Economic and Environmental Concerns in Philippine Upland Coconut Farms: An Analysis of Policy, Farming Systems and Socio-Economic Issues

Isabelita M. Pabuayon, Simplicio M. Medina,
Cynthia M. Medina, Erlene C. Manohar and Jan Irish P. Villegas

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Comments should be sent to: Dr. Isabelita M. Pabuayon, Department of Agricultural Economics, College of Economics and Management, University of the Philippines Los Baños, 4031 College Laguna Philippines

Tel. 63-049-536-3292; 09287506470

Email: isabelitampabuayon@yahoo.com

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EXECUTIVE SUMMARY

This study provides an assessment of the farming and agroforestry systems in upland coconut-based farms and the policy and socio-economic issues in the cutting of coconut trees in the Philippines.

In general, there is a lack of focus on the environmental and agro-ecological aspects of coconut-based farming and agroforestry systems (CBF/AFS) R&D and program initiatives. Nevertheless, earlier works provide recommendations that include soil conservation and the planting of perennials and forest species in the upland and steeply sloping coconut farms. In practice, however, annual crops are planted even in steep slopes; intercropping of coconuts with forest species is uncommon. Generally, coconut intercropping provides higher returns than coconut monocrop. A few recent works provide some lessons on soil erosion in upland coconut farms, intercropping with forest species in limited sites, and environmental impacts of coconut logging; although these do not form part of the national coconut R&D program.

Government programs emphasize rehabilitation of coconut farms but this is constrained by the indiscriminate cutting of coconut trees. A cutting regulatory policy is being implemented which requires obtaining a cutting permit. The topography of the coconut farm and possible environmental impact of cutting are not considered in evaluating permit applications even though around 30% of the coconut lands are in mountainous areas. Currently, there is a moratorium on the issuance of permits nationwide to address the continuing illegal cutting. Responses of key informants on the implementation of the moratorium are mixed; some believe it is effective in stopping illegal cutting, others think otherwise.

There is more cutting in sloping than in relatively flat areas in the study sites. The potential threat to the environment of not maintaining adequate vegetative cover was observed when the destructive typhoon "Frank" hit the country in June 2008. There was evidence of some rill and gully forms of erosion in certain coconut farms that are predominantly sloping.

Farmers obtain immediate financial benefits from the cutting of coconut trees; and they are more inclined to do so when coconut prices are unfavorable as is true in the past. Currently, farmers believe that cutting should not be done due to upward trends in coconut prices. The environmental threat is not apparent at least among the case farmers. This finding suggests a limited appreciation of the social benefits and costs of indiscriminate cutting of coconut trees vis-à-vis sustainable production and agroforestry systems in the upland coconut farms. Given the limited resources of the government and weak local institutions and law enforcement agencies, cutting is likely to continue as long as there are appreciable financial returns. A prudent course of action requires a thorough and in-depth assessment of CBF/AFS covering a wider study area in order to obtain more robust results and conclusions. This is to integrate in the analysis the great variability in the biophysical characteristics, socio-economic settings of farmers, and market conditions in different parts of the country. These differences will affect the choice, acceptability and adaptability of possible CBF/AFS that may be considered to address both economic and environmental concerns in upland coconut farms.

1.0 INTRODUCTION

1.1 Context and Problem Description

Due to the scarcity of wood in the Philippines, cutting of coconut trees for commercial sale of coco lumber (coco wood) or coconut logging has become widespread. This has raised sustainability concerns both on the economic viability and competitiveness of the coconut industry and the environment considering that an estimated 30% of the coconut lands in the country are in mountainous areas.

Thus, the cutting of coconut trees is generally prohibited and allowed only under certain conditions, after payment of mandatory fees and planting of replenishment seedlings, in which case a permit-to-cut (PTC) is issued. Republic Act (RA) 8048 otherwise known as the "Coconut Preservation Act of 1995", stipulates that a PTC may be issued when the trees are already unproductive, disease- or pest-infested, a hazard to life and property; or the coconut land has been approved for conversion to another use.

Despite the above policy, indiscriminate and illegal cutting of coconut trees continues in many areas (Medina 2005; Aranas 2006 and Esguerra 2007). While the policy also aims "to promote the growth of the national industry by embarking on a sustainable and efficient replanting program", success rate of the program is limited.

Medina (2005) reported about illegal coconut logging in her study of coconut communities in two municipalities in Quezon province. Coconut logging occurs in various forms, namely: (a) cutting without a PTC from the Philippine Coconut Authority (PCA), (b) recycling of approved PTC and transport clearance, (c) cutting in excess of the approved volume, and (d) cutting without replanting. While cutting of trees at least 60 years old is allowed, there are claims that trees as young as 15 years old are cut for immediate income. The study also reported that 32% of the coconut farmers had their farms in sloping areas. Of these, 61% confirmed being engaged in coconut logging.

1.2 Significance of the Study

Unabated and lacking replenishment, coconut logging could lead to deterioration of the coconut resource base, and eventually declining competitiveness of the industry. This is a primary concern since the coconut industry is a major pillar of the Philippine economy with considerable contribution in agricultural value added, annual foreign exchange earnings of US$965 million, and livelihood dependency for 3.4 million coconut farmers plus some 25 million people more employed in coconut-based enterprises. Unfortunately, coconut communities are among the poorest sectors in Philippine society.

Environmental risks are associated with the loss of the soils' water-holding capacity particularly during persistent torrential rains when trees are cut on large scale basis. A study in Quezon shows that although erosion rate in coconut farms is lower in coconut plantation compared to other cases such as coconut with corn intercrop, bare area and fallow area, it generally increases with slope in all cases (Josue 1999 as cited by Sangalang, and FSSRI et al. 2003). Cutting of coconut trees without replanting exposes the soils to adverse weather conditions and makes them vulnerable to erosion. In extreme cases, soil erosion in hilly and sloping areas causes landslides and flashfloods. The country's experiences of massive destruction of lives and properties from natural catastrophes (land/mudslides and flashfloods due to strong typhoons) in Ormoc, Leyte (1991), Southern Leyte and Surigao (2003), and Aurora and Quezon (2004), *which are all coconut-producing areas*, attest to environmental degradation arising from forest denudation and possibly logging in coconut farms.

Given the situation, there are reasons why farmers choose to cut their coconut trees, and when they do, they do not fully replant. Considering widespread poverty in coconut communities, it appears that while cutting provides immediate financial returns to poor farmers, the same does not manifest in replanting. Financial incentives appear small to warrant maintaining adequate stock of trees that will ensure continued viability of the coconut farming business while at the same time reduce the risk of environmental damage during adverse weather conditions. Such divergence between private interest (financial incentives to farmers) and public interest (risk of environmental damage) provides scope for government intervention. The ineffectiveness of the current policy, however, suggests its weakness to address the economic needs of the farmers and mitigate the adverse environmental impacts of continued cutting of coconut trees.

While this problem may be addressed through management and production possibilities that meet both economic and environmental objectives, a preliminary analysis of the issues involved is imperative. This initial work provides basis for undertaking a more in-depth study of resource management options aimed at determining improvements in the current coconut preservation policy and rehabilitation program of the country.

1.3 Research Objectives

This study aims to provide an assessment of the farming and agroforestry systems in upland coconut-based farms and the policy and socio-economic issues in coconut logging. The specific objectives are to:

1. Assess research works and initiatives relating to agricultural production systems and agroforestry practices in upland coconut-based farms;
2. Review the coconut cutting regulatory policy guidelines and assess the extent of implementation; and
3. Understand the socio-economic factors that lead farmers to engage in coconut logging.

2.0 RESEARCH METHODOLOGY

2.1 Conceptual Framework

Coconut logging refers to the cutting of coconut trees for processing into lumber, called coco lumber or coco wood. In the Philippines, coco lumber began to be used significantly when premium wood from forest species became scarce as a result of deforestation. When protected from sun and rain, and especially when applied with preservative treatment, coco lumber lasts a good number of years and provides a cheap alternative to the expensive wood species.

Coconut logging takes two forms depending on the extent and management system (Figure 1). The first is as a sustainable farm management option to eliminate old, unproductive trees and replace them with new coconut plants that become productive starting on the sixth to 10th year depending on the variety. The second involves indiscriminate cutting such that even productive trees are cut while replanting is not or inadequately done. Either way, the practice provides a quick and good source of income for farmers. The first option provides a sustainable resource base for the livelihood of farmers (the micro effect) and the growth of the coconut industry to supply the needs of domestic and international markets and obtain foreign exchange and generate employment for the economy (the macro effect). It also protects the environment particularly in the uplands through control of soil erosion, maintaining biodiversity, microclimate enhancement, and carbon sequestration. The second option lowers farm productivity and leads to loss of income and employment in farming communities and dependent coconut-based industries. Continuous indiscriminate cutting could lead to adverse impacts on the environment.

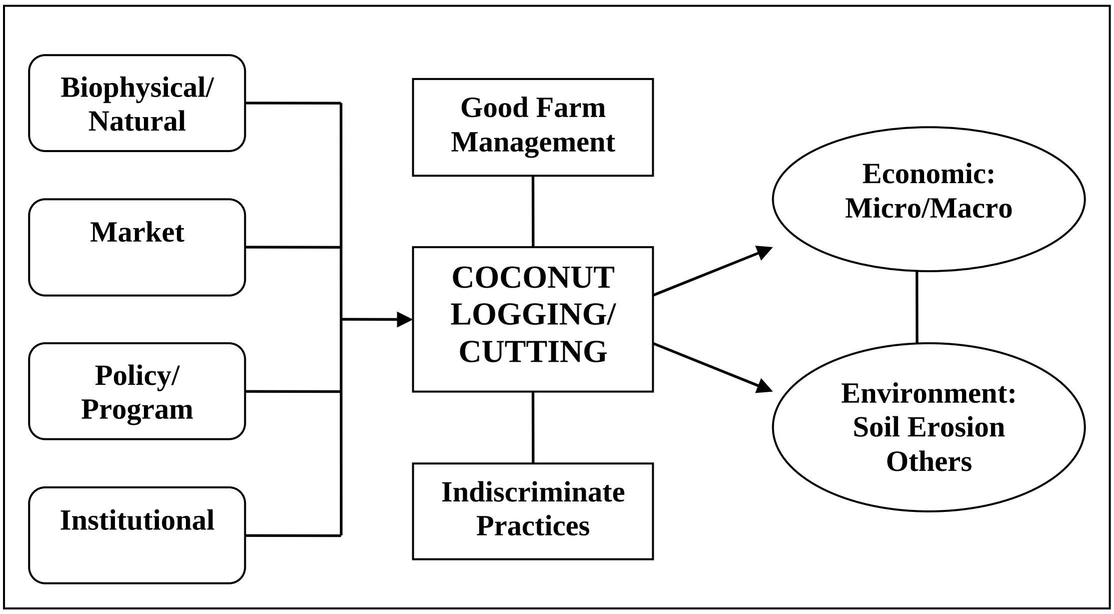


Figure 1. Conceptual Framework Showing the Causes and Effects of Coconut Logging/ Cutting

Various factors influence farmers' decision to cut their coconut trees and in ways that could bring about positive or negative economic and environmental effects. Biophysical and natural factors include the age and productivity of trees; occurrence of typhoons and natural calamities including pests and diseases that damage the trees; and topography of coconut farms. Market factors refer to prices and profitability of coconut farming relative to other productive activities as well as prices of coco lumber. Poor prices of coconut products such as whole nuts, copra, coconut oil and other non-wood coconut products result in low farm incomes and create disincentives for good farm management practices. Effective implementation of the cutting regulatory policy and adequate support for replanting and intercropping could enhance farm productivity. Institutional factors such as coordination among farmers' groups, the private sector, local government units (LGUs), and the government regulatory agency could lead to greater success of farm productivity and income enhancing measures and may reduce indiscriminate cutting of trees.

This preliminary study looks at some of these factors as they affect coconut cutting as well as reviews coconut-based farming systems (CBFS) research and policy initiatives.

2.2 Study Approach

The approach of the study reflects the various aspects of the methodology adopted (Figure 2). These include the focus, data requirements and sources, and scope of analysis.

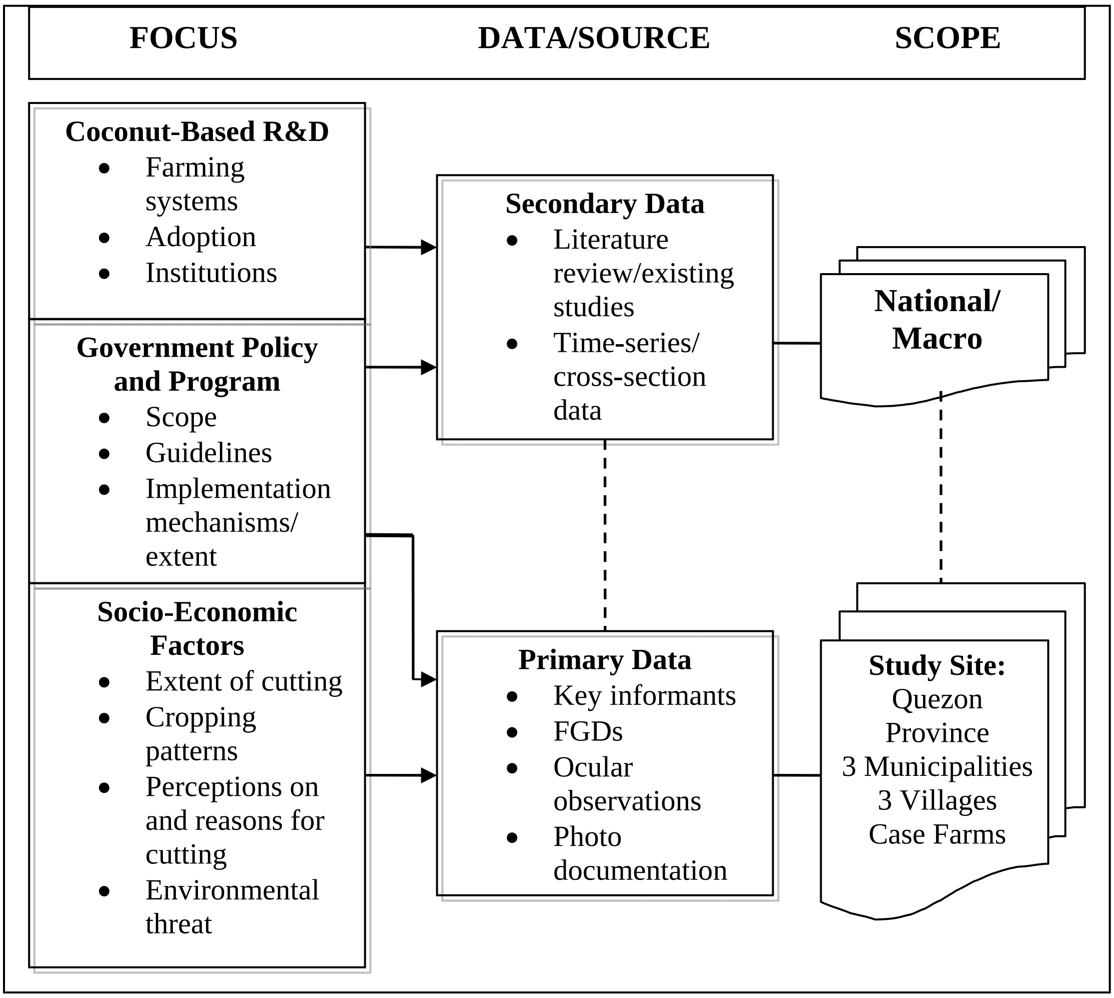


Figure 2. Study Approach in Terms of Focus, Data and Sources and Scope

2.2.1 Focus of Analysis

The study covers three main aspects; namely, (a) the current state of CBFS research including R&D institutions, cropping patterns, and farm adoption; (b) the coconut cutting regulatory and replanting policy guidelines and implementation; and (c) the socio-economic factors that affect the farmers' decision-making environment including the characteristics of the case farms and preliminary observation of environmental threat of coconut logging in the study sites.

2.2.2 Types and Sources of Data

Assessment of CBFS R&D involved review of studies undertaken in various research and academic institutions. The studies were classified according to the period when undertaken; geographical scope; institution; type of study or material; data used; and ecosystem. Policy evaluation was done by reviewing the cutting policy guidelines, analyzing time-series data, and consulting with key informants from PCA and other stakeholders. The socio-economic context of coconut logging was analyzed by obtaining primary data from case farmers and their farms through focus group discussions, key informant interviews, ocular characterization, and photo documentation of the farms.

2.2.3 Scope and Tools of Analysis

Review of CBFS R&D and evaluation of the coconut cutting policy was done in the national context. However, the socio-economic analysis in relation to the national R&D and policy was undertaken in selected study sites consisting of three *barangays* (villages) from three municipalities (towns) of Quezon province (see map in Figure 3). These are Brgy. Pandakaki in the municipality of Tayabas, Brgy. Concepcion in Mauban, and Brgy. Bulihan in San Antonio. Each *barangay* typifies certain characteristics to allow comparison across different topographies and farming systems. Additional information from other municipalities assigned to PCA personnel who served as key informants were analyzed to provide insights for Quezon province. The FGDs consisted of 10-12 participants each comprising of farmers, *barangay* officials, and a representative from the PCA. From the FGDs, key informants representing 15 case farms were interviewed to obtain detailed data on their socio-economic characteristics and farming operations including sensitive information that could not be obtained during the FGDs. Sensitive information refers to illegal cutting operations. The case farms included five in Tayabas, eight in Mauban and two in San Antonio. These farms were visited for observation of actual farming conditions.

Data analysis is largely qualitative involving the use of descriptive statistics (means, totals, percentages) with data presented in tabular and graphical forms. Assessment of economic relationships involved simple costs and returns and correlation analyses. Farm productivity and net income were estimated for typical CBFS. Some market relationships were derived by correlating coconut prices and extent of coconut logging.

