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REGIONAL WOOD ENERGY DEVELOPMENT PROGRAMME IN ASIA

PATTERNS OF COMMERCIAL WOODFUEL SUPPLY, DISTRIBUTION AND USE IN THE CITY AND PROVINCE OF CEBU, PHILIPPINES

University of San Carlos
Cebu City, Philippines

Department of Energy
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FOREWORD

Improving the woodfuel production, distribution and utilization systems in its member countries are the major objectives of the Regional Wood Energy Development Programme in Asia. Understanding the conditions that determine the flow of woodfuels from producer to consumer is a first step towards developing policies and programmes for sustainable use and affordable access to this renewable source of energy.

Most surveys on woodfuel consumption have been carried out in rural areas and woodfuel use in urban areas has received little attention in the past. Energy policies for urban areas have nearly always been supply driven in the expectation that urban economic development would allow for an upward fuel switching to fossil based fuels or electricity within a relatively short period. However there is increasing evidence that wood and biomass will continue to be one of the main sources of energy for the urban poor. But unlike in the rural areas market forces will determine to a large extent the volume and type of fuels to be used in the urban households, food processing and other industries.

In order to plan any interventions for an improved energy supply to urban poor, wood energy using industries and enterprises it is essential to assess current distribution systems for their present strengths and weaknesses and potential threats and opportunities in the future. For this purpose, RWEDP initiated a series of micro level studies on woodfuel flows and marketing systems in several places in Asia. The present study is part of this series and focuses on woodfuel supply, distribution and use in the city and province of Cebu, Philippines.

Mr. Terrence G. Bensel and Mrs. Elizabeth M. Remedio present the outcome of an indepth survey that provides an excellent insight in market mechanisms and consumer attitudes towards different sources of energy. The study also indicates that fuelwood and charcoal use does not cause deforestation, but may well be an added incentive for villagers to grow trees, thereby reversing a trend in deforestation caused by agricultural expansion. The value of this study beyond Cebu Province and the Philippines is further enhanced by the detailed description of the methodologies and survey instruments used.

This project wishes to express its sincere thanks to the authors for their very significant contribution to the understanding of the problems and potential of woodfuel use in Cebu. The USAID-funded Forest/Fuelwood Research and Development Project of Winrock International shared the costs of the study with RWEDP, which is highly appreciated. We join the authors in their acknowledgement of all the persons and organizations who participated and contributed to the successful outcome of the study. I also wish to thank Ms. Panpicha Issawasopon for her editorial support and text lay out.

It is hoped that this document will be useful to energy and forestry planners in the Philippines and other parts of Asia, when considering various policies and strategies for affordable access to sustainable sources of energy. Any comments or other feedback from readers will be highly appreciated.

Egbert Pelinck
Chief Technical Adviser

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Finally, we wish to acknowledge the financial and administrative support provided to this research by Mr. Egbert Pelinck of the FAO-Regional Wood Energy Development Programme, as well as by Dr. Rick van den Beldt of the Winrock International Forestry/Fuelwood Research and Development Project. We also acknowledge institutional and administrative support provided by the University of San Carlos Office of Research, the Philippine Office of Energy Affairs Non-Conventional Resources Division, and the University of New Hampshire Complex Systems Research Center. During the latter portion of the research Terrence Bensel was supported by a Fulbright-Hayes research scholarship and wishes to thank Dr. Alex Calata and his staff at the Philippine-A merican Educational Foundation for support given during this time.

To all of these individuals who helped along the way, and to the countless others not mentioned, we wish to extend our heartfelt gratitude. Naturally, the authors take full responsibility for any errors or omissions in the report and for the opinions expressed herein.

T.G.B.
E.M.R.

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GLOSSARY OF TERMS AND ABBREVIATIONS

A&D	Alienable and Disposable
CENRO	Community Environment and Natural Resources Office
DENR	Department of Environment and Natural Resources
FAO	Food and Agriculture Organization of the United Nations
ICS	Improved Cook Stove
ITP	Industrial Tree Plantation
LPG	Liquefied Petroleum Gas
LTO	Land Transportation Office
MMBFOE	Million Barrels of Fuel Oil Equivalent
NGO	Non-Governmental Organization
OEA	Office of Energy Affairs
PC/INP	Police Constabulary/Integrated National Police
PHES	Philippine Household Energy Strategy
RRA	Rapid Rural Appraisal
RWEDP	Regional Wood Energy Development Programme
USC-ANEC	University of San Carlos Affiliated Non-Con Energy Center

bahin	a sharing arrangement between wood-cutters and landowners
balut	boiled duck or chicken eggs
barangay	the smallest political unit in the Philippines
bibingka	baked rice cake
bico	glutinous rice cooked in coconut milk
bijon	a type of noodle
bok-bok	a wood-eating weevil
carenderias	small canteens or eateries
chicharon	fried pork rinds
gu-od	split bamboo trunks used for fuel
ibabao	points above
lechon	roast pig
lugaw	rice porridge
miki	a type of noodle
pakyaw	a contract arrangement between a wood-cutter and landowner
palwa	coconut fronds used for fuel
pancit	a type of noodle
plansa	traditional charcoal iron
pogon	traditional brick or cement oven
poso	rice cooked in woven coconut leaves
puto	steamed rice cakes
raja	bundles of fuelwood containing well-dried, well-split sticks of wood with the bark removed
sansan	to compress sawdust into a special stove designed for this fuel
sari-sari	a small neighborhood store
sud-an	meat, fish or vegetable dishes eaten with rice (viands)
suki	a regular customer or supplier
tabo	a weekly market held in rural areas
tong	bribe money
trisikad	bicycle with side car
tuba	coconut toddy wine
ubos	points below
ukay-ukay	loosely-tied fuelwood bundles containing un-split, green wood for sale to commercial and industrial establishments

EXECUTIVE SUMMARY

Woodfuel and other forms of biomass fuel are by far the most significant indigenous energy source in the Philippines today. Despite this status, little is understood of the ways in which these fuels are grown, harvested, traded and consumed. As a result, much uncertainty exists over the environmental consequences of widespread woodfuel use and the ultimate sustainability of this resource. Recent efforts to quantify the woodfuel supply/demand picture at the national level are a necessary first step in addressing the uncertainties surrounding woodfuel extraction and use in the country. Such studies can also help to identify particular regions of the country that, due to a combination of environmental, demographic and socioeconomic factors, may be experiencing localized woodfuel problems. From there, more focused studies of patterns of woodfuel production and use in those regions can be undertaken, and strategies for improving the situation in those areas can be developed.

This report presents the results of one such local study, conducted from September 1991 to March 1993 in the City and Province of Cebu, Philippines. Cebu is considered a critical area for the study of woodfuel production and use for a number of reasons. First, the province is widely regarded as one of the most environmentally denuded areas in the country, with less than 1% remaining forest cover and severe soil erosion throughout the island's extensive upland areas. Second, woodfuel use remains widespread in Cebu, with 90% of rural and 60% of urban households still dependent upon various forms of biomass fuel for some or all of their cooking needs. Lastly, continued high population growth, coupled with already high population densities and the extent of environmental denudation on the island, has resulted in concern over the sustainability of woodfuel supplies in the province and suggests a possible need for remedial policy action in order to address the situation.

Our research focused on the *commercial* trade in woodfuels which centers around the Cebu City metropolitan area (population 650,000), and consisted of three broad phases dealing with; 1) woodfuel demand by households, institutions, commercial and industrial establishments in the city; 2) the trading and transport network for moving woodfuels from rural producing areas to urban consumers, and; 3) the methods by which woodfuels are grown, managed and harvested by smallholders, tenant farmers and woodfuel-gatherers in rural Cebu. A variety of research methodologies were employed during the conduct of this study ranging from highly-structured survey questionnaires on household energy consumption to the use of rapid rural appraisal techniques for the study of woodfuel management and harvesting practices. The major finding s of the research are as follows.

1. *Residential Sector Energy Demand:* Fuel-choice decisions in the residential sector appear to be strongly affected by income, with 75% of the low-income households utilizing woodfuels as their primary cooking fuel while 80% of high-income households utilize LPG. Overall, woodfuels are the primary cooking fuel for 35% of the city's households, LPG for 37%, and kerosene for 20%. Fuelwood and charcoal are also widely utilized as a supplemental or back-up fuel to LPG and kerosene. Strong taste preferences for food cooked with woodfuels, combined with economic considerations which prevent more widespread use of LPG, appear to be the most important factors in explaining continued strong residential demand for fuelwood and charcoal. In addition, concern over the safety of LPG and kerosene cooking devices, and a lack of security in low-income households, have also prevented more widespread substitution of these fuels for charcoal and fuelwood. On an end-use basis, kerosene appears to be the least expensive cooking fuel,

followed by LPG, and then by charcoal and fuelwood. The actual cost of using fuelwood, however, is offset somewhat by the fact that close to half of the households using this fuel are able to freely collect some or all of the wood they use from the surrounding environment, mostly in the form of construction waste and scrap wood. In addition, households were also found to be making extensive use of non-woody biomass fuels like coconut fronds and bamboo, both purchased and freely gathered. For those households where fuelwood is the primary cooking fuel, per capita annual consumption averaged 303 kg, for households using charcoal as the primary cooking fuel this figure was 65 kg. These estimates need to be reduced by 22.5% and 13.8%, respectively, if consumption of fuelwood and charcoal for commercial activities undertaken in the household are to be subtracted from the residential sector totals. In 1992, woodfuel consumption in the residential sector of Cebu City amounted to 43,000 metric tons of fuelwood and 6,900 tons of charcoal, or 63% and 51% of overall fuelwood and charcoal in the city, respectively. Overall, annual woodfuel consumption in the city is equivalent to around 220,000 barrels of oil, worth an estimated $4 million (P100 million) at 1992 prices.

2. *Residential Sector Fuel-Switching Trends:* Between 1960 and 1990, the percentage of households in Cebu City using fuelwood or charcoal as their primary cooking fuel declined from 92% to a little over 40%, with LPG use increasing from 1% to over 30%. The absolute number of households utilizing woodfuels as their primary cooking fuel, however, actually increased by close to 10,000 due to a near tripling of the residential sector population. In recent years this fuel-switching trend away from woodfuels and towards "modern" fuels like LPG and kerosene has continued, although actual switching behavior is rarely discrete and there is a significant amount of "reverse" fuel-switching also taking place. The two most commonly reported fuel-switches are from fuelwood to kerosene and kerosene to LPG, supporting the general notion of a move from traditional to modern fuels with kerosene serving as a transition fuel in the process. However, even in those cases where a household switches out of fuelwood or charcoal, these fuels are still widely utilized on a back-up and supplemental basis. In addition, 4% of the sampled households (or 21% of the households reporting a fuel-switch in the last five years) were found to have actually shifted from kerosene or LPG *back* to woodfuels, mainly as a result of stove problems or concern over the safety of modern fuel cooking devices. Overall, household fuel-choice decisions in Cebu City appear to be quite flexible and most households maintain the capability to use two or more different fuels at any given point in time. Besides fuel-switching, an additional factor affecting levels of residential sector woodfuel demand is the tendency towards increased household purchases of pre-cooked meals from neighborhood food vendors and eateries. Since low-income households generally purchase pre-cooked foods far more frequently, and since these households also tend to be woodfuel-users, this trend should serve to reduce residential sector woodfuel demand. At the same time, food vendors were also found to be highly reliant on woodfuels, but the possibility of scale economies in energy consumption by these businesses may be having the effect of keeping *overall* levels of woodfuel demand at a lower level than would be the case in their absence.

3. *Commercial and Industrial Sector Woodfuel Demand:* Woodfuel-using businesses and institutions account for 37% of the fuelwood and 49% of the charcoal consumed annually in Cebu City. The largest consumers of fuelwood are eateries and food vendors, bakeries, snack food vendors, and a variety of industrial firms including manufacturers of rattan furniture and fashion accessories. The largest commercial

sector consumers of charcoal are sidewalk barbecue stalls, eateries and food vendors, and bakeries. The larger commercial establishments were found to be receiving much of their woodfuel directly from rural traders, by-passing the urban trading network altogether. The rattan furniture and fashion accessory manufacturers were also found to be meeting a significant portion of their fuelwood demand through the use of self-generated scrap and wood wastes. Overall, commercial sector establishments were generally less dependent on *primary* fuelwood than households, with some types of businesses making extensive use of scrap and wood wastes or a variety of non-woody biomass fuels like bamboo and coconut fronds, husks and shells. The factors most responsible for maintaining commercial sector woodfuel demand differed from those for households, and were also found to vary significantly among the different types of businesses surveyed. In general, small-scale informal sector businesses used woodfuels either because they could not afford modern cooking equipment or because woodfuels were more appropriate to the type of activity undertaken (such as charcoal for barbecuing). Large-scale formal sector businesses tended to utilize woodfuels because they found these fuels relatively inexpensive or, in some cases, could be obtained for free in the form of self-generated wood wastes.

