natural resource accounting. Your community had been choosen as one of the places of study.

This interview is estimated to last for more or less one to two hours. If needed, we will add another 30 minute at other times if more answers are needed.

Questions are related to your livelihood activities in the farm, forest within or adjacent to your community. You may not participate in the interview if in your opinion, will cause harm to you by giving out information. Your answers will not be reported. Only the group of researchers will the contents of the interview.

Your name will not be written in the questionnaire. The completed questionnaire will be handed and handled by Gem Castillo. You may ask for the summary report of interviews if you request.. If you have some questions or doubts on the interview please, send us a letter through this addresses::

Mr. Gem B. Castillo, **14-A Bellamaja Townhomes** **411 Aglipay St., Mandaluyong,** **Metro Manila, 1550** **Telephone no. (63-2) 532-1557**	**Dr. Larry Leefers,** **Department of Forestry,** **126 Natural Resources Building,** **Michigan State University,** **East Lansing, MI 48824,** **Tel 517-355-0097**

Respondent no. _____ **Time Started:** _____

Barangay: _____ **Time Finished:** _____

Sitio/Purok: _____ **Interviewer:** _____

Place: (House o a place) _____ **Date:** _____

Read the introductory letter and if the respondent agrees to the interview check this box ☐

Questionnaire (Translated)

For the interviewer: Please answer the following questions honestly:

A. MINIMUM BASIC NEEDS

A ***What are the basic needs of your household?*** *(A "household" used in this interview include only actual residents and excludes members of the family living in another household. Included in the "household" are members of the family not physically living in the house but are dependent on the income generated by the household such as children in school outside of the community).*

1. What kind of food do you need on a daily basis[2]? *(Please make sure to indicate the quantity)*

Food[1]	How much is needed in one day/ week/ month?[2]	What is your unit of measure?[3]	How much does one unit cost?	Where do you get/buy these? (Use the codes below)[4]	Additional information?	Code
Code						

[1] *Rice, vegetables, meat, salt, sugar, coffee, milk, spices, water, etc.*

[2] *It is likely that respondents will provide answers to certain items used not on a daily basis, in which case indicate in the "Other information column" the frequency metioned.*

[3] *Units of measure: kilograms, bd ft, meters, (Refer to conversion table)*

[4] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter.*

2. What are your daily clothing needs? ☐

Clothing Needs[1,4]	What do you use?	How much do you use in one day/week/month/year?	What is the unit of measure?[2]	How much is the cost of one unit?	Where do you get or buy? Use codes below[3]	Code
Code						

[1] *Laundry soap, materials used for ironing e.g. charcoal or electric, materials used for laundry and how much is used per day, etc.*

[2] *Units of measure: kilograms, bd ft, meters, (Refer to conversion table for calculations)*

[3] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)*

[4] *Note: The purchase of clothing is not considered a daily requirement, although many allot for needs such as school uniforms. With this in mind, ask how many school uniform are bouth each year. If otherwise , (no school uniform) ignore the item and indicate only expenses for clothing.*

3. What are your daily health needs? ☐

What are your health needs? See examples below[1,3]	What do you use?[2]	What is your unit of measure?	How many do you use per day/week/month /year?	How much do you spend?	Where do you get them? Use code below[4]	Other remarks?	Code
Code							

[1] *Examples: headache medicine; medicine for other ailment; bath soap; shampoo; toothpaste, atbp.*

[2] *Exmples: tablet, tube (toothpaste), bar soap. Do not use brand name here*

[3] *Note: Include free medicine from Health Center and indicate in appropriate boxes. For addition answers not appropriate for the boxes include "Other remarks" (Last column).*

[4] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter*

4. ***Do you have education expenses****?* Yes ☐ No ☐

Level of education?	*What types and how much*			
	Tuition	*Transportion*	*Meals*	*Others?*
Pre-School:				
Elementary:				
High School:				
College:				

5. What are your household assets/properties?

Household assets/properties[1]	Quantity?	When was this bought/made? (year)	Cost of purchase	Average lifespan?	Where do you get or purchase this? Use code below[2]	Other remarks?	Code
Code							

[1] *Appliances, dressers, kitchenwares, dining wares, sala set, tables etc. NOTE: This should not include farm implements and machinery used in livelihood/production activities)*

[2] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)*

6. Description of the house
Floor area of the house? _____
How old is the house? _____ (year)

Types of materials used in the house? *(Write answer inside cell or box)*

House component	Type of material?[1]	Where was is getd or purchase? Use code below[2]	Estimate the the amount of	What is the unit of	How much is the cost?	Average life span	Othercomm ents?	Code
Code								

[1] *Measurement and quantity of house panelings/walls, roofing, flooring, and if these was made of wood, concrete, or native materials etc.*

[2] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)*

7. **If your daily needs can be bought, what is the total amount you would have to spend?** *(How much is needed to supply your daily needs? This is considered the* ***budget*** *of the household)*

a. P 50-99	☐	b. P100-149	☐
c. P 150-199	☐	d. P200-249	☐
e. P 250-299	☐	f. P300-349	☐
g. P350-399	☐	h. P400-over	☐

8. **What do you substitute for those needs you are unable to buy or those bought in the market, store, grocery, drug store or hardware?** *Explain: It is possible this is due to lack financial resources or other reasons. (Note: The respondent may not be needy or lack financial resource but substitutes items anyway. Explain clearly so that their intention for substitution is understood)*

Regularly purchased items[1]	What is your substitute?[2]	Unit of measure for substitute?	What are your sources for substittues?[3]				Code
			How much come fromthe forest?	How much comes from farms?	How many comes from garden?	Do you have other sources?	
Code							

[1] *Vegetables, meat, salt, sugar, coffee, milk, water, etc?, For health?, For clothing? (You may refer to previous question)*

[2] *These could be of different type such as sweet potatio as substitute for rice.*

[3] *Example: All = 100%; Half = 50%; quarter = 25%; Otherwise record the quantity.*

9. Where do you get your fuel or energy source?

Type of Fuel[1]	Where was it getd or purchased? Use codes below[2]	How many do you need per day?[3]	What is your unit of measure?	How much is one unit?	Do you have other commen ts?

[1] *Example: Gas (LPG), Kerosene, charcoal (separate those produced from wood and coconut shell), wood, electric,... etc*

[2] *Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi.*

[3] *It is likely that the respondent do not measure daily use. Record the quantity in this column. Record other comments in the last column.*

10. What is the price of fuel within the community?

Type of fuel	What is the unit of measure?	What is the price per unit?	What conversion factor do you use?
1.			
2.			
3.			
4.			
5.			

B. SOURCE OF INCOME OR LIVELIHOOD

What are your sources of income or livelihood? *Check the appropriate box.*

11. **Do you have a farm?** Yes ☐ None ☐

Livelihood in the farm	What is you total income?	How oftenly do you work? (Check the appropriate category)						Code
		Daily	Weekly	Monthly	Yearly	Not definite	How frequent?	
Code								
a.		☐	☐	☐	☐	☐		
b.		☐	☐	☐	☐	☐		
c.		☐	☐	☐	☐	☐		
d.		☐	☐	☐	☐	☐		
e.		☐	☐	☐	☐	☐		
f.		☐	☐	☐	☐	☐		
g.		☐	☐	☐	☐	☐		
h.		☐	☐	☐	☐	☐		

[1] *Example: Planting vegetables; Planting, care, and harvesting coconut; Planting and harvesting rice; Planting and harvesting corn; Copra production; Planting and harvesting fruit trees*

[2] *Example: 2t = twice a year, 3t = three times a year, ... etc. ; 2w = twice a week.. etc; 2b = twice per month.. etc;*

12. If you have a farm, please answer the following questions?

Type of farm	Size?	Doyou own this? Yes or no	Do you use water/ irrigation? If Yes, please Check cell.	Estimate of erosion from farm?	Do you use fertilizer?	Where does the water from your flow?[2]	Currently Use? Yes, No

[1] *Rice paddy, corn field, peanut farm, CSC, fruit orchard et.*
[2] *Specify the river or stream where the irrigation water flows.*

13. What are your farm expenses?

What are your cost items?[1]	How many per production?	What is the unit of measure?	What is the frequency in a year?	Cost per unit	Total Expenses?[3]	Conversion[2]	Code
Example: *Fertilizer*	*3*	*bags*	*3*	*P420*	*3780*	*50kg/ bag*	
Labor	14	Daily	2	125	3500	8/hrs/d	

[1] *Example: Fertilizer, insecticide, herbicide, gas, labor, food, kahoy, vine, water, etc.*
[2] *Explain the conversion to kilogram, meters, cubic meters, liters*
[3] *Need not compute the total.*