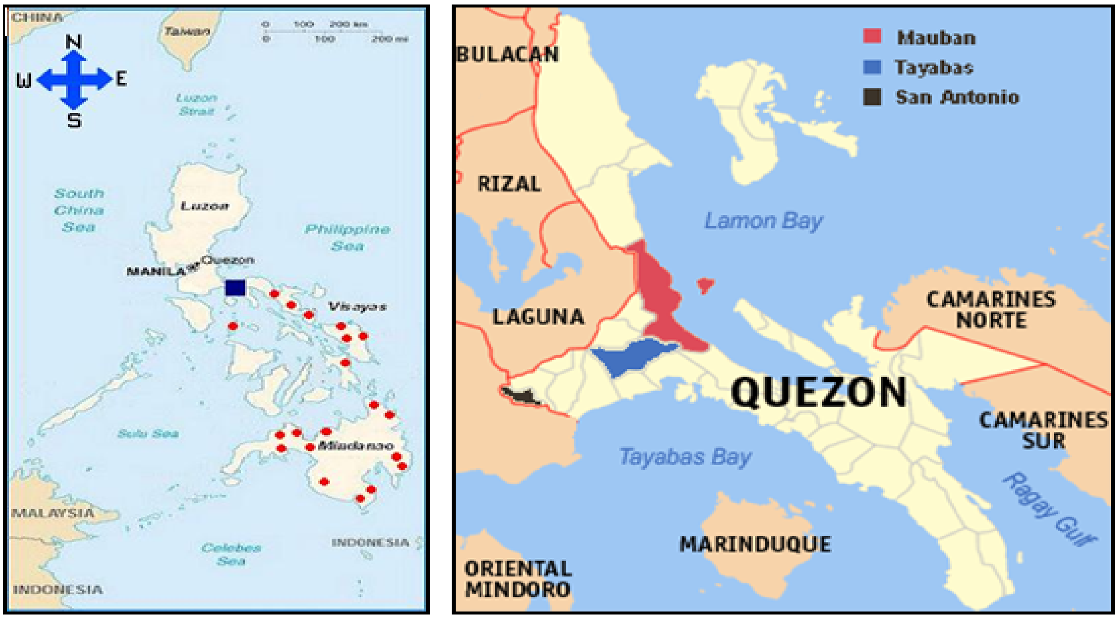


Figure 3. Map of the Philippines (left) Showing the Study Site (blue rectangle) and other top 19 Coconut Producing Provinces (red dots), and Quezon Province (right) with the three Municipalities covered (red, blue and black)

3.0 ASSESSMENT OF COCONUT-BASED FARMING AND AGROFORESTRY SYSTEMS R&D

3.1 Overview of Researches Undertaken

This section reviews research on CBFS and agroforestry systems (AFS). Reference to CBFS/AFS varies considerably across the materials reviewed depending on their respective contents and scopes. Table 1 provides a summary of the 35 materials reviewed; classified by year, agency, type, geographical scope, data analysis employed, and indicative ecosystem covered by the study. The materials are listed in the References.

Table 1. Number of Studies/Materials on Coconut Farming Systems by Classification, Philippines, 1981-2008

Classification	*Number*	*Percent*
By Year		
1981 – 1990	9	26
1991 – 2000	14	40
2001 – 2008	12	34
Total	35	100
By Agency		
BAR	5	14
World Agroforestry Centre (ICRAF)	1	3
PCA	2	6
PCARRD	15	43
United Coconut Associations of the Philippines (UCAP)	5	14
UPLB	7	20
Total	35	100
By Type		
Book series/booklets	5	14
Paper/Research Compilation	16	46
Proceedings and Paper Presented	8	23
Research Report	2	6
Thesis/Dissertation	4	11
Total	35	100
By Geographical Scope		
National	20	57
Regional/Provincial/Local	15	43
Total	35	100
By Methodology		
Primary Data Analysis		
Actual/case and survey farms	12	35
Experimental/on-farm trials	10	29
Both actual/case and survey farms and experimental/ on-farm trials	2	6
Secondary Data Analysis		
Review of selected studies	7	20
Review of selected studies with data series analysis	4	11
Total	35	100
By Ecosystem/landform		
Includes Upland/Sloping	12	34
General	23	66
Total	35	100

The studies are mostly listed under the Philippine Council for Agriculture and Natural Resources Research and Development (PCARRD) since it is the national coordinating body for agricultural R&D. It spearheads meetings, workshops and symposia for presentation; review; and dissemination of research findings conducted by various institutions such as the PCA, Bureau of Agricultural Research (BAR), and University of the Philippines Los Banos (UPLB) particularly those of the Farming Systems and Soil Resources Institute (FSSRI).

R&D on coconut began in the 1980s or even earlier and continued on until the present. The studies are currently available in the form of individual papers or compilations published in books, monographs, and proceedings. Some are student theses and dissertations. Some are national in scope; others are focused on specific study areas. Studies involve primary data analysis of actual farms covered by socio-economic surveys or experiments/on-farm trials. Others analyzed time-series data or previously reported results of other studies. Most studies do not distinguish between upland, lowland or other landforms with a few that mentioned uplands but only to a limited extent. Exceptions include one dissertation focused on the upland coconut ecosystem and a fertilization study for various agro-ecological coconut farms.

3.1.1 Trends in CBFS Research

The coconut R&D agenda is in line with the priority thrusts of the government for the development of the agricultural sector in general and the coconut industry in particular. The National CBFS R&D Program in the 1980s was anchored on the objectives of increasing coconut production, improving farm productivity, and enhancing farm income. Thus, most studies focused on the technical production aspects like fertilization, breeding, crop protection, and cultural management of farms.

Significant outputs during the 1980s and 1990s were compiled in a number of publications. One is the *State of the Art: Coconut Research* which gives an overview of the status of the coconut industry and research in the Philippines until 1983. It traces the research developments in coconut breeding, propagation and nursery management, nutrition, multiple cropping, coconut-livestock farming system, pests and their control, processing and utilization. The other is the *Coconut-Based Farming Systems: Status and Prospects* (1984) which is an integration of information from scattered experiences and research undertaken by the FSSRI and PCA. This publication defines CBFS and its objectives and presents the technical aspects of farm and soil resources management (proper planting methods, fertilization and other production techniques), specific cropping/intercropping patterns including costs and returns, and the requirements for optimum growth of coconut. Two other publications included in PCARRD's book series are the *Coconut R&D* (1988) and *Coconut-Based Farming Systems* (1994).

As part of CBFS R&D program, success stories involving case farms in various coconut-producing areas were documented in the early 1990s to assess current practices and impacts of introduced technologies. BAR also put together existing knowledge and practices on CBFS in its publication in 1991. In 1993, PCARRD coordinated the consolidation of information on actual practices and recommended technologies from farm production to processing, marketing and utilization via its publication *The Philippines Recommends for Coconut*. The processing aspect includes timber utilization to convert unproductive trees that were cut into commercially beneficial wood products.

Except for recommendations on the intercropping of perennials in upland coconut farms, the environment aspect received little attention in CBFS research up until the late 1990s. Most of the on-farm trials involved annual crops and were done in relatively flat coconut areas. There was no particular focus on sloping coconut farmlands.

Thereafter, the increasing concern for the environment and natural resources and the need to address sustainability as well as poverty alleviation issues provided a new focus for coconut R&D, although not as part of the national coconut R&D agenda. Additionally, trade/marketing and policy issues have become increasingly important. Most recent studies are on coconut rehabilitation in typhoon-damaged areas and effect of fertilization in agro-ecological areas (personal communication with PCARRD staff). Still, the environmental aspect relating to soil erosion control is not a key focus of these studies.

The new wave of studies attempted to address the intertwined objectives of (a) increasing the efficiency of coconut production, (b) improving farm incomes of coconut farmers, and (c) ensuring a sustainable coconut resource base. The latter has received comparatively less emphasis in early CBFS R&D although mention has been made about the advantages of intercropping using perennials in upland and sloping areas, other appropriate soil conservation practices, and the ideal environment for coconut farming. Some key concerns addressed in the recently conducted studies are as follows:

1. Environmental impacts (soil erosion) of coconut-corn cropping system and coconut monocrop (Josue 1999);
2. Yield and income from coconut-*gmelina* and multiple crop combinations (Secretaria and Magat 2004/2005);
3. The coconut market chains, constraints and opportunities (Pabuayon et al. 2006);
4. Evolution of intercropping and effects of intercrops including forest species such as teak, *mahogany* and *gmelina* on coconut in a selected community (Bullecer et al. 2006);
5. Recommended technologies and practices for coconut-based AFS (PCARRD 2006);
6. A framework and methodology for analyzing the total value of goods and environmental services provided by coconut (UPLB 2002);
7. Economic and environmental impacts of cutting coconut trees (Medina 2005); and
8. Policy recommendations considering the links among poverty, environment and market factors (Pabuayon and Medina 2007).

3.1.2 Economic Analysis in CBFS Research

In most cases, research on CBFS/AFS involved financial analysis to demonstrate the returns to coconut farmers adopting particular cropping patterns. The usual analytical tool is one-time costs and returns on per hectare per year basis; some involving only cash revenue and expense items, others only gross revenues without cost analysis. Investment analysis involving several years timeframe appropriate for coconut, perennials and tree species is rarely done; if at all, this did not involve discounted benefit-cost analysis (BCA). Except for Medina (2005), total valuation that includes environmental costs and benefits (discounted) was not undertaken. The UPLB study (2002) attempted to develop and demonstrate such valuation methodology but this was only for the benefits (costs excluded) covering one-year period. While Medina's study provided a superior framework of analysis compared to the rest, it was not focused on upland coconut farms and did not consider possible AFS involving forest species suitable in steep and mountainous areas. Moreover, it only covered two municipalities in one province out of the 69 coconut-producing provinces in the country. Enforcement cost of coconut cutting policy was also not accounted for.

3.2 Coconut Suitability and Environmental Considerations

3.2.1 Suitability in the Philippines

Coconut is grown extensively in the tropics with commercial production concentrated mainly in Asian and Pacific regions. The Philippines, Indonesia, India, Sri Lanka, Thailand, Malaysia and Papua New Guinea together account for about 80% of the world coconut production (Magat 1993). This proves the suitability of coconut in these regions in terms of biophysical and environmental considerations. Anywhere in the Philippines, coconut can be seen in the landscape, though abundance would depend on the presence of favorable conditions for growth. It is estimated that 60% of our coconut lands are under sloping areas (Magat 1995 as cited in UPLB 2002).

The importance of coconut in environmental protection is viewed from its role in soil erosion control in fragile ecosystems through the ground cover provided by the palms as well as by the intercrops usually planted under it. The coconut crown intercepts raindrops which could be funneled through the frond and flow through the stem. This reduces velocity and raindrop impact that could otherwise detach soil particles and seal the surface upon ground contact. Surface sealing would prevent further rainfall infiltration through the ground that could cause surface run-off and soil erosion. It was earlier found by Roose (1977) that the crop factor of coconut, together with ground cover in the Universal Soil Loss Equation (USLE) is 0.1-0.3, which means that the presence of coconut can control soil erosion by as much as 70-90% from a bare soil.

3.2.2 Standard Optimum Conditions

While coconut tolerates a wide range of conditions, it demands certain standards for optimum growth and productivity. These standards are either climatic or physical conditions that could have direct influence on its growth and performance. Based from the works of PCA, FSSRI and PCARRD, these conditions are presented in Table 2.

It is worth noting that while a slope of less than 8% is ideal for coconut growing, around 60% of coconut lands in the Philippines are in sloping and mountainous areas. As farmers have observed, the top soil in some Mauban farms have already been eroded causing depletion of essential nutrients and organic matter. This explains the lower yields in sloping areas compared to flatlands (discussed in later sections). This situation implies the need for appropriate management practices in coconut farms in Philippine uplands.

3.3 Cropping Models/Technologies

With palm spacing from 7m x 7m to 10m x 10m, coconut growing is one of the most inefficient ways of using land. Given a one hectare coconut farm with a planting distance of 8m x 8m, the effective root area per palm is only 12.5m^2 or about 20% of the total available area, leaving 80% for other possible uses (Rosario 1983). Hence, if productivity is used as measure of land value, coconut lands would rank very low compared to other croplands (FSSRI 1984).

But the potential exists considering that of the more than 3 million hectares planted to coconut in the Philippines, only one-third is intercropped, with 2 million hectares suitable for intercropping (Gapasin 1983 and DA-BAR 1991). The positive effects of intercropping are as follows (Bernard 1994 as cited in CBFS, PCARRD Book Series 146):

1. Intercropping with coconut improves the upkeep of the field; pure coconut stand is usually not well- maintained;
2. Fertilizer on intercrops improves coconut nutrition as well;
3. Legumes, if intercropped enhance the available nitrogen level in the soil; and
4. Harvest is done more easily as farmers visit the stand more frequently.

Table 2. Optimum Environmental Conditions for Coconut Growing

Parameter	*Description*	*Remarks*
Rainfall	Total annual rainfall of 1,800-2,000 mm or more, evenly distributed throughout the year; less rainfall allows normal growth with enough moisture or high water table with good drainage	Coconut areas are prioritized according to rainfall type but prioritization may be complicated when rainfall intensity and slope are factored in
Altitude and latitude	Limit is 600 meters above sea level (masl). In terms of latitude, commercial production is found between 20^o N and 20^o S of the equator.	Above 600 masl, palms usually grow poorly and become stunted suffering from long immaturity period and poor yields
Drainage	Moderate to well-drained soils	Coconut is most sensitive to water logging and soil compaction
Topography	Slope less than 8%	Need to integrate appropriate management practices to mitigate soil erosion hazards considering that 60% of coconut lands are found in sloping areas and the tendency to cultivate and plant intercrops under coconut
Soil depth	Minimum depth of 75cm of solum is best especially if intercropping is to be undertaken; most suitable is soil depth of 100 cm or thicker	Roots of coconut not as extensive as those of forest trees
Soil pH	5.5 – 6.5 pH is ideal; coconut palms can tolerate 5.0 – 8.0 pH	Most intercrops require 5.5 – 6.5 pH
Soil texture	Sandy to clayey but satisfactory growth is achieved in light to medium textured soils with high water holding capacity	Loamy soils with medium to high fertility levels are best for intercropping
Inherent soil fertility	Adequate essential elements (N, P, K, Ca, Mg, S, Fe, Cl, Mn, Zc, B, Cu, Mb) and OM	Erosion of top soil in sloping areas causes depletion of these nutrients and OM

However, there are also some possible negative effects of intercropping under coconut but these could be mitigated by proper management or integrating other practices in the system. These negative effects are as follows:

1. Water and nutrient competition;
2. Deficiencies induced by some crops, such as boron deficiency with cassava in sandy soils;
3. Soil compaction when integrating cattle with coconut;
4. Damage to leaves of young coconuts if cattle or goats are raised with the coconut;
5. Erosion in sloping areas; and
6. Pest and disease damages induced by intercrops, such as *Phytopthora* which can damage both durian and coconut.

As such, there are several cropping models and technologies with coconut as the main crop that could maximize the use of the land and substantially increase farmers’ income (Villegas 1991). These are explained below.

Coconut + Annuals

Annuals maybe planted in flat to gently rolling areas where there is less soil erosion hazard. Growing of annual crops can accelerate soil erosion in steep slopes or hilly lands due to clean culture and frequent cultivation (FSSRI 1984). Where there is little choice but to plant annual crops on sloping lands, appropriate soil conservation practices such as terracing or strip cropping should be done if technically and economically feasible. Nonetheless, there should be a limit to slope steepness when planting annual crops. Vegetables can be planted for slopes of 5% and fruit crops for intermediate slopes of 8-15%. At 16-30% slope, pasture grasses can be planted. Above these, annual crops should not be planted anymore.

The preferred annual intercrops with coconut are corn, cassava, sweet potato, upland rice, *gabi*, peanut and vegetables (Cuevas 1975 and Escalada et al. 1982). At present, most coconut farms, whether in flat or sloping lands have the same intercrops since they provide a ready source of food and income. These intercrops however need intensive cultivation, are nutrient-depleting, or may require cutting the coconut. Corn intercropped under coconut increases the rate of soil erosion relative to monocrop coconut (Josue 1999). The current vegetable (tomato) production in the sloping areas of Liliw, Laguna had caused the cutting of coconuts. The exposed farmlands which are subjected to continuous cultivation for vegetable growing have become prone to soil erosion. This implies that the environmental concerns and preservation of coconut have seemingly taken a backseat then and even now.

There are guidelines on the cultivation of annual crops and as coconut intercrop in sloping areas (Gomez and Gomez 1983) but these are not widely practiced. These guidelines should form the basis for a more sustainable coconut + annuals intercropping system. They include the following:

a) Maintain a vegetative cover on the soil and practice relay cropping, ratooning, minimum tillage and mulching;

b) Rotate nutrient-depleting crops such as grasses and root crops or intercrop them with nutrient-conserving crops like legumes;

c) Plant longer maturing crops which require less frequent disturbance in soil which is highly erodible and where rainfall is heavy; and

d) Grow root crops on coarse- to medium-textured soils.

Coconut + Perennials

Perennials maybe confined to the steeper slopes (FSSRI 1984). In slopes beyond 30%, forest trees are recommended (Yahata 1977 as cited in FSSRI 1984). At steep slopes (30% and above), watershed trees such as *mahogany*, *narra*, teak, bamboo and coconut should be planted while planting annuals must be strictly avoided (Josue 1999).

The popular perennial intercrop under coconut in the Philippines is banana. Though commonly planted in flatlands due to their vulnerability to typhoons and strong winds, they are intercropped even in the sloping coconut farms in Mauban, Quezon. Other preferred perennial intercrops in Southern Luzon are coffee, *lanzones*, pineapple and *papaya*. In Mindanao, choice intercrops also include coffee, black pepper, pineapple and cacao.

Compared to annuals, perennials as intercrops are advantageous because they provide a sustained supply of additional food and income; give longer term or permanent soil cover to reduce soil erosion in hilly areas; are more suitable than short-term crops for stony, rolling and steep formations; and offer effective land use (FSSRI 1984). When high-value fruit trees are cut together with coconut as in land conversion cases, the prospect of environmental protection brought about by denser canopy may be compromised. More research is needed to underscore the observation of Medina (2005) that the presence of coconut improves the microclimate which in turn enhances the growth and productivity of *lanzones.*

Coconut-based Agroforestry/Multi-storey Cropping System

Multi-storey cropping is growing coconut and a combination of crops of different heights; rooting characteristics; and canopy patterns so as to maximize utilization of sunlight, nutrients and moisture (FSSRI 1984). In the same manner, the wide spaces between coconuts in coconut-based AFS allow the planting of intercrops such as annuals or perennials (*Philippines Recommends for Agroforestry* 2006).

Though both systems involve annuals, they are suitable also in sloping lands because of crop complementation and increased canopy cover providing greater soil and environmental protection. Multi-storey cropping offers a more efficient resource utilization and effective land protection not only on a long-term basis but also at any one time. Coconut-based AFS, exemplified by the 1:4 AFS developed in Silang, Cavite, involves planting four types of crops which can be developed in four stages. During the last stage, there must be at least four semi-perennial or permanent crops planted. Soil protection is provided over time and soil compaction is reduced.

Integrating trees with coconut could also be done in flat and sloping lands, but it should be done with caution. Bullecer et al. (2006) found that planting fast-growing and timber trees under coconut such as *Leucaena*, *mahogany* and *gmelina* is not recommended since they can adversely affect copra production. While environmental protection is afforded, economic benefits from coconut is reduced which could make the scheme less acceptable to farmers.

Coconut-Livestock Integration

Integrating livestock with coconut offers bright prospects toward filling-up the meat requirements of the country and provides one-time sizable income to the farmer. However, one disadvantage is the resulting soil compaction when raising large animals. Also, the farmer would have to engage in pasture development to sustain the animal. If this is done under coconut, it may preclude planting of intercrops that maybe preferred by the farmer.