4. *Woodfuel-Producing Land Use Systems and Tree Species:* Indications are that there has been a substantial trade in woodfuels in the urban areas of Cebu since at least the early part of this century. Initially, much of this trade involved the extraction of naturally-growing tree species from shrub and secondary forest areas in the Central Cebu hillylands. Today, the bulk of commercially-traded woodfuels in the province are produced from planted trees grown and managed on agricultural lands. Fast-growing varieties like *Leucaena leucocephala* and *Gliricidia sepium* account for close to 60% of fuelwood (excluding non-woody biomass) and over 70% of charcoal being sold. These trees are propagated and managed as part of a variety of land use categories including tree fallows, small woodlots, tree plantations, and in combination with food and cash crops. Fruit-bearing trees such as mango, star apple, and tamarind are the second most important category in terms of woodfuel production, accounting for 23% of fuelwood and 14% of charcoal traded. These trees are found growing throughout the agricultural landscape and are rarely, if ever, felled for woodfuel purposes. Instead, fallen branches and/or storm-damaged trees are utilized. Naturally-growing shrub and tree species common in patches of secondary regrowth, including *Vitex parviflora, Psidium guajava*, and *Buchanania arborescens*, still make up 16% of fuelwood and 12% of charcoal commercially traded in the city. Government regulations regarding the harvesting and transport of these species are much stricter than those for planted varieties, but large areas of idle land and shrubland in interior portions of the province still contain these species and are regularly exploited for woodfuel purposes, generally without the proper permits. On the whole, however, most of the commercially-traded woodfuel in Cebu meets government requirements of originating from a *planted* variety harvested from *titled* lands. The existence of a strong urban demand for woodfuels even appears to have induced more widespread tree-planting by Cebuano farmers, a development which is beneficial both in terms of the environment and for rural living standards as well.
5. *Woodfuel Harvesting and Conversion Practices:* Fast-growing tree species like

Leucaena and *Gliricidia* are typically harvested on a two-year rotation, with the most common approach being to coppice these trees at a height of about 25 cm. above the ground. Cutting is done with simple hand-held machetes, smaller branches are usually removed immediately and left on the slope as ground cover and green manure, and in some instances corn is planted around the coppiced stumps for one harvest before the trees are allowed to grow back again. Depending on conditions, harvested trees are either cut up for fuelwood bundles and/or converted to charcoal at the point of extraction, or are hauled *as is* to a roadside for further conversion. Most charcoal is produced in simple earth-pit kilns, although some charcoal-makers in the north prefer an above-ground pile method. Smallholders growing trees in woodlots or as part of an agroforestry approach will tend to harvest these trees on their own. In cases where trees are being grown in larger fallow areas or in plantations, cutting and conversion is usually done by tenants and/or hired wood-cutters on either a sharing or wage basis. The harvesting and conversion of trees for sale in commercial woodfuel markets of the province is estimated to provide at least supplemental employment and income to 35,000 rural families, or 15% of the population.

6. *Rural Woopfuel Marketing and Transport:* The rural trading and transport network provides the link between woodfuel-producing areas of the province and urban markets. There is no single "system" of rural woodfuel trading in Cebu, instead the approach taken and the number of intermediaries involved varies greatly depending on distance to the city, the fuel being traded, and the history of the commercial woodfuel trade in that particular area. Generally speaking, the rural traders are widely perceived as being "exploitative middlemen" among urban residents and government and NGO officials. In contrast, our research indicates that the rural traders perform a critical role in the trade, expending large amounts of time and financial capital in the process, and earning returns generally commensurate with their effort and the risks involved in the trade. Woodfuels are transported from rural to urban areas in a variety of conveyances. Six-wheel drive cargo trucks with capacities of from 2 to 10 tons generally ply the longer-distance routes originating from points north and south of the city. Passenger jeepneys are more commonly used for loads of woodfuels originating from mountain *barangays* west of the city in the Central Cebu hillyland area. In general, the commercial woodfuel trade appears competitive throughout, with margins earned by each group of actors in the trade tending to reflect the costs actually encountered by them. Although there was significant variation throughout the province, wood-cutters and charcoal-makers typically earned from 30 to 50% of the final selling price of these fuels, landowners 15 to 20%, vehicle owners 10 to 25%, rural traders 10 to 20%, and urban traders 10 to 20%.

7. *Urban Woodfuel Markets:* Of all the woodfuels originating from rural areas of the province and ultimately consumed in the urban areas, close to 80% first pass through the hands of one of hundreds of woodfuel wholesalers and retailers found throughout Metro Cebu. In some cases the urban traders simply buy and sell fuelwood and charcoal *as is*, while in others they practice "break of bulk" in order to make these fuels available in smaller units and at prices more affordable to low-income consumers. Urban traders tend to stock different *types* of woodfuels in

different *quantities* depending on the needs of their primary customers. Large wholesalers stock bulk fuelwood logs and sacks of charcoal for sale to bakeries and other commercial establishments. Small retailers carry split fuelwood sticks in bundles weighing as little as .6 kg. each, and re-packed charcoal in cellophane bags of ten weighing only .2 kg. each, for sale to low-income residential consumers. With a few notable exceptions, the urban woodfuel traders were found to be relying on this activity for most of their income, and they generally belonged to a lower socioeconomic bracket than their rural counterparts. They also reported that the business is less profitable today than in the past due to a combination of increased competition in the trade and fuel-switching in urban households and commercial establishments.

8. *Policy and Research Issues:* The study findings indicate that changes are needed in the way in which the woodfuel trade is regulated in Cebu. In addition, the results also suggest the need for additional research on certain aspects of the commercial woodfuel system, and revisions in current reforestation and upland agriculture projects in the province. First, regulations currently in place to manage the woodfuel trade are largely ineffective and may be discouraging more widespread tree-planting on the part of farmers. An alternative regulatory system is proposed which is based on the licensing of larger traders and enforced solely on the basis of tree *species* being shipped, as opposed to the current system which attempts to determine the origin of each shipment. A species-based/licensing approach is generally more acceptable to woodfuel traders, it would generate more revenue for the government, would tend to encourage more tree-planting even by farmers who are technically squatting on government land, and would be just as, if not more effective at protecting remaining forested areas and government reforestation projects than the current system. Second, additional research is sorely needed in order to better understand certain aspects of the woodfuel trade in Cebu and suggest areas for improvement. In particular, a thorough assessment of woodfuel potential from *all* land use categories should be undertaken in order to determine the true extent of a "shortage" on the island, and research should be conducted into the possibility of increasing potential woodfuel supplies through variations in species and management practices. On the demand-side, research needs to be carried out on the potential costs and benefits of programs aimed at increasing the efficiency of woodfuel use in homes and businesses in Cebu City. Finally, reforestation and upland agriculture projects currently being undertaken in the province appear to have paid little attention to the potential for propagation of fast-growing tree species *primarily* for woodfuel purposes, even though Cebuano farmers have long realized the benefits of such an approach. A combination of economic, social and natural factors extant in most rural areas of the province make highly cash- and labor-intensive agroforestry approaches a non-option. Furthermore, longer-maturing hardwood tree species, while yielding much higher returns per unit of land, are often not readily planted by farmers because of a combination of uncertain tenure, short time horizons, and a shortage of labor needed to establish and maintain these stands.

1 INTRODUCTION

1.1 Background

The island of Cebu, in the Central Visayan region of the Philippines, is considered by many to be the most environmentally degraded province in the country. Recent estimates of land use patterns reveal that the province is 99.6% deforested (World Bank 1989a), population densities are 520 persons/km^2, over twice the national average (NSO 1990), and three-fourths of the island's land area is greater than 20% in slope (PPDS 1987). This combination of near total lack of forest cover, steep terrain, high population densities and widespread cultivation of annual crops (mainly corn) by upland tenant farmers and smallholders has led to concern over rates of soil loss, with nearly all of Cebu's uplands classified as suffering from moderate to severe erosion (DA, no date). This situation has prompted government, civic, and even church leaders in the region to predict a dire environmental future for Cebu in the form of water shortages, flash floods and desertification unless drastic measures are taken to reforest large areas of the island. The extraction and utilization of woodfuels is often pointed to as a primary agent in the denudation of Cebu's environment, and public perception, at least in urban areas and among policy-makers and government officials, is that woodfuel use should be discouraged.

However, a careful appraisal of the issues of land use and the environment in Cebu in general, and the role of woodfuel extraction in environmental denudation in particular, leads to a number of serious questions. To begin with, the current extent of deforestation and erosion in the uplands of Cebu appears to be nothing new. Reports of the island already being 94% deforested and suffering from serious soil erosion can be found dating back as far as 1870 (Ahern 1901; Vandermeer 1963; Roth 1983, cited in Poffenberger 1990). Second, the vast majority of the island's rural residents have remained dependent on woodfuels and other biomass fuels for their cooking needs, while the commercial woodfuel trade in the urban areas continues to flourish with prices for these fuels changing little, in real terms, over the last 20 years (Wiersum 1982; Remedio 1988; Bawagan 1989). Such evidence, combined with findings from our research to be presented below, suggests that woodfuel extraction may have little to do with deforestation and resource denudation in the past or the present, and that current systems of land use and tree management in non-forested areas of the province may be capable of providing adequate woodfuel supplies for the foreseeable future.

Given historical land use patterns in the province, and current farming and tree-planting practices in the uplands, it is apparent that the issue of deforestation and environmental degradation in Cebu is far more complicated than often assumed. The role of woodfuel extraction and use as an agent in this process appears especially prone to misunderstanding. This report presents the results of research conducted between September 1991 and March 1993 on the commercial woodfuel trade in Cebu Province. While the report cannot hope to provide definitive answers to all of the questions surrounding woodfuel-environment interactions, it will argue that current perceptions of the woodfuel trade as a major source of environmental degradation are widely inaccurate. In contrast, many of the woodfuel production practices that have evolved in Cebu over the years, largely in response to strong urban demand, are having the effect of stabilizing upland environments and providing rural residents with a critical source of cash income. Seen from this perspective, the commercial woodfuel trade in the province goes from being a problem to be discouraged, to an opportunity to be nurtured and promoted.

1.2 Purpose and Scope of the Study

In order to best meet the objectives of the study, our research was designed and carried out in three separate phases dealing, respectively, with issues of commercial[1] woodfuel demand, woodfuel transport and marketing, and woodfuel production and harvest. The sequencing of the research was arranged so that each phase would provide us with information needed in the preparation and execution of subsequent work. For example, interviews with urban woodfuel traders helped in defining the sample frame for later surveys of woodfuel-using commercial and industrial establishments, as well as in selecting sites for the investigation of woodfuel production and harvest patterns. Portions of the study dealing with woodfuel marketing and consumption were intentionally more quantitative than those dealing with how woodfuel-producing trees are grown and harvested. This approach was taken for a number of reasons to be discussed in more detail in Appendix A. As a result of these decisions, however, we found ourselves employing a variety of survey methodologies and techniques ranging from highly-structured, pre-coded questionnaires of household energy use to Rapid Rural Appraisal (RRA) methods for exploring the broader patterns of woodfuel production and transport. Given this background, the following can be set forth as the objectives of the study and as issues which will be addressed in the remainder of this report.

1. Quantify the importance of woodfuels as a source of energy for households, institutions, and commercial and industrial establishments in Cebu City.

2. Determine the factors which create and maintain a commercial demand for woodfuels in Cebu, and examine the extent to which a fuel-switching transition away from woodfuels and towards conventional fuels has, or is likely, to take place.

3. Explore the ways in which woodfuel-producing trees are grown, managed, and harvested in the province and examine the implications (both positive and negative) these practices may have for the regional environment.

4. Determine the contribution of the commercial woodfuel industry to employment and income generation in both rural and urban areas of the province.

5. Analyze the process by which woodfuels are moved from rural producing areas to urban consuming centers, and assess the competitiveness of the trade at each stage in this process.

6. Examine the legal and policy framework within which woodfuel production and use takes place in Cebu, and suggest changes in policies, projects, and research agendas which might improve the sustainability and efficiency of the commercial woodfuel system.

7. Evaluate the effectiveness of a variety of research methodologies and survey techniques for the study of commercial woodfuel systems, and offer guidelines to researchers interested in conducting similar types of studies.

[1] By commercial woodfuel demand we are referring to fuelwood, charcoal and other biomass fuels that are *traded* in markets as opposed to freely gathered.

The first two objectives are to be addressed in Section 2 where we discuss the patterns of, and factors affecting, the use of woodfuels by households, businesses and institutions in Cebu City. Objectives 3, 4 and 5 are discussed in Section 3, which examines the processes by which woodfuels are grown, harvested, converted, traded and transported before finally reaching the urban woodfuel traders and consumers. Objective 6 is addressed in Section 4 which discusses woodfuel policy issues and provides suggestions for how the commercial woodfuel trade in Cebu could be made more efficient and sustainable. Finally, objective 7 is dealt with in Appendix A where we discuss the research techniques employed in this study and debate the relative merits of various other approaches available for the study of commercial woodfuel systems in developing countries.

In terms of the scope of this study, it should be pointed out that estimates of woodfuel consumption by households and business establishments presented below apply only to the 49 urban *barangays* [2] of Cebu City proper, population 550,000. In contrast, the greater Cebu City metropolitan area, including urban Cebu City, the hillyland *barangays* of Cebu City, Mandaue and Lapu-Lapu Cities, as well as adjoining municipalities, has a population of close to 1.1 million. In addition, Mandaue City contains a large number of industries utilizing woodfuels in their production activities, including rattan furniture factories, carrageenan manufacturers, and producers of fashion accessories. Future research will attempt to further quantify woodfuel use in these businesses and in other sectors in the Metro Cebu area. In the meantime, the estimates presented below should be seen as representing perhaps only one-half of *urban* woodfuel consumption in Cebu Province, and none of the *rural* consumption since this is largely met through subsistence gathering and our primary focus at this point is to examine the workings of the commercial woodfuel trade.

Before proceeding directly to the findings of our research, a more thorough description of the study site, as well as an introduction to the role of woodfuels and other biomass in the overall Philippine energy system, is in order.

1.3 Description of Study Site

The Province of Cebu is situated in the Central Visayan region of the Philippines, 550 km. south-east of Manila (Figure 1). The island is long and narrow, stretching 220 km. on a north-south trend while only 40 km. in breadth at its widest point. With a 1990 population of 2.65 million inhabitants, and a land area of 5,088 km^2, Cebu's population density stood at 520 persons/km^2, making it the sixth most densely populated province in the country. Slightly over 1 million of the island's residents are concentrated in the Cebu City metropolitan area which, besides Manila, is the most populous urban center in the country. The remaining 1.5 million residents live in largely rural areas of the island's uplands and coastal plain.