14. What tools and equipment do you use in farming?

Farming implement or tool[1]	Where do you get or buy? Use code below[2]	How many?	How often do you replace?	How much per unit?	Other comments?[3]

[1] *Exmple: Water buffalo, cart, thresher, plow, dryer etc.*

[2] *Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely) SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certificate of Stewardship contract lands Example: Price not known*

15. **What are your output from the farm?**

Type of Output	Quantity of harvest[1]	Unit of measure used	Price per unit	Pemcent sold[2]	Percent used in household	Percent used in farm?	Percet used in other livelihood

[1] *State average or normal production output insteaqd of current output that were affected by typhoon or other natural calamity.*

[2] *Note: If you use quantity in one cell do the same from in all the rest.*

16. **Do you have livelihood activities in the forest?**

Yes ☐ None ☐ Occasionally ☐

Forest Livelihood Activity[1]	How much do you earn?	Daily	Weekly	Monthly	Yearly	Not regular	How frequent[2]	Code
Code								
a.		☐	☐	☐	☐	☐		
b.		☐	☐	☐	☐	☐		
c.		☐	☐	☐	☐	☐		
d.		☐	☐	☐	☐	☐		
e.		☐	☐	☐	☐	☐		
f.		☐	☐	☐	☐	☐		
g.		☐	☐	☐	☐	☐		

[1] *Wood harvesting for charcoal production; Harvesting and marketing lumber; White clay mining; Trapping wildlife; Wood cutting for firewood; Collecting vines; Other Livelihood _____. Mentiond if this is CSC or Natural forest*

[2] *Example: 2/t = twice a year, 3/t = 3 times a year, ... etc. ; 2/w = twice a week.. etc.; 2/b = twice per month.. etc.; ht = not definite/regular*

17. **What are expenses in forest activities?**

What are your expense items?[1]	Quantity per production activity	What is the unit if measure?	How many time s in one year?	Cost per unit	Total e xpenses?	Conversion[2]	Code
Example: *Fertilizer*	*3*	*Bags*	*3*	*P420*	*3780*	*50kg/ bag*	
Labor	14	Daily	2	125	3500	8-hrs/d	

[1] *Sample answer: Fertilizer (sa CSC holders), insecticide, herbicide, gasoline, labor, food, wood, vines, water, etc.*

[2] *Explain how the units are converted to standard unit of measures such as kilogram, meters, cubic meters, liters etc.*

18. **What forestry tools and implements do you own?**

Forestry tools and implement[1]	Where do you get or buy? Use codes below[2]	How many?	Frequency if replacement?	Cost per unit?	Other comments?

[1] *Example: Water bufallo cart, thresher, plow, coconut dryer.*

[2] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contract land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)*

19. **What do you harvest from the forest?** (With or without permanent livelihood in the forest)

Products harvested[1]	Quantity harvested	Unit of measure used	Price per unit	Percent sold	Percent used for household	Percent use for farming?	Percent used for other livelihood

[1] Example: timber, vines, wildlife, white clay, bamboo, rattan, herbs or medicinal plants etc.

20. What forest products do you use for other livelihood?

Products from the forest?	Use Quantity or percent used				
	Used for farming?	Forestry	Sold in the market	Other livelihood	Used in household
Example: Wood	100%	Na	Na	Na	Na
Medicinal plants	Na	Na	50%	Na	50%

21. **Do you an experience in harvesting timber from the forest?** Yes ☐ No ☐

22. What species of timber have you harvested?

Timber species	Volume in cu m?	Destination?	Price per cu m?

23. **What is the frequency of timber harvesting in a year?** _____

24. **Based on your experience, and having the right condition, how much timber can you harvest?**

Materials	How much can one person accomplish in one day[1]					
	Quantity harvested	Unit of measure?	Number of hours	Number of household members involved	Cost in harvesting	Other comments[2]

[1] *(Factors affecting this include demand, quantity of available resources, activities within the community such as house construction, and need or requirement. More importantly, this all depends on the capacity of one person.)*

[2] *Include expense items.*

25. **How far is the forest from your house?** *(Note: This refers to the boundary of the forest)*
Hours walked? (= 0 if household resides within the forest)
Distance in kilometers? (= 0 if household resides within the forest)

26. **What are your other activities other than your regular livelihood activities in the forest?**

What are your activities?[1]	Frequency of visits?	Duration?	How much do you spend?	Other comments?

[1] Include hobbies such as wildlife trapping, willplants collection, going with others on timber harvesting activities *etc.*

27. **What are substitutes for natural resources that you harvest?** *(Are there substitutes when natural resources are exhausted?)*

Forest Resources[1]	Substitute	Where do you get or buy the substitute? Use code below[2]

[1] *Example: Metal sheets substitute for anahao leaves used for roofing; medicine tablets substitute for medicinal plants, bricks substitute for timber,.. etc.*

[2] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)*

28. **In your opinion, how much fores resources remains at present?** *(Optional - Ask the respondent if he/she has knowledge of this.)*

Forest resources	What is the unit of measure?	Quantity?	What conversion factor do you use?

29. **Do you have other livelihood activities besides farming and forestry?**

Yes ☐ No ☐

Other Livelihood[1]	How much is your income?	Daily	Weekly	Monthly	Yearly	Not definite/ regular	How frequent[2]
a.		☐	☐	☐	☐	☐	
b.		☐	☐	☐	☐	☐	
c.		☐	☐	☐	☐	☐	
d.		☐	☐	☐	☐	☐	
e.		☐	☐	☐	☐	☐	
f.		☐	☐	☐	☐	☐	

[1] *Coconut lumber production; carpentry; blacksmith; dress making; retail store (groceries); basket-making, home décor; tiger grass broom-making; jeepney driver; other forest activities; coconut production helper. Wage employment is not included here, but covered by the next question.*

[2] *Example: 2/t = twice a year, 3/t = 3 times a year, ...etc.; 2/w = twice a week.. etc; 2/b = twice a month.. etc; ht = no definite/regular*

30. What are your expenditures for these activities?

What are your expenditure items?[1]	How many per production?	What is the unit of measure	How many times a year?	Price per unit	Total expenses?	Conversion[2]	Code
Example: *Fertilizer*	*3 s*	*bags*	*3*	*P420*	*3780*	*50kg/ bag*	
Labor	14	Daily	2	125	3500	8-hrs/d	

[1] *Sample answer: Fertilizer, insecticide, herbicide, gasoline, labor, food, wood, vine, water, etc.*

[2] *Explain how the units are convereted to standard unit of measures such as kilogram, meters, cubic meters, liters etc.*

31. What tools/equipment do you use for these livelihood activities?

What tools/ equipment?[1]	Where do you get or buy? Use code below[2]	How many?	How frequent do you replace?	What is the price per unit?	Other comments?

[1] *Example: Water buffalo, cart, thresher, plow, coconut dryer.*

[2] *SA=from own agricultural land (A&D land); SG=homemade; CSC=from Certi. Of Stewardship Contrac land (forest land); G=from natural forest; B=bought from market or grocery; BL=bought from within village; D=donation; BR=barter (Two or more answers is likely)*

32. What are your products (off-farm production)?

Name of product[1]	Quantity produced	Unit of measure	Price per unit	Percent sold	Percent for household	Percent for farm?	Percent used for other livelihood

[1] *Example: wood, vines, wildlife, white clay, bamboo, rattan, etc.*

33. **Is there a member of the household who works for wages or employee in the community or outside the community in the current year?**
Yes ☐ None ☐ Occassionally ☐

34. What kind of work?

Kind of work[1]	**How much is the salary?** (*Choose appropriate answer)*					
	Daily	Weekly	Monthly	Yearly	Not regular/ definite	How frequent?[2]
a. Example: Carpenter (2nd child)	125	na	na	na	na	5/w, ht
b.						
c.						
d.						
e.						
f.						
g.						
h.						
i.						

[1] *Example: Write the type of work of the respondent and other members: carpenter, farm labor, wage labor, community officer ..etc.*

[2] *Example: 2/t = twice a year, 3/t = 3 times a year, ...etc. ; 2/w = twice a week.. etc; 2/b = twice a month.. etc; ht = not definite/regular*

35. **Record on a montly basis all activities mentioned above (All: farm, forest and off-farm).** (What are your monthly activities each month?)

Livelihood	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Example: Planting	—				—				—			
Harvest				—				—				—
How much is your income per month? (Indicate the livelihood activity)												
TOTAL												
How much do you spend each month? (Write expense items and value)												
Example: Fertilizer	35 00				35 00				35 00			
TOTAL												

36. Where do you spend your livelihood income?

Livelihood[1]	Income (net) (Optional)[2]	Calculate the proportion or percent for each column								
		Food	Clothing	Education	Shelter (house)	Health	Livelihood expenses	Recreastion	Savings	Others

[1] The enumerator/interviewer should list all livelihood activities.
[2] Indicate total income from production.