Highlights of Cropping Systems/Models Research

The models that are adopted in the Philippines or have been the subject of on-farm experimental trials are presented in Appendix Table 1 by location and source of information. The salient points from the review are as follows:

1. Majority of the coconut intercropping studies were done in the late 1970s to early 1990s when a greater pre-occupation was to improve the income of small coconut farmers.

2. More annual crops were involved in the cropping models and systems during the early periods. This underscores the need for short-term economic returns over other benefits such as environmental protection. For perennials planted with coconut, most are high-value fruit trees which may cause cutting of coconut if the latter damages the high-value crop during its most productive years.
3. Most of the researches were done in Luzon, especially Southern Luzon and in Mindanao and only a few in the Visayas.
4. Intercropping forest tree species with coconut is limited. While there are researches pointing to their negative effects on copra yield, this has to be studied and verified more extensively because of their environmental functions and benefits.

3.4 Productivity and Profitability of Cropping Systems

Economic studies specific to CBFS include profitability or cost and return analysis in on-farm trials and actual coconut farms, and feasibility studies of various crop combinations under coconut. In profitability analysis, incomes and costs of each crop were estimated individually and added to incomes from coconut either in copra or whole nut production on an annual basis. The feasibility studies involved the estimation of accumulated annual net benefits of different crop mixes over several years.

While majority of the research findings concluded that higher productivity and income in coconut farms are associated with diversified cropping, research results differ across sites. For instance, Bueno (1978) showed that combined income from perennial intercrops such as coffee, cacao, and *lanzones* is substantial and even exceeds that from coconut; but De Luna (2008) and Cabangbang et al. (1991) revealed that net incomes are lower in farms with more intercrops. The latter is due to substantial additional labor costs incurred when integrating more intercrops in coconut farms (De Luna 2008). Income from the four-crop combination involving coconut + coffee+ black pepper + *lanzones* is half that from the two-crop combination of coconut + coffee, according to Cabangbang et al. (1991). Thus, whilst diversification or intercropping is admittedly one good strategy to increase farmers' income, identifying the right combinations of intercrops in relation to cultural management practices is crucial considering the additional cash requirements of each intercrop.

Most of the past profitability studies are about coconut monocrop and intercropping with either perennial or annual agricultural crops. Limited study was done on the profitability of forest tree species grown with coconut. The financial analysis conducted in Davao City by Secretaria et al. (2004) showed that the farming system combining coconut and *gmelina* is profitable even if coconut yield is reduced to a certain extent.

Appendix Table 2 shows the net incomes from coconut farms across various cropping systems. Direct comparison to determine the most financially rewarding crop combinations is not possible since studies were done at different times and locations. Each case is unique with own attributes in terms of cultural management practices as well as socio-economic and biophysical environments (e.g., input cost, yield, selling price of output, size of farm, availability of labor, marketing cost, soil type, slope, rainfall, and variety).

3.5 Coconut Diversification Programs

Intercropping maybe considered for weed control, restoring or improving soil fertility, producing firewood, feeding livestock, diversifying crops or increasing farm productivity.

This is to fully utilize the cultivated areas through intensification of farming system. However, only one-third of the coconut areas in the country are intercropped although more areas are suitable for intercropping. Thus, the government has implemented programs to encourage coconut farm intensification. These programs intended to bring to the farmers appropriate CBFS developed through R&D. However, a major issue in program implementation is the apparent lack of attention on environmental concerns. Assessment of CBFS in coastal, lowland and upland areas is not considered in programs so far implemented.

3.5.1 *Maunlad* Program (1999-2001)

The *Maunlad Na Niyugan Tugon sa Kahirapan* Program was launched by the PCA and implemented in all coconut growing provinces to uplift the plight of the coconut farm households and enhance food security. Intended to showcase CBFS technologies, some 300 model farms were established. As of 2006, only 200 such farms exist with a total area of 5,076 hectares. The farm projects that have been sustained involved intercropping coconut with fruit trees, banana and vegetables; and cattle fattening. The components of the program are as follows:

1. Farm productivity such as intercropping, organic fertilization, replanting, cover cropping, crop diversification, aquaculture, livestock and poultry integration;
2. Research, development and extension which included packaging, transfer of technologies, training of field staff and farmers, information dissemination and technology generation;
3. Credit and marketing assistance to support viable enterprises;
4. Post-harvest and processing (provision of copra dryer and charcoal kilns) and training on processing and post-harvest handling of farm products;
5. Infrastructure support and common services such as construction of farm-to-market roads, installation of shallow tube wells and small farm reservoirs, warehouses, and farm mechanization;
6. Monitoring and evaluation to enhance closer coordination and cooperation among the beneficiaries and implementers to ensure the needed support; and
7. Administrative services to fully equip PCA in spearheading the program.

3.5.2 Poverty Reduction in Coconut Growing Communities (2002-2008)

This was conceptualized by the Coconut Genetic Network as a people-oriented project to test sustainable coconut-based income-generating technologies in strategic coconut growing communities. The strategy is to involve community-based farm organizations (FOs) in the utilization of technically feasible, economically viable, socially acceptable and environmentally safe technologies. Implemented by the PCA, nine pilot project sites were already established. These have been proposed for replication in the 69 coconut growing provinces nationwide (one demo site each). The project components are as follows:

1. Skills training and capacity building;
2. Production and marketing of high-value intercrops and coconut products;
3. Integration of livestock and poultry raising;
4. Provision of equipment and fabrication of simple equipment; and
5. Establishment and improvement of the micro credit system.

4.0 COCONUT CUTTING REGULATORY POLICY

4.1 Enabling Laws

Due to the importance of the coconut industry to the Philippine economy and dependent sectors, the government's objective is to maintain a sustainable coconut resource base. Although the objective has environmental implication, the underlying premise is more economic in nature - ensuring an adequate supply of raw materials and products for the coconut industry. Four major enabling laws support this objective, namely:

1. RA 8048 or the Coconut Preservation Act of 1995 and its Implementing Rules and Regulations as defined in PCA Administrative Order No. 02 Series of 2005;
2. Executive Order No. 213 of 2000 Constituting the National Enforcement Task Force or NETFORCE on Coconut Tree Conservation;
3. Executive Order No. 015 Series of 2007 of the Office of Quezon Provincial Governor Reconstituting the Quezon Coconut Industry Development Council, Appointing the Members Thereof and for Other Purposes; and
4. Memorandum Circular No. 02 Series of 2008 or the Moratorium on the Issuance of Permit to Cut Coconut Trees.

In addition, the PCA implements various rehabilitation and replanting programs supported by funds from both national appropriation and foreign donors.

RA 8048 is an act providing for the regulation of the cutting of coconut trees, its replenishment, providing penalties therefore and for other purposes. The basic policy reads as follows:

> "The State recognizes the role of the coconut industry in nation building and development due to the importance of the coconut industry in the economy, it being one of the principal industries and one of the largest income earners of the country, benefits from which should meaningfully be felt by farmers. Thus it becomes mandatory for the Government to step in and regulate the unabated and indiscriminate cutting of coconut trees. For reasons of national interest, it is hereby declared the policy of the State to provide for the *regulation of the cutting of coconut trees* as well as to promote the growth of the national industry by *embarking on a sustainable and efficient replanting program*."

EO 213 supports RA 8048 by ensuring an effective and timely coordination among the concerned agencies, LGUs and private sector in implementing its provisions. Called the NETFORCE, this coordinating body is composed of the heads of the Department of Agriculture (DA), PCA, Department of Agrarian Reform (DAR), Department of Justice (DOJ), Department of Environment and Natural Resources (DENR), Philippine National Police (PNP), Bureau of Internal Revenue (BIR), Coast Guard, and National Mapping and Resource Information Authority (NAMRIA). Its functions are as follows:

a) Formulate plans of action to control the rampant cutting of coconut trees;
b) Organize the Regional Composite Teams composed of the member-agencies to execute the plans of action; and
c) Establish detachment stations and designate roving inspectors and patrols to monitor coconut-cutting related activities and effect the arrest of violators.

EO 015 is a provincial ordinance that creates a Council with specified functions some of which are as follows:

a) Formulate an annual and long-term development plan to ensure the successful rehabilitation of the coconut industry;
b) Ensure the full participation of non-governmental organizations (NGOs), peoples' organizations (POs) and other sectoral organizations, the private sector and LGUs within Quezon province in the rehabilitation of the coconut industry;
c) Coordinate, monitor and evaluate the implementation of the project; and
d) Create a Task Force to monitor the illegal cutting of coconut trees pursuant to RA 8048.

MC 02 is also a national directive from the PCA stating that "all issuances of permit to cut coconut trees and the corresponding transport/transshipment clearances are suspended nationwide except on a limited exception and under certain circumstances". It was issued to arrest the ever-increasing and unabated incidence of illegal cutting of coconut trees.

4.1.1 Implementing Rules and Guidelines

Under RA 8048, the cutting of coconut trees is prohibited. However, there are requisites under which cutting is allowed in which case a PTC must be obtained from the PCA. These requisites are as follows:

1. Existence of a valid ground which could be any of the following: (a) the tree is 60 years old or more; (b) the tree is no longer economically productive; (c) the tree is severely disease-infected and/or pest-infested; (d) the tree is damaged by typhoon or lightning; (e) the coconut land shall have been approved for conversion into residential, commercial or industrial areas; (f) the coconut land shall be converted into other agricultural-related activities; and (g) the tree would cause hazard to life and property;
2. Filing of valid application and payment of non-refundable application fee amounting to PhP100-1,000 depending on the number of trees, and cutting permit fee of PhP25 for every tree applied for cutting;
3. Planting of the required equivalent number of coconut seedlings;
4. Delivery to PCA of the equivalent number of seedlings or payment of PhP100 for every tree applied for cutting in case of land conversion; and
5. Issuance by PCA of a valid PTC.

For coconut lands to be converted to other uses, the cutting application must be accompanied by an approval certificate from the DAR and DA for (1-e) and (1-f), respectively; as well as the zoning regulations of the LGUs. In general, land conversion projects must also satisfy environmental compliance under the Philippine Environmental Impact Assessment System. In any case, from the point of view of the PCA, only the approval of these agencies is required in addition to their requirement that the coconut farm is no longer economically productive. The latter applies specifically to (1-f). Thus RA 8048 is silent on whether cutting may be disallowed if the removal of coconut trees in a given area (partial or clear cutting) could potentially bring about environmental problems. Such problems are likely in areas where trees are cut in sloping and marginalized areas without guarantee of replanting, reforestation, or soil conservation measures. As shown below, cutting is done both in upland

and lowland coconut farms. Topography of the area is not considered in evaluating cutting applications. The procedure for securing the PTC is shown in Figure 4.

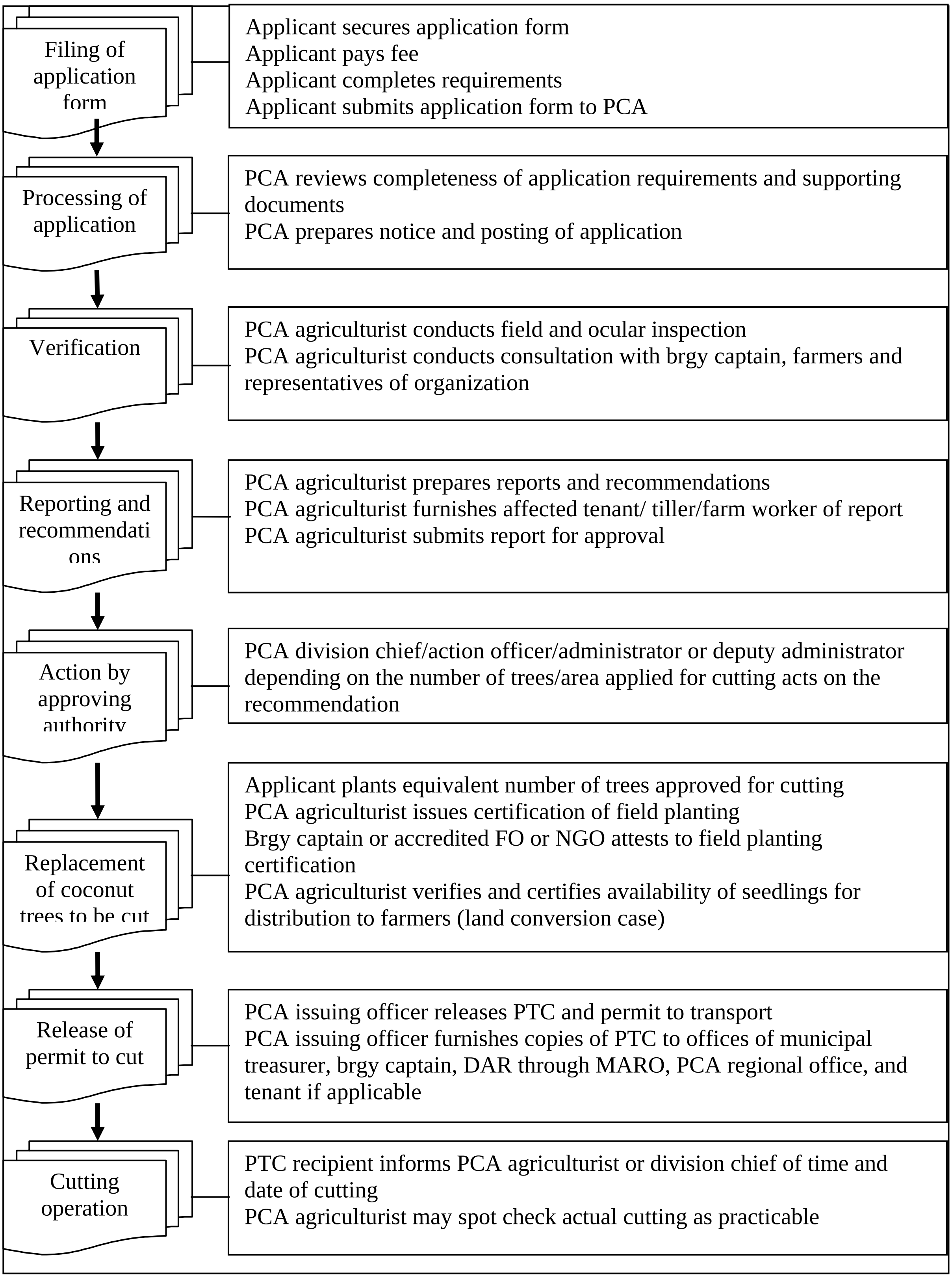


Figure 4. Procedure of Securing Coconut Cutting Permits

Since replanting is part of the process, theoretically, every tree cut is replaced. However this is not the case for those involving land conversions wherein seed nuts are simply certified as being available for distribution to farmers. Whether they are actually planted or not is not fully monitored. The process also shows that spot checking of actual cutting operations is not compulsory and post-cutting report is not required. After issuance of the PTC, transport monitoring rests with the police agency.

RA 8048 also specifies the provisions for (a) form and validity of the PTC; (b) monitoring including application and issuance of transport permit with payment of corresponding fees; (c) registration of sawmills and lumberyard operators, and processors and dealers of coconut wood products; (d) deputation of the members of the police and law enforcement agencies to investigate, apprehend and cause the prosecution of violators; and (e) enforcement and penalties. Upon conviction, violators are punishable by imprisonment of not less than one year but not more than six years, or a fine of not less than PhP50,000 but not more than PhP500,000, or both.

The issuance of the EO 015 and MC 02 is an indication that RA 8048 and EO 213 are inadequate to control rampant illegal cutting. Following the example of Quezon province to suspend issuance of cutting permits, the PCA imposed a total ban nationwide with the following exceptions:

1. For typhoon-damaged coconut trees in declared typhoon calamity areas;
2. For trees which pose threat and danger to life, limb or property;
3. For trees in areas covered by land use conversion or crop conversion orders duly issued by the DAR and DA, respectively; and
4. Trees needed for personal use of the farmer for family housing or animal shed, not exceeding five trees.

Thus under MC 02, permits are not issued for cutting unproductive trees. If issued under any of the four conditions above, the transport clearance shall cover a maximum volume of 2,000 board feet of coco lumber for transport within the province only. For Quezon, the application is forwarded to the provincial governor's office for clearance before final approval by the PCA. Based from the FGDs, the procedure involves a long process and the moratorium is being strictly implemented since it took effect in September 2007 in the case of Quezon province and February 2008 for the rest of the country.

4.1.2 Institutions Involved and Coordination Mechanism

The PCA takes the lead in implementing the cutting policy and replanting program. It has regional and provincial offices nationwide and employs coconut development officers (CDOs) who work directly with the farming communities. Each CDO (the PCA agriculturist referred to in RA 8048) is assigned to 1-2 municipalities and covers from 16 to 47 *barangays* in the case of Quezon. As RA 8048 provides, the PCA shall coordinate with the various agencies in implementing the cutting policy and replanting program (Table 3).

However despite the existence of the NETFORCE that acts as the coordinating body, effective implementation of the policy remains a problem suggesting a structural weakness in the policy. One key informant from PCA indicates the following problems: (a) the agency is only involved in the farm-level implementation and not in the trading aspect of coco lumber,

(b) it has no police powers to track down violators, and (c) approval of land conversion involving large scale cutting of coconut trees rests with other agencies. One observation is the seeming indirect role of the DENR. This role is largely in the monitoring of logs and lumber being transported rather than in ensuring that the environmental aspect of cutting coconut trees in the uplands and mountainous areas is taken into account. In fact, the DENR is not mentioned in RA 8048 and in its implementing rules and regulations.

Table 3. Coordination Mechanisms with Various Agencies in Implementing RA 8048

Agency	*Role*	*Area of Coordination*
DAR	To approve conversion of coconut lands into residential, commercial or industrial areas To prioritize coconut lands for acquisition and distribution under CARP	Processing of cutting permit Disposition of coconut lands subject of violation under RA 8048
DA	To approve conversion of coconut lands into production of other commodities	Processing of cutting permit
SCFO/PO/NGO	To certify field planting of replacement for coconut trees applied for cutting To assist PCA in enforcement of rules	Processing of cutting permit Monitoring, apprehension, confiscation, and prosecution relating to violations
LGU – *Barangay* chairman	To certify field planting of replacement for coconut trees applied for cutting	Processing of cutting permit
LGU - City or municipal mayor	To issue cutting permit if authorized by PCA To implement coconut rehabilitation programs	Processing of cutting permit Rehabilitation of coconut farms
Land Bank	To receive deposits of fees paid to PCA	Processing of cutting permit
DILG	To provide assistance to PCA, together with Small Coconut FO/NGO, in formulating programs related to indiscriminate cutting regulation	Program monitoring for regulating indiscriminate cutting of coconut trees
Provincial or City Prosecutor	To process complaints relating to violations of RA 8048	Prosecuting violations of RA 8048
DTI-BDT, SEC, BIR	To provide information as required by PCA	Registration of lumber processors
PNP/other law enforcement agencies	To assist PCA in enforcement of rules by investigating, apprehending and causing the prosecution of violators	Enforcement of RA 8048
DSWD/DPWH/ DepEd/DOH/ LGU	To identify recipients of illegally cut coconut trees, logs and lumber for disposition	Disposition of illegally cut coconut trees and lumber
Private sector and academe	To assist in formulating coconut development programs	Formulation of programs
DOJ, NAMRIA, DENR, Coast Guard	To serve as members, together with other agencies, of the NETFORCE tasked to coordinate activities for effective implementation of RA 8048	Coordination of activities for RA 8048 implementation

4.2 Extent of Implementation

The cutting regulatory policy took effect in 1995. The PCA monitors and keeps records of cutting, replanting and violations of the provisions of the law. Statistics on trees cut are those covered by the cutting permits; excluded are those illegally cut believed to be substantial. Similarly, data on trees planted are based on official records.