Essentially, the province has two distinct economies. The urban economy of Metro Cebu serves as the center for commerce, manufacturing, services, transport and communication for the Visayas and Mindanao. Over three-fourths of the city's workforce is employed in the commercial, service and manufacturing sectors (NSO 1992), with a highly export-oriented manufacturing sector producing, among other things, electronics, fashion accessories, furniture, watches, food additives,

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[2] A *Barangay* is the smallest political unit in the Philippines.

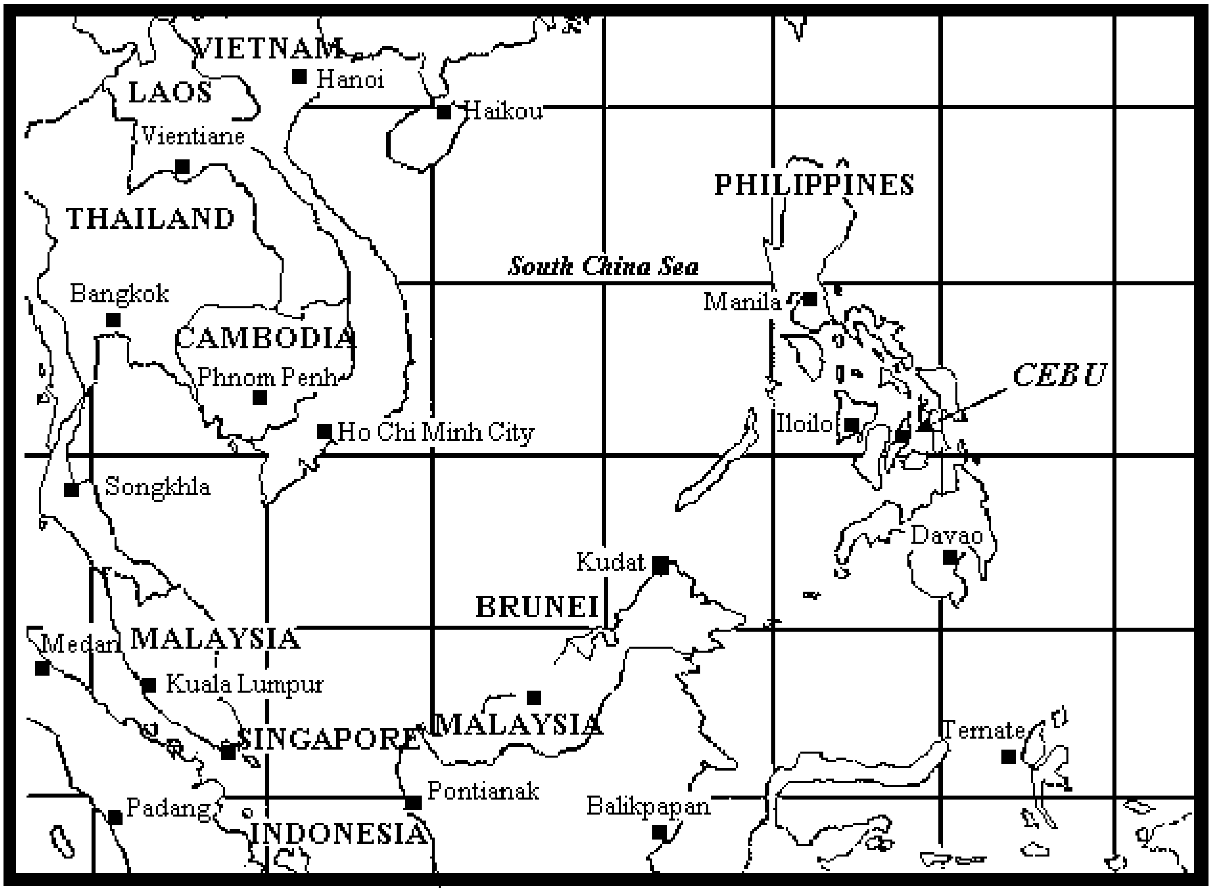

Figure 1: Map of the Philippines and Southeast Asia

glassware, activated carbon, garments, and processed coconut products. The rural economy, in contrast, is dominated by near-subsistence farming and fishing activities, with over 60% of those employed in the rural areas reporting farming or fishing as their major occupation (NSO 1992). Corn and coconut are the most widely grown crops with a combined hectarage of 1,600 km^2, close to one-third of the island's land area and 70% of the area under cultivation (World Bank 1989a). In addition, large portions of the province are classified as having a “mixed extensive” land use pattern, including grassland and cultivated area mixed with brushland (NAMRIA 1988).

The island's topography is dominated by the uplands. Only one-fourth of the total land area is in the 0 to 18% slope category. Rugged mountains in the island's interior rise to as high as 1,000 meters above sea level, with slightly over 80% of the land area in the range of 100 to 800 meters (PPDS 1987). The province receives an annual average rainfall of around 1,500 mm with no pronounced dry or wet season. Cebu's location, in the central portion of the Visayan region, helps to shelter it from most of the typhoons that batter the eastern and northern provinces of the country. As recently as November 1990, however, the island received a direct hit from a super typhoon which left large areas of the province without power or running water for over a month.

Since 1987, the province has experienced what some local politicians and business leaders have labelled “Ce-Boom”. Recent years have seen the expansion of Cebu's Export Processing Zone and dozens of Filipino and transnational firms are building new plants both within and outside of the zone, some locating increasingly further away from what had been considered Metro Cebu. In an attempt to entice even more investors, the provincial government is promoting Cebu as an attractive alternative to Metro Manila with its congestion, power problems, and bureaucratic inertia. A five-year building boom in office complexes, housing subdivisions and industrial estates has transformed the skyline and shows little indication of letting up. Cebu's international airport now receives direct flights from Japan, Hong Kong and other parts of Asia, making the island a major tourist destination in the region. Although statistics for Cebu only are hard to come by, evidence for the Central Visayan region as a whole is that the recent economic boom has done little to alter prevailing rates of poverty within the region, with over half the population still living below the government-established poverty threshold (Balisacan 1992; Cruz and Repetto 1992).

1.4 The Wood Energy Situation in the Philippines [3]

The contribution of woodfuels and other forms of biomass[4] to the overall energy needs of the Philippines is a matter of some uncertainty. The Office of Energy Affairs (OEA) in its National Energy Plan for 1992-2000, reports the current contribution of non-conventional fuels (of which woodfuels form only a part) at less than 13% of the total (OEA 1992). In contrast, the Biomass Users Network (BUN) reports that fuelwood *alone* accounts for 52% of total energy consumption in the country, with all forms of biomass contributing to 73% of the total (cited in Hall 1991). The major difference between the two estimates is that the OEA only considers the use of bagasse and other forms of agricultural wastes and residues by large agro-industrial consumers, overlooking the consumption of biomass fuels by thousands of smaller-scale industries as well as in close to 8 million households nationwide. On the other hand, the BUN estimate of 73% is significantly higher than the most frequently cited figures of between 35 and 50%, including a recent estimate of 36% made in perhaps the most comprehensive study of biomass fuel use in the Philippines so far (DAP 1992). If the figure of 36% is taken as the current best estimate, then it appears that biomass fuel use in the Philippines is on the order of 60 million barrels of fuel oil equivalent (MMBFOE) annually. Since 60 MMBFOE is equivalent to approximately 80% of the Philippines' actual oil imports for 1991, biomass fuel use can be said to have reduced the *potential* oil import bill by almost half. At the same time, the recently completed Philippine Household Energy Strategy (PHES) study estimates that approximately 10% of rural Filipino households (600,000 in all) derive some income from selling woodfuels in commercial markets, with these sales providing an average of 40% of the cash income for those involved in the trade (cited in DAP 1992).

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[3] The discussion in this section can only provide a brief introduction to the topic. For more details the reader is referred to Wiersum 1982; Hyman 1983, 1984, 1985; Bawagan 1989; DENR 1989; Pasicolan 1989; Serna 1989; Cruz et al. 1991; Soussan 1991; Bensel and Remedio 1992; and DAP 1992.

[4] Throughout this report we will use the term ‘woodfuel’ in the broadest sense to refer to woody fuels from trees (*primary* fuelwood and charcoal) and non-woody biomass fuels such as coconut fronds (*secondary* fuelwood).

According to the DAP (1992) study, the industrial (i.e. non-residential) sector accounts for slightly over one-third of all the biomass fuel consumption nationwide, with most of this usage being accounted for by bakeries, sugar factories, tobacco curing barns, and a variety of small-scale commercial and industrial establishments (e.g. eateries, brick-making, lime kilns and food processors). There are, however, significant differences between the residential and industrial sectors in both the *types* of biomass fuels they consume as well as the *ways* by which these fuels are obtained. Non-woody biomass (e.g. coconut shells and husks, bagasse, rice hulls) and wood wastes constitute over 60% of industrial biomass fuel use, whereas these fuels are only estimated to make up 15% of residential consumption. In terms of how these fuels are obtained, the industrial consumers are far more dependent on *traded* biomass fuels while most households, with the exception of those in urban areas, usually gather their own supplies freely. Overall, 36% of biomass fuel demand in the Philippines is traded in commercial markets, with industrial users purchasing close to two-thirds of this total.

Just as there is uncertainty over the level of woodfuel consumption in the Philippines, there are also questions over the volume of available supplies and any contribution woodfuel use may make to regional environmental degradation. The Department of Environment and Natural Resources (DENR) Master Plan for Forestry Development estimates an available fuelwood supply in 1990 of only 23.2 million m^3 (approximately 17.4 million tons using conversion figures from the DAP study) versus a fuelwood demand of 38.7 m^3 (29 million tons), resulting in a shortage of 15.5 m^3 which, presumably, must be made up for by further exploitation of forest resources (DENR 1989; DENR 1990). A vastly different estimate, prepared by members of the PHES mission, places annual *sustainable* biomass fuel yields at over 100 million metric tons, more than three times greater than demand (Soussan 1991). Furthermore, over 60% of this estimated sustainable supply is said to be available from *non-forest* lands, a notion generally supported by PHES results which show that 90% of rural and 70% of urban woodfuel needs originate from lands outside of the forest (Soussan 1991; Pujanes 1993a). As was the case with the estimates for woodfuel demand, it appears that a more realistic assessment of total biomass fuel supplies would likely fall somewhere within the range set out by the two estimates discussed above. The biggest uncertainties over the level of biomass fuel supplies in the Philippines stem from disagreements over estimates of sustainable yields from various land use categories, degree of inclusion of non-woody biomass sources, and the extent to which each estimate accounts for the *availability* of woodfuels relative to population and consuming centers.

While developing an accurate assessment of the woodfuel supply and demand picture at the national level is important, we need to keep in mind that woodfuel situations vary greatly between regions *within* the country. A favorable overall national picture, such as that developed by the PHES study, does not exclude the possibility of regionalized woodfuel shortages with the potential of subsequent impacts on the local environment. As a first step in highlighting these regional variations a number of studies have adopted a “typological approach” which combines local assessments of the environment/biomass situation with socioeconomic and demographic data in order to categorize the local biomass situation relative to other areas of the country (Mercer and Soussan 1992; Soussan et al. 1992a). In Pakistan, the recently completed UNDP/World Bank ESMAP Household Energy Strategy Study Project conducted a 2-stage sampling scheme whereby low-resolution satellite imagery was combined with geographic data (topography, climate) in order to develop an initial agro-ecological zonation. These zones were then used as the basis for a more detailed classification scheme from which areas for field sampling and actual measurement of biomass yields could be made (Archer 1993; Ouerghi 1993). In the Philippines, a much simpler zonation was developed using uniform conversion factors to develop estimates of *primary*, *secondary* and *tertiary* biomass fuel supplies given the areas under various land use categories in each province. This biomass supply indicator is then combined with data on population density to arrive at a provincial categorization that relates potential supplies with population (Soussan 1991; DAP 1992). While the latter approach may be too simplistic to suggest detailed policy measures at the regional level, they are an effective way to focus attention upon those areas most susceptible to potential forms of woodfuel stress. From there, more detailed local studies can be conducted to suggest specific interventions for that area.

In recent years, understanding of the contribution of woodfuels and other biomass fuels to the energy needs of the Philippines has improved dramatically. Likewise, the perception of how woodfuel extraction and use affects the environment has undergone revision. These advances in understanding *have* had an impact on policy in the energy and environment sector, including fundamental improvements in regulations relating to the harvesting and transport of trees planted on private lands. Overall, however, policy has not been able to keep up with the changes taking place. More importantly, development and implementation of policy in the energy and forestry sectors has not been devolved to the local level, making an improved understanding of local woodfuel situations somewhat irrelevant from the perspective of suggesting and carrying out policy changes. This will have to be the next big challenge for the energy and environment departments, to figure a way in which improved local understanding of woodfuel systems can be translated into specific actions for that region without sacrificing the national objectives of forest and environmental protection.

2 THE DEMAND FOR WOODFUELS IN CEBU CITY

2.1 Overview

This section presents the results of a series of surveys on the energy consumption patterns of households, institutions, commercial and industrial establishments administered from February to December 1992, in the 49 urban *barangays* of Cebu City. In all, 603 households, 56 institutions, and 456 businesses were surveyed, and information was gathered on the types of energy they consume, quantities consumed, sources and prices paid, reasons for choosing certain fuels over others, and general background information on the household or establishment. A random sampling approach was utilized for the household survey based on a sampling frame developed from the master list of households compiled by the National Statistics Office 1990 Census of Population and Housing. A combination of random and non-random sampling approaches were used for the surveys of institutions, commercial and industrial establishments (henceforth referred to as the "commercial" sector) depending on the availability or lack of accurate local government listings on the true population of these establishments. A more detailed description of the methodologies employed in conducting these surveys can be found in the discussion below, as well as in Appendix A of this report and in a separate paper by Remedio (1993).