K. OTHER SOURCES OF MONEY INCOME

37. Do you have other sources if your livelihood income is not enough?

What is your source?[1]	How much?	How often do you receive it?	Respondent's explanation	Interviewer's Comments

[1] *Example: Money remitted by other members of the family working in other places; house/land rent, inheritance, donation.. etc*

D. Leisure and Recreation

38. What are your recreation activities?

Recreation activity[1,2]	How frequent and how many hours?						
	Daily	Weekly	Monthly	Yearly	Not definite	How frequent?	How many hours?
a.	☐	☐	☐	☐	☐	☐	
b.	☐	☐	☐	☐	☐	☐	
c.	☐	☐	☐	☐	☐	☐	
d.	☐	☐	☐	☐	☐	☐	
e.	☐	☐	☐	☐	☐	☐	
f.	☐	☐	☐	☐	☐	☐	

[1] Card games, watching TV, basketball, social drinking, story-telling, wildlife hunting, cockfighting..etc. Sample question for interviewer: *"After farming, forestry, fishing, what are your other activities other than sleeping?"*

[2] *Ask if this is LA = outside the community; G = inside the forestt; IL = river; O = other places (may specify exact place)*

E. HEALTH AND ENVIRONMENTAL SANITATION

39. Did anybody in your household got ill this past 3 years? What is it? What was the cause?

Who got ill? Do not mention name.[1]	Type of illness?	What was the suspected cause?

[1] *Write only the relationship with the respondent, not the name.*

40. Do you have a toilet? *(Check appropriate column)*

Yes ☐ No ☐

Inside or outside the house?	Water Sealed and Sanitary Pit[1]	Open Privy Pit[1]	Dropped[1]	Overhang[1]

[1] The Interview should describe what each choices mean.

41. **Where do you dispose your waste?** Check appropriate column.

Type of waste?[1]	Dumped somewhere else	Burned	Composted	Buried underground	Fed to domestic animals	Others

Bwastes from the kitchen, plastic, metals, etc..

42. **Did you have opportunities to plant trees ?** Yes ☐ o No ☐

43. **Where did you plant those trees?** Encircle apprpriate answer

a. Own-farm
b. Within the CSC
c. Inside the "protection forest"
d. Surrounding household
e. Other places _____

44. What kind of trees did you plant?

45. How many did you plant?

46. Do you have other comments?

Province: _____ ENVIRONMENTAL AND NATURAL RESOURCE ACCOUNTING FRAMEWORK Household Number:
Municipality: _____ FOR THE COMMNITY-BASED FOREST MANAGEMENT SYSTEM IN THE Sample Number:
Barangay: _____ PHILIPPINES Date Sampled:
Purok: _____ 1998 Interviewer:

SOCIO-DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

BASIC INFORMATION	NAME	AGE	SEX		VIL STATU				HIGHEST EDUCATIONAL ATTAINMENT						EMPLOYMENT												STATUS OF EMPLOYME				AVERAGE MONTHLY INCOME								
			MALE	FEMALE	SINGLE	MARRIED	WIDOW	SEPARATED	PRE-SCH	ELEM	HS	COLLEGE	VOC	NO EDUC	FARMER	FISHERMAN	PROFESSIONAL	TECH/REL WORKER	OFFICE WORKER	SKILLED LABORER	UN-SKILLED LABOR	OTHERS	BUSINESS ENTR-PRENEUR AL			PERMANENT	CASUAL	SELF-EMPLOYED	UNEMPLOYED	BELOW 1500	1500 - 2000	2001 - 2500	2501 - 3000	3001 - 3500	3501 - 4000	4001 - 4500	4501 - 5000	OVER 5000
																							SMALL	MEDIUM	LARGE													
FAMILY HEAD																																						
SPOUSE																																						
DEPENDENT CHILDREN																																						
FROM ELDEST TO YOUNGEST	1.																																					
	2.																																					
	3.																																					
	4.																																					
	5.																																					
	6.																																					
	7.																																					
	8.																																					
	9.																																					
	10.																																					
	11.																																					
	12.																																					
EXTENDED FAMILY MEMBERS/OTHERS																																						
RELATION TO FAMILY HEAD	1.																																					
	2.																																					
	3.																																					
	4.																																					
	5.																																					
	6.																																					
	7.																																					
	8.																																					
	9.																																					
	10.																																					
	11.																																					
	12.																																					

THANK YOU FOR YOUR PATIENCE IN ANSWER QUESTIONS. In case we have additional question we may request for another intervie time not to exceed 30 minutes. If you you some comments or questions, you may write to:

<table>
<tr>
<td>Mr. Gem B. Castillo,
14-A Bellamaja Townhomes
411 Aglipay St., Mandaluyong City
Metro Manila, 1550
Telephone no. (63-2) 5321557</td>
<td>Dr. Larry Leefers,
Department of Forestry,
126 Natural Resources Building,
Michigan State University,
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</tr>
<tr>
<td colspan="2">Dr. Marian S. delos Angeles
Project Director
Environmental and Natural Resources Accounting Project
Unit 3N YGB Building
219 Katipunan Ave. Blue Ridge, QC 1109</td>
</tr>
</table>

B.2. Stand and Stock Tables for the three Peoples' Organization in the study site.

Table 19. Stand and stock table for CPEU, Inc.[a]

D/N	Species Class	DBH CLASS									
		20		30		40		50		60	
		T	V	T	V	T	V	T	V	T	V
D	Apitong	2.94	0.28	2.57	0.97	0.74	0.35	1.10	2.17	1.47	4.81
D	Phil Mahogany Grp	156.99	20.42	81.25	28.95	24.63	19.17	13.60	20.12	12.50	26.92
D	Yakal	2.94	0.42	3.68	1.03	2.94	1.95	1.10	1.34		
N	CFW	29.04	3.59	21.32	6.84	7.72	4.99	4.78	5.32	1.10	2.47
N	Lessur Used Species	119.12	12.16	46.32	14.36	12.13	9.38	4.41	4.76	2.21	3.77
N	Nato	5.15	0.78	1.84	0.64	1.10	1.04	0.37	0.46		
N	PMS			0.37	0.12						
N	Premium Species	1.10	0.12								
N	Softwood	0.37	0.08								
	Total	317.65	37.85	157.35	52.91	49.26	36.88	25.36	34.17	17.28	37.97

D/N	Species Class	DBH CLASS										Harvestable
		70		80		90		>90		Total		
		T	V	T	V	T	V	T	V	T	V	
D	Apitong									8.82	8.58	2.405
D	Phil Mahogany Grp	7.72	21.76	6.62	27.57	1.10	5.35	4.06	37.37	308.47	207.63	105.51
D	Yakal									10.66	4.74	0
N	CFW			0.37	1.51		0.37	1.50		65.83	25.09	3.115
N	Lessur Used Species	0.37	0.66							184.56	45.09	2.545
N	Nato									8.46	2.92	0
N	PMS									0.37	0.12	0
N	Premium Species									1.10	0.12	0
N	Softwood									0.37	0.08	0
	Total	8.09	22.42	6.99	29.08	1.10	5.72	5.56	37.37	588.64	294.37	113.58

[a]D = Dipterocarps or species of the family Dipterocarpaceae; N = non-dipterocarps species
T= number of trees per hectare
V= volume, in cubic meters per hectare

Table 20. Stand and stock table for MUFFIN, Inc.[a]

D/N	Species Class	DBH CLASS									
		20		30		40		50		60	
		T	V	T	V	T	V	T	V	T	V
D	Philippine Mahogany Group	8.05	0.77	19.00	5.63	14.70	8.37	8.62	8.54	9.77	14.90
D	Yakal	0.86	0.10	1.15	0.32	0.86	0.82	0.29	0.18		
D	CFW	2.87	0.28	2.59	0.63	3.16	1.70	0.29	0.26	0.86	1.02
N	Lessur Used Species	2.01	0.22	4.31	1.03	2.87	2.25	2.01	2.05	1.44	3.82
N	Premium Species	0.57	0.12	0.57	0.27	0.29	0.29			0.29	0.48
	Total	14.36	1.49	27.62	7.88	21.88	13.43	11.21	11.03	12.36	20.22

D/N	Species Class	DBH CLASS								Harvestable
		70		80		90		Total		
		T	V	T	V	T	V	T	V	
D	Philippine Mahogany Group	3.16	8.12	3.74	12.50	1.44	5.69	68.48	64.52	33.76
D	Yakal							3.16	1.42	0
D	CFW			0.29	0.48			10.06	4.37	0.99
N	Lessur Used Species	0.29	0.44	0.29	1.01			13.22	10.82	3.36
N	Premium Species							1.72	1.16	0.24
	Total	3.45	8.56	4.32	13.99	1.44	5.69	96.64	82.29	38.35