4.2.1 Cutting by Region

Since the implementation of the cutting policy, the number of trees cut based on the permits issued by PCA totaled 8,136,413 or an average of 625,878 trees per year (Appendix Table 3a). Cutting rose sharply by more than three times from 230,830 trees in 1995 to 982,713 trees the following year. It further increased to 1,088,896 trees in 1997, the highest ever during the last 13 years, before it showed a downward trend reaching a low level of 257,690 trees in 2005. Cutting increased again in the last two years which could be the result partly of the large number of trees blown down by the destructive typhoon *Milenyo* in 2006. Although showing great year-on-year variability, trees cut grew at an average of 27% per year.

Heaviest cutting occurred in the large coconut producing regions (Figure 5). These are Region 4A or CALABARZON where Quezon province belongs, Region 5 (Bicol), Region 10 (Northern Mindanao), Region 11 (Davao), and Region 7 (Central Visayas). Altogether, these regions had 74% of the total trees cut with Region 4A's share at 34%. The latter is equivalent to 2,809,214 trees during the period 1995-2007. For the rest of the country, heaviest cutting occurred in the years 1996, 1997 and 2006.

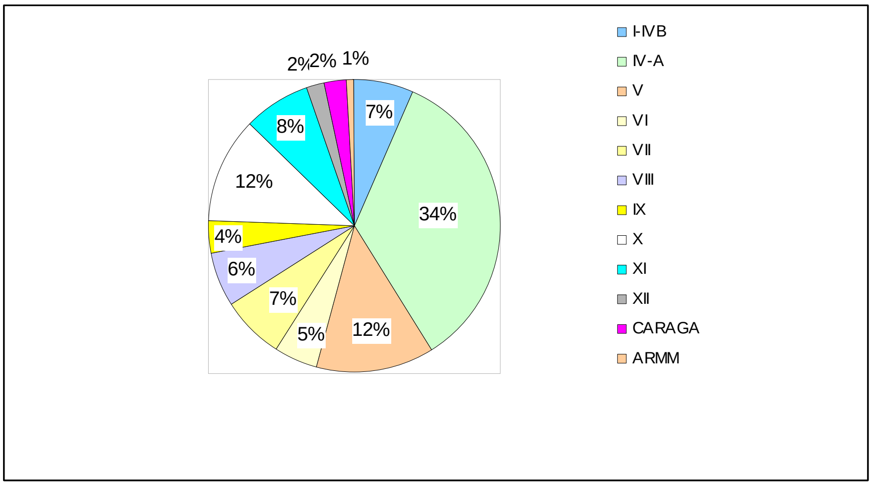


Figure 5. Regional Distribution of Trees Cut, Philippines, 1995-2007

4.2.2 Cutting in Quezon Province

Previous surveys reveal extensive cutting in Quezon (Medina 2005 and Pabuayon et al. 2006). In Pagbilao and Tayabas, Quezon, majority of the farmers (72%) did partial or clear cutting of coconut trees at least once for the period 1980-2004. On the average, cut trees numbered 204 trees per farm with the highest at 2,150 trees. Annually, cut trees ranged from 5 to 150 trees per hectare. More extensive cutting occurred prior to 1995 averaging 95 trees per hectare compared to 66 trees thereafter. The number of trees actually cut was reported to be 50% to 100% greater than that approved for cutting by the PCA. In Sariaya and Tayabas, about 44% of the farmers have cut some coconut trees during the period 1996-2005. At any one time, cut trees ranged from 10 to as high as 500 trees.

Among the case farmers interviewed in June-August 2008, 12 had cut their trees in the past at an average of 63 trees per farm. While more cutting was reported in Mauban, "clear cutting" (with PCA permit) was done in San Antonio in 2004 due to predominance of unproductive, low-yielding and old trees. Cut trees were sold at PhP474 to PhP700 each but it is rare that tenants get a share of the income; if at all, they get a 20% share.

A total of 693,024 trees were cut from 1995 until September of 2007 in Quezon 1 where Tayabas, Mauban and San Antonio belong (Appendix Table 4). Considering the extent of illegal activities, actual cutting rate would be much higher. By topography, cutting is greater in sloping than in flat coconut farms, even though there were more flat *barangays* than sloping ones covered by the permits issued in 2006-2007 in both municipalities (Table 4).

Table 4. Cutting and Replanting in Coconut *Barangays* by Topography, Tayabas and Mauban, Quezon, March 2006-2007

Item	*Tayabas*		*Mauban*		*Both*	
	No.	*%*	*No.*	*%*	*No.*	*%*
Total number of *barangays* covered by permits issued[a]						
Sloping	15	38	13	45	28	41
Flat	25	62	16	55	41	59
Total	40	100	29	100	69	100
Total number of cut trees						
Sloping	12,498	55	16,499	53	28,997	54
Flat	10,402	45	14,594	47	24,996	46
Total	22,900	100	31,093	100	53,993	100
Total number of replanted trees						
Sloping	13,799	56	16,693	52	30,492	54
Flat	10,869	44	15,239	48	26,108	46
Total	24,668	100	31,932	100	56,600	100

[a] Topography of *barangays* was identified by PCA Coconut Development Officers (CDOs)
Source: PCA Provincial Office, Quezon

4.2.3 Replanting by Region and in Quezon

While the policy is to replant every tree that is cut, the national replanting rate is only 61.67% in the period 1995-2007 (Appendix Table 3b). Nevertheless, replanting has been increasing over time, from only 17.31% in 1997 (none recorded for 1995-1996) to as high as 93.56% in 2002. The number of replanted trees even exceeds those cut in 2005 (Figure 6). Replanting data however do not reflect actual survival rate since no post-cutting evaluation is being done by the PCA.

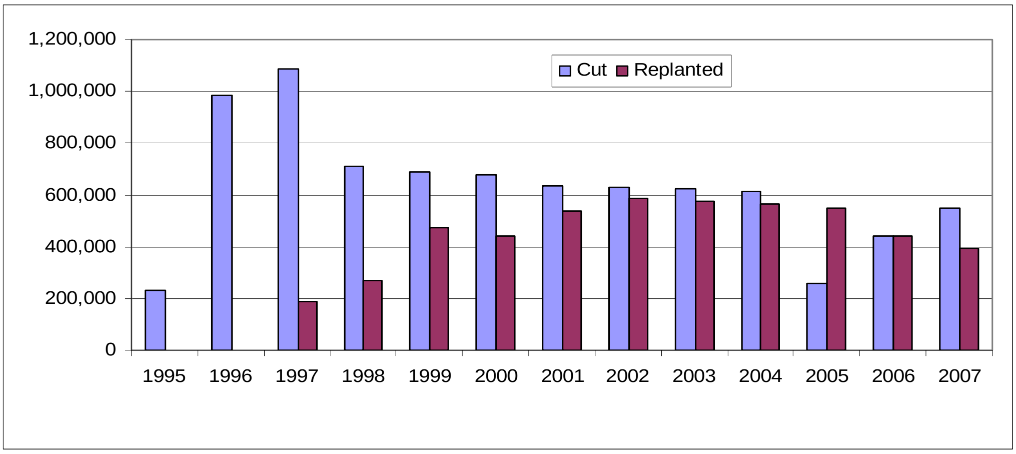


Figure 6. Number of Cut and Replanted Trees, Philippines, 1995-2007

Across regions, there is a high correlation between the number of trees cut and the number of trees replanted as well as their respective rankings with correlation coefficient of 0.96 and 0.88, respectively (Table 5). Thus, regions which cut more also tend to replant more.

However, replanting rate which is the percentage of trees planted to total trees cut is negatively correlated with the number of trees cut with correlation coefficients of -0.45 and -0.36, for the ranking and actual number of trees cut, respectively. Thus regions which cut more trees are not necessarily those which show high replacement rate, meaning that they do not replant adequately.

Table 5. Regional Ranking of Trees Cut and Replanted and Replanting Rate, 1995-2007

Region	*A1*	*A2*	*B1*	*B2*	*C1*	*C2*
	Cut (No.)	*Rank*	*Replant (No.)*	*Rank*	*Replant (%)*	*Rank*
I-IVB	540,117	6	279,234	7	51.70	10
IV-A	2,809,214	1	1,665,809	1	59.30	6
V	1,056,158	2	376,467	4	35.64	12
VI	387,428	8	207,614	9	53.59	7
VII	558,836	5	470,193	3	84.14	4
VIII	498,347	7	259,546	8	52.08	9
IX	288,476	9	133,368	11	46.23	11
X	949,522	3	723,525	2	76.20	5
XI	612,555	4	320,973	5	52.40	8
XII	172,923	11	191,265	10	110.61	3
CARAGA	201,097	10	318,605	6	158.43	1
ARMM	61,740	12	70,929	12	114.88	2
TOTAL	8,136,413		5,017,528		61.67	
Correlation A1xB1		0.96				
Correlation A2xB2		0.88				
Correlation A2xC2		-0.45				
Correlation A1xC1		-0.36				

CALABARZON which cut and planted the most number of trees has a replanting rate of only 59.30%, lower than the national average of 61.67%. Bicol ranking second in cutting ranked lowest in replanting rate (12th) with only 35.64%. Northern Mindanao although ranking second in terms of number of trees cut posted only fifth in replanting rate. On the other hand, regions which have the lowest number of trees cut (SOCCSKSARGEN, CARAGA and ARMM) had the highest replanting rate. This result may indicate the difficulty of monitoring large areas given the current field manpower of the PCA. Figure 7 compares cutting and replanting in the different regions.

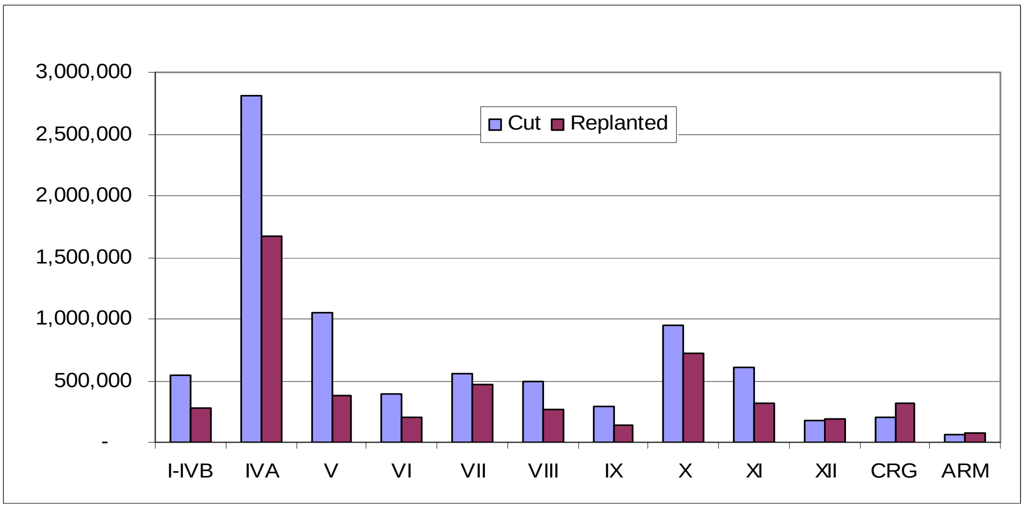


Figure 7. Number of Cut and Replanted Trees, by Region, 1995-2007

Specifically in Tayabas and Quezon, replanting rate is about 89% (Appendix Table 4), although there are some years when the number of replanted trees exceeded the number cut. In the later years, it appears that the policy of replanting every cut tree is more effectively implemented (Figure 8). This is also revealed in Table 4 where the trees cut and replanted are almost equal in 2006 and 2007 in both sloping and flat coconut farms. Some 83% of the case farmers also reported that they replanted after cutting their coconut trees.

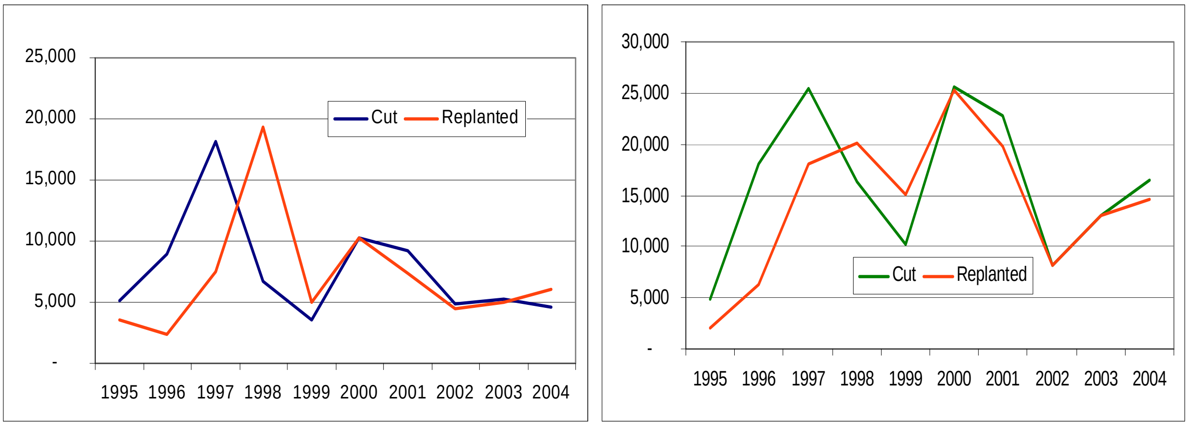


Figure 8. Number of Trees Cut and Replanted in Tayabas (left) and Mauban (right), Quezon, 1995-2004

4.2.4 Violations of Cutting Regulations and Cases Filed

Aside from inadequate replanting rate, the most common form of violation is cutting without permits issued by PCA. For the period 1997-2008, the number of cases filed in Quezon totaled 76 with the highest in Tayabas, Sariaya and Mauban (Appendix Table 5). More than half of these were filed in 2007 and 2008 when the moratorium of issuing cutting permits began to be implemented. According to key informants, however, conviction rate for the filed cases has been very low. For the 1st semester of 2008, all reported cases that were filed were in Region IV-A and only in Quezon (Appendix Table 6). No cases were filed in other regions of the country. Only three cutting permits were issued in Quezon out of the total 1,019 permits issued in the region during the period.

5.0 ENVIRONMENT AND BIOPHYSICAL CHARACTERISTICS OF UPLAND COCONUT FARMS

5.1 Profile of the Sites and Case Farms

The study sites are compared below with respect to their biophysical characteristics in terms of soil type, rainfall pattern and topography (Table 6). Differences may reflect variations in the cropping patterns. The information for the other municipalities of Quezon shown in Appendix Table 7 indicates that the number of predominantly sloping *barangays* is even slightly higher than the flat *barangays*.

5.1.1 Topography/Slope

Mauban differs from Tayabas and San Antonio in that it is predominantly sloping. In general, Tayabas has a slope ranging from 5% to 8% with some rolling terrain. Mauban is more sloping with a slope of 15-50% (Figure 9). Many farms are in mountainous areas.

5.1.2 Soil Type

The soil type in Tayabas ranges from clayey to loamy while it is mostly sandy loam to sandy clay in Mauban and San Antonio. Both soil types are suitable for coconut planting which requires light to medium textured soils. When internal soil drainage is considered, though, the lighter soil texture in Mauban is more suitable to coconut.

Figure 9. Sloping and mountainous coconut farms in Mauban, Quezon (left) and slightly rolling farms in Tayabas, Quezon (right) (Photo by the study team, July 2008)

Table 6. Coconut farm information in selected municipalities in Quezon, 2008

Farm Information	*Municipality*			
	Tayabas	*Mauban*	*San Antonio*	*Average*
Average distance of farm from *barangay* road (km)	0.84	1.32	3.6	1.92
Access to farm				
Walking	√	√	√	
Animal ride	√	√	√	
Motorcycle	√	√	√	
Jeepney	√		√	
Topography (% of total farm area)				
Flatland	96	21	77	65
Sloping	4	79	23	35
Soil texture	clay loam	sandy loam	sandy loam	
Rainfall pattern	rainy May – December	rainy September – January	rainy June – August	
Land utilization (hectares)				
Ave. land/farm area	5.4	6.7	7	6.4
Ave. land area planted to coconut and intercrops	4.4	6.5	7	6.0
Ave. land area planted to other crops[a]	1.0	0.2	0	0.4

[a] Refers to separate parcels of land planted to other crops (not planted under coconut)

5.1.3 Location and Accessibility of Farms

Tayabas is bounded by the municipalities of Lucban and Mauban on the north, Pagbilao on the west, Sariaya on the east and the city of Lucena on the south. It is located approximately at 121°38'E longitude; 13°59'N latitude. Mauban is bounded on the north by Real, by Atimonan and Tayabas on the south, by Sampaloc on the west and by Lamon Bay on the east. It is found approximately at 121°37'E longitude, 14°15'N latitude. San Antonio is located at

121°15'E longitude and 13°54'N latitude. It is bounded by the municipality of Tiaong, province of Laguna and Batangas in north and western parts.

Farms in Tayabas and Mauban are generally more accessible compared to San Antonio. Access to the farms is usually by walking, animal ride, motorcycle or *jeepney*. However, Mauban may also be accessed by boat as it is a coastal municipality.

5.2 Farming and Agroforestry Systems in Tayabas and Mauban

Average farm size is 6.4 hectares with small portions as separate parcels in Tayabas and Mauban that are planted to other crops. These crops are rice or other annuals like vegetables cultivated in open and flat areas with planted area averaging 0.4 hectare. They are usually for home consumption since harvests are quite small. The smallest farm is 1.5 hectares; the largest is 15 hectares. However, there are several farms that are relatively large at 8 to 14 hectares. On the average, farms in San Antonio and Mauban are slightly bigger than those in Tayabas. Table 7 provides the description of farming systems of coconut farms in Tayabas and Mauban.