The information garnered from these surveys suggest that fuelwood and charcoal are still a significant source of energy in both the residential and commercial sectors of Cebu City, and are likely to remain so for the foreseeable future. Besides this, however, patterns of woodfuel procurement and use were found to vary substantially between the residential and commercial sectors in a number of different ways, and even *within* the commercial sector there was substantial variation between the different types of establishments. For example, households meet a significant portion of their fuelwood demand by "freely" gathering a variety of woody and non-woody biomass fuels, with the rest coming mainly from urban wholesalers and retailers. Large commercial establishments, in contrast, generally obtain their fuelwood direct from rural traders, by-passing the urban trading network altogether. Some industrial establishments depend mainly on scrap wood and other wood wastes, either generated on-site or purchased from urban merchants dealing in this resource. Due to differences that were found to exist between the different categories of woodfuel consumers, the discussion below will be divided into two broad sections looking first at household usage and then at commercial establishments. Following this, a brief summary discussion will synthesize the findings on the demand for woodfuels in Cebu City and suggest the likelihood of these fuels remaining a significant source of energy in the future.

2.2 Patterns of Woodfuel Use in the Residential Sector of Cebu City

2.2.1 Fuelwood

Table 1 presents the breakdown of *primary* cooking fuel usage in Cebu City households by income category for the year 1992. Perhaps not surprisingly, the table shows that income exerts a strong influence on household fuel choice decisions, with 74.4% of the lowest-income households dependent on fuelwood or charcoal and 80% of the highest income households utilizing LPG as their main cooking fuel. Kerosene is clearly a lower middle-income fuel, increasing in usage among

Table 1: Primary Cooking Fuels for a Random Sample of 603 Cebu City Households, by Income Category, 1992

	Income (Pesos/Month)					
	0-1,999 (*n*=82) % using	2,000-4,999 (*n*=235) % using	5,000-9,999 (*n*=165) % using	10,000-19,999 (*n*=81) % using	20,000-highest (*n*=40) % using	Total (*n*=603) % using
Fuelwood	64.6	32.3	20.6	9.9	0.0	28.4
Charcoal	9.8	6.4	4.2	1.2	2.5	5.3
Kerosene	15.9	24.3	21.8	9.9	5.0	19.2
LPG	4.9	23.8	46.1	69.1	80.0	37.1
Electric	1.2	0.0	0.0	1.2	5.0	0.7
Sawdust	0.0	3.0	0.6	0.0	0.0	1.3
Multiple Primary Fuels	2.4	8.9	6.7	8.6	7.5	7.3
Not Cooking	1.2	1.3	0.0	0.0	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

households with over P2,000 monthly income[5] but sharply declining after income reaches P10,000. A small percentage of households were found to be using electricity (0.7%) and sawdust (1.3%) as their primary cooking fuels, while another 0.7% of the surveyed households reported doing no cooking at all, instead relying on food vendors and neighborhood eateries for their meals.

In addition to specific fuel types, Table 1 also includes a category for "multiple fuels", with 7.3% of the surveyed households listed under this category. These households utilize two or more fuels near equally and often simultaneously, with the most common combination being fuelwood and kerosene. A typical pattern is to use fuelwood or charcoal for cooking rice while a kerosene stove is utilized in preparing the vegetable, fish or meat side dishes. Other households will utilize scrap wood or freely gathered fuelwood for most of their cooking if, and when, these are available, and then rely mainly on kerosene when they are not. Some higher-income households utilize a combination electric/LPG range, while others allow their maids to use a combination of LPG and charcoal because of strong taste preferences for certain types of food cooked with the latter. As a result, it would be inaccurate to list these households under any single fuel category. Furthermore, the practice of multiple fuel usage is an indication of the degree of flexibility that many households have in making fuel-choice decisions, a fact that has important implications for estimating household woodfuel demand and for understanding the dynamics of household fuel-switching transitions.

It should be pointed out that a far greater percentage of households actually practice multiple fuel usage than the 7.3% listed in Table 1. The difference is that most households have a single primary fuel which they rely on for the bulk of their cooking needs, while one or more other fuels are secondary and only utilized on a back-up or supplemental basis. This pattern of primary/secondary cooking fuel usage also has important implications for a discussion of household woodfuel demand since it is clear that fuelwood and charcoal are, by far, the most widely used secondary and/or tertiary fuels. While only one-third of the city's households use woodfuels on a primary basis, nearly half were found to be using fuelwood, and nearly three-fourths

5 In 1992, the foreign exchange rate for the Philippine Peso (P) was usually close to U.S. $1 = P25.

charcoal, at least once a month for special cooking needs (such as the slow cooking of soups or beans and grilling of meat or fish), on certain occasions when a lot of cooking is done (e.g. fiestas, weddings, birthdays), and as a back-up or reserve fuel primarily for LPG.

Fuelwood-using households cited a variety of reasons for their decision to utilize this fuel, and these are summarized in Table 2. It's interesting to note that a preference for the taste of food cooked with fuelwood appears to be the most commonly cited reason for using this fuel (65.2%), and the single most important determinant for nearly one-third (30.4%) of the fuelwood-using households. Next in importance as a determining factor is a perception of fuelwood as an inexpensive fuel, although by this many respondents were referring to the overall economics of using this fuel including stove costs and ability to purchase in small quantities, not necessarily just the per unit price of the fuel itself. In fact, convenience and ease of purchase were important factors for 33.9% of the fuelwood-using households, with most families being able to purchase fuelwood within a few hundred meters from their residence in quantities and at prices commensurate with their budget and restricted cash flows. Close to one-third of the households using fuelwood cited an access to free sources of this fuel (such as scrap and construction wastes) as one reason for using wood, with this being the single most important determinant for 13.4% of them. Other common reasons cited include the fact that fuelwood fires cook food fast and that fuelwood stoves are more flexible in their usage than kerosene and LPG stoves, the use of fuelwood for specific cooking purposes, the low cost (or no cost) of fuelwood stoves, and using fuelwood temporarily because a kerosene or LPG stove is under repair or the household cannot yet afford to refill an LPG canister. These findings suggest that non-cost factors such as taste and easy availability are often important determinants in household decisions to use woodfuels, and that considerations of fuel costs include not just the prices of the fuels themselves but also equipment costs and the ability to purchase in small quantities on a daily basis in order to match low-income household budget constraints.

In trying to understand the factors that create household demand for fuelwood, it is equally informative to look at the major reasons cited by residential consumers for why they *do not* utilize alternative fuels such as kerosene and LPG. As will be discussed further below, patterns of primary cooking fuel usage in the residential sector of Cebu City have undergone significant change over the last three decades, but thousands of urban households still rely mainly on woodfuels. What factors are inhibiting a more widespread and comprehensive residential sector fuel-switch to conventional petroleum fuels? In the case of kerosene, the most widely cited reason for not using this fuel was that kerosene stoves are perceived as unsafe and a fire hazard. Nearly 60% of the households not using kerosene as a cooking fuel cited this as a factor in their decision, with a number of households reporting that they had actually experienced kerosene stove fires, prompting them to later switch to another fuel. Other important factors cited include kerosene being a “dirty” fuel to use (38.2%), and kerosene stoves imparting a bad taste to cooked food (20.4%). As was the case with fuelwood, the ready availability of kerosene at most neighborhood *sari-sari* stores in quantities as small as 75 ml turned out to be an important determinant for households that *do* make use of this fuel for cooking purposes. It should also be mentioned that the cost of kerosene stoves was *not* perceived as a major obstacle to the use of this fuel. In the case of LPG, 61.4% of the households not using this fuel cited economic considerations as the *single most important* factor in their decision, while another 31.8% cited safety reasons and a fear of LPG canister explosions. Not a single non-using household cited problems with availability as a factor in their decision, a finding not surprising to local oil company officials who claim that the LPG distribution system in Cebu has been well-established and functioning for over 20 years.

Table 2: Factors Cited by Fuelwood-Using Households for Use of This Fuel

Reason	% of Respondents Citing as *a* Reason for Use	% of Respondents Citing as *Most Important* Reason for Use
Food Cooked with Wood Tastes Better	65.2%	30.4%
Fuelwood is Inexpensive	47.8%	15.9%
Fuelwood is Available Nearby/Easy to Purchase/ Always Available	33.9%	13.8%
Household Able to Obtain Fuelwood for Free	31.2%	13.4%
Fuelwood Gives off High Heat/Cooks Food Fast	16.3%	9.1%
Fuelwood Used Only for Specific Types of Cooking	8.3%	4.0%
Fuelwood Stoves are Inexpensive	19.6%	2.5%
Others	43.5%	10.9%
TOTAL		**100.0%**

Overall, it appears that problems with availability of LPG or kerosene are *not* a significant factor in explaining continued widespread usage of fuelwood by urban households in Cebu, although ready availability of fuelwood *is* important. Economic factors relating to the costs of LPG stoves, tank deposits, and the “lumpy” nature of LPG purchases requiring a one-time payment of over P130 for an 11 kg. tank are the most significant hindrance to more widespread use of this fuel. Even if a stove purchase were possible, many residents of low-income neighborhoods indicated that the presence of such a device on their premises, along with an LPG canister, would just be inviting theft. Safety concerns and fears of fires and explosions also proved a significant hindrance to greater use of LPG and kerosene. Records kept with the Cebu City Fire Department do in fact indicate that 61.6% of the stove/cooking fires reported in the city in 1990-91 involved kerosene or LPG stoves, with slightly more cases of kerosene stove fires. In contrast, 36.4% of the fires involved fuelwood and/or charcoal stoves. In general, it also appears that the woodfuel-induced fires were easier to contain. Nearly all of the fires involving the use of LPG were caused by improper placement and use of the cylinder and involved human error. The fires caused by kerosene, on the other hand, often resulted from the generally shoddy quality of many of the kerosene stoves available on the market.

It is obvious then, that factors such as taste preferences, safety concerns, and inability to purchase the equipment necessary to utilize LPG are significant enough for households to continue using fuelwood even if this fuel is apparently more expensive on an end-use basis. Our data indicate that the average LPG-using household spends around P142/month on this fuel, the average kerosene-using household P140/month on kerosene for cooking purposes, and the average fuelwood-using household, after accounting for freely gathered supplies, P163/month on fuelwood purchases. However, the relatively small cost advantage of LPG and kerosene fuels are somewhat offset by equipment costs. A brand new, Philippine-made single-burner LPG stove can be purchased for anywhere from P650-900, while a locally rebuilt unit can be obtained for P350-400. Stove dealers estimate that the new units will typically last for five to ten years, depending on usage. In order to actually use these stoves the owner has to also purchase a hose and regulator set for P200-400, and either *purchase* an LPG cylinder for close to P2,000 or place a P1,000 deposit for one from a dealer. In the end, at least P1,500 will have been spent, while the fanciest multiple burner gas/electric ranges go for as much as P9,000. Given the general lack of security in low-income households, and the magnitude of this purchase relative to family income, it's no wonder that very few low-income households actually use LPG, while those that do either received an LPG stove as a gift from a relative working abroad, or are utilizing a 10-20 year old second-hand, single-burner unit purchased for as little as P20. Kerosene equipment costs are much less prohibitive, with brand new single burner units available for anywhere from P250 (wick type) up to P450 (gravity feed or pressure type), with an estimated useful life of three to five years, again depending on usage. Second hand rebuilt units can be found for as low as P150-200 but the quality is generally poor and some households reported having to replace the burner after less than one year.

In contrast, nearly 45% of the fuelwood “stoves” in use in Cebu City households cost nothing, including crude three-stone or cinder block arrangements as well as somewhat elaborate designs fashioned by a household member out of biscuit tins, paint and cooking oil cans, or iron reinforcing rods. A variety of ceramic, metal and cement fuelwood stoves can also be purchased for around P25-30 from artisans and at markets throughout the city, typically lasting for anywhere from one to ten years. Though many of these designs are inherently inefficient, we've observed that household cooks using these stoves generally make an effort to shield the open flame from the wind by using scrap roofing material, plywood or other means, suggesting that actual efficiencies of these devices may not be as low as that suggested in the literature. Once stove and equipment costs (after being amortized and discounted)[6] are factored into the equation on monthly expenditures associated with using each fuel, it appears that the “average” LPG-using household has to spend P158/month in order to use this fuel, while kerosene- and fuelwood-using households spend P147 and P164 per month, respectively. While end-use costs for LPG and fuelwood are quite similar (although fuelwood is actually more expensive if time and effort spent gathering “free” supplies were also factored in), the large initial investment needed to use LPG, fear of theft, safety concerns over the use of LPG, and to some extent taste preferences for food cooked with wood, all combine to inhibit wider use of LPG. For kerosene, equipment costs are not a factor, but a strong dislike for the taste of food cooked with kerosene stoves and widespread safety concerns are enough to prevent many households from using this fuel, even if small savings could be achieved. Therefore, any intervention aimed at reducing household fuelwood consumption in Cebu City would do better to address issues of equipment costs and safety as a first priority.

[6] Assuming a 10% discount rate.

In deriving an estimate of average levels of residential fuelwood consumption, care had to be taken to account for those households that only use this fuel on a secondary basis, as well as for households where a significant amount of commercial sector activity takes place on the premises. For the city as a whole, including both fuelwood-using and non-using households, the average per capita and household consumption levels were 93 kg/annum and 541 kg/annum, respectively. Looking only at fuelwood-using households, regardless of whether this is the primary cooking fuel or not, per capita and household consumption levels increase to 204 kg/annum and 1,183 kg/annum, respectively. Finally, taking only those households where fuelwood is the primary cooking fuel, per capita consumption increases further to 303 kg/annum and household consumption to 1,757 kg/annum. Depending on how we want to categorize sectoral woodfuel consumption, however, the latter estimates of per capita and household fuelwood usage can be revised still further to reflect the widespread usage of this fuel in household-based commercial activities. If we subtract out fuelwood usage for commercial purposes, our estimates of per capita and household fuelwood consumption for those families that use wood as their primary cooking fuel decline to 235 kg/annum and 1,362 kg/annum, respectively. As will be discussed further below, thousands of households in Cebu are engaged in "informal sector" commercial activities within the home, and many of these are food-related businesses that consume significant quantities of woodfuels.