[a]D = Dipterocarps or species of the family Dipterocarpaceae; N = non-dipterocarps species
T= number of trees per hectare
V= volume, in cubic meters per hectare

Table 21. Stand and stock table for TIBKOI, Inc.[a]

D/N	Species Class	DBH CLASS									
		20		30		40		50		60	
		T	V	T	V	T	V	T	V	T	V
D	Phil Mahogany Group	113.24	12.59	58.09	15.86	25.37	15.32	6.25	5.99	5.51	8.79
D	Yakal	1.10	0.10	0.74	0.38	0.37	0.12			0.37	0.68
D	CFW	30.88	3.12	3.12	5.43	6.62	3.37	1.84	2.00	1.47	1.75
N	Lessur Used Species	5.88	0.61	0.61	1.81	5.15	2.48	2.94	2.49	0.74	1.03
N	Nato	3.31	0.33	0.33	0.56			0.74	0.48		
N	PMS	0.37	0.01	1.00	0.26						
N	Premium Species	11.76	1.18	1.18	1.61	2.94	1.21	0.37	0.19	0.37	0.30
	Total	166.54	17.94	65.07	25.91	40.45	22.50	12.14	11.15	8.46	12.55

D/N	Species Class	DBH CLASS										Harvestable
		70		80		90		>90		Total		
		T	V	T	V	T	V	T	V	T	V	
D	Phil Mahogany Group	4 41	8.20	1 84	4 52	0.74	3 22	0.37	6 23	215 82	80 72	26.565
D	Yakal									2 58	1 28	0 34
D	CFW	0 37	0 66					0 37	3 04	44 67	19 37	4 575
N	Lessur Used Species									15 32	8 42	0 515
N	Nato									4 38	1 37	0
N	PMS									1 37	0 27	0
N	Premium Species									16 62	4 49	0 15
	Total	4 78	8 86	1 84	4 52	0 74	3 22	0 74	9 27	300 76	115 92	32.145

[a]D = Dipterocarps or species of the family Dipterocarpaceae; N = non-dipterocarps species
T= number of trees per hectare
V= volume, in cubic meters per hectare

APPENDIX C

Appendix to Chapter 5

APPENDIX C: Appendices to Chapter 5

C.1 Schematic Model of the SAM.

Table 22 shows the schematic model of endogenous and exogenous accounts of the SAM in equation form. The symbols, and numeric symbols sparingly used in subsequent discussions on multipliers, are shown and defined in the table. Table 23 show average propensities for expenditures, A_E and G_E (average propensity for leakage) derived from the SAM. These figures measure the contribution or proportion of each account element to total expenditures. If it is assumed that accounts are not related or connected, any exogenous injections into the system will change SAM accounts by a fixed proportion (A_E). In reality, accounts are interconnected so that the resulting change (multiplied by a factor M_E) is greater than the value of the injection (multiplied by A_E), because there are direct and indirect impacts created by account interconnections. The actual change created is calclated by transforming the average propensities (A_E) to a Leontief-type multiplier (M_E) through a process that involved matrix inversion. The result, shown in Tables 24, is a matrix of endogenous multipliers (M_E) for each endogenous account. These multipliers transmit impacts of exogenous changes around the SAM.

Table 22. Summary notations for endogenous and exogenous accounts of the SAM.[a]

Accounts			Expenditures							
			Endogenous Factors				Exogenous Factors			Total Receipts
			Production Activities	Factors of Production	Institutions	Capital	Government	Rest of the world	Deficit/ Surplus	
Receipts	Endogenous	Production Activities Factors of Production Institutions Capital	$Y_E = A_E \hat{Y}$				X_E			$C_E = Y_E + X_E$
	Exogenous	Government Rest of the world Deficit/Surplus	$X_E = G_E \hat{Y}$				T			$N_X = X_E + T$
Total		Total Expenditures	$\hat{Y}$				$B_E = X_E + T$			R = E

Where:

[a]Y_E = vector of row sum endogenous receipts
A_E = matrix of average endogenous expenditure propensities
$\hat{Y}$ = vector of total expenditures per account
X_E = matrix of exogenous injections into endogenous acc'nts
C_E = vector of row sums of endogenous and exogenous expenditure accounts
X_E = vector of row sums of exogenous injections into acc'nts
G_E = matrix of average propensities to leak
T = matrix of transactions between exogenous accounts
N_X = row sums of exogenous accounts = B_E column sums
R = E = scalar value of total receipts/expenditures

Average Expenditure Propensities			Expenditures							
			Production Activities							
			Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
			1	2	3	4	5	6	7	8
Receipts	1	Agri. Farming						0.0600		
	2	Forest Exploitation						0.1629	0.1429	
	3	Wage Employment								
	4	Retail Trading								
	5	Fisheries								
	6	Other sources								
	7	Wood-based fuel	0.0003	0.0065				0.0106		0.0050
	8	CBFM								
	9	Family Labor	0.9070	0.4885	0.9625	0.8189	0.8596	0.5942		
	10	Other domestic inputs	0.0350	0.0235	0.0143	0.0047	0.0029	0.0045		0.6832
	11	Hired Labor	0.0273	0.0038	0.0219		0.0005	0.0007		0.0439
	12	Man-made capital	0.0009	0.0006			0.0779			
	13	Natural capital	0.0028			0.0033	0.0005	0.0039		
	14	Smallholder households								
	15	Smallhold Household bound								
	16	Landless households								
	17	Landless Household bound								
	18	People's Organization								
	19	Others not specified								
	20	Investment/Savings								
	21	Natural Capital Depreciation		0.4718					0.8571	0.2084
	22	Natural Capital Accumulation								0.0473
	23	Human Capital								
	24	Government								
	25	Rest of the world	0.0267	0.0054	0.0013	0.1731	0.0587	0.1632		0.0121
	26	Deficit/Surplus								
	27	Total Expenditures	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 23. Matrix of endogenous average propensities for expenditures.

Table 23. Matrix of endogenous average propensities for expenditures...cont.

		Aggregate Monetary Accounts	Expenditures											
			Factors of Production					Institutions						
								Smallholder households Expenditures		Landless households Expenditures		Others Institutional	
			Family Labor	Other Domestic Inputs	Hired Labor	Man-made Capital	Natural Capital	Market Purchases of smallholders	Household bound production	Market Purchases of landless	Household bound production	People's Organizatin	Others not specified
			9	10	11	12	13	14	15	16	17	18	19
Receipts	1	Agri. Farming							0.7287		0.1159		0.7372
	2	Forest Exploitation							0.0310		0.0330		0.2628
	3	Wage Employment						0.0806		0.1339			
	4	Retail Trading						0.0658		0.0014			
	5	Fisheries						0.0711	0.0154	0.1240	0.1031		
	6	Other sources							0.0202		0.0943		
	7	Wood-based fuel							0.2046		0.6537		
	8	CBFM										0.8080	
	9-12	(No entries)											
	14	Smallholder households	0.8501	0.0854	0.7269	0.7146	0.8925						
	15	Smallhold Household bound											
	16	Landless households	0.1499	0.1140	0.0117	0.2854	0.1075						
	17	Landless Household bound											
	18	People's Organization		0.8006	0.2614							0.0219	
	19	Others not specified						0.0513		0.0001			
	20	Investment/Savings						0.0175		0.0061		0.0485	
	21	Natural Capital Depreciation											
	22	Natural Capital Accumulation											
	23	Human Capital										0.0020	
	24	Government										0.1196	
	25	Rest of the world						0.7137		0.7346			
	26	Deficit/Surplus											
	27	Total Expenditures	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 23. Matrix of endogenous average propensities for expenditures...cont.

Aggregate Monetary Accounts		Expenditures						
		Capital				Exogenous Factors		
		Investment/ Savings	Natural Capital Depreciation	Natural Capital Accumulation	Human Capital	Government	Rest of the world	Deficit/ Surplus
		20	21	22	23	24	25	26
Receipts	1 Agri. Farming						0.6289	
	2 Forest Exploitation						0.1233	
	3 Wage Employment							
	4 Retail Trading							
	5 Fisheries	0.0644					0.0248	
	6 Other sources	0.2143					0.0564	
	7 Wood-based fuel	0.3943						
	8 CBFM	0.3269		1.0000			0.0220	
	9-12 (No entries)							
	14 Smallholder households					1.0000	0.0496	
	15 Smallhold Household bound						0.0369	
	16 Landless households						0.0524	
	17 Landless Household bound							
	18 People's Organization				0.0124		0.0056	
	19 Others not specified							
	20 Investment/Savings							
	21 Natural Capital Depreciation							
	22 Natural Capital Accumulation							
	23 Human Capital				0.9876			
	24 Government							0.1971
	25 Rest of the world							0.8029
	26 Deficit/Surplus		1.0000					
	27 Total Expenditures	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Table 24. Matrix of M_E of endogenous accounts and average propensities for exogenous accounts.