Table 7. Description of Farming Systems of Coconut Farms, Tayabas and Mauban, Quezon, 2008

Farming System	*Municipality*	
	Tayabas	*Mauban*
Coconut		
Average area planted	4.4	6.5
Average number of trees per hectare	164	190
Age of trees (range in years)	15-80	2-100
Frequency of harvest per year	Every 30 or 45 days	Three times per year
Yield (whole nuts, kg/ha/year)	8,927	4,753
Banana Intercrop		
Average area planted	4.01	4.13
Average number of trees per hectare	103	200
Age of trees (range in years)	2	1-5
Frequency of harvest per year	Once/twice/monthly	Once/monthly/every 2 months
Yield (pieces/ha/year)	20,493	8,365
Other Intercrops	Cassava, *gabi*, *lanzones*, *rambutan*, mango	None
Reasons for choice of crop:	Number reporting	Number reporting
Provides additional income	2	2
Provides food	1	1
Easy to grow and sell	1	2
Suitable to the area	1	2
High-value crop	2	0

Tayabas has a more diverse landscape in terms of economic crops planted. In the slightly sloping coconut areas, other crops like banana, cassava, *lanzones* and *rambutan* are also planted. In Mauban, 90% of the land is planted to coconut and generally spaced closely at 6m x 6m. This dense planting leaves little chance to plant other crops, though banana and some timber trees are planted. In flat and open areas, vegetables are usually planted.

Banana is a common choice for planting under coconut, especially when coconut stand is still young. This crop is easier to manage and provides a long-term source of income, long enough before the coconuts bear nuts at approximately 7 years old. Cassava and *gabi* are planted in Tayabas which give returns in a shorter period of time. These crops are chosen by the farmers because they provide food, are easy to grow and sell, are suitable in the area, and require less maintenance, similar with coconut.

The planting of *lanzones,* rambutan and mango, especially in Tayabas is due to the high-value potential of these fruit trees. They also provide a more stable source of income when the time comes that coconut would be cut for whatever reason. The farming system in Tayabas can be considered an example of coconut-based AFS.

5.3 Environmental Conditions in Tayabas and Mauban

5.3.1 Erosion Occurrence and/or Threat

The farmers in Tayabas indicated that there is no observed occurrence of erosion or threat in their area. A visual observation of the surroundings did not reveal any occurrence of erosion such as rill, gully or landslide. This was attested by the assigned CDO in the area.

In Mauban, however, while the farmers did not confirm any occurrence of erosion in their area, a reconnaissance made by the study team around the place revealed presence of some rills and gullies on the ground surface (Figure 10). The CDO confirmed the occurrence of landslide during a strong typhoon in 1995. Of the 12 key informant CDOs from Quezon, eight admitted to occurrence of erosion in their areas of responsibilities (Table 8).

Figure 10. Erosion (left) and logged-over coconut farms in Mauban, Quezon (Photo by the study team, July 2008)

5.3.2 Factors/Biophysical Characteristics Contributory to Erosion

Considering the coconut agro-ecosystem in the sites, the more diverse and multi-storey type of canopy in Tayabas is more effective against any threat of erosion. The reason is that raindrop impact will be greatly reduced if it passes several layers of canopy before reaching the ground. In Mauban where coconut planting is denser, the fewer intercrops under coconut that intercept erosive raindrops allow a greater degree of vulnerability to erosion, considering its steeper slope.

Except in the event of excessive rainfall brought about by strong typhoons, the amount of rainfall being received in Mauban and Tayabas (based on the number of rainy and dry months) may not be considered a major contributory factor to erosion. While Tayabas has more rainy months, its topography is not prone to erosion. On the other hand, while Mauban has a more sloping topography, it has lesser rain months presupposing less rainfall received in the area.

The soil type in the sites could be considered not of the erodible type. The light to medium soil texture, sandy loam to sandy clay for Mauban and clayey to loamy for Tayabas, would have greater infiltration capacity where erosive surface runoff could be reduced. However, a farmer in Mauban mentioned that the swaying of tall and old trees during typhoons accompanied by strong winds could trigger erosion. As the trees sway, the soil could move and loosen. The farmers were emphatic that cutting of coconut trees without replanting is a major factor that could contribute to soil erosion.

Given these considerations, the presence of coconuts (and other intercrops) with proper farming systems management, even under predisposing factors such as slope and other soil factors, can reduce the threat of soil erosion.

Table 8. Occurrence of Soil Erosion or Environmental Degradation, Quezon, 2008

Municipality	*Presence of Soil Erosion or Environmental Degradation*	*Type of Soil erosion*[a]	*Date of Occurrence*	*No. of Farms Affected*	*No. of Barangays Affected*
Burdeos/ Patnanungan	Yes	Gully erosion	June 2008	10	Don't know
Candelaria	Yes	Rill erosion	During heavy downpours	No answer	Most of the *barangays*
Dolores	No	None	NA[b]	NA	NA
General Nakar/Jomalig	Yes	Landslide	2004	150	19
Infanta	Yes	Landslide	2004	Don't know	Don't know
Mauban	Yes	Landslide	1995 (during typhoon *Rosing*)	Minimal	4
Pagbilao	Yes	Rill erosion	Farms/ *barangays* not that affected	Farms/ *barangays* not that affected	Farms/ *barangays* not that affected
Panukulan/ Polillo	Yes	Rill erosion	2004	5	2
San Antonio	No	None	NA	NA	NA
Sariaya	Yes	Rill erosion and Landslide	Aug – Dec	Don't know	5
Tayabas	No	None	NA	NA	NA
Tiaong	No	NA	NA	NA	NA

[a] Rill erosion refers to soil removal to form small but well-defined channels caused by surface run-off. Channels can be smoothed by normal tillage operations. Gully erosion is when surface channels have been eroded to the point that they cannot be smoothed over by normal tillage operations.

[b] NA means not applicable

6.0 SOCIO-ECONOMICS OF COCONUT FARMING SYSTEMS AND CUTTING OF TREES

6.1 Socio-Economic Characteristics of the Case Farmers

Farm operations are mostly done by the male operators but females are involved in the management and assist in the financial and marketing-related activities. Most farmers are in their fifties with considerable farming experience, have finished elementary education, and have coconut farming as the only income source (Table 9).

Table 9. Distribution of Case Coconut Farmers by Socio-economic Characteristics, Quezon, 2008

Characteristics	*Number Reporting*	*Percent*
Gender		
Male	11	73
Female	4	27
All	15	100
Age (years)		
< 40	1	7
40 – 50	6	40
51 – 60	6	40
> 60	2	13
All	15	100
Average age: 50		
Educational Attainment		
Elementary	6	40
High school	6	40
Vocational	1	7
College	2	13
All	15	100
Source of Income		
Coconut farming only	9	60
Farming and off/non-farm activities	4	27
Remittances	2	3
All	15	100
Years in Farming		
3 – 10	3	20
11-20	3	20
21-30	6	40
31 or more	3	20
Average years: 23		
Tenurial Status		
Owner	4	27
Share-tenant	11	73
All	15	100
Sharing Scheme (Farmer-landowner)		
30 – 70	1	9
50 – 50	10	91

Eleven coconut farmers are share tenants while four are landowners. Two of the landowners are from San Antonio; one is formerly a tenant with the farm later transferred to him through the comprehensive agrarian reform program (CARP) of the government. Other farmers have also benefited from the program. Among the tenants, one has a 30-70 sharing of coconut produce with his landlord; he gets only 30% of the output. The rest practice the 50-50 sharing scheme with expenses shouldered by the farmer. Income and harvest from the intercrops usually accrue to the tenants. With permission from the landlord, tenants could plant other crops under coconut.

6.2 Profitability of Coconut Farming

While intercropping has become popular, there are still many coconut farmers especially in the uplands of Quezon that do not practice it. Upland coconut areas in Mauban, for example, are mainly planted to coconut monocrop. If intercropping is practiced, intercrops are mostly limited to banana. Annual vegetable crops are usually not intended for commercial production, but grown in small patches of farms closer to houses for home consumption. Perennial crops are planted in Tayabas and San Antonio but commercial scale is limited.

For the case farmers, annual net farm income ranges from only PhP9,448 to PhP42,990 per hectare (Table 10). Profitability is considerably higher in diversified coconut farms than in mono-cropped farms. Nevertheless, the income share from coconut remains higher than from intercrops. Income varies depending on how coconuts are sold, i.e., either as copra or whole nuts, and on how distant the farm is to the market. When farms are closer to the market, farmers usually sell their coconuts as whole nuts; otherwise coconuts are better sold as copra to reduce hauling costs. This explains why most farmers in the uplands and mountainous areas sell copra instead of whole nuts. In contrast, farmers in Tayabas and Sariaya which are closer to market centers mostly sell whole nuts.

Table 10. Costs and returns per hectare per year and income contributions for various coconut-based cropping systems, Quezon, 2008 [a]

Cropping System	*Returns (PhP/ha/ year)*	*Costs (PhP/ha/ year)*	*Net Farm Income (PhP/ ha/year)*	*Income Share (%)*	
				From Coconut	*From Intercrops*
Coconut monocrop					
Coconut sold in nuts	38,133	19,306	18,828	100	-
Coconut sold as copra	22,050	12,602	9,448	100	-
Coconut + banana					
Coconut sold in nuts	27,101	11,802	15,300	78	22
Coconut sold as copra	75,352	40,977	34,375	92	8
Coconut + banana + cassava	54,585	37,981	16,604	86	14
Coconut + banana + cassava + fruit trees	84,832	41,842	42,990	88	12
Coconut + banana + fruit trees	33,800	5,920	27,880	95	5
Coconut + *lanzones* + coffee + cacao + black pepper	46,106	5,197	40,909	74	26

[a] At the time of the study exchange rate is PhP43-44 per US dollar

The cash requirement for coconut farming is relatively lower than for other major crops. The primary cash cost is hired labor during harvesting of nuts. Material inputs for nutrient management and pest control requiring immediate cash are nil. In intercropped farms, coconut may actually benefit from the fertilizers applied to intercrops. But in the study sites where “coconut + banana” production system is common, fertilization is rarely done. With minimal cash outlay for coconut, farmers continue to maintain their farms as long as coconut prices are favorable. This is the case in recent months; one reason why farmers believe that they should not cut their trees. Non-cash costs are mainly for the landowner’s share and unpaid family labor spent for clearing and maintenance operations (Appendix Tables 8a-8f).

6.3 Coconut Farm Yields by Cropping System

Profitability of the different coconut-based farming systems varies according to the yield of coconut. The latter is determined by factors such as age of coconut, soil fertility status due to management practices, and even location or topography of farms. Coconut yields of the case farms are shown in Table 11.

Average annual coconut yield for all farms was 4,912 kg per hectare or approximately 49 nuts per tree per year. Except for monocrop, coconut yields are higher in flat areas than in sloping farms, at 5,272 and 2,374 kg per hectare, respectively. The farmers explained that the lower yields in sloping farms are due to the trees being much older and poor land fertility resulting from erosion of top soil. Although coconut trees older than 60 years usually have lower yield, this study shows that coconut trees as old as 70 years are still productive. The average age of coconut trees in the study sites is 46 years. Coconut trees without intercrops are relatively younger with average age of 37 years. At ages of 20-40 years, coconut canopy covers much of the ground resulting in little sunlight penetration, making the condition relatively unsuitable for most intercrops.

Table 11. Average coconut yield by cropping system, topography and average age of coconut trees, Quezon, 2008.

Cropping System	*Yield (kg/ha/year)*			*Age (years) of Coconut Tree*
	Flat	*Sloping*	*Both*	
Coconut monocrop	1,350	4,703	2,018	37
Coconut + banana	5,265	1,977	3,621	59
Coconut + banana + cassava	8,550	-	8,550	70
Coconut + banana + cassava + fruit trees	7,200	-	7,200	15
Coconut + banana + fruit trees	6,000	2,000	4,000	60
Coconut + lanzones + coffee + cacao + black pepper	3,266	817	4,083	35
Average	5,272	2,374	4,912	46

6.4 Returns from the Sale of Coconut Trees

At the time of the study, the moratorium was already in effect. Hence the case farmers refused to provide details of the sale of coconut trees. However, an earlier study (Pabuayon et al. 2006) showed that farmers received from PhP500 to PhP800 per tree sold to the lumber trader or processor depending on the distance of the farm from the nearest road. The closer the farm is to the road, the higher is the selling price. Lower prices are paid for coconut trees coming from distant farms because the trader has to pay higher transport cost from the farm to the road. Since the trader shoulders all the expenses including those for the processing of the cutting permits, the farmer gets the full selling price as return from the sale of his coconut tree. The selling price could go as high as PhP1,500 for very large trees yielding about 350 board feet of lumber per tree. Regular tree sizes yield from 200 to 250 board feet of lumber.

The same study showed that for a one-month operation involving two deliveries of coco lumber from the source to the market outlet, the trader obtained a net return of PhP65,555 from 30,000 board feet of lumber or PhP437 per tree. Another study (Medina 2005) showed that a typical lumber processor who cuts an average of 25 coconut trees earns as much as PhP6,588 daily. A bigger scale processor who operates an average of 20 power saws daily can fell up to 100 trees and can earn a huge net profit of P26,352 per day. The return on variable cost is approximately 24%. Appendix Table 9 shows the costs and returns for a large lumber processor.

6.5 Coconut Prices and Relationship to Cutting

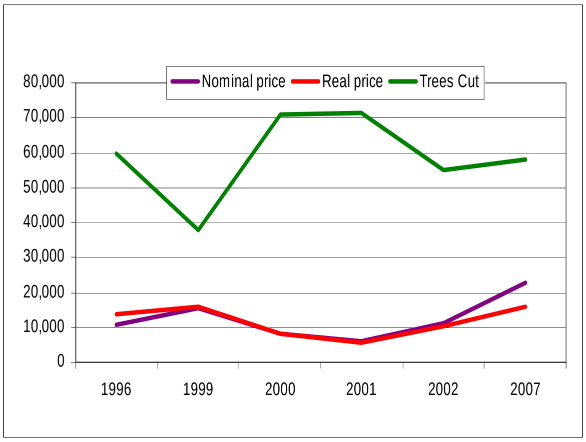
At the time of the study, coconut prices are favorable compared to the previous years (Appendix Table 10). From only PhP4.04 per kg in 2004, farm price of copra increased to PhP16 per kg in 2005 and to as high as PhP22.70 per kg in 2007. Mill gate prices of whole nuts increased by 33% from 2005 to 2007. The rising prices are attributed to the declining supply due to massive cutting of coconut trees and destructive typhoons vis-à-vis the increasing demand for coconut as raw materials for high value coco-based products. With minimal cash input requirement in coconut farming, an increase in the farm price improves the farmer's income. This scenario may prompt the farmers to replant more coconuts trees. Based from the FGDs, many farmers now regret having cut their trees in the past.

There is a negative relationship between coconut prices and cutting with significant correlation coefficients ranging from -0.77 to -0.91 (Table 12). This implies that farmers are likely to cut their trees when they face unfavorable prices; they will preserve their trees when farming becomes profitable due to rising coconut prices, other things being the same. The policy allows cutting under certain conditions. Figure 11 shows the generally opposite behavior of copra farm and mill gate prices and number of coconut trees cut.

Table 12. Relationship Between Coconut Prices and Number of Coconut Trees Cut, Quezon, 1996-2007

Item	*Copra*	*Whole Nuts*
	Correlation Coefficient (r)	
Nominal Prices		
Farm gate x Cutting	-0.54	-0.68
Mill gate x Cutting	-0.45	-0.66
Real Prices[a]		
Farm gate x Cutting	-0.77*	-0.91***
Mill gate x Cutting	-0.41	-0.86**

*, **, *** Significant at 10%, 5% and 1% probability level, respectively
[a] Deflated using consumer price index (CPI=2000)



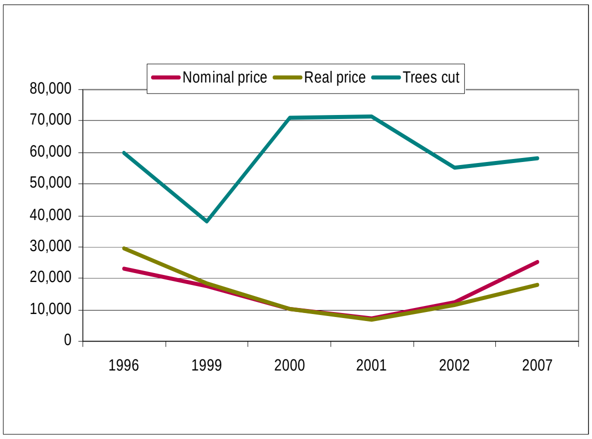


Figure 11. Copra Farm Price (PhP/t) and Number of Trees Cut (left) and Copra Mill Price (PhP/t) and Number of Trees Cut, Quezon, 1997-2007

6.6 Poverty Situation in Coconut Farms

The above shows that coconut monocrop provides very low income for farmers, about PhP9,000 to PhP18,000 per hectare annually. However, those with intercrops could obtain up to PhP43,000 per hectare. With an average of 6 hectares for the case farms considered here, a farmer that practices intercropping could potentially get a monthly income of PhP21,500. However, in general, farmers have small farm sizes as a result of the CARP; hence they actually get much lower income.

Most studies show that coconut farmers are poor and oftentimes in a situation when cash is badly needed. Thus poverty exacerbated by unfavorable price and market conditions is one of the driving forces for the decision to cut their coconut trees for lumber. Medina (2005) showed that cutting the trees provide an immediate source of income since farmers are paid by traders right away. Based from the latest poverty statistics of the National Statistical Coordination Board (NSCB), the coconut farming communities in general are worse than the country as a whole and the regions where they belong (Table 13).

Table 13. Incidence of Poverty in the Top 3 Coconut Producing Regions and Top 20 Coconut Producing provinces, Philippines, 2006

Production Ranking/Province		*Poverty Incidence (%)*	
		Province (Rank)	*Region*
	Philippines	32.9	
1	Davao Region		36.6
2	Southern Tagalog		36.8
	CALABARZON subregion		20.9
	MIMAROPA subregion		52.7
3	Eastern Visayas		48.5
1	Quezon	47.7 (14)	20.9
2	Davao Oriental	48.8 (13)	36.6
3	Davao del Sur	27.4 (20)	36.6
4	Leyte	47.3 (16)	48.5
5	Lanao del Norte	52.2 (8)	43.1
6	Misamis Oriental	37.5 (18)	43.1
7	Zamboanga del Sur	33.8 (19)	45.3
8	Surigao del Sur	55.1 (7)	52.6
9	Camarines Sur	49.9 (12)	51.1
10	Maguindanao	69.3 (1)	61.8
11	Misamis Occidental	56.3 (5)	43.1
12	Zamboanga del Norte	67.5 (2)	45.3
13	Saranggani	52.0 (9)	40.8
14	Surigao del Norte	60.2 (4)	52.6
15	Western Samar	47.6 (15)	48.5
16	Northern Samar	61.1 (3)	48.5
17	Eastern Samar	51.9 (10)	48.5
18	Compostela Valley	47.1 (17)	36.6
19	Romblon	51.7 (11)	52.7
20	Sorsogon	55.3 (6)	51.1
	Average	51.0	45.4
	Relative Poverty Philippines	55.0	
	Relative Poverty Region	13.2	

Poverty incidence in terms of the proportion of the population having income below the poverty threshold in the top three coconut-producing regions; namely, Davao region, Southern Tagalog and Eastern Visayas, is higher than for the country as a whole which is 32.9%. Except for Davao del Sur which includes the highly urbanized city Davao City, all top coconut-producing provinces have poverty incidence that exceeds the national average. The poorest provinces are Maguindanao, Zamboanga del Norte, and Northern Samar where more than 60% of the population are below the poverty threshold. Quezon, the largest coconut-producing province, ranks 14th in poverty incidence with 47.7%. Considering all 20 provinces, more than half of the population is poor.