Given the consumption estimates presented above, and a 1990 population of 102,446 households in urban Cebu City, we estimate the residential sector consumption of fuelwood to be on the order of 152 metric tons/day, or around 55,480 tons/year. As already suggested, a number of clarifications need to be made before we can accurately interpret the significance of these numbers. These clarifications relate to whether fuelwood is used for household or commercial activities, how fuelwood is obtained, and what "types" of fuelwood are actually being used. To begin with, it's already been mentioned that a significant amount of household fuelwood usage is actually intended for commercial activities rather than for the preparation of family meals. Based on our survey, we estimate that approximately 22.5% of all the fuelwood consumed by households in Cebu City actually goes towards commercial activities, particularly food and snack vending. As a result, close to 12,500 tons of the annual residential sector fuelwood consumption total will be deducted and included under commercial consumption, even though this consumption takes place on household premises.

Second, it was mentioned above that households using fuelwood as their primary cooking fuel spend approximately P163/month on purchases of this fuel *after* accounting for freely gathered supplies. Overall, 25.8% of the fuelwood consumption of Cebu City households consists of wood that has been freely gathered from the urban environment, amounting to 14,314 tons/year. Some families obtain this wood from construction or demolition activities occurring on or near their premises, or from a household member that works at a lumber yard, or a construction site, or as a carpenter or woodcrafter. Other families collect this wood from vacant lots, garbage dumps, parks, and along riverbanks and the coast, with the responsibility for collection being shared about equally between male and female members of the household. Slightly over half of the fuelwood-using households collect some of their supplies for free, with over 20% of these households relying on collection for all of their fuelwood needs. A failure to account for such a significant amount of fuelwood gathering in the urban milieu could result in overestimates of the financial burden of fuelwood purchases on the poorest households. At the same time, it could also be argued that time spent collecting wood should also be valued, and that the social costs of some collection activities, such as children searching for wood in garbage dumps, exceed even the market price for this fuel.

One final qualification that needs to be made with regards to the aggregate fuelwood consumption figures presented above relates to the fundamental issue of how we define the term "fuelwood" itself. As just mentioned, many fuelwood-using households rely on freely gathered wood for some or all of their consumption needs. Much of this collected fuelwood is in the form of scrap wood and wood wastes from construction sites, woodcraft and furniture factories, lumber yards, garbage dumps and warehouse and pier areas. There is even a growing commercial trade in sawdust and scrap wood, with the latter either recycled into the manufacture of wooden packing crates or split and bundled for sale as fuelwood (see Section 3.5). Besides scrap, two other forms of "fuelwood" deserve to be mentioned and accounted for. Coconut fronds (referred to locally as *palwa*) and coconut husks and shells are the primary cooking fuel for nearly three-fourths of the rural households in Cebu Province (Olofson et al. 1989). In urban areas, only the fronds are widely traded and utilized as a cooking fuel, although shells and husks are freely collected and used to a limited extent by close to 10% of households. In addition, split bamboo trunks, referred to in Cebu as *gu-od*, are also traded and utilized by both household and commercial establishments in the city. Overall, approximately 22.6% of the total "fuelwood" consumption in the residential sector of Cebu City (12,538 tons/year) is in the form of coconut fronds, 16.0% (8,877 tons/year) is scrap wood, and 1.8% (980 tons/year) is split bamboo trunks. Throughout the remainder of this report, woody biomass fuels originating directly from felled or coppiced trees in either rural or urban areas will be referred to as *primary* fuelwood, while any discussion of fuelwood in general will be inclusive of scrap wood and the non-woody biomass fuels discussed above.

Figure 2 summarizes the qualifications made above and provides a clearer picture of the various components of household fuelwood demand in Cebu City. Table 3 looks only at fuelwood use for residential cooking purposes (exclusive of commercial activities), and provides a percentage breakdown of fuelwood consumption for these purposes on the basis of the source of the fuel (purchased or gathered) and the types of fuelwood being used. Looking first at Figure 2, we see again that nearly one-fourth of fuelwood consumption in the residential sector goes towards commercial activities taking place within the household. Of the 12,500 tons of fuelwood used annually by household-based businesses, nearly 80% is consumed by households operating either a small eatery and food vending business within the household, or an itinerant food vending business with the cooking being done on the premises. The remaining 20% is accounted for by household-based snack food vendors and food processors. The actual woodfuel use patterns of these businesses, and the possible implication of their increasing numbers on overall levels of fuelwood consumption, will be discussed further in Sections 2.3 and 2.2.3, respectively. For now, it's interesting to point out that nearly half of the fuelwood consumed as part of household-based commercial activities is in the form of coconut fronds, reflecting a combination of the lower per unit cost of this biomass fuel relative to primary fuelwood and its suitability for the type of cooking practiced in small-scale eatery and food vending businesses.

In Table 3, we turn our attention solely to fuelwood consumption for household cooking, exclusive of fuelwood-using commercial activities within the household. The largest single source of fuelwood for household cooking is purchases of primary fuelwood from urban wholesalers, retailers, roving vendors and rural traders. This wood is usually contained in bundles referred to by traders as *raja*, containing well-dried and split sticks from fast-growing tree species like *Leucaena leucocephala* and *Gliricidia sepium*. These bundles are generally sold to households at a per unit price

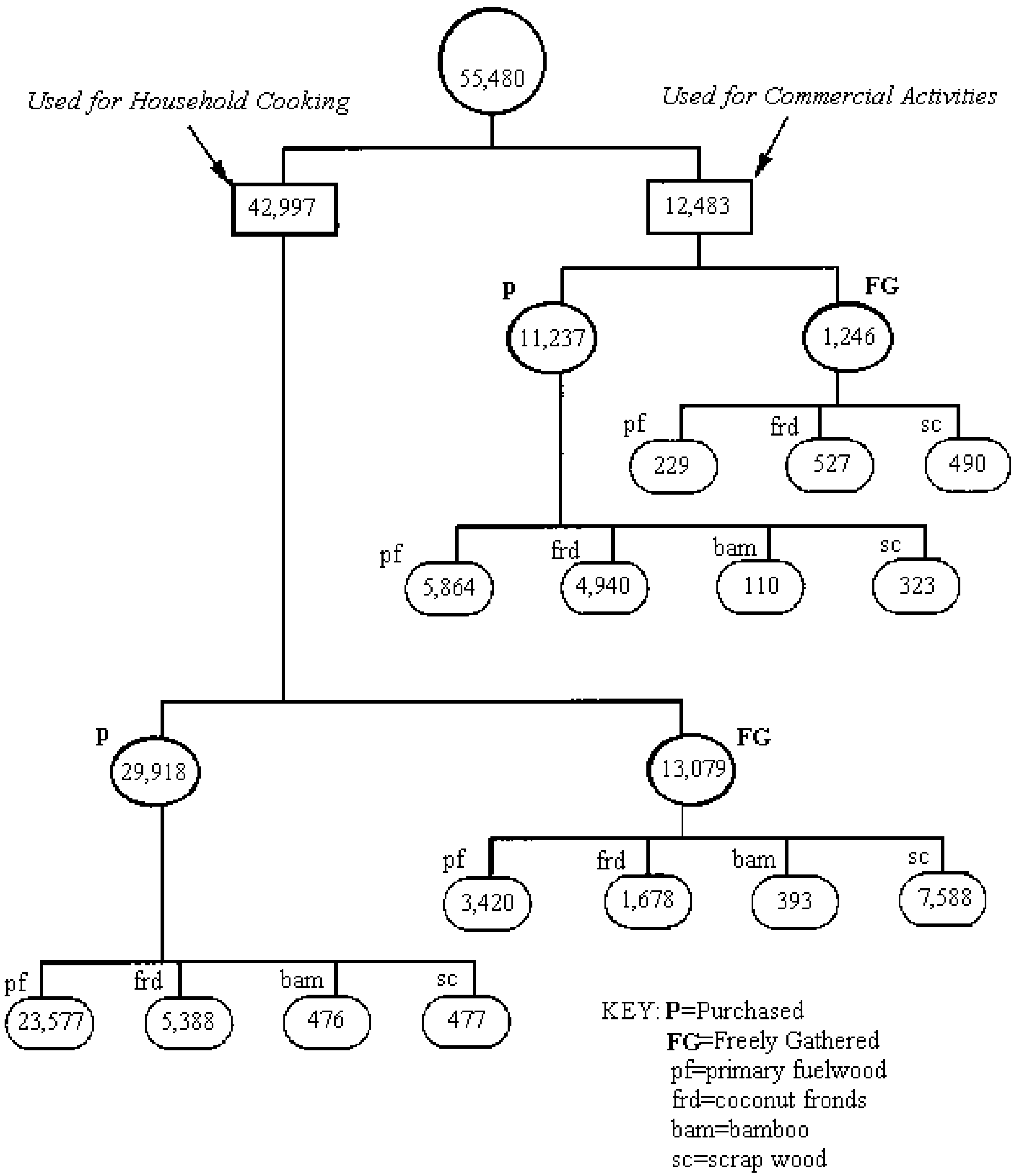

Figure 2: Fuelwood Consumption in Residential Sector of Cebu City, 1992 (metric tons/year)

Table 3: Household Fuelwood Usage by Source and Type of Fuel. Exclusive of Consumption by Household-Based Businesses (metric tons/year).

	Amount Consumed	Percentage of Total
Purchased *Primary* Fuelwood	23,577	54.8
Gathered *Primary* Fuelwood	3,420	8.0
Total *Primary* Fuelwood	26,997	62.8
Purchased Coconut Fronds	5,388	12.5
Gathered Coconut Fronds	1,678	3.9
Total Coconut Fronds	7,066	16.4
Purchased Bamboo	476	1.1
Gathered Bamboo	393	0.9
Total Bamboo	869	2.0
Purchased Scrap Wood	477	1.1
Gathered Scrap Wood	7,588	17.7
Total Scrap Wood	8,065	18.8
TOTAL	42,997	100.0
Overall Purchased	29,918	69.6
Overall Gathered	13,079	30.4

of around P1.50 /kg, compared with bulk fuelwood logs and branches sold to bakeries and other commercial users by rural traders for around P.70-.80 /kg. The well-dried quality and optimal sizing of wood contained in *raja* bundles could conceivably further enhance the efficiencies of fuelwood-use in the typical wood stove designs found in Cebu (Leach and Gowen 1987; Bormann et al. 1991). On the average, fuelwood-using households purchase this fuel close to six times a week, although frequency of purchase ranged from once or twice a month (10.8%) up to two and even three times a day (12.7%). Generally, frequency of purchase increased for households located in densely populated squatter settlements (such as T. Villa, Lorega and Pasil) where traders and retailers often make fuelwood available in bundles as small as .6 kg for sale at P1, presumably enough wood to cook a small pot of rice. Families in these areas rarely have any extra space to store wood and the nature of their household budget (highly constrained cash flows) limits their enough wood to cook a small pot of rice. Families in these areas rarely have any extra space to store wood and the nature of their household budget (highly constrained cash flows) limits their ability to purchase fuelwood in larger quantities even if this did prove less expensive on a per unit basis. Nearly all of the households using fuelwood reported being able to purchase this fuel within a 1 km. distance from their residence, a convenience also frequently cited by households using kerosene. Households located in *Barangays* Quiot, Pardo, Tisa and Guadalupe, near to the foothills, frequently reported being able to purchase both fuelwood and charcoal from people who carry it down from the mountains west of the city. In addition, a relatively minor number of households, most of whom were operating a small retail store or eatery on the premises, reported receiving supplies directly from rural woodfuel traders.

Overall, Figure 2 and Table 3 suggest that one needs to be careful in making assessments of the impact of urban "fuelwood" use on rural environments based simply on an extrapolation of per capita or household consumption figures. Approximately one-third of urban household fuelwood use in Cebu originates from within the city, and much of that originating from the countryside is non-woody biomass fuel generated primarily as a by-product of agricultural activities. Commercial sector users make even greater use of scrap and non-woody biomass fuels (see Section 2.3). In Section 3 of this report it will be suggested that even the significant quantities of *primary* fuelwood originating from rural areas to meet urban demand (30,000 tons/year just for households in the 49 urban *barangays* of Cebu City) may be having little detrimental impact on rural environments, and may even be inducing more widespread tree-planting in these areas. With these considerations in mind, many of the arguments for introducing policy measures to curb urban household fuelwood demand become less convincing. Should such a policy approach be advocated, however, the above discussion illustrates that there are still numerous barriers to more widespread use of alternative fuels by low-income households in Cebu, although there is some potential to improve efficiencies of woodfuel use in this sector. The next section will briefly discuss patterns of charcoal consumption in the residential sector. This will be followed by a more detailed discussion of the dynamics of household fuel-switching in a rapidly developing area like Cebu, as well as the proliferation of small-scale "street food" vendors in the city and the possible implications these developments may have for overall levels of woodfuel consumption.

2.2.2 Charcoal

The use of charcoal as a primary cooking fuel is limited to only 5.3% of the households in Cebu City. However, charcoal is widely used in traditional irons (*plansa*), for grilling meats and fish, as a back-up fuel, and for specific cooking activities requiring slow, steady heat over a long period of time (e.g. stewing of beans and meat bones). Overall, charcoal is utilized at least once a month in 71.6% of the city's households.