Accounts				Endogenous							
				Production Activities							
				Agriculture farms	Forest Exploitation	Wage Employment	Retail Trading	Fisheries	Other Sources	Wood fuel production	CBFM
				1	2	3	4	5	6	7	8
Endogenous	1	1	Production: Agri. Farming	1.041	0.022	0.043	0.035	0.040	0.092	0.003	0.012
		2	Forest Exploitation	0.017	1.010	0.017	0.014	0.016	0.177	0.144	0.011
		3	Wage Employment	0.112	0.060	1.117	0.098	0.112	0.088	0.009	0.049
		4	Retail Trading	0.071	0.037	0.074	1.062	0.069	0.055	0.005	0.020
		5	Fisheries	0.102	0.054	0.106	0.088	1.101	0.079	0.008	0.049
		6	Other sources	0.005	0.003	0.005	0.004	0.004	1.004	0.000	0.014
		7	Wood-based fuel	0.010	0.012	0.010	0.008	0.008	0.019	1.002	0.036
		8	CBFM	0.083	0.046	0.052	0.025	0.025	0.032	0.007	2.085
			Sub-total	1.441	1.243	1.422	1.333	1.376	1.546	1.178	2.277
	2	9	Factors: Family Labor	1.209	0.649	1.276	1.080	1.158	0.964	0.093	0.131
		10	Other domestic inputs	0.096	0.057	0.054	0.025	0.024	0.036	0.008	1.426
		11	Hired Labor	0.035	0.008	0.028	0.004	0.005	0.007	0.001	0.093
		12	Man-made capital	0.009	0.005	0.008	0.007	0.086	0.006	0.001	0.004
		13	Natural capital	0.003	0.000	0.000	0.004	0.001	0.004	0.000	0.000
			Sub-total	1.351	0.719	1.367	1.121	1.274	1.018	0.103	1.654
	3	14	Institutions: Smallholder households	1.070	0.566	1.116	0.932	1.052	0.836	0.081	0.303
		16	Landless households	0.195	0.105	0.200	0.167	0.201	0.151	0.015	0.184
		18	People's Organization	0.088	0.049	0.052	0.022	0.021	0.031	0.007	1.195
		19	Others not specified	0.055	0.029	0.057	0.048	0.054	0.043	0.004	0.016
			Sub-total	1.408	0.749	1.425	1.169	1.328	1.062	0.107	1.698
	4	20	Capital: Investment/Savings	0.024	0.013	0.023	0.018	0.021	0.017	0.002	0.064
		21	Nat Capital Depreciation	0.034	0.496	0.027	0.018	0.020	0.106	0.928	0.471
		22	Natl Capital Accumulatio	0.004	0.002	0.002	0.001	0.001	0.002	0.000	0.099
		23	Human Capital	0.014	0.008	0.008	0.004	0.003	0.005	0.001	0.192
			Sub-total	0.076	0.519	0.061	0.041	0.045	0.130	0.931	0.826
Exogenous	5	24	Government	0.010	0.006	0.006	0.003	0.003	0.004	0.001	0.143
		25	Rest of the World	0.955	0.498	0.967	0.979	0.977	0.890	0.071	0.386
		26	Deficit/Surplus	0.034	0.496	0.027	0.018	0.020	0.106	0.928	0.471
			Sub-total	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table 24. Matrix of M_E of endogenous accounts and average propensities for exogenous accounts...cont.

Accounts					Endogenous				
					Factors of Production				
					Family Labor	Other Domestic Inputs	Hired Labor	Man-made Capital	Natural Capital
					9	10	11	12	13
Endogenous	1	1	Production	Agri Farming	0 043	0 015	0 039	0 038	0 045
		2		Forest Exploitation	0 017	0 014	0 018	0 015	0 018
		3		Wage Employment	0 118	0 062	0 093	0 126	0 116
		4		Retail Trading	0 075	0 024	0 066	0 066	0 077
		5		Fisheries	0 107	0 062	0 086	0 114	0 105
		6		Other sources	0 005	0 019	0 010	0 004	0 005
		7		Wood-based fuel	0 009	0 042	0 020	0 008	0 009
		8		CBFM	0 022	1 413	0 477	0 021	0 022
				Sub-total	0.396	1.650	0.809	0.392	0.397
	2	9	Factors	Family Labor	1 317	0 164	0 267	0 317	0 317
		10		Other domestic inputs	0 019	1 967	0 330	0 018	0 020
		11		Hired Labor	0 005	0 064	1 024	0 005	0 005
		12		Man-made capital	0 008	0 005	0 007	1 009	0 008
		13		Natural capital	0 000	0 000	0 000	0 000	1 000
				Sub-total	1.350	2.201	1.628	1.350	1.350
	3	14	Institutions	Smallholder households	1 131	0 358	1 005	0 996	1 174
		16		Landless households	0 202	0 251	0 092	0 338	0 160
		18		People's Organization	0 017	1 631	0 545	0 016	0 017
		19		Others not specified	0 058	0 018	0 052	0 051	0 060
				Sub-total	1.409	2.258	1.693	1.401	1.411
	4	20	Capital	Investment/Savings	0 022	0 087	0 045	0 020	0 022
		21		Nat Capital Depreciation	0 020	0 337	0 125	0 019	0 021
		22		Natl Capital Accumulation	0 001	0 067	0 023	0 001	0 001
		23		Human Capital	0 003	0 262	0 088	0 003	0 003
				Sub-total	0.046	0.753	0.280	0.043	0.047
Exogenous	5	24		Government	0 002	0 195	0 065	0 002	0 002
		25		Rest of the World	0 978	0 468	0 810	0 979	0 977
		26		Deficit/Surplus	0 020	0 337	0 125	0 019	0 021
				Sub-total	1.000	1.000	1.000	1.000	1.000

Table 24. Matrix of M_E of endogenous accounts and average propensities for exogenous accounts...cont.

Accounts				Endogenous					
				Institutions					
				Smallholder households		Landless households Expenditures		Others Institutions	
				Market Purchases	Household bound	Market Purchases	Household bound	People's Organization	Others not specified
				14	15	16	17	18	19
Endogenous	1	Production	Agri. Farming	0.049	0.762	0.011	0.136	0.012	0.773
	2		Forest Exploitation	0.019	0.077	0.005	0.148	0.014	0.278
	3		Wage Employment	0.110	0.089	0.164	0.040	0.043	0.099
	4		Retail Trading	0.084	0.056	0.020	0.025	0.018	0.062
	5		Fisheries	0.099	0.096	0.151	0.140	0.045	0.089
	6		Other sources	0.005	0.024	0.003	0.096	0.022	0.005
	7		Wood-based fuel	0.010	0.213	0.005	0.659	0.050	0.011
	8		CBFM	0.023	0.064	0.014	0.021	1.760	0.073
			Sub-total	0.400	1.382	0.373	1.266	1.965	1.389
	9	Factors	Family Labor	0.317	0.957	0.318	0.432	0.126	1.062
	10		Other domestic inputs	0.020	0.074	0.013	0.024	1.204	0.085
	11		Hired Labor	0.005	0.026	0.005	0.006	0.079	0.028
	12		Man-made capital	0.008	0.008	0.012	0.011	0.004	0.008
	13		Natural capital	0.000	0.002	0.000	0.001	0.000	0.002
			Sub-total	0.351	1.068	0.348	0.475	1.413	1.185
	14	Institutions	Smallholder households	1.281	0.847	0.283	0.383	0.270	0.938
	16		Landless households	0.052	0.155	1.053	0.071	0.158	0.172
	18		People's Organization	0.018	0.068	0.012	0.021	2.033	0.077
	19		Others not specified	0.066	0.043	0.015	0.020	0.014	1.048
			Sub-total	1.417	1.113	1.363	0.495	2.475	2.235
	20	Capital	Investment/Savings	0.024	0.019	0.012	0.008	0.104	0.021
	21		Nat Capital Depreciation	0.022	0.233	0.009	0.639	0.417	0.156
	22		Natl Capital Accumulation	0.001	0.003	0.001	0.001	0.083	0.003
	23		Human Capital	0.003	0.011	0.002	0.003	0.327	0.012
			Sub-total	0.050	0.266	0.024	0.652	0.931	0.193
Exogenous	24		Government	0.002	0.008	0.001	0.003	0.243	0.009
	25		Rest of the World	0.976	0.759	0.989	0.358	0.340	0.835
	26		Deficit/Surplus	0.022	0.233	0.009	0.639	0.417	0.156
			Sub-total	1.000	1.000	1.000	1.000	1.000	1.000

Table 24. Matrix of M_E of endogenous accounts and average propensities for exogenous accounts...cont.