Relative poverty incidence (RPIP), estimated as poverty incidence of the province as percentage of the national average, ranges from -17% for Davao del Sur to 111% for Maguindanao. Compared to the respective regions where the provinces belong, RPIR ranges from -21% for Misamis Oriental and Zamboanga del Sur to 128% for Quezon. The high

RPIR for Quezon indicates its very low economic condition compared to CALABARZON subregion. Eleven provinces have positive RPIRs, meaning that they are poorer than their respective regions as a whole. The estimates are plotted in Figure 12. The higher the bar for the province is, the worse its situation is relative to the country and the region as a whole.

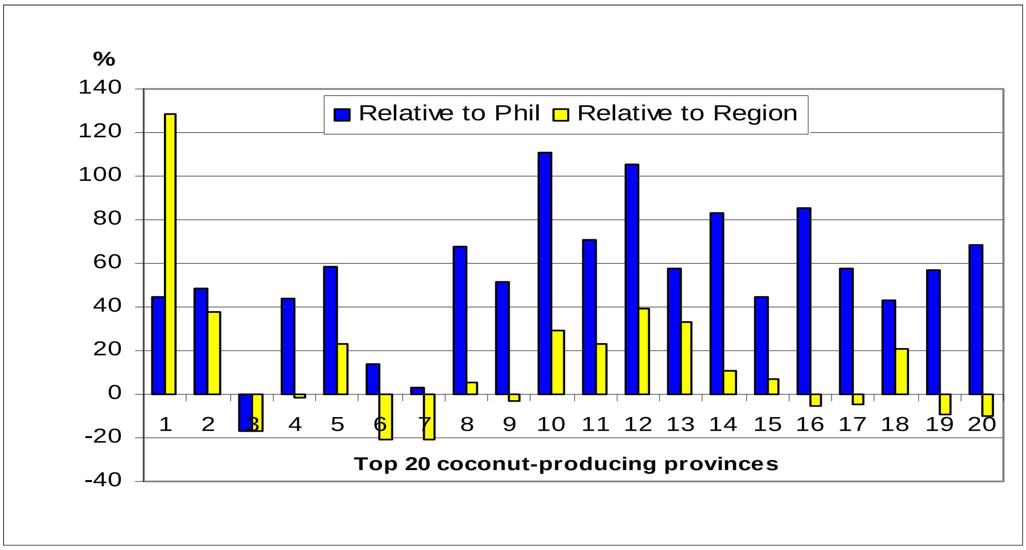


Figure 12. Relative Poverty Incidence of Top 20 Coconut-Producing Provinces, Philippines, 2006

6.7 Perceptions of the Different Stakeholders on the Coconut Regulatory Policies

The stakeholders consisting of the LGUs, the PCA, and farmers have perceptions on the regulatory policy guidelines and on the cutting and replanting situations in the study sites. These are presented below.

6.7.1 Coconut Cutting and Replanting Guidelines

The Local Government (LGU)

The collective involvement of various sectors through the creation of the Quezon Industry Development Council is a positive step toward the rehabilitation of the coconut industry in the province. One task of the Council is to effectively monitor and stop the illegal cutting of coconut trees. This is currently being done through a moratorium on the issuance of cutting permits. The primary reason is economic; the environmental concern is only secondary. It is believed that the threat posed by the rampant cutting of coconut trees could adversely affect the coconut industry and the economy of the province. Continuous cutting and inadequate replanting could lead to unsustainable supply of raw materials for the major coco-based industrial users such as oil mills and desiccated coconut processing plants. While the ban on cutting could result in a loss of employment and income for the lumber processors and traders, a more aggressive replanting and rehabilitation of coconut farms could provide opportunities for absorbing the displaced workers in the coco lumber industry.

The stricter application procedure for securing cutting permits has reduced drastically the number of permits being issued. However, this could lead to even more illegal cutting due to the tedious and long process the applicants have to go through. On the rehabilitation of coconut farms, the major difficulty is the lack of available seed nuts for replanting.

The Regulatory Agency (PCA)

The PCA Regional Manager agrees that protection of the environment is secondary to the economic reason for the moratorium. This is so even when the CDOs believe that heavy cutting of coconut trees in at least two municipalities contributes to soil erosion (Table 14). While severe soil erosion in most coconut farms is not yet observed, the CDOs generally agree that further massive cutting of coconut trees particularly in sloping areas could be detrimental to the environment. However, some CDOs stated that severe soil erosion could be avoided since replanting is provided for under the law.

Table 14. Causes of Soil Erosion and Recommendations of the CDOs on its Prevention, Quezon, 2008

Item	*Number Reporting*[c]	*Percent*
Causes of soil erosion		
Heavy cutting of forest trees	6	50
Heavy cutting of coconut trees	2	17
Heavy rainfall	6	50
Intensive cultivation of coconut farms	1	8
Stone quarrying	1	8
Will continuous cutting of coconut trees result in soil erosion or other environmental problems?		
Yes, for the following reasons	9	75
Denudation of the area will occur	1	8
More surface run-off will occur due to absence of canopy and roots that will hold water	1	8
Trees planted in sloping areas have water holding capacity; if these are cut, flooding will occur	2	17
Heavy cutting results to landslide	1	8
Will not happen because there is always replanting of coconut trees	5	42
No response	2	17
Recommendations for the coconut farms in the sloping areas to avoid any possible environmental problem in the *barangays*		
No more cutting in sloping areas	7	58
Crop diversification		
Annuals		
Perennials[a]	5	42
Forest species[b]	10	83

[a] Perennials recommended include citrus, *lanzones, rambutan*, mangosteen, and *santo*l
[b] *Mahogany, narra, apitong, yakal, batino, antipolo, kamagong, mulawin, malapapaya* and other forest species
[c] Multiple responses

When presented with possible options to avoid environmental problems arising from production activities in the sloping coconut farms, more than half agreed that cutting should be stopped in sloping areas. Crop diversification is a popular option among the CDOs with large majority indicating forest species appropriate in sloping areas. Many also consider perennial crops acceptable to farmers because of their income potential. Annuals are not considered suitable in sloping coconut farms as intercrops.

The CDOs are split about the effectiveness of the moratorium in controlling the cutting of coconut trees (Table 15). Among those who said it is effective, the main reason is that it provides for a total cutting ban unlike RA 8048 which allows issuance of cutting permits under certain conditions. Another key problem with RA 8048 is that it does not assure proper inspection during and after cutting operations; only at pre-cutting stage as part of the requirements for issuing the permit. Budget support for additional personnel and logistics to undertake improved monitoring system is not enough.

Table 15. Responses of CDOs on the Implementation of RA 8048 and Moratorium, Quezon, 2008

Item	*Number Reporting*	*Percent*
Is the moratorium effective in preventing the cutting of coconut trees?		
Yes	6	50
No	6	50
Recommendations if moratorium is not effective		
Lift the moratorium and implement RA 8048 effectively with full force	2	33
Impose moratorium also on the buying/trading of coco lumber	1	17
Lift moratorium and do selective cutting of coconut trees only	1	17
Barangay officials in the area should not allow cutting	1	17
No response	1	17

While some CDOs consider the moratorium effective, they recognize some problems. These are loss of income for lumber processors and their workers and the fact that diseased trees could not be immediately cut since the process of securing permit is quite difficult. The latter could lead to the spread of the disease to more coconut farms. According to the CDOs in the municipalities of Jomalig and General Nakar, some 300,000 to 400,000 coconut trees in 8 municipalities of Quezon are infected with "*cadang-cadang*" disease and these should be considered for cutting.

Indirectly, the CDOs agree that illegal cutting continues even with the moratorium and this manifests in the continuing sale of significant amounts of coco lumber in hardwares and retail outlets. During the field visit conducted after the typhoon "Frank", it was observed that there are many uprooted trees lying around the area but these are not being processed into lumber since permits are still to be secured from the PCA and provincial government offices. The felled trees are therefore not being utilized and the wood quality would soon deteriorate due to direct exposure to sun and rain. The moratorium thus appears to have made the system even more complicated.

Other CDOs explicitly stated that the moratorium is not effective in controlling illegal cutting of coconut trees. Instead they suggest that the moratorium be lifted but RA 8048 should be more effectively implemented. Since the CDOs cannot adequately monitor all the coconut areas assigned to them, the *barangay* officials should be stricter and ensure that illegal and indiscriminate cutting does not occur in their respective areas. If the moratorium will continue, they suggest that the same should apply in the trading operations for coco lumber. The argument is that controls, if to be used, should be imposed at all levels in the marketing chain of coco lumber. Overall, there are more CDOs who believe that RA 8048 is already adequate for the preservation and development of the coconut farms in Quezon if it is effectively implemented (Table 16). In particular, the provision of issuing permits if the trees are already unproductive and/or diseased coupled with assurance of complete replanting is sound. Viable CBFS/AFS should be promoted. To some, moratorium should be selective and implemented only in areas where rampant illegal cutting is uncontrolled. About one-third of the CDOs however believe that the moratorium should continue indefinitely coupled with effective replanting program. This is especially true in areas where it is considered effective in controlling illegal cutting.

Table 16. Opinion of CDOs on the Preservation and Development of Coconut Farms, Quezon, 2008

Item	*Number Reporting* [d]	*Percent*
Effectively implement RA 8048 and lift moratorium[a]	9	75
Continue moratorium indefinitely coupled with effective replanting program	4	33
Selective moratorium[b]	6	50
Promote viable coconut-based farming and agroforestry systems coupled with effective implementation of RA 8048 only[c]	6	50
Correct implementation of all the programs of the government	1	8

[a] Allow cutting unproductive/damaged/diseased trees and ensure complete replanting
[b] Only in provinces where there is rampant illegal cutting of coconut trees
[c] No moratorium
[d] Multiple responses

The Coconut Farmers

Not all coconut farmers who served as key informants are aware of the cutting regulatory policy (Table 17). Among those who are aware, they specifically know the provisions relating to coconut rehabilitation or replanting, no cutting without permit, no cutting of trees below 60 years old, and imposition of penalty if cutting is done without permit. They learned about these through seminars conducted by the PCA, LGU or DA.

Table 17. Farmers' Awareness of the Cutting Regulatory Policy, Quezon, 2008

Item	*Number Reporting*	*Percent*
Aware of Republic Act 8048		
Yes	9	60
No	6	40
Source of Information		
Seminars by PCA/DA/LGU	6	40
Other farmers	3	20
Knowledge on RA 8048[a]		
Coconut rehabilitation	1	7
No permit no cutting	5	33
Penalty if cutting without permit	2	13
No cutting of trees below 60 yrs old	2	13
Policy is/was effective		
Yes	1	7
No	4	27
No response	7	47
Form of violations known		
Cutting without permit	13	87
Awareness on penalized violators [a]		
Confiscation of illegally cut trees	4	27
Confiscation of power saw	1	7
Payment of fine	1	7
Cased were filed but dismissed/no one was convicted	2	13

[a] Multiple responses

More farmers believe that the policy is not effectively implemented. The most number of farmers however did not categorically respond to the question while only one considered the policy effective in regulating the cutting of coconut trees. When asked about their knowledge regarding the form of violation against the policy, majority stated cutting without permit. This implies that farmers are aware of illegal cutting happening in their *barangays*. During informal discussions, they indicated that *barangay* officials allow them to cut their trees without a PCA permit. Although they are aware that violators are penalized through confiscation of illegally cut trees and power saws and payment of fines, two of them stated that cases filed are usually dismissed with no one eventually being convicted.

Except for two farmers who believe that total log ban (including forest species) should be implemented, the general perception is that the cutting regulatory policy is favorable but there is a need for proper implementation particularly the provision on replanting (Table 18). They believe that as long as only unproductive, diseased and damaged trees are cut and these are adequately replaced through new plantings, the coconut resource base will be sustainable. The PCA should coordinate closely with the *barangay* officials and violators should be penalized.

On the moratorium of issuing cutting permits, majority believe that it is being effectively implemented. Others think it is not effective since illegal cutting continues and it should be lifted. Most farmers however understand that the moratorium was imposed due to rampant illegal cutting which could eventually lead to income loss among farmers. Some farmers even realize now that they should not have cut their coconut trees since at the time of the field visits, coconut prices are favorable. They said that if they have more harvests (that is, if no cutting was done and more replanting was undertaken in the past), then their income would be much higher.

Table 18. Perceptions of Farmers and Suggestions on the Cutting Regulatory Policy, Quezon, 2008

Item	*Number Reporting*	*Percent*
On Coconut Preservation Act of 1995 (RA 8048)[a]		
The policy is good	3	20
Proper implementation of the policy	4	27
Coordination with the *barangay* LGU	2	13
Violators should be penalized	3	20
Total log ban	2	13
Strict implementation of coconut replanting	3	20
Creation of other livelihood programs	1	7
On Moratorium of issuing cutting permits (MC 02)		
Moratorium is effective	8	53
Moratorium is not effective	2	13
Moratorium should be lifted	1	7
Reasons for the moratorium		
Illegal cutting was very rampant	2	13
Loss of income if coconut trees will be cut	7	47

[a] Multiple responses

The above findings confirm earlier research results that monitoring of illegal cutting has been inadequate, replanting falls short of targets, implementation of RA 8048 is on the whole ineffective, and there are considerable opportunities for corrupt practices and violation of the law among implementers (Pabuayon and Medina 2007). Specifically, PCA personnel fail to monitor the following:

1. Actual number of trees cut relative to that specified in the permit since there is very limited evaluation during and after the cutting operations;
2. Actual cutting since local officials issue "permits" under certain circumstances even if they know that only permits issued by the PCA are legal and official;

3. Actual volume transported since PCA personnel are not deployed in check points (this is the responsibility of the police and military authorities);
4. Actual replanting when allowed to be done after cutting (this is to ensure that planted seedlings are not destroyed during felling operations); and
5. Survival rate of planted seedlings since there is no monitoring related to maintenance and care of planted seedlings.

The extent of illegal cutting operations is evident in the earlier surveys of Medina (2005). It was reported that 87% of coconut farmers surveyed in Pagbilao and Tayabas, Quezon believe that the implementation of RA 8048 is ineffective, 95% do not think that the PCA personnel undertake monitoring of coconut farms, and 55% know that illegal cutting of coconut trees are happening in their respective *barangays*.

6.7.2 Reasons for Cutting/Not Cutting the Coconut Trees

The main reasons reported by those who have cut their trees in the past (before the moratorium) are those stated in the law since these are the conditions under which they could be issued permits by the PCA. These are: the trees are already old, unproductive and damaged by natural calamities; and the coconut land has been approved for conversion to another use (Table 19). The two tenants reported that cutting was the decision of the landowner. But even in the latter case, a cutting permit has been secured from the PCA. One farmer stated that the sale of coco lumber provided him good income.

Table 19. Farmers' Reasons for Cutting/Not Cutting their Coconut Trees, Quezon, 2008

Item	*Number Reporting* [a]	*Percent*
Reason for cutting		
Old and unproductive	5	42
Damaged by typhoon/lightning	4	33
Coco lumber is a good source of income	1	8
Ordered by the landowner	2	17
Land conversion	1	8
Reason for not cutting		
Good coconut production/high yields	2	17
Coconut is a good and stable source of income	2	17
Favorable price of copra especially at present	2	17

[a] Multiple responses

Based on records of PTC applications in Tayabas and Mauban for 2006-2007, 83% of the applications had indicated that the coconut trees are already unproductive (Table 20). The rest of the trees to be cut as stated in the applications have been damaged by typhoon.

Table 20. Reasons for Cutting Stated in PTC Applications, Tayabas and Mauban, Quezon, 2006-2007

Reason for Cutting	*Flat*	*Sloping*	*Both*	*Percent*
Damaged by typhoon	43	27	70	17
Unproductive	155	181	336	83
Both	198	208	406	100

Source: PCA Quezon Provincial Office

During years of heavy cutting and these are up until 2006, the primary reasons for cutting the coconut trees is the highly profitable coco lumber processing associated with the high demand for coco lumber. Wood from forest species has become scarce due to large scale forest denudation in the country. At the same time, coconut prices have been very unstable, often very low caused by the influx of substitute vegetable and palm oils to the country. Still, the high land tenancy at that time and the effort of the landowners to evade land/agrarian reform by converting their lands to non-agricultural uses contributed to widespread cutting of coconut trees. In recent years, the prospect of high demand for bio-diesel, increasing use of coconut for health products like the virgin coconut oil, and the declining supply of coconut resulting from both natural factors (typhoons and diseases) and ineffective government policy (rampant illegal cutting and inadequate replanting) are influential factors for the favorable trends of coconut prices.

Thus, a key motivation for not cutting the coconut trees is the good income coconut farming could provide to farmers. This was the case for farmers whose trees are still very productive. Others believe that cutting is not a good option (aside from the fact that no permits are currently being issued by the PCA) since they observe that coconut prices are favorable. At the time of the field visit, copra prices averaged about PhP37 and PhP42 per kg at the farm and mill site, respectively. These are considerably higher than in the past when farm gate copra prices hit bottom lows of PhP3-PhP5 per kg. Some farmers stated that the coconut tree being 'a tree of life' provides a continuous source of income. Once it becomes productive, harvests could be done every 45 days without much production inputs.

None mentioned about the environmental aspect of cutting the coconut trees until it was brought up by the research team during the FGDs. This is because none of the farmers present has experienced serious soil erosion in his coconut farm. In Tayabas where lands are mostly flat, farmers do not consider soil erosion as an environmental threat. Even in Mauban where most coconut farms are in the sloping areas, they appear silent about the soil erosion problem. Although they admitted having experienced flooding and landslides some time in the past, this was not attributed to soil erosion resulting from cutting of coconut trees. Rather, they claimed that this was due to unusually heavy downpour brought about by the typhoons *Rosing* and *Milenyo* in 2006.