The role of income as a determining factor in charcoal use is less clear than that for fuelwood. While lower-income households are more likely to utilize charcoal as a primary cooking fuel, even high-income households make extensive use of this fuel, especially on festive occasions like weddings, birthdays, or graduations where roasted pig (*lechon*) is standard fare. Charcoal-using households did not consider price to be an important factor in their decision to utilize this fuel either, although a perception of charcoal as "expensive" did appear to act as a strong deterrent to more widespread use of this fuel in the lowest-income category. In reality, those households using charcoal as the primary cooking fuel spent only P156/month on average for purchases of this fuel (less than that spent by fuelwood-using households on purchases of wood). Therefore, it appears that the perception of charcoal as being expensive would probably apply mainly to households who use fuelwood they've been able to gather for free. In general, however, household demand for charcoal is driven more by specific end-uses for which this fuel is appropriate, as well as by strong taste preferences and a perception of charcoal as a safe fuel, rather than by factors such as price and income.

Aggregate charcoal consumption in Cebu City households is approximately 7,966 tons/year (around 500,000 sacks), compared with the aggregate fuelwood consumption of 55,480 tons. Per capita and household charcoal consumption levels in Cebu City, regardless of whether the household uses this fuel or not, are 13 kg/annum and 78 kg/annum, respectively. Looking only at charcoal-using households, but not considering whether this is a primary or supplemental fuel, we get a per capita consumption level of 19 kg/annum and a household consumption level of 109 kg/annum. Finally, considering only those households where charcoal is the primary cooking fuel, per capita and household consumption levels increase to 65 kg/annum and 380 kg/annum, respectively. At this level of consumption, only 26% (2,066 tons) of residential sector charcoal usage is actually accounted for by households where charcoal is the primary cooking fuel. The remaining 74% of residential sector charcoal usage takes place in households where this is a secondary fuel and/or is used for ironing.

Just as with fuelwood, it will help in interpretation if we divide the aggregate consumption figure for charcoal into a number of smaller components. For example, 31.1% of household charcoal consumption (2,481 tons) is utilized for the ironing of clothes, while another 38.3% (3,050 tons) is used specifically for grilling or roasting meats and fish. It will be recalled that commercial activities within households accounted for 22.5% of the residential sector's fuelwood consumption. A similar pattern can be discerned for charcoal, with 13.8% of annual household charcoal consumption (1,099 tons) going to commercial activities within the household, most commonly for barbecuing meats for vending.

The vast majority of households using charcoal purchase this fuel in small cellophane bags weighing from .2 to 1 kg. each, at an average per unit price of around P5/kg. These bags are available from *sari-sari* stores in most neighborhoods or from itinerant charcoal vendors who make their way through residential areas hawking their wares from a pushcart or a bicycle with side car. Households that make greater use of charcoal for family cooking or for commercial purposes, and a number of higher-income households as well, usually either purchase charcoal by the sack from urban traders or have sacks delivered directly to them by urban vendors or rural traders. Most sacks of charcoal weigh around 15-16 kg. each and cost approximately P60, resulting in an average per unit price of around P4/kg. The lower per unit price of charcoal purchased in sacks compared to that in bags is, however, partially offset by the fact that anywhere from 5-15% of the weight of a charcoal sack was found to consist of essentially unusable fines.

It's possible given the rapid rate of urbanization occurring in the Metro Cebu area, that charcoal will enjoy more widespread use as a household cooking fuel and perhaps serve as a transition fuel for a more long term fuel-switching trend from fuelwood to LPG. Charcoal is more suitable than fuelwood for crowded low-income residential areas of the city since it is cleaner, less bulky and far less smoky than wood. Charcoal stoves are inexpensive (or cost nothing) and portable, also important considerations in these neighborhoods. And on a “delivered energy” price basis charcoal and fuelwood are comparable, although fuelwood, unlike charcoal, can occasionally be gathered for free. It's not clear at this time to what extent a switching trend from fuelwood to charcoal has or is likely to take place. In 1960, only 0.2% of the city's households reported using charcoal as their primary cooking fuel, by 1990 this had increased to 4.6% (see Tables 4 and 5), and by 1992 to 5.3%. These changes are small enough, however, that they could just as easily be explained by sampling errors. It will be suggested in Section 4.3.2 of this report that the economics of charcoal use versus fuelwood use be carefully studied in the local context. Such a comparison would need to look at the overall efficiency of the commercial fuelwood and charcoal markets, from the point of extraction and conversion right through to consumption, as well as health and safety issues associated with the use of each fuel (see Bormann et al. 1991 for a discussion of how this might be done). If the results suggest that charcoal is significantly more efficient and/or better from a health standpoint than fuelwood, then a justification may exist for local research into the manufacture and dissemination of low-cost, locally acceptable, charcoal stoves for low-income household consumers.

2.2.3 Fuel-Switching and Food Vending: Implications for Household Woodfuel Demand

Table 1, discussed above, enables us to determine the percentage of households in each income class utilizing woodfuels, LPG or kerosene as their primary cooking fuel. However, the image presented in Table 1 is a very static one, concealing dynamic changes in household fuel-use patterns common to nearly all developing country urban areas. Much of this dynamic takes the form of fuel-switching, with the most widely-reported trend being that of urban households replacing woodfuels with kerosene, LPG or electricity. In some cities this trend has been very rapid and one-directional, in others, including Cebu, the fuel-switching trend appears to be moving in fits and starts and sometimes even reversing itself over time. The pace of and extent to which household fuel-switching will take place in the future will have important implications for the level of woodfuel demand in the residential sector. In addition to discussing fuel-switching, this section will also address the proliferation of small-scale food vendors in low-income districts of the city and what this implies in terms of overall levels of woodfuel demand.

The notion of a household fuel-switching transition in urban areas of the developing world is widely reported in the literature (Sathaye and Meyers 1985; Leach 1988; Fitzgerald et al. 1990; Soussan et al. 1990; Sathaye and Tyler 1991). A number of factors are considered to be behind this trend, namely, increasing incomes, improved availability and access to modern fuels, and basic changes in urban lifestyles and settlement patterns which make cleaner, more compact fuels such as kerosene and LPG more attractive to household users. Generally speaking, the extent to which modern fuels have replaced woodfuels in a particular urban area has been determined by city size and the level of economic development of the country involved. Therefore, we see that cities like Bangkok and Kuala Lumpur have only a small percentage of households still reliant on woodfuels (Sathaye and Meyers 1985; Sathaye and Tyler 1991), while smaller cities like Cebu, or cities in relatively low-income countries such as Port-au-Prince, Haiti or Kano, Nigeria are still heavily reliant on woodfuels for meeting household cooking needs (Stevenson 1989; Cline-Cole et al. 1990a; Hosier and Bernstein 1992).

An important point to stress in discussing fuel-switching is to acknowledge that switching behavior is rarely discrete, and that “reverse” fuel switching can, and in fact, has occurred in a number of places (Leach and Mearns 1988; Munslow et al. 1988; Leitman 1991). The first point leaves open the possibility that even after a household has switched to LPG or kerosene, they may countries like the Philippines on *imported* petroleum, and the strain this places on scarce foreign exchange. It's not inconceivable that much of the increased usage of kerosene and LPG in Philippine households over the last 30 years could be erased in the event of a new world oil crisis on the magnitude of that experienced in the early and late-1970s.

Tables 4 and 5 illustrate the changes in primary cooking fuel usage by the residential sector in Cebu City for the census years 1960, 1970, 1980 and 1990, as determined by the decadal Census of Population and Housing.[7] From Table 4, a clearly discernible trend away from fuelwood and towards more widespread use of LPG and kerosene can be noted. The most rapid change, on a percentage basis, occurred between 1960 and 1970, at a time of low and steady petroleum prices and substantial improvements in the handling, storage and delivery facilities of oil companies operating in the Philippines (Paderanga and Paderanga 1988). The trend stalled somewhat between 1970 and 1980 due in large part to sharp price increases and curtailed supplies of petroleum products in 1973-74 and again in 1980, the year of the census. The period from 1980 to 1990 witnessed another significant drop in the percentage of households using fuelwood as their primary cooking fuel, with increased kerosene usage accounting for much of this change. It should be noted, however, that the 1990 census was conducted in May of that year, two months prior to the outbreak of conflict in the Persian Gulf and subsequent price increases and rationing of petroleum products in the Philippines.

Table 4: Primary Cooking Fuels in the Residential Sector of Cebu City 1960-1990 (in percent)

	1960	1970	1980	1990
Fuelwood*	91.8	65.1	57.6	36.9
Charcoal	0.2	0.2	**	4.6
Kerosene	5.4	14.4	12.5	22.5
LPG	1.0	18.4	27.6	31.6
Electric	0.8	1.7	1.8	4.1
Others	0.8	0.3	0.5	0.3
None	***	***	***	0.2

[7] It should be noted that in Table 4, 36.9% of the city's households are reported as using fuelwood in 1990, whereas results from our survey, reported in Table 1, show only 27.9% using fuelwood in 1992. This discrepancy is a result of three differences in the surveys. First, the census figures include the 10.7% of the city's households residing in the largely rural mountain *barangays* west of downtown, around 90% of whom utilize fuelwood as their primary cooking fuel, whereas our figures are for the 49 urban *barangays* only. Second, the census figures include sawdust under fuelwood, we've separated it out. Lastly, the census figure have no multiple-fuel category. When these factors are considered, the 1990 figures of the National Statistics Office, based on a 10% sample, are remarkably close to ours derived from a 0.6% sample.

Table 5: Primary Cooking Fuels in the Residential Sector of Cebu City, 1960-1990 (in number of households using each).

	1960	1970	1980	1990
Fuelwood*	37,513	36,449	51,136	42,277
Charcoal	82	115	**	5,272
Kerosene	2,207	8,058	11,098	25,804
LPG	409	10,290	24,459	36,207
Electric	327	966	1,638	4,646
Others	326	154	439	327
None	***	***	***	175
Total	40,864	56,032	88,770	114,708

* Including sawdust; ** Included under fuelwood; *** Not reported

Sources: Jacobson 1969; BCS 1972; NCSO 1983; NSO 1992.

A number of qualifications need to be made, however, before we can attempt to interpret the significance of the numbers in Table 4 on levels of residential fuelwood demand in Cebu City. To begin with, while Table 4 shows a dramatic trend away from fuelwood on a *percentage* basis between 1960 (91.8%) and 1990 (36.9%), Table 5 reveals that the *number* of households using fuelwood as their main cooking fuel actually increased by close to 5,000 during the same period due to a near tripling of the residential population in the city. Usage of charcoal as a primary cooking fuel also increased by over 5,000 households. Second, relative prices for fuelwood, kerosene and LPG in Cebu may undergo significant change in the near future with the impending deregulation of the petroleum industry in the Philippines and planned phase-out of cross price subsidies for the latter two fuels. Elimination of subsidies on “social” fuels like kerosene, LPG and diesel might lead to as much as a 30-40% increase in their price (Pujanes 1993b), while increasing diesel prices could translate into slightly higher fuelwood prices since much of the commercially-traded woodfuel is transported in diesel conveyances. While a 30-40% price increase for LPG and kerosene fuels would be unlikely to induce significant “reverse” fuel-switching, it could have the effect of slowing down current trends and encourage increased use of woodfuels on a supplemental basis. This combined with continued increases in population is likely to result in a situation where the absolute demand for woodfuels will remain steady if not actually increase.

While the census data clearly show the extent to which households in Cebu City have changed their primary cooking fuel between 1960 and 1990, it provides no information on the reasons for, or the context within which, these fuel-choice decisions took place. Our survey asked respondent households to provide information on any fuel switching they may have undergone in the five years prior to the interview. In all, 18.7% of the households reported at least one fuel switch during that period, and a number of households experienced two and even three switches over a five year span. Table 6 illustrates the forms of fuel-switching taking place and the relative importance of each. The two most common switches were from fuelwood to kerosene (34.5% of the total) and kerosene to LPG (15% of the total), a result which tends to support the notion that the five years prior to the interview. In all, 18.7% of the households reported at least one fuel switch during that period, and a number of households experienced two and even three switches over a five year span. Table 6 illustrates the forms of fuel-switching taking place and the relative importance of each. The two most common switches were from fuelwood to kerosene (34.5% of the total) and kerosene to LPG (15% of the total), a result which tends to support the notion that fuel-switching in most developing country urban areas proceeds from traditional to modern fuels, and that kerosene is usually a "transition" fuel between traditional woodfuels and the more preferred modern fuels, LPG and electricity. Of those households switching out of fuelwood, the three most important reasons given for this decision relate to the inconvenience involved in using fuelwood (too smoky, too time consuming, needs to be watched closely), the higher cost of fuelwood relative to kerosene or LPG, and the lack of space needed to store fuelwood supplies.

Table 6: Fuel-Switching Trends for a Random Sample of 603 Households, Cebu City, 1987-1992

Type of Switch	No. of Respondents Reporting	% of Total
Fuelwood to Kerosene	39	34.5%
Kerosene to LPG	17	15.0
Kerosene to Fuelwood	15	13.3
Fuelwood to LPG	9	8.0
LPG to Kerosene	8	7.1
Charcoal to LPG	6	5.3
Kerosene to Charcoal	5	4.4
Charcoal to Kerosene	3	2.6
Fuelwood to Charcoal	2	1.8
LPG to Fuelwood	2	1.8
LPG to Charcoal	2	1.8
Others	5	4.4
TOTAL	113	100.0

Households switching out of kerosene moved in two different directions and for two very different sets of reasons. Around half of the households switching out of kerosene changed to LPG, usually as a result of improvements in the household financial situation or the receipt of an LPG stove as a gift, often from a family member working abroad as an overseas contract worker. Another 54% of the households switching out of kerosene moved to fuelwood or charcoal, almost always as a result of the fact that their kerosene stove "broke" and they could not afford to repair it, or their stove was defective and they were fearful of starting a fire. It appears that once a household is able to start using LPG they are far less likely to switch back out of it again compared with the case for kerosene. There were, however, a number of switches out of LPG back into kerosene, fuelwood and charcoal. These switches resulted either from a perception of kerosene as a less expensive fuel, problems with an LPG stove, or fear of continued use of LPG due to news reports of cylinder explosions and fires associated with the use of this fuel.