Accounts				Endogenous			
				Capital			
				Investment	Natural Capital Depreciation	Natural Capital Accumulation	Human Capital
				20	21	22	23
Endogenous	1	Production	Agri Farming	0 028	-	0 012	0 012
	2		Forest Exploitation	0 100	-	0 011	0 014
	3		Wage Employment	0 045	-	0 049	0 043
	4		Retail Trading	0 025	-	0 020	0 018
	5		Fisheries	0 107	-	0 049	0 045
	6		Other sources	0 220	-	0 014	0 022
	7		Wood-based fuel	0 411	-	0 036	0 050
	8		CBFM	0 693	-	2 085	1 760
			Sub-total	1.629	-	2.277	1.965
	9	Factors	Family Labor	0 360	-	0 131	0 126
	10		Other domestic inputs	0 479	-	1 426	1 204
	11		Hired Labor	0 033	-	0 093	0 079
	12		Man-made capital	0 008	-	0 004	0 004
	13		Natural capital	0 001	-	0 000	0 000
			Sub-total	0.881	-	1.654	1.413
	14	Institutions	Smallholder households	0 378	-	0 303	0 270
	16		Landless households	0 111	-	0 184	0 158
	18		People's Organization	0 401	-	1 195	2 033
	19		Others not specified	0 019	-	0 016	0 014
			Sub-total	0.910	-	1.698	2.475
	20	Capital	Investment/Savings	1 027	-	0 064	0 104
	21		Nat Capital Depreciation	0 544	1 000	0 471	0 417
	22		Natl Capital Accumulation	0 033	-	1 099	0 083
	23		Human Capital	0 065	-	0 192	80 862
			Sub-total	1.668	1.000	1.826	81.466
Exogenous	24		Government	0 048	-	0 143	0 243
	25		Rest of the World	0 408	-	0.386	0 340
	26		Deficit/Surplus	0 544	1 000	0 471	0 417
			Sub-total	1.000	1.000	1.000	1.000

C.2. Livelihood Activities of Households

Table 25. Livelihood activites of households in five communities.

Primary Livelihood Activity	Total	Secondary Livelihood	Total	Tertiary Livelihood	Total
abaca production	7	abaca production	1	banana farming	1
carpentry	9	banana farming	3	carpentry	4
charcoal production	2	carpentry	8	coconut farming	4
coconut farming	72	charcoal production	3	community councilor	2
construction worker	2	charcoal trading	2	community security	1
cook	1	coconut farming	29	construction worker	1
corn farming	1	community security	1	cook	2
family subsidy	1	cook	1	electrician	1
farm caretaker	1	corn farming	1	fishing	5
fishing	36	fishing	7	hauling timber	4
forest farming	4	handicraft	2	lowland farming	8
forestry	1	hired laborer	2	metal worker	1
forestry and lowland farmin(	1	jeepney driver	2	na	255
government employee	1	jeepney operator	1	piggery	1
handicraft	1	lowland farming	12	renting house	1
hired farm labor	3	masonry	2	retail store	2
hired labor	6	na	187	retail store & bakery	1
ice cream	1	rattan trading	2	rice farming	1
jeepney conductor	1	renting	3	teacher	1
jeepney driver	2	retail store	3	vines harvesting	1
jeepney operator	1	retail trading	4		
laundry	1	rice farming	11		
local councilor	2	timber harvesting	1		
lowland farming	44	vegetable farming	1		
masonry	2	vines harvesting	2		
midwifery	1	white clay mining	6		
na	50				
rattan harvesting	3				
rattan marketing	1				
renting	2				
retail store	1				
retail trading	2				
rice farming	21				
timber harvesting	1				
timber hauler	3				
utility worker	1				
vegetable farming	4				
vines harvesting	1				
white clay mining	2				
wood charcoal production	1				

C.3. Various Examples of Approaches to SAM Evaluation

A number of approaches of evaluation result from examining the SAM. In Chapter 5, the focus of evaluation was on natural resources exploitation. Below are summary evaluation that pertain in general to community economic performance.

Level of Dependence

The variation of the level of contribution suggests a number of possible explanations. These include lack of capacity for other forms of production, or immobility or unavailability of some form of capital for production; ownership of factors of production, and possibly initial endowment or wealth.

Table 26 shows that agriculture generates the most income for rural households. Total household-production value consists of 49% from agriculture, 27% from forestry (including fuelwood production and CBFM), and 23% percent from other livelihood that includes fishing, wage employment, retail trading and other small-scale livelihood activities. Therefore, households in five communities are more agriculture-intensive rather than forestry-intensive. The overall forest exploitation that includes community-based management program and fuelwood production a fourth of total production income in 1998, the survey year. It is important to note that the larger value in this forest production obtains from potential production that the CBFM reported (P 8,920,866 see

Table 12), instead of actual production and sale. Nonetheless, it provides potential information on the depreciation of natural resources.

Table 26. Total value of production activities of the 5 communities.

Production Activity	Values (Pesos)	Proportion
Agricultural Farming	35,375,061	49%
Forest Exploitation	6,905,719	10%
Wage Employment	5,077,387	7%
Retail Trading	3,072,002	4%
Fisheries	5,884,294	8%
Other sources	2,833,365	4%
Wood-based fuel	3,582,927	5%
CBFM	8,920,866	12%
Total	71,651,622	100%

Income Distribution

On consumption of own-production, landless households have comparatively higher values for non-agriculture-based production, particularly fuelwood. Both household types showed no purchase of agriculture and forest products. Aggregate factor receipts of landless households were lower than small-holders considering that the landless comprise only 23% of total households. For consumption expenditures (market purchases), landless households import expenditures total 74% while small-holders total only 71% suggesting greater consumption of own-farm production by the latter. Logically, wage employment and purchases from fisheries output is relatively higher for landless households, due to lack of land to cultivate and produce agricultural crops for own-consumption, essentially relying on "free goods."

Self-sufficiency in Production

Sufficiency of production output also suggests less significant import of consumption goods. In the constructed SAM, if imports of communities exceed exports, communities are net importers of consumption goods as a result of two possible scenarios. One scenario is that prices of production outputs compared to prices of consumption goods purchased outside of the community are considerably low. The other is that production technology cost is relatively higher, because of potentially higher imported input costs. The outcome remains that a considerable part of natural resource exploitation remains "un-transacted" in the market. Thus, an aspect of this evaluation that links natural resources and economic performance is to identify marketed or non-marketed outputs of production. In the five communities, non-traded output for aggregated household production was 23%. Total marketed component of all production output was 77%. The marketed component covers local purchases/sales and exports outside of the community. This is consistent with previous estimated figure of 25% of GNP by James (1996) for national accounts.

A cursory analysis of forestry production by households reveals that 20% did not enter the market (direct household consumption and used for other purposes), the rest were sold outside of the community. Directly consumed forestry output considering the

whole community, that includes CBFM production, was 23%. This shows the increasing emphasis of household exploitation of natural resources for trade in the market, because of relatively high value-added relative to other production outputs. However, the significant value of non-traded output and consumption of own-production suggest less than full integration of the communities to the market; shadow prices diverge from market prices; and, transaction costs are ubiquitous. Subsistence production, significant divergence between shadow price and market price, and trade imbalances suggest that certain production outputs remain unrecorded in national accounts. In most instances, natural resources exploitation occurs but not recorded, hence, its condition remains undetermined.

C.4. Valuation Approaches

The value-added of forest resources harvested by household and POs involved with the CBFM program of the five communities was based on market value; that is the stumpage value of timber calculated as shown in Table 27. This represents the rent captured by the community in the exploitation of non-produced natural capital. CBFM output were basically priced at market value. However, value of timber harvested was based on residual stumpage price after costs of extraction were subtracted.

Table 27. Calculation of timber price (in Pesos) and proportion of cost components.[a]

Pricing of timber harvest	Value	Percent of timber sales value
Sales per bd ft	17.00	100.0%
Reforestation	1.00	5.9%
BENRO/Protection	1.00	5.9%
Savings/Livelihood	1.00	5.9%
Admin Cost	1.50	8.8%
Chain saw operator	2.75	16.2%
Slicing	1.50	8.8%
Hauling	4.00	23.5%
Forest Charges	2.50	14.7%
Trucking	1.50	8.8%
Miscellaneous expenses	0.25	1.5%
Estimated timber rent or stumpage value	4.50	26.5%
Estimated net export value	2.00	11.8%

[a] Based on the calculations by the CPEU Inc. officers in 1998.