A revealing observation made during the FGDs that supports the cutting of unproductive old trees is the fact that these tall and slender trees if left uncut could actually trigger soil erosion when they are swayed and eventually uprooted by strong winds and typhoons. This is likely to occur in upland areas and especially when there is no crop cover or intercrops that could protect the soil from the heavy torrential rains and strong winds associated with destructive typhoons. In fact if the old trees are cut with a portion of the base left intact, these could still hold the soil even while waiting for the full protection to be provided by the growing replanted coconut trees. Maintaining the old unproductive coconut trees is also not economically beneficial due to the high cost and difficulty of harvesting the few nuts of tall trees and then transporting them to the market.

6.7.3 Reasons for Limited Replanting

Replanting is primarily undertaken because it is a requirement for the approval of applications for a cutting permit. Even then, full replanting is not done since actual trees cut often exceed that approved in the cutting permit. Moreover, there is no way replacement could be enforced for illegally cut trees. Medina (2005) reported that 69% of the farmers who have cut their coconut trees did not replant.

Despite the government's efforts to rehabilitate the country's coconut farms, full success is limited by the unavailability of seed nuts for replanting. Thus, the PCA in 2008 embarked on an incentive system that would encourage farmers to provide the required seed nuts for replanting. Under the scheme, farmers will be paid up to PhP30 per seed nut that has been fully out planted in the field. Payment is to be made as follows: PhP7 once the seed nut is maintained at the nursery, additional PhP7 when the seed nut is already at the seedling stage of about one foot in length, and finally, an additional PhP16 after out planting in the field for a total of PhP30. For Quezon 1 alone, farmers have some 541,000 seed nuts already being maintained in their nurseries as of mid-2008.

7.0 SUMMARY AND CONCLUSIONS

This study aimed to provide an assessment of the farming and agroforestry systems in upland coconut-based farms and the policy and socio-economic issues in the cutting of coconut trees. A review of CBFS/AFS research and related initiatives as well as the coconut cutting policy and extent of implementation was undertaken. Using primary data from selected villages in Quezon province, the socio-economic factors affecting farmers' decision to engage in coconut cutting was analyzed.

The CBFS R&D program in the 1980s and earlier was anchored on the objectives of increasing coconut production, improving farm productivity, and enhancing farm income. Thus, most studies focused on the technical production aspects like fertilization, breeding, crop protection, intercropping, and cultural management of farms. Continuing until the 1990s, additional research areas are timber utilization of felled coconut trees, marketing, and financial analysis of CBFS. Studies involved both experiments/on-farm trials and socio-economic surveys of coconut farms. Research efforts were consolidated in key publications such as the *State of the Art: Coconut Research*, *Coconut-Based Farming Systems: Status and Prospects*, *Coconut R&D*, *Coconut-Based Farming Systems*, *The Philippines Recommends for Coconut*, and *The Philippines Recommends for Agroforestry*. Although recommended farming systems have included planting of perennials and forest species in the uplands/steep slopes and soil conservation practices, the environmental aspect of CBFS has received relatively little emphasis. Exceptions are the few recent works that provide some lessons on soil erosion in the upland coconut farms, combining coconut with forest species in limited sites, and economic valuation of environmental impacts of coconut logging.

Studies on cropping models involved combination of coconut with agricultural crops (annuals and perennials) and livestock, including basic costs and returns analysis. Generally, diversified coconut farms yield higher income than coconut monocrop. Intercropping with forest species is limited. This raises some environmental concerns considering that around 60% of the coconut lands are in the sloping areas and 30% in mountainous sites. While recent government programs attempt to promote CBFS mainly to rehabilitate coconut farms through replanting and to reduce rural poverty, there is apparent lack of focus on agro-ecological impacts.

Rehabilitation of coconut farms is constrained by the indiscriminate cutting of coconut trees. Thus the government implements a cutting regulatory policy as provided for in RA 8048 or the *Coconut Preservation Act of 1995*. This law requires obtaining a cutting permit from the PCA upon satisfying certain conditions. These are: (a) a valid reason relating to old age and unproductivity of trees, disease or pest infestation, damage due to natural factors, hazard to life and property, or land conversion; (b) payment of fees; and (c) replacement of trees to be cut through actual replanting or provision of coconut seedlings. The law does not consider the topography of the coconut farm and possible environmental impact of cutting in evaluating applications. If at all, coordination with the environment and natural resources agency (DENR) is in the transport of trees that have already been cut. Despite the required coordination among the various agencies in implementing the law, illegal cutting operations have continued. This has rendered the replanting provision of the law virtually ineffective.

Currently, a moratorium on the issuance of cutting permits is being implemented nationwide. Since the cutting regulatory policy came into effect in 1995, cutting is recorded at more than 8 million trees with replanting rate at roughly 62%. Heaviest cutting occurred in the large coconut-producing regions and provinces. CALABARZON where Quezon province belongs has more than one-third share of the recorded number of trees cut. Previous surveys and recent visits (this study) to Quezon confirm that most farmers have been engaged in coconut logging, with some not having a cutting permit. In the study sites, there was more cutting done in sloping than in flat and rolling coconut farms. In Mauban which is predominantly sloping, there are fewer intercrops (mostly banana) in contrast to Tayabas where coconut farms are more diversified (with more fruit trees) even as most farms are flat and slightly rolling with soil erosion threat nil in the latter. While replanting has not kept pace with cutting, some regions which cut more have relatively low replacement rate. Although cases have been filed against violators of the law, conviction rate has been very low.

The potential threat to the environment of not maintaining adequate vegetative cover has been observed in the study sites; after the destructive typhoon “Frank” hit the country in June 2008. There was evidence of some rill and gully forms of erosion in certain areas of Mauban which is predominantly sloping. De-vegetation could have resulted from deforestation, limited intercropping with appropriate crop and forest species, and possibly cutting of the coconut trees. Majority of the PCA personnel confirmed the occurrence of soil erosion and in some cases landslides in their respective areas of responsibilities. They also agree that continuous cutting of coconut trees in the uplands could result in some environmental problems. These could be averted through reduced cutting in the uplands and greater crop diversification with perennials and forest species. However, the farmers appeared less inclined to admit occurrence of soil erosion in their farms and the environmental threat does not pose a major or alarming issue for them at this point in time.

The cutting of coconut trees has a multi-faceted dimension. Although the ‘official’ reasons stated in the cutting applications are that the trees are already unproductive or damaged by typhoons or land is approved for conversion to other uses, farmers are quick to say that cutting provides immediate source of income especially in emergency situations. This is particularly the case during the height of cutting operations when coco lumber processing is considered a very profitable business due to high demand for coco lumber. This makes economic sense if the cut trees are already unproductive and need to be replaced while at the same time providing income and employment to farmers and workers. The problem, however, is the indiscriminate nature of cutting as indicated by the apparent refusal of those involved to obtain permit from the PCA. Additionally, replacement to sustain the coconut resource and the flow of its benefits is not assured since replanting is insufficient.

It thus appears that while the financial benefits of cutting are well appreciated, the possible adverse environmental impact is not well understood and not yet felt at least in the case farms. Unless there is full awareness of the trade-offs of cutting, the short-run financial returns will be a key factor in the unsustainable management of upland coconut farms. This is so since coconut communities are poorer than the country as a whole with poverty incidence averaging 51% compared to the 33% national average. Some coconut farmers would be better off when their farms are bigger and diversified and planted with high-value crops. Majority of the farms, however, are small (maximum of 3 hectares under the agrarian reform program) and only about one-third of the coconut areas in the country are intercropped.

Favorable market forces reduce the pressure of cutting the coconut trees. Improving price trends of coconut products in recent months caused farmers to think that past cutting is regrettable, that is, if they did not cut their trees, they would have bigger harvests now. There is evidence of a negative relationship between coconut prices and volume of trees cut. Other things being the same, farmers are likely to cut their trees when prices are unfavorable; they will preserve their trees when coconut farming becomes profitable due to rising prices. This is because despite the constraints farmers face, coconut provides year-round returns since good management allows harvest every 45 days. There are also opportunities for maintaining high income by adopting appropriate farming systems involving high-value intercrops and possibly forest species that could offset the low returns from coconut when prices are less favorable.

More regulations from the government such as the imposition of a moratorium on the issuance of cutting permits do not appear effective in controlling cutting. Given the limited resources of the PCA and weaknesses of the local institutions such as LGUs, law enforcement agencies, and farmers' organizations, cutting is likely to continue as long as there are appreciable financial returns. This trend will persist in view of the sustained demand for cheap coco wood. Even market forces favoring intercrops may cause cutting of coconuts to a certain extent. The latter though should not create adverse environmental impact in the uplands as long as proper soil management practices and 'optimum' crop and tree species mixes are adopted.

Farmers appear responsive to the financial incentives offered by the government through the seed nut development program that could support replanting and rehabilitation of coconut farms. One positive approach to complement the rehabilitation program is to enhance public awareness on the social benefits and costs of indiscriminate cutting of coconut trees vis-à-vis sustainable production and agroforestry systems in the upland coconut farms. Results from the case farms however are not sufficient to demonstrate the relative social (un)profitability of these production management options. The environmental threat at present remains not significant. However, even if this is the case, a more prudent course of action requires a thorough and in-depth assessment of CBFS/AFS covering a wider study area in order to obtain more robust results and conclusions.

8.0 RECOMMENDATIONS FOR FUTURE WORK

The study provides insights on the following:

1. Possible farming and agroforestry systems that may be adopted in sloping coconut farms compared to the actual crop combinations in the study sites;
2. Extent of cutting in sloping and flat coconut farms in the study sites vis-à-vis the environmental threat of clearing the vegetation in these farms;
3. Institutional constraints in implementing the coconut cutting regulatory policy; and

4. Limited appreciation of the social costs and benefits of cutting the coconut trees relative to other production management possibilities.

Future work is needed to address the above aspects covering more coconut-producing provinces. This is to integrate in the analysis the great variability in the biophysical characteristics of the areas, socio-economic settings of farmers, and market conditions in major island groups of the country: Luzon, Visayas and Mindanao. These differences will affect the choice, acceptability and adaptability of possible CBFS/AFS that may be considered to address both economic and environmental concerns in upland coconut farms. The broad areas of this future study would include the following:

1. Resource mapping (GIS) to reflect extent of cutting, replanting, and environmental threat relative to biophysical characteristics such as topography, rainfall and soil conditions;
2. Quantitative assessment of factors affecting crop choice combinations (annuals, perennials, livestock and forest tree species); and
3. Benefit-cost analysis for possible CBFS/AFS that may be proposed in the selected study areas based on certain criteria (biophysical, socio-economic and market).

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APPENDICES

Appendix Table 1. Coconut-Based Cropping Systems Adopted and Subject of On-Farm Trials, Philippines

Cropping System	*Location*	*Source*
Coconut + woody perennials + agricultural annuals/perennials	Bagong Silang, Los Banos, Laguna	De Luna (2008)
Coconut + lanzones +coffee + banana + rambutan.	Sto. Tomas, Batangas	Medrana (2007)
Coconut + peanut + pineapple + papaya + coffee + guayabano + black pepper	Silang, Cavite	Philippines Recommends for Agroforestry (2006)
Coconut + lanzones	Lucban and Tayabas, Quezon	Baracol (2006)
Coconut + lanzones + banana	Tayabas and Pagbilao, Quezon	Medina (2005)
Coconut + eggplant + radish	Tayabas and Pagbilao, Quezon	
Coconut + gmelina	Davao City, 1993 – 2003	Secretaria et al. (2004/2005)
Coconut + banana	Davao City	Magat (2004/2005)
Coconut + corn	Davao City	
Coconut + corn	Batabat Sur, Bondoc Peninsula	Josue (1999)
Coconut + pineapple + banana + cacao		Philippines Recommends for Coconut (1993) (PR)
Coconut + sitao + ampalaya + squash + papaya + cacao	Quezon	PR
Coconut + gabi+ sweetpotato + ubi + lanzones	Quezon	PR
Coconut + pineapple + patola + upo + sitao + chico	Quezon	PR
Coconut + papaya + ampalaya + upo + patola + black pepper	Batangas	PR
Coconut + pineapple + gabi + ubi + cacao	Batangas	PR
Coconut + sitao + green corn + banana + lanzones	Batangas	PR
Coconut + gabi + chayote + mungo + papaya + jackfruit	Cavite	PR
Coconut + ampalaya + upo + patola + squash + banana + lanzones	Cavite	PR
Coconut + pineapple + sitao + eggplant + ubi + gabi + sweetpotato + guava	Cavite	PR
Coconut + pineapple + sitao + ginger + black pepper	Laguna	PR
Coconut + rice + green corn + mungo + guayabano	Laguna	PR
Coconut + gabi + sweetpotato + ubi + papaya + guava	Laguna	PR
Coconut + banana + coffee + guyabano + jackfruit + ube + gabi + cassava	Silang, Cavite	Aguilar (1991)
Coconut + chayote + beans + passion fruit	Lucban, Quezon, 1990	Aguilar et al. (1991)
Coconut + pineapple + banana	Leyte	Aparra, et al. (1991)
Coconut + livestock		Bulatao, et al. (1991)
Coconut + eggplant + ampalaya + tomato + string beans + cucumber	Bansalan, Davao del Sur, 1989-1990	Cabangbang et al. (1991)
Coconut + coffee	Cotabato City	Cabangbang et al. (1991)
Coconut + coffee	Cotabato City	Cabangbang et al.

		(1991)
Coconut + black pepper + coffee	Cotabato City	Cabangbang et al. (1991)
Coconut + black pepper + coffee + lanzones	Cotabato City	Cabangbang et al. (1991)
Coconut + black pepper + corn + rambutan	Cotabato City	Cabangbang et al. (1991)
Coconut + cacao	Davao del Sur, 1989	Cabangbang et al. (1991)
Coconut + coffee + rambutan		Cabangbang et al. (1991)
Coconut + coffee		Magat (1991)
Coconut + banana	Butuan, Agusan, 1989	Notario (1991)
Coconut + cacao	Regions 9, 10, 11	Notario (1991)
Coconut + corn	Regions 9, 10, 11	Notario (1991)
Coconut + pineapple	Regions 9, 10, 11	Notario (1991)
Coconut + cassava	Regions 9, 10, 11	Notario (1991)
Coconut + sweet potato	Regions 9, 10, 11	Notario (1991)
Coconut + peanut	Regions 9, 10, 11	Notario (1991)
Coconut + root crops (sweet potato, cassava, yam, arrowroot)	Quezon Agricultural Experiment Station	Villegas (1991)
Coconut + coffee	Quezon Agricultural Experiment Station	Villegas (1991)
Coconut + banana + papaya + gabi + pineapple	Cavite	Deomampo (1988)
Coconut + pineapple		
Coconut + black pepper	Davao City, 1983	Detiblan et al. (1985)
Coconut + black pepper	Davao City, 1983	Detiblan et al. (1985)
Coconut + black pepper + papaya	Davao City, 1983	Detiblan et al. (1985)
Coconut + black pepper + cacao	Davao City, 1983	Detiblan et al. (1985)
Coconut + black pepper + pineapple	Davao City, 1983	Detiblan et al. (1985)
Coconut + black pepper + pineapple + papaya	Davao City, 1983	Detiblan et al. (1985)
Coconut + black pepper + pineapple + cacao	Davao City, 1983	Detiblan et al. (1985)
Coconut + gabi		CBFS Status and Prospects (1984) (CBFS)
Coconut + black pepper		CBFS
Coconut + black pepper + cacao		CBFS
Coconut + black pepper + pineapple		CBFS
Coconut + black pepper + pineapple + cacao		CBFS
Coconut + cucumber + black pepper + gabi		CBFS
Coconut + cucumber		CBFS
Coconut + camote + mungo		CBFS
Coconut + coffee	Cavite, 1979	CBFS
Coconut + coffee + banana + lanzones		CBFS
Coconut + coffee + cacao + banana + black pepper +lanzones		CBFS
Coconut + coffee + cacao + lanzones	Bay, Laguna, 1977-78	CBFS
Coconut + coffee + cacao + black pepper + banana	Lipa City, 1979	CBFS
Coconut + cacao		CBFS
Coconut + papaya	Cavite, 1979	CBFS

Appendix Table 2. Net Incomes from Different Crop Combinations under Coconut by Location of Farms, various years

Location	*Crop Combinations Under Coconut*	*Net Income PhP/ha/ year*	*Reference*
Bagong Silang, Los Baños, Laguna	Coconut+ woody perennials + agricultural annuals/perennials:		De Luna (2008)
	2-3 crop combination	49,140	
	4 crop combination	68,469	
	5 crop combination	55,184	
	6 crop combination	42,844	
	7 crop combination	34,397	
	8-11 crop combination	33,814	
Davao City	Coconut monocrop	3,851	Detiblan et al. (1985)
	Coconut + blackpepper	4,206	
	Coconut + blackpepper + papaya	2,724	
	Coconut + blackpepper + papaya +pine apple	4,103	
	Coconut + blackpepper +cacao	5,213	
	Coconut + blackpepper +cacao+ pineapple	6,226	
Batangas	Coconut + papaya+ ampalaya + upo + patola + black pepper	25,027	Pablo (1983)
	Coconut + pineapple + gabi + ube + cacao	60,680	
	Coconut + sitao + green corn + banana +lanzones	38,423	
Cavite	Coconut + gabi+ chayote+ mungo + papaya + jackfruit	28,995	Pablo (1983)
	Coconut + ampalaya+ upo + patola + squash + banana + cacao	67,007	
	Coconut + pineapple+ sitao+ eggplant + ubi + gabi+ sweet potato + guava	51,086	
Cotabato City	Coconut + coffee	60,144	Cabangbang et al. (1991)
	Coconut + coffee+ black pepper	41,374	
	Coconut + coffee+ black pepper + lanzones	28,823	
	Coconut + black pepper + corn + rambutan	28,887	
Davao City	Coconut+ gmelina	28,000	Secretaria et al. (2004-05)
Davao City	Coconut + banana	86,800	Magat (2004-05)
	Coconut + corn	42,950	
Leyte	Coconut monocrop	2,052	Aparra et al. (1991)
	Coconut + cacao	6,261	
Quezon	Coconut monocrop	10,880	Baracol (2006)
	Coconut + lanzones	41,835	
Sariaya, Quezon	Coconut + livestock	20,866	Bulatao et al. (1991)
Lucban, Quezon	Coconut + chayote +beans + passion fruit	23,454	Aguilar et al. (1991)
Sto. Tomas, Batangas	Coconut monocrop	7,774	Medrana (2007)
	Coconut+lanzones+coffee+banana+rambutan	41,486	