Once all fuel switches are accounted for, we find that out of our sample of 603 households there were 33 fewer fuelwood users than five years ago, 20 more LPG users, 13 more kerosene users, and the same number of charcoal users (on the basis of primary cooking fuel). While this result supports the overall trend away from fuelwood and towards LPG (with charcoal and kerosene acting as transition fuels), the discussion above should also have made it abundantly clear that urban household fuel-switching behavior in a setting like Cebu is an extremely dynamic and non-discrete process.

In addition to fuel-switching and associated changes in the composition of the household energy budget, our survey also found evidence of other changes in household cooking behavior that could alter future levels of demand for wood and other household cooking fuels. One of the more significant changes involves increasing household purchases of pre-cooked meals prepared in neighborhood eateries and by "street food" vendors. Although we are unable, at this point, to determine the *pace* at which commercially prepared foods are substituting for those prepared in the home, we can comment on the *magnitude* of these purchases and offer some hypotheses for why this trend is taking place.

The proliferation of an informal sector street food trade is not unique to Cebu or the Philippines, instead, it appears to be a widespread phenomenon common to many urbanized areas of the developing world (Tinker and Cohen 1985; Astilla et al. 1988; Leach and Mearns 1988; Sathaye and Tyler 1991). In Cebu, as elsewhere, the street food trade offers up an astounding variety of products for sale and serves as a crucial source of income and employment to large numbers of urban poor. In Section 2.3, the woodfuel use patterns of three broad categories of street food vendors in Cebu will be discussed, namely, those selling snack foods (such as cakes, peanuts and fried bananas), barbecue vendors, and those selling small quantities of meat, fish and vegetable dishes locally referred to as *sud-an* or viands. At this point we are mainly interested in discussing the last category, which we refer to as "prepared food" vendors, and the possibility that increased household purchases from these vendors could alter overall levels of woodfuel consumption.

The largest concentration of prepared food vendors are located in low-income districts of the city and in areas where there are large numbers of factories, schools, or government offices. Some of these vendors do all of the cooking and marketing of the food right on the household premises, others set up a "portable" roadside eatery early in the morning and pack everything up again at the end of the day, and still others prepare foods at home and resort to ambulant vending to sell their product. The size of these businesses vary, but typically they operate at an extremely small scale, often only preparing and selling enough food to recoup their expenses for the next day's purchase of supplies with a small "profit" of either cash (maybe P20-30/day) and/or food to feed the vendor's own family.

The proliferation of prepared food vendors in low-income districts of cities like Cebu is most likely an outcome of changes in work and settlement patterns brought on by increased urbanization. With household members, both male and female, adults and children, being drawn into the workforce (regardless of whether this means formal sector employment in a factory, sub-contracted piece work done at home, or scavenging for resalable junk), less time is available for other activities, including daily marketing for fresh foods (since these households typically lack refrigeration) and preparing meals. In Cebu, it appears that the frequency of household purchases of prepared foods increases just as income declines. In the lowest two income categories (below P5,000 monthly income), over 40% of respondent households were purchasing from prepared food vendors *at least* once a day, while close to one-fourth patronize these vendors two or more times daily. In contrast, only around 10% of the households in the highest income categories (over P10,000 monthly income) reported daily purchases of prepared foods, with this more likely coming from formal sector *carenderias* or eateries. Likewise, only 70% of low-income households reported cooking three times a day, while for high-income households this figure was 94%.

What impact does this trend have on demand for cooking fuels in general, and for fuelwood in particular? More to the point, to what extent does the trend towards increased food purchases lead to reductions in overall levels of woodfuel demand as a result of the possibility that food vendors achieve scale economies in energy consumption? Results from Kenya suggest that such a trend towards increased purchases of pre-cooked foods, combined with other factors, has resulted in 30% reductions in levels of urban charcoal use (Bess 1989). In Cebu, two offsetting factors are at work. To begin with, prepared food vendors sell mainly to low-income households and these households use mainly fuelwood. On the other hand, the prepared food vendors themselves are highly reliant on fuelwood, with around 70% of them using this fuel on a primary or supplemental basis. At the very least we can conclude that the proliferation of prepared food vendors is having the effect of altering the relative shares of urban woodfuel used in the residential and commercial sectors. With regards to overall levels of woodfuel consumption, however, more research would be needed to estimate the extent of woodfuel savings brought about by this trend, if any. Our intuition, evidence from other countries, and preliminary findings from interviews with 94 prepared food vendors, suggest that the trend towards purchases of pre-cooked foods by urban households in Cebu *is* having the effect of reducing overall per capita woodfuel consumption, although, as stated above, more research would be needed to determine by how much.

A final caveat regarding the discussion in this section is that while trends in fuel-switching and in prepared food purchases may be having the effect of reducing the relative contribution of woodfuels in the household energy budget, population growth and in-migration to the city is combining to keep absolute levels of woodfuel use near constant. As a result, fuelwood and charcoal will continue to be important fuels in the residential sector of Cebu City, a fact that need not have negative implications on the sustainable management of rural environments in the province. Section 3 will discuss how Cebuano farmers have responded over the years to continued high levels of urban woodfuel demand. Before turning to that topic, however, a discussion of woodfuel use in the commercial sector of the city is in order.

2.3 Patterns of Woodfuel Use in Commercial, Industrial and Institutional Establishments of Cebu

In the introduction to this report it was pointed out that commercial, industrial and institutional establishments (the “commercial” sector) account for approximately one-third of overall woodfuel consumption in the Philippines. It was also mentioned that commercial sector users are far more reliant on *traded* woodfuels as opposed to freely gathered, and are far more likely to utilize wood wastes and a variety of non-woody biomass fuels than households. The situation in Cebu tends to support these observations, and the discussion below will illustrate how demand for woodfuels by commercial establishments differs from that of households in terms of the types of fuels being used, the ways in which these fuels are acquired, and the reasons for continuing to use woodfuels.

Table 7 lists the charcoal and fuelwood consumption of the major commercial sector end-users of woodfuels in Cebu City and compares this with levels of household consumption. It also gives a percentage breakdown of fuelwood consumption for each end-user on the basis of the *type* of fuelwood being used. Overall, it appears that the commercial sector accounts for 49.1% of charcoal consumption and 37.4% of fuelwood consumption in Cebu City. The commercial sector is also somewhat less dependent on *primary* fuelwood than the residential sector, with certain commercial end-users, such as eateries, food vendors, *poso* makers, and various industrial establishments making extensive use of coconut fronds, bamboo and scrap wood.

Commercial establishments obtain a greater percentage of their fuelwood from traded sources than do households, and many are likely to obtain their supplies direct from rural traders, by-passing the urban retailers and wholesalers altogether. Referring back to Table 3 in the Section 2.2.1, we see that urban households in Cebu meet 30.4% of their fuelwood demand through gathering activities, in the commercial sector this figure is only 4.1%, with fuelwood gathering usually confined to small-scale establishments like food and snack vendors. When purchasing fuelwood, households and small-scale commercial establishments almost always deal with local urban traders of this fuel, whereas the larger commercial users like bakeries and noodle factories obtain as much as 80-95% of their fuelwood direct from rural suppliers.

Commercial establishments also tend to pay significantly lower per-unit prices for both fuelwood and charcoal than do households for at least two reasons. First, as mentioned above, a much larger percentage of commercial sector woodfuel demand is being met directly by rural traders, eliminating some of the additional price mark-ups that would accrue if urban traders were involved. Second, commercial establishments usually purchase woodfuels in larger quantities and with little break of bulk having taken place. In the case of charcoal, this implies purchasing by the sack which can mean per unit savings of from 20-40% over charcoal purchased in smaller quantities (like cellophane bags), with actual savings depending on whether the charcoal is purchased from urban or rural traders. In the case of *primary* fuelwood, this means that commercial establishments are far more likely to buy wood in the form of large un-split logs, branches and even roots, typically at a per unit price of from P.60-.80/kg, whereas households usually purchase this fuel in bundles containing well-dried, well-split sticks of wood at prices ranging from P1.10-2.00/kg, again depending on where it is purchased from. As a result, it appears that there are a number of different “woodfuel markets” in Cebu, selling these fuels in varying quantities, shapes and forms, involving a range of intermediaries, and designed to make specific fuels available at the appropriate prices and quantities demanded by different categories of end-users.

For the commercial sector in general, it appears that fuelwood prices play a more important role in their decision to use this fuel than was the case for households. As discussed above, LPG and kerosene are, on average, less expensive to use than fuelwood in the residential sector. However, the costs of purchasing a stove, taste preferences and other non-price factors limited the extent to which households, especially low-income ones, could give up the use of fuelwood. In contrast, for a commercial establishment such as a bakery, fuelwood is often as cheap or cheaper than LPG because they buy un-split logs, in bulk, direct from rural traders at prices as low as P600/ton, less than half the average per unit price paid by residential consumers. Besides price, other commercial establishments are compelled to utilize woodfuels because they

Table 7: Fuelwood and Charcoal Use of Commercial, Industrial and Institutional Establishments in Cebu City, 1992

End-User	Charcoal Consumption (tons/year)	Fuelwood Consumption (tons/year)	% Primary Fuelwood	% Coconut Fronds	% Scrap Wood	% Bamboo
Bakeries	533	3,590	97.7	2.3	-	-
Restaurants/Eateries/ Prepared Food Vendors	1,327	13,566	41.4	54.5	2.6	1.5
Barbecue/*Lechon* Vendors	4,744	49	24.0	72.3	-	3.7
Poso Making	-	1,167	28.6	40.2	16.6	14.6
Commercial Food Processors	10	542	77.4	18.4	4.2	-
Snack Food Vendors	-	2,228	78.5	11.6	9.5	0.4
Industrial Users	-	3,898	25.7	-	74.3	-
Institutions	4	598	61.4	24.4	14.2	-
Total Commercial	6,618	25,638	50.8	33.1	14.7	1.4
Total Household	6,867	42,997	62.8	16.4	18.8	2.0
Overall Total	13,485	68,635	58.3	22.6	17.3	1.8

are undertaking an activity, or using equipment, that is fuel specific. Food vendors and eateries, for example, often prepare large pots of soup and rice at one time and find standard kerosene or LPG stoves too lightweight for this type of cooking, and commercial-size stoves out of their price range. Cast iron rings on three legs, or even a 3-stone stove is better suited for this type of cooking. Barbecue and *lechon* vendors are almost totally constrained to using charcoal for their business because of the type of food they are preparing.

We see then, that woodfuel use in the commercial sector differs somewhat from that in households in terms of the types of fuels being used, the way these fuels are obtained, and the factors that are motivating the use of woodfuels in the first place. However, even within and among commercial establishments there is also substantial variation in all of these aspects. The discussion below will focus on a number of specific types of commercial establishments that make use of woodfuels in Cebu, detailing the purchasing and fuel-use patterns of each.

2.3.1 Bakeries

A total of 70 out of 340 registered bakeshops in Cebu City were interviewed regarding their energy-use patterns. Slightly more than 25% of the interviewed bakeries were found to be using fuelwood or charcoal as their primary fuel, with LPG being used in two-thirds. Another 7% of the bakeries were found to be simultaneously using a combination of fuels, usually either an LPG/fuelwood or LPG/charcoal mix, with LPG being used for the baking of cakes and pastries requiring careful temperature control while fuelwood or charcoal is used for baking large batches of bread. Overall, bakeries consume 3,590 tons of fuelwood and 533 tons of charcoal annually, 5.2% and 4.0% of total fuelwood and charcoal consumption in Cebu City, respectively.

The factors responsible for continued usage of fuelwood and charcoal in the city's bakeries are varied, but a few important determinants can be identified. To begin with, the largest and oldest bakeshops in the city are located in the commercial and market districts of downtown and have been built around large wood-fired brick and cement *pogons* (ovens). A number of these bakeries are capable of consuming over one ton of fuelwood on a busy day, with most having been in the business for over 30 years. The owners of these bakeries indicated that they find fuelwood economical, and that it would be difficult for them to justify a large investment in new ovens. In fact, the average fuelwood-using bakery was found to be operating for a little over 17 years, compared to an average of under six years for those using LPG. The older bakeries, built at a time when fuelwood was essentially the only fuel considered, will continue to use this fuel for the foreseeable future, with some phase-out possible if these businesses close, undergo significant renovation, or change location. In the meantime, very few new bakeries were found to be using fuelwood, with the only exceptions located in less-crowded suburban areas closer to sources of woodfuel supply.

Should the price of fuelwood go high enough, or should fuelwood be in short supply, one might expect to see even the old woodfuel-using bakeries attempt a switch to another fuel. As of now, however, the average per unit price of fuelwood purchased by bakeries is less than half that paid by households, with per unit charcoal prices being about two-thirds that paid in the residential sector. As mentioned above, these price differences stem from the ways in which bakeries obtain their supplies of woodfuel and the form these supplies take. Fully 94% of the fuelwood and 54% of the charcoal consumed in the city's bakeshops is delivered directly to them by rural traders, by-passing urban wholesalers and retailers altogether. Most fuelwood-using bakeries will only purchase from urban traders to avoid running out of fuel during busy periods. The fuelwood being delivered to bakeries by rural traders usually takes the form of large and un-split logs, as well as roots and branches of fallen or typhoon-damaged fruit trees. Charcoal is delivered in sacks weighing 12-20 kg. each. So while it appears that woodfuels are actually a more expensive fuel than LPG for the typical household consumer, this is usually not the case for bakeries and helps to explain the continued usage of woodfuels by these establishments.

Interviews with owners of woodfuel-using bakeries, as well as the bakers working for them, indicate that besides fuel price and the cost of new equipment, a major factor in their decision to continue using woodfuels is that bread baked with wood and charcoal is of a superior quality to that baked with LPG or other conventional fuels. Many customers seem to share this opinion, and the large woodfuel-using bakeries in the downtown district are often a requisite stop-off point for bus and boat passengers bound for the province. A number of bakers using fuelwood expressed a specific preference for the wood of two mangrove species, locally referred to as *bakhau* and *pagatpat* (*Rhizophora candelaria* and *Sonneratia alba*, respectively, following Merrill 1926 and Salvosa 1963). These types of wood are said to burn better, giving off more heat over longer periods, and to impart a better aroma and taste to the baked bread, than other species. Although cutting of *bakhau* and *pagatpat* is for the most part prohibited, some supplies (probably around 150-200 tons a year) still find their way into the ovens of the city's bakeshops, usually brought in by small outrigger boats from surrounding islands. This inter-island trade in mangrove fuelwood appears to be responsible for reports that Cebu is so deforested fuelwood has to be imported into the island (Hyman 1983a). In reality, besides this specific *type* of wood being imported for a specific *end-user*, we found no indication of shipments of fuelwood into Cebu from other islands.

Very few of the new bakeries opened in Cebu City within the last five to ten years utilize fuelwood or charcoal, this being due mainly to space limitations for storing woodfuels and improved availability of both LPG ovens and LPG fuel itself. The long established bakeries currently utilizing woodfuels, however, expressed little indication of wanting to switch to other fuels citing, once again, the better quality of bread baked with woodfuels, the lower costs of these fuels, and the significant expense involved in installing new ovens. It appears then, that for the foreseeable future bakeries will continue to account for a large percentage of woodfuel consumption in Cebu, assuming of course that supplies of these fuels remain available at reasonably competitive prices.

2.3.2 Restaurants/Eateries/Prepared Food Vendors

This category of end-user includes restaurants and eateries formally registered with the city government, registered and unregistered *carenderias* (canteens or small restaurants), and a variety of (largely unregistered) prepared food vendors selling fish, meat and vegetable dishes from street stalls, their homes, or on an ambulant basis to office employees, construction workers, students, factory workers and around low-income residential neighborhoods.

Developing an accurate estimate of woodfuel consumption by these establishments is far more challenging than that for households or bakeries since only a small percentage of the former are actually registered with the local government (making them difficult to locate), and since we lacked any initial estimate of their numbers. As a result, a variety of techniques have been employed to arrive at the estimates presented below. To begin with, local government records list 757 eateries in the city, most of these being either “formal sector” restaurants, larger carenderias, or small- to medium-scale eateries located on the premises of city-operated markets. A random sample of 10% of these establishments was selected and interviewed on their patterns of energy use. Second, a non-random sampling approach was used to survey 60 unregistered eateries and prepared food vendors operating *outside* of their home in ten areas of the city characterized by either low-incomes and/or the presence of government offices, schools, construction sites, factories, piers or bus terminals. Finally, data on energy consumption was analyzed from 34 of the 603 household survey respondents that reported operating either an eatery or prepared food vending business *within* their household.

The next difficulty encountered was how to estimate the total number of restaurants, eateries and food vendors actually operating in the city. As mentioned above, local government records list 757 restaurants and eateries, but these do not account for the far more numerous small-scale eateries and food vendors common in Cebu. In order to arrive at a first approximation we considered the results of research conducted on the "street food" trade in four developing country urban areas (Tinker and Cohen 1985), including Iloilo, Philippines, a city quite similar to Cebu in population and other socioeconomic characteristics. It was found in Iloilo that there is approximately one street food vendor for every 50 residents of that city. Applying this figure to Cebu would result in an estimate of around 11,000 street food vendors in the city. By comparison, our household energy consumption survey identified 54 out of 603 respondents as operating a "food-related" business within the home which, if extrapolated to the city as a whole would lead to a total of 9,174 *household-based* street food vendors. In addition, we've estimated that there are close to 4,000 other street food vendors operating outside of the home, most of whom are barbecue vendors (see Section 2.3.3 for how this figure was derived). As a result, we estimate that there are approximately 13,000 street food vendors operating in Cebu City, or one for every 42 people. Out of this total, slightly less than half could be considered to be operating the type of eatery or food vending business we are discussing here, the remainder consist mainly of barbecue and sundry other forms of snack food vendors who will be discussed further below.

Based on these numbers, the restaurants, eateries and prepared food vendors (listed and unlisted) in Cebu City are estimated to consume 13,566 tons of fuelwood and 1,327 tons of charcoal annually. This is equivalent to 19.8% and 9.8% of the total fuelwood and charcoal consumption in the city, respectively. The bulk of this consumption is taking place in the unregistered and household-based establishments, with the registered restaurants accounting for only 5.9% of the fuelwood and 27.2 % of the charcoal being consumed by this category of users overall.

Referring back to Table 7, it can be seen that restaurants, eateries and prepared food vendors rely extensively on coconut fronds (*palwa*) for their fuelwood needs. A major reason cited by owners of these establishments for this pattern relates to the price of the fuel itself, *palwa* generally being some 20 to 30% cheaper than *primary* fuelwood on a per unit weight basis. While cheaper, *palwa* is not necessarily considered an "inferior" fuel, with some food vendors actually preferring fronds for certain types of cooking (such as deep frying) requiring a fast-burning fuel that gives off a lot of heat. In addition to coconut fronds, and smaller amounts of scrap wood and bamboo, eateries and food vendors were also found to be making use of inexpensive sawdust and even wood shavings purchased from lumber yards. Although we did not attempt to actually quantify the consumption of sawdust by this sector, it does appear to be an important fuel, being used to some extent by close to 10% of these establishments in what is locally referred to as a *sansan* ("to compress") stove. Once the sawdust is packed into a *sansan* stove and ignited, it will continue to burn slowly and evenly for as long as six hours, making this an ideal arrangement for cooking stews or for keeping foods warm throughout the day.

In addition to the lower costs of *palwa* and sawdust, and the advantages of using these fuels for specific types of cooking, eateries and food vendors tend to prefer these fuels in particular, and fuelwood in general, for a number of other reasons. For one, many of these businesses, especially the household-based food vendors and non-registered eateries, are owned and operated by low-income entrepreneurs who are often financially unable to purchase a kerosene or LPG stove. Even if such a purchase were possible, most would only be able to afford the lighter-weight models designed for ordinary household use, not particularly well-suited to the long cooking hours and large and heavy pots, kettles and deep pans being utilized by food vendors and eateries. If and when these businesses do make use of kerosene, or to a lesser extent, LPG, it is usually in combination with woodfuels, with the latter being used for the bulk of the heavy cooking while the former are reserved for lighter cooking needs such as the reheating of small batches of food or for fast frying or other quick cooking needs. In addition, eateries and prepared food vendors found operating outside of the home reported that they prefer to use fuelwood over LPG or kerosene because they can easily carry a wood stove to and from their place of operation and simply buy enough fuelwood for the day from a nearby trader. This is an important consideration since these establishments are rarely permanent, instead they typically set up along roadsides in the morning and then pack everything up again at the end of the day to be hauled home.

Overall, this category of users are far more dependent on urban traders for their woodfuel supplies than was the case for bakeries. The reasons for this are similar to those encountered in the residential sector. Few eateries or prepared food vendors have the financial means to purchase large quantities of woodfuels direct from rural traders, even if this could result in cost savings. In addition, these establishments rarely have the space to securely store any significant amount of fuelwood or charcoal since, more often than not, they are located in densely populated low-income districts of the city. In general, the only exception to this are the medium- to large-scale eateries and *carenderias* that stock large amounts of woodfuels for their own use *and* for sale to local residents, in essence doubling as an eatery and a woodfuel trader. In the end, 30% of this sectors' fuelwood use and 17.4% of its charcoal use comes straight from rural traders, while an additional 6% of fuelwood demands are met through the free gathering of supplies in the city by the owners of some of these establishments. The remaining 64% of the fuelwood and 82.6% of the charcoal is purchased from urban retailers and wholesalers.

Given the generally low-incomes of the owners of many of the eateries and food vending businesses in Cebu, and the nature of their business and types of cooking being done, it is likely that woodfuel use will remain significant in this sector for some time to come. However, in this sector just as in the residential sector there is some indication of a fuel-switching transition away from woodfuels and towards greater use of kerosene and LPG. How this will ultimately affect overall future levels of woodfuel consumption will depend on two offsetting factors. First, the absolute number of these establishments is increasing, as discussed in Section 2.2.3. Second, even if they are able to purchase an LPG or kerosene stove, many of these businesses continue to make extensive use of woodfuel for cooking foods that take a long time to prepare (such as stews, beans and soups), and for cooking that requires the use of large and heavy cooking vessels for which simple fuelwood “stoves” are more appropriate.

2.3.3 Barbecue/Lechon Vendors

While businesses selling barbecue and *lechon* (roasted pig) might also be considered a form of prepared food vending, they are discussed separately because of their almost singular dependence on charcoal for their business activities. The sidewalk barbecue stall is a nearly ubiquitous site in the evening hours throughout Cebu City, with the largest concentration found near piers, bus terminals, parks and schools. These are typically very small operations consuming, on average, only 3 to 4 kgs. of charcoal each evening in order to roast a few kilos each of sliced pork, chicken, sausage, fish, chicken entrails and dried squid, among others. These are sold right from the vendors' stand, usually along with *poso* (rice cooked in woven coconut leaves), soft drinks and beer. The *lechon* vendors operate in a different fashion than the small barbecue stands, but they also utilize significant amounts of charcoal. The term *lechon* refers to the type of cooking being done, the grilling or roasting of meats. The larger commercial vendors sell both *lechon ng manok* (roasted chicken) and *lechon ng baboy* (roasted pig, usually a suckling). A few hundred small-scale household-based *lechon* vendors specialize in this business, preparing roasted pig on an order basis for family occasions such as birthdays, weddings and graduations, or on Sundays for sale by the kilo outside of churches.

In developing an estimate for woodfuel consumption by barbecue and *lechon* vendors we encountered similar problems as those discussed in the case of eateries and prepared food vendors. Namely, since local government listings are grossly incomplete, how many of these businesses are there and how do we find them in order to conduct interviews? As a result, the following approach was taken. First, local government listings of business establishments show 19 *lechon* vendors which appears to account for nearly all of the large commercial operations of this sort. Faced with such a small sample an effort was made to interview each and every one of these establishments. Second, based on results from our residential energy survey we have estimated that there are close to 200 household-based *lechon* vendors operating on an order basis only, a number of whom were subsequently located and interviewed. Finally, arriving at a figure for the number of barbecue stands operating in the city was a bit more tricky since nearly all of these stands are “portable”, set up by the proprietor in the early evening in a busy location and literally folded up and carted home once everything is sold. In order to arrive at an initial estimate we convened our field workers in the office, most of whom are very familiar with the city, and did a district-by-district mental tally of the number of barbecue stands in each place, arriving at a figure of from 3,000 to 4,000 for Cebu City alone. This tally later proved to be in agreement with an estimate of 3,200 barbecue stalls made by a local NGO as part of a feasibility study for a coal-briquetting plant to be built in Cebu (JCI 1992). Their estimate was derived at by doing an ocular tally from a moving car throughout the city and is considered a reliable *minimum* estimate (Chiu 1993). We therefore settled on a figure of 3,500 such establishments, 166 of which were subsequently interviewed.

Overall, the *lechon* and barbecue vendors in Cebu City are estimated to consume 49 tons of fuelwood and 4,744 tons of charcoal annually, or .07% and 35.2% of the overall fuelwood and charcoal consumption in the city, respectively. Fuelwood use in these businesses is limited to a small number of barbecue vendors who prepare their own *poso* (most purchase these from vendors who specialize in preparing this type of rice, see below), and for the boiling of water by *lechon* vendors to be used for cleaning the pigs before roasting. While the barbecue vendors may be small in size compared to the commercial *lechon* vendors, their larger numbers help to explain the fact that they account for 89% of the charcoal being consumed by this category of users. Even more astounding is the fact that these small-scale barbecue vendors alone account for 31.3% of all the charcoal used in Cebu City.

Because the vast majority of barbecue vendors are operating at such a very small scale, and since these businesses are usually “portable”, being set up only in the evening, most vendors prefer to purchase their charcoal in smaller cellophane packs from urban retailers and charcoal re-packers rather than by the sack. Overall, only 23.2% of the charcoal used in this category is delivered direct from rural traders, and most of this is going to the commercial *lechon* vendors and/or the larger and more permanent barbecue vendors.

The barbecue and *lechon* vendors utilize charcoal because of the fuel-specific nature of the product they are preparing. Some *lechon* vendors are reportedly able to reduce charcoal consumption through the careful use of coconut fronds mixed with charcoal for part of the four to five hours it takes to prepare this product, but such a practice is generally considered to lead to inferior results. The absolute number of barbecue and *lechon* vendors in Cebu appears to be increasing, as was the case with prepared food vendors and conceivably for many of the same reasons. Though usually not considered enough for a meal, the sticks of roasted meat and fish sold by barbecue vendors can supplement other purchased or prepared foods. If, as we suspect, urban households are doing less cooking, then purchases from these vendors, and thus their numbers, will likely increase. As a result, charcoal consumption by this category can be expected to remain significant. The NGO project discussed above is hoping to substitute briquettes made of low-grade coal for some of the current end-uses of wood charcoal. It seems doubtful, however, given the