Depreciation value was based on the imputed value of natural capital used in production activities. The most widely used approach was stumpage valuation. Other valuation approaches for various commodities are described below:

- Fuelwood consumed by households were either purchased from the market or directly consumed production outputs. There is a divergence of prices of fuelwood observed from responses to the survey. This is an indication of an imperfect market. Therefore, in calculating the value of wood fuel, market price of wood fuel in urban center or local market was used. Fuelwood valued using the wage rate, calculated as wage rate in the locality multiplied by the

number of hours spent on harvesting this product, proved to be higher that market price of fuelwood per unit. Thus, there is great divergence between the shadow price of fuelwood and its market price;

- Values in agriculture output were based on market prices;

- Family labor following the general valuation for all activities represent residual values after other factor value added were removed;

- Other forestry outputs were based on market price both for conventional factors of production and natural resource exploited;

- Wage employment values were based on local wage rates. Wage differences occurs in five communities; those closest to urban centers recorded higher wage rates;

- Retail trading values were based on market values;

- Fisheries output were based on market values, both locally sold or in urban centers;

- Other sources were valued at cost; and

- Natural capital depreciation value was based on rent on natural resources, and computation differ for each activity. Household forestry activities were based on stumpage value in harvesting timber and non-timber forest resources. CBFM output were based on stumpage value after CBFM costs were removed. Costs component for each natural resource vary depending on the activity. Using common stumpage will overvalue some of natural resource outputs and undervalue some. For instance, the stumpage value for timber harvest by a household would differ from the stumpage value of that harvested by the CBFM, because cost components and technology employed in harvesting differ.

C.5. Simulation Runs with Varying Fire Occurrences and Optimal Level of Harvest

Spreadsheet simulation made use data from the stand and stock table of the three POs at the Bicol National Park. The aggregate growing stock from these three tables was 540,196 cubic meters (yield per hectare multiplied by the total area of 3,290 hectares). This figure is the initial opening stock of timber in the simulation model. Closing stock was derived by deducting harvest, natural mortality and fire damages from the opening stock and adding in-growth from existing growing stand and new growth (regeneration) from opened areas. Table 28 presents various parameters used in the simulation model.

Table 28. Parameters used in simulation.

Variables/Parameters	Unit of Measure	Values
Market price of timber	P/bd ft	17
Harvest damage values		
Abandoned logs	%	3.75
Butt trimmings	%	2.5
Stumps	%	0.1
Residual damage	%	50
Tops and branches	%	33.75
Forest fire damage	%	5.2
Harvest volume per hectare	cu m/ha/yr	184.07
Initial opening stock	cu m	540,196
Initial basal area	cu m/ha	8.0
Initial Years elapsed after logging	years	25.0
Growth rate per hectare	cu m/ha/yr	3.9

The growth function (Balangue, 1991) used to derived the growth was the Revilla model:

$$\text{Yield} = 0.84288+0.40458*ln(\text{BPO})+0.33674* ln(\text{YEAL})+0.46925* ln(\text{BPO})* ln(\text{S})$$

Where:

BPO – dipterocarp basal area at YEAL = 0

YEAL – years elapsed after logging

S – measure of site quality

A number of simulation runs were done to evaluate various scenarios. Of particular significance to this study are: (1) Simulate stock trend at various levels of harvest expressed as hectares harvested, (2) opening and ending stock at 12 hectares of harvest and varying fire occurrences to present optimal level of harvest and (3) trends of stock based on the three harvest scenario discussed in Chapter 5.

Table 29 presents stock scenario at various harvest levels. Table 30 presents simulation results that evaluates the harvest levels at various fire occurrences. Table 31 presents stock levels for three harvest scenarios discussed in Chapter 5. Figure 8 presents the trend of opening and closing stocks for three harvest options discussed in Chapter 5. Trend of site disturbances is also presented.

Table 29. Simulation trials with varying area harvested and fire occurrences.

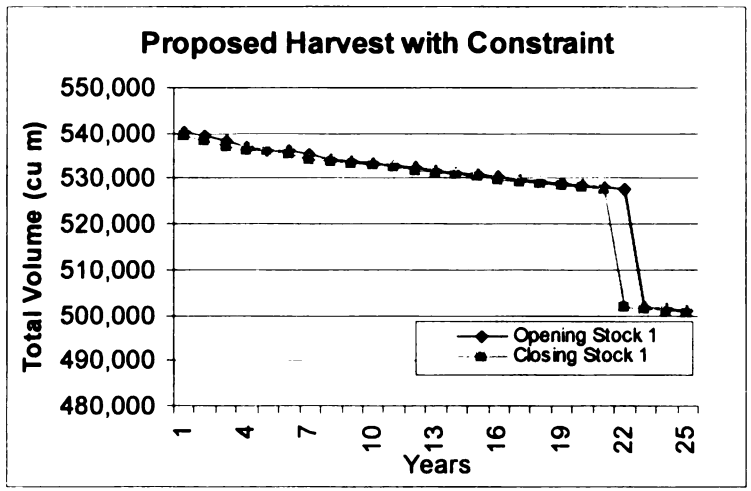
No. of Trials	Hectares Harvested	Beginning Stock	Ending Stock	Difference	Volume Harvested	Freq of Fires
1	74	540,196	194,999	345,197	13,621	1
2	73	540,196	173,931	366,265	13,437	1
3	60	540,196	273,901	266,295	11,044	1
4	50	540,196	349,700	190,496	9,204	0
5	49	540,196	328,715	211,481	9,019	1
6	48	540,196	334,752	205,444	8,835	1
7	46	540,196	329,643	210,553	8,467	2
8	45	540,196	374,982	165,214	8,283	0
9	44	540,196	390,125	150,071	8,099	0
10	42	540,196	351,502	188,694	7,731	2
11	41	540,196	353,250	186,946	7,547	2
12	40	540,196	377,563	162,633	7,363	1
13	39	540,196	385,516	154,680	7,179	1
14	38	540,196	419,980	120,216	6,995	0
15	37	540,196	345,840	194,356	6,811	3
16	36	540,196	404,991	135,205	6,627	1
17	35	540,196	412,416	127,780	6,442	1
18	34	540,196	441,953	98,243	6,258	0
19	33	540,196	452,949	87,247	6,074	0
20	32	540,196	400,897	139,299	5,890	2
21	31	540,196	457,860	82,336	5,706	0
22	30	540,196	464,448	75,748	5,522	0
23	29	540,196	444,439	95,757	5,338	1
24	28	540,196	424,292	115,904	5,154	2
25	27	540,196	431,334	108,862	4,970	2
26	26	540,196	416,490	123,706	4,786	3
27	25	540,196	470,551	69,645	4,602	1
28	24	540,196	502,506	37,690	4,418	0
29	23	540,196	452,107	88,089	4,234	2
30	22	540,196	486,551	53,645	4,050	1
31	21	540,196	464,095	76,101	3,865	2
32	20	540,196	468,511	71,685	3,681	2
33	19	540,196	529,338	10,858	3,497	0
34	18	540,196	536,617	3,579	3,313	0
35	17	540,196	540,835	-639	3,129	0
36	14	540,196	529,516	10,680	2,577	1
37	13	540,196	563,625	-23,429	2,393	0
38	12	540,196	544,371	-4,175	2,209	1
39	12	540,196	489,045	51,151	2,209	3
40	11	540,196	492,992	47,204	2,025	3
41	10	540,196	581,607	-41,411	1,841	0

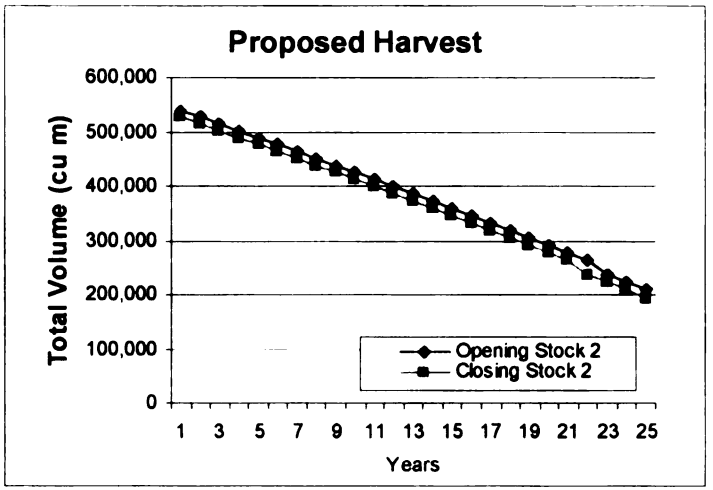
Table 30. Simulation to determine the optimal level of harvest at varying fire occurrences.

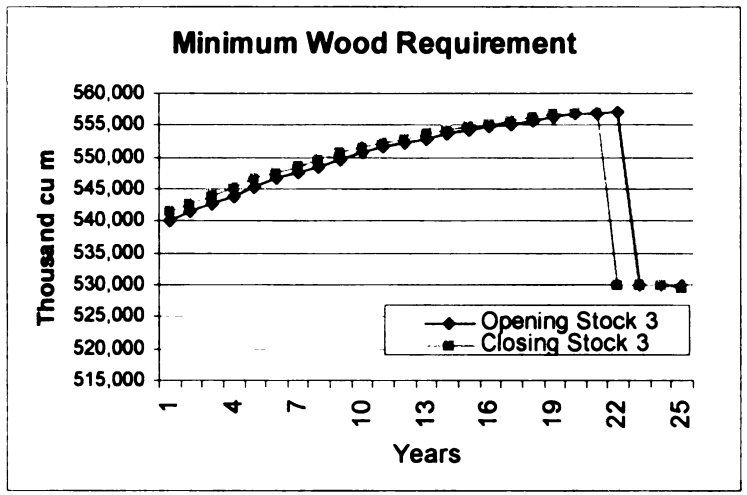
No. of Trials	No. of Hectares	Beginning Stock 2	Ending Stock 2	Difference	Volume Harvested	Freq of Fires
1	12.00	540,196	572,188	-31,992	2,209	0
2	12.00	540,196	571,682	-31,486	2,209	0
3	12.00	540,196	571,114	-30,918	2,209	0
4	12.00	540,196	571,043	-30,847	2,209	0
5	12.00	540,196	570,128	-29,932	2,209	0
6	12.00	540,196	570,029	-29,833	2,209	0
7	12.00	540,196	569,901	-29,705	2,209	0
8	12.00	540,196	542,682	-2,486	2,209	1
9	12.00	540,196	542,108	-1,912	2,209	1
10	12.00	540,196	541,615	-1,419	2,209	1
11	12.00	540,196	541,088	-892	2,209	1
12	12.00	540,196	541,016	-820	2,209	1
13	12.00	540,196	540,827	-631	2,209	1
14	12.00	540,196	540,015	181	2,209	1
15	12.00	540,196	539,904	292	2,209	1
16	12.00	540,196	539,532	664	2,209	1
17	12.00	540,196	539,476	720	2,209	1
18	12.00	540,196	516,789	23,407	2,209	2
19	12.00	540,196	516,627	23,569	2,209	2
20	12.00	540,196	516,331	23,865	2,209	2
21	12.00	540,196	516,199	23,997	2,209	2
22	12.00	540,196	515,876	24,320	2,209	2
23	12.00	540,196	515,134	25,062	2,209	2
24	12.00	540,196	515,112	25,084	2,209	2
25	12.00	540,196	515,040	25,156	2,209	2
26	12.00	540,196	514,092	26,104	2,209	2
27	12.00	540,196	514,056	26,140	2,209	2
28	12.00	540,196	513,972	26,224	2,209	2
29	12.00	540,196	512,936	27,260	2,209	2
30	12.00	540,196	489,947	50,249	2,209	3
31	12.00	540,196	489,090	51,106	2,209	3
32	12.00	540,196	488,401	51,795	2,209	3
33	12.00	540,196	488,195	52,001	2,209	3
34	12.00	540,196	487,878	52,318	2,209	3
35	12.00	540,196	487,036	53,160	2,209	3
36	12.00	540,196	465,915	74,281	2,209	4
37	12.00	540,196	465,068	75,128	2,209	4
38	12.00	540,196	464,154	76,042	2,209	4
39	12.00	540,196	463,214	76,982	2,209	4
40	12.00	540,196	462,052	78,144	2,209	4
41	12.00	540,196	439,967	100,229	2,209	5
42	12.00	540,196	438,357	101,839	2,209	5
43	12.00	540,196	436,758	103,438	2,209	5
44	12.00	540,196	434,920	105,276	2,209	5
45	12.00	540,196	165,414	374,782	2,209	2

Table 31. Summary of simulation run for opening and closing of stock of timber.

Years	YEAL	Harvest = Growth	Proposed Harvest	Min Wood Req.	Closing Stock 1	Closing Stock 2	Closing Stock 3	Harvest 1	Harvest 2	Harvest 3	Natural Mortality 1	Natural Mortality 2	Natural Mortality 3	Random Fire Occurrence
1	26	540,196	540,196	540,196	539,815	529,446	541,968	4441	13621	2535	229	703	131	0
2	27	539,815	529,446	541,968	539,297	518,180	543,677	4438	13621	2535	368	1131	210	0
3	28	539,297	518,180	543,677	538,258	505,186	545,109	4434	13621	2535	906	2784	518	0
4	29	538,258	505,186	545,109	537,289	492,308	546,587	4425	13621	2535	829	2553	475	0
5	30	537,289	492,308	546,587	537,067	481,236	548,056	4016	13621	2535	67	226	42	0
6	31	537,067	481,236	548,056	536,869	470,170	549,549	4014	13621	2535	39	134	25	0
7	32	536,869	470,170	549,549	536,083	456,984	550,688	4012	13621	2535	645	2190	408	0
8	33	536,083	456,984	550,688	535,157	443,211	551,747	4007	13621	2535	788	2679	499	0
9	34	535,157	443,211	551,747	534,893	431,649	553,222	4000	13621	2535	100	339	63	0
10	35	534,893	431,649	553,222	534,170	417,786	553,942	3598	13621	2535	589	2231	415	0
11	36	534,170	417,786	553,942	533,739	404,962	554,868	3593	13621	2535	286	1085	202	0
12	37	533,739	404,962	554,868	533,409	392,454	555,871	3590	13621	2535	179	678	126	0
13	38	533,409	392,454	555,871	532,805	378,799	556,688	3588	13621	2535	460	1747	325	0
14	39	532,805	378,799	556,688	532,294	365,420	557,574	3584	13621	2535	362	1374	256	0
15	40	532,294	365,420	557,574	531,507	350,558	558,024	3381	13621	2535	653	2632	490	0
16	41	531,507	350,558	558,024	531,257	337,816	558,874	3376	13621	2535	98	397	74	0
17	42	531,257	337,816	558,874	530,776	324,044	559,557	3375	13621	2535	335	1352	252	0
18	43	530,776	324,044	559,557	529,994	308,947	560,020	3372	13621	2535	643	2597	483	0
19	44	529,994	308,947	560,020	529,220	293,787	560,490	3367	13621	2535	633	2561	477	0
20	**45**	**529,220**	**293,787**	**560,490**	**501,846**	**264,050**	**532,203**	**2966**	**13621**	**2535**	**501**	**2301**	**428**	**1**
21	46	501,846	264,050	532,203	501,262	248,710	532,134	2813	13621	2535	461	2234	416	0
22	47	501,262	248,710	532,134	500,695	233,367	532,080	2810	13621	2535	443	2149	400	0
23	48	500,695	233,367	532,080	500,114	217,876	532,012	2807	13621	2535	455	2210	411	0
24	49	500,114	217,876	532,012	499,462	201,942	531,878	2803	13621	2535	528	2567	478	0
25	50	499,462	201,942	531,878	499,156	187,452	531,832	2613	13621	2535	181	942	175	0







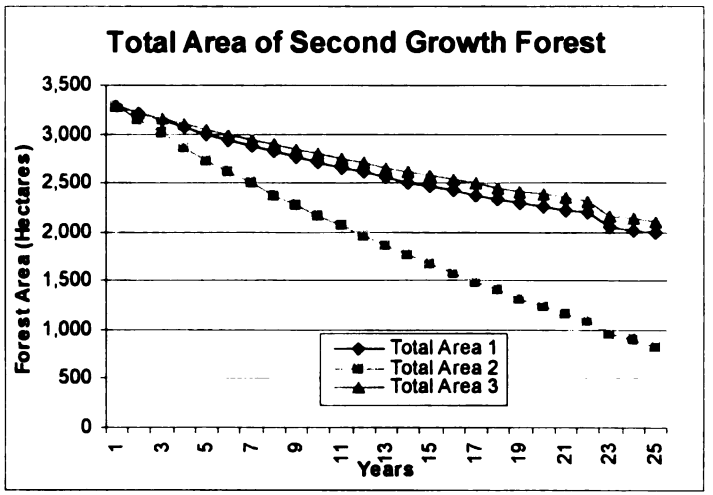


Figure 8. Trend of Opening and Closing Stock for three harvest options, and area disturbed.