Appendix Table 3a. Number of Trees Cut by Region, Philippines, 1995-2007

Region	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
I-IVB	9,354	38,705	48,174	27,605	28,667	27,157	30,611	42,543
IV-A	98,461	302,305	304,348	220,344	171,615	214,416	229,508	214,095
V	15,239	156,980	222,850	86,532	117,853	115,030	70,471	57,201
VI	28,811	116,111	58,925	29,760	29,242	20,429	18,767	23,074
VII	14,608	60,478	69,341	59,540	68,803	56,233	46,612	40,483
VIII	11,824	63,991	127,455	49,678	46,564	38,660	42,876	35,325
IX	4,650	27,870	31,309	28,928	35,177	22,040	18,195	22,778
X	16,696	127,102	119,720	107,237	72,160	91,162	91,633	105,999
XI	29,812	62,403	55,867	52,165	81,981	47,846	48,835	49,700
XII	1,375	14,624	24,110	17,249	15,472	18,158	18,023	14,496
CARAGA		10,836	23,220	26,338	18,732	22,538	18,471	15,757
ARMM		1,326	3,577	5,954	4,556	5,781	3,601	5,514
TOTAL	230,830	982,731	1,088,896	711,330	690,822	679,450	637,603	626,965

Continuation Appendix Table 3a

Region	*2003*	*2004*	*2005*	*2006*	*2007*	*TOTAL*	*Percent Share*	*Rank*
I-IVB	70,293	50,681	23,002	72,540	70,785	540,117	6.64	6
IV-A	213,551	258,126	122,072	243,557	216,816	2,809,214	34.53	1
V	57,215	28,099	11,292	9,790	107,606	1,056,158	12.98	2
VI	18,018	23,152	4,160	6,751	10,228	387,428	4.76	8
VII	39,310	57,136	6,724	18,097	21,471	558,836	6.87	5
VIII	32,574	20,414	5,292	7,645	16,049	498,347	6.12	7
IX	29,159	33,467	13,781	11,247	9,875	288,476	3.55	9
X	68,247	46,503	37,427	19,145	46,491	949,522	11.67	3
XI	53,745	62,673	16,382	29,785	21,361	612,555	7.53	4
XII	18,719	11,902	5,465	6,289	7,041	172,923	2.13	11
CARAGA	17,979	14,309	6,509	10,219	16,189	201,097	2.47	10
ARMM	7,655	9,129	5,584	5,324	3,739	61,740	0.76	12
TOTAL	626,465	615,591	257,690	440,389	547,651	8,136,413	100.00	

Appendix Table 3b. Number of Trees Replanted by Region, Philippines, 1995-2007

Region	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
I-IVB			6,934	13,287	17,006	3,278	15,962	52,353
IV-A			36,797	35,087	90,633	118,968	210,687	197,755
V			4,040	18,763	77,367	80,545	37,210	41,938
VI			18,973	33,361	29,444	15,786	16,162	17,681
VII			50,959	61,159	68,665	53,554	46,476	40,483
VIII			3,015	11,391	27,875	23,265	53,402	35,045
IX			970	2,378	2,939	1,658	285	22,778
X			14,120	41,012	126,279	86,072	91,555	106,434
XI			41,492				35,313	42,528
XII			6,752	15,817	12,857	14,937	13,252	14,496
CARAGA			3,876	36,072	23,060	41,779	15,730	9,558
ARMM			550	2,249	50		763	5,514
TOTAL			188,478	270,576	476,175	439,842	536,797	586,563
Replanting Rate (%)	0	0	17.31	38.04	68.93	64.74	84.19	93.56

Continuation Appendix Table 3b

Region	*2003*	*2004*	*2005*	*2006*	*2007*	*TOTAL*	*Percent Share*	*Rank*
I-IVB	33,503	41,800	14,452	67,289	13,370	279,234	5.57	7
IV-A	207,329	222,443	127,168	195,132	223,810	1,665,809	33.20	1
V	56,583	28,099	11,292	9,790	10,840	376,467	7.50	4
VI	17,474	22,762	25,899	10,072		207,614	4.14	9
VII	39,310	57,265	35,690	14,928	1,704	470,193	9.37	3
VIII	28,774	20,414	26,460	19,362	10,543	259,546	5.17	8
IX	29,159	33,467	28,569	11,165		133,368	2.66	11
X	68,247	45,503	104,321	14,672	25,310	723,525	14.42	2
XI	53,745	62,673	58,527	4,393	22,302	320,973	6.40	5
XII	18,719	11,902	53,855	28,678		191,265	3.81	10
CARAGA	12,662	11,202	32,545	51,176	80,945	318,605	6.35	6
ARMM	7,655	9,129	28,847	12,433	3,739	70,929	1.41	12
TOTAL	573,160	566,659	547,625	439,090	392,563	5,017,528	100.00	
Replanting Rate (%)	91.49	92.05	212.51	99.71	71.68	61.67		

Source of basic data: Philippine Coconut Authority (PCA)

Appendix Table 4. Number of Cut and Planted Trees, Tayabas and Mauban, Quezon 1, Region IV-A, 1995 – 2007

Year	*Region IV-A*		*Quezon I*		*Tayabas*		*Mauban*	
	Cut	*Planted*	*Cut*	*Planted*	*Cut*	*Planted*	*Cut*	*Planted*
1995	98,461	53,326	30,409	18,250	5,107	3,500	4,800	2,050
1996	302,305	193,847	59,941	46,120	8,912	2,327	18,139	6,338
1997	304,348	36,797	84,212	86,183	18,186	7,554	25,515	18,100
1998	220,344	35,087	56,462	150,492	6,649	19,364	16,388	20,166
1999	171,615	90,633	37,974	55,663	3,572	4,970	10,166	15,147
2000	214,416	118,968	70,914	82,020	10,315	10,262	25,541	25,293
2001	229,508	210,687	71,245	62,067	9,158	7,337	22,734	19,775
2002	214,095	197,755	55,179	46,074	4,913	4,410	8,162	8,122
2003	213,551	207,329	65,873	56,031	5,215	5,045	12,959	12,959
2004	258,126	222,443	58,113	53,212	4,557	6,078	16,445	14,675
2005	122,072	127,168	44,480	42,521				
2006	243,557	195,132						
2007[a]	216,816	223,810	58,222	64,275	11,225			
Total	2,809,214	1,912,982	693,024	762,908				
Average	216,093	147,152	57,752	63,576	7,983	7,085	16,085	14,263
% Replanted		68.10		110.08		88.75		88.67

[a] From January to September only due to the Moratorium on issuance of permit
Source: PCA, Region IV-A (no entry means data not available)

Appendix Table 5. Number of Violation Cases Filed by Municipality, Quezon, 1997-2008

Site of Crime	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*Total*
Agdangan												1	1
Burdeos						1							1
Candelaria	2					1		1			2		6
Dolores							2						2
Gumaca												1	1
Lucban								1			2	1	4
Lucena City								1	1		1		3
Mauban	3		1	1	1	1	2		1	1			11
Pagbilao									2		2	4	8
Real						1	1						2
Sariaya		1					1				5	7	14
Tayabas			1						3	1	8	6	19
Tiaong			1				1	1			1		4
Total	5	1	3	1	1	4	7	4	7	2	21	20	76

Appendix Table 6. Status of Implementation of Moratorium in Issuing Cutting Permits, 1st Semester 2008

Region/Province	*No. of Applicants*	*No. of Permits Issued*	*No. of Trees Cut*	*Replacement*		*Total Fees Collected (PhP)*	*No. of Cases Filed*
				No. of Seed Nuts	*No. of Seedlings*		
IV-A	248	248	14,109	0	12,844	394,450	21
Batangas	75	75	4,303	---	3,881	121,475	---
Cavite	10	10	847	---	202	23,075	---
Laguna	160	160	8,561	---	8,561	239,350	---
Quezon I	1	1	15	---	---	475	18
Quezon II	2	2	383	---	200	10,075	3
Rizal	---	---	---	---	---	---	---
VII	688	680	4,067	5,610	175	234,275	0
Bohol	341	341	1,867	---	---	93,350	---
Cebu	162	162	925	4,605	20	82,575	---
Negros Oriental	165	165	1,229	775	155	53,700	---
Siquijor	20	12	46	230	---	4,650	---
IX	52	28	616	3,080	0	72,850	0
Zamboanga del Norte	39	18	374	1,870	---	45,900	---
Zamboanga del Sur	8	6	92	460	---	10,500	---
Sibugay	3	2	85	425	---	8,575	---
Zamboanga City	1	1	25	125	---	3,375	---
Isabela City	1	1	40	200	---	4,500	---
XII	60	63	2,774	0	0	374,750	0
North Cotabato	3	3	31	---	---	3,225	---
Sultan Kudarat	6	6	128	---	---	15,500	---
South Cotabato	7	7	55	---	---	9,725	---
Sarangani	44	47	2,560	---	---	346,300	---
Total	1,048	1,019	21,566	8,690	13,019	1,076,325	21

Appendix Table 7. Biophysical Characteristics of Municipalities of Quezon I, 2008

Municipality	*Type of Soil*	*Climatic Patterns*		*Topography of Coconut Barangays (Number)*	
		Rainy Months	*Dry Months*	*Predominantly Sloping*	*Predominantly Flat*
Burdeos	Sandy loam/clay loam	Sept – Jan	Feb – Aug	14	0
Candelaria	clayey to loamy soil	May – Nov	Dec – Apr	7	16
Dolores	clayey to loamy soil	July – Dec	Jan – Jun	9	2
General Nakar/Jomalig	Sandy loam/clay loam	Sept – Feb	Mar – Aug	19	5
Infanta	Sandy loam/clay loam	Sept – Feb	Mar – Aug	5	4
Mauban	Sandy loam/clay loam	Sept – Jan	Feb – Aug	34	2
Pagbilao	Sandy loam/clay loam	Jun – Feb	Mar – May	11	11
Panukulan/ Polillo	Sandy loam/clay loam	Sept – Feb	Mar – Aug	25	6
Patnanungan	Sandy loam/clay loam	Sept – Jan	Feb – Aug	7	0
San Antonio	sandy loam/clay loam	July – Dec	Jan – June	2	18
Sariaya	sandy loam/clay loam	May – Dec	Jan – Apr	7	30
Tayabas	clayey to loamy soil	May – Dec	Jan – Apr	12	35
Tiaong	clayey to loamy soil	May – Dec	Jan – Apr	5	26
All				157	155

Source: Quezon Coconut Development Officers

Appendix Table 8a. Summary of costs and returns per hectare per year for various coconut-based cropping systems, Quezon, 2007

Municipality/Cropping System	*Returns (PhP/ha/year)*		*Costs (PhP/ha/year)*			*Net Farm Income (PhP/ha/year)*
	Coconut sold in whole nuts	*Coconut sold as copra*	*Cash Costs*	*Non-Cash Costs*	*Total Costs*	
Tayabas						
Coconut + banana + cassava + rambutan + santol + mango + gabi	84,832	---	3,360	38,482	41,842	42,990
Coconut + banana	80,602	---	733	41,652	42,386	38,216
Coconut + banana + cassava	54,585	---	4,800	33,181	37,981	16,604
Mauban						
Coconut Monocrop	38,133	---	2,104	17,202	19,306	18,828
	---	22,050	1,577	11,025	12,602	9,448
Coconut + banana	27,101	---	600	11,202	11,802	15,300
	---	75,352	2,684	38,294	40,977	34,375
San Antonio						
Coconut + lanzones + cacao + coffee + black pepper	46,106	---	4,397	800	5,197	40,909
Coconut + banana	33,800	---	5,920	0	5,920	27,880

Appendix Table 8b. Costs and returns per hectare per year for coconut + banana + cassava + rambutan + santol + mango + gabi cropping system, coconut sold as whole nuts (kg), Brgy. Pandakaki, Tayabas, Quezon, 2007

Item	*Coconut + Banana + Cassava + Fruit Trees Cropping System*							
	Coconut (whole nuts)	*Banana*	*Cassava*	*Rambutan*	*Santol*	*Mango*	*Gabi*	*All Crops*
Returns								
Gross yield (quantity/ha/year)	7,200 kg	8,000 pieces	500 kg	30 kg	10 kg	30 kg	100 kg	
Price per unit (PhP/unit)	3.50;7.30	0.6	7	15	15	10	10	
Value (PhP/ha/year)	74,632	4,800	3,500	450	150	300	1,000	84,832
Costs								
Cash Costs								
Hired Labor	2,160	200	200	200	200	200	200	3,360
Non-cash Costs								
Unpaid Family Labor	0	0	0	0	0	0	0	0
Home Consumption	146	0	0	0	0	0	0	146
Given Away	146	0	0	0	0	0	0	146
Land-owner Share	37,170	480	350	45	15	30	100	38,190
Harvester Share	0	0	0	0	0	0	0	0
Land Tax	0	0	0	0	0	0	0	0
Total Costs (PhP/ha/year)	39,622	680	550	245	215	230	300	41,842
Net Farm Income	35,010	4,120	2,950	205	-65	70	700	42,990

Appendix Table 8c. Costs and returns per hectare per year for coconut + banana cropping system, coconut sold as whole nuts (kg), Brgy. Pandakaki, Tayabas, Quezon, 2007

ITEM	*Coconut + Banana Cropping System*		
	Coconut (whole nuts)	*Banana*	*All Crops*
Returns			
Gross yield (quantity/ha/year)	11,029 kg	28,289 pcs	
Price per unit (PhP/unit)	3.50;7.30	0.6	
Value (PhP/ha/year)	62,560	18,042	80,602
Costs			
Cash Costs			
Hired Labor	733	0	733
Non-cash Costs			
Unpaid Family Labor	4,237	2,083	6,320
Home Consumption	333	3,532	3,866
Given Away	0	1,932	1,932
Land-owner Share	19,752	0	19,752
Harvester Share	5,735	0	5,735
Land Tax	4,048	0	4,048
Total Costs (PhP/ha/year)	34,838	7,548	42,386
Net Farm Income	27,722	10,495	38,216

Appendix Table 8d. Comparative costs and returns per hectare per year various coconut-based cropping system, Brgy. Concepcion, Mauban, Quezon, 2007

ITEM	*Coconut-Based Cropping System*			
	Coconut Monocrop		*Coconut + banana*	
	Sold in whole nuts, kg	*Sold as copra, kg*	*Coconut sold in whole nuts, pieces*	*Coconut sold as copra, kg*
Returns				
Value (PhP/ha/year)	38,133	22,050	27,101	75,352
Costs				
Cash Costs				
Hired Labor	2,104	1,577	600	2,684
Non-cash Costs				
Unpaid Family Labor	935	0	810	3,150
Home Consumption	0	0	42	204
Given Away	0	0	0	252
Land-owner Share	16,267	11,025	10,349	34,688
Harvester Share	0	0	0	0
Total Costs (PhP/ha/year)	19,306	12,602	11,802	40,977
Net Farm Income	18,828	9,448	15,300	34,375

Appendix Table 8e. Costs and returns per hectare per year for coconut + lanzones + cacao + coffee + black pepper, coconut sold as whole nuts (kg), Brgy. Bulihan, San Antonio, Quezon, 2007

ITEM	*Coconut + Lanzones + Coffee + Cacao + Black pepper Cropping System*					
	Coconut (whole nuts)	*Lanzones*	*Cacao*	*Coffee*	*Black Pepper*	*All Crops*
Returns						
Gross yield (quantity/ha/year)	4,083	125	10	20	42	
Price per unit (PhP/unit)	8.4	20	80	40	185	
Value (PhP/ha/year)	34,297	2,500	800	800	7,708	46,106
Costs						
Cash Costs						
Hired Labor	3,022	344	344	344	344	4,397
Non-cash Costs						
Unpaid Family Labor	0	0	0	0	0	0
Home Consumption	0	0	0	0	0	0
Given Away	0	0	0	0	0	0
Land-owner Share	0	0	0	0	0	0
Harvester Share	0	0	400	400	0	800
Land Tax	0	0	0	0	0	0
Total Costs (PhP/ha/year)	3,022	344	744	744	344	5,197
Net Farm Income	31,276	2,156	56	56	7,365	40,909

Appendix Table 8f. Costs and returns per hectare per year for coconut + banana + fruit trees (non-bearing) cropping system, coconut sold as whole nuts (kg), Brgy. Bulihan, San Antonio, Quezon, 2007

Item	*Coconut + Banana Cropping System*[a]		
	Coconut (whole nuts)	*Banana*	*All Crops*
Returns			
Gross yield (quantity/ha/year)	8,000	3,600	
Price per unit (PhP/unit)	4.0	0.5	
Value (PhP/ha/year)	32,000	1,800	33,800
Costs			
Cash Costs			
Hired Labor	5,920	0	5,920
Total Costs (PhP/ha/year)	5,920	0	5,920
Net Farm Income	26,080	1,800	27,880

[a] Includes fruits trees but still unproductive

Appendix Table 9. Costs and returns for coconut lumber production, Pagbilao and Tayabas, Quezon, 2004

Item	*Per Tree*	*Per board foot*	*Per day*	*Per trucking*	*%*
Gross returns, PhP					
Sales from coconut lumber	1375	5.50	34,375	82,500	
Costs, PhP					
Application fee for PTC	25	0.125	625	1,875	2
Purchase of coconut tree from farmer	625	2.50	15,625	37,500	56
Labor cost:					
Wages for loggers/saw miller	125	0.50	3,125	7,500	11
Wages for hauling of logs	75	0.30	1,875	4,500	7
Trucking cost	50	0.20	1,250	3,000	4
Material cost:					
Fuel/ lubricants for chain saw	175	0.70	4,375	10,500	16
Chainsaw blades	4.80	0.02	120	300	1
Agent's fee	25	0.10	625	1,500	2
Seedling cost for replanting	6.25	0.025	156	375	1
Depreciation	0.44	0.002	11	26	-
Total cost, PhP	1111	4.47	27,787	67,076	100
Net return, PhP	264	1.03	6,588	15,424	

Source: Medina, 2005

Appendix Table 10. Average farm gate and mill gate prices of copra and whole nuts, Quezon I, 1983 – 2007

Year	*Average Price of Copra (PhP/t)*		*Average Price of Whole Nuts (PhP/t)*	
	Farm Gate	*Mill Gate*	*Farm Gate*	*Mill Gate*
1983	3,410	3,710	Nd	Nd
1984	7,140	8,440	Nd	Nd
1985	3,330	3,980	Nd	Nd
1986	2,060	3,440	320	643
1987	4,070	5,050	816	1,380
1988	5,730	7,050	1,088	1,682
1989	5,690	6,740	1,249	1,508
1990	3,420	4,580	717	1,051
1991	5,180	6,460	1,133	1,668
1992	6,880	8,110	1,247	1,854
1993	5,340	6,940	1,301	1,712
1994	8,240	Nd	776	Nd
1995	7,820	Nd	1,613	Nd
1996	10,730	23,110	2,297	3,018
1997	9,350	Nd	Nd	Nd
1998	12,950	Nd	Nd	Nd
1999	15,280	17,740	3,950	4,704
2000	8,210	10,270	1,923	2,348
2001	5,840	7,300	1,569	1,907
2002	11,310	12,560	2,818	3,088
2003	12,930	14,460	Nd	Nd
2004	4,070	Nd	4,074	4,686
2005	16,100	18,690	3,21	3,860
2006	14,900	17,990	3,863	4,771
2007	22,680	25,270	4,764	5,764

Note: Nd means no data
Source: PCA Region IV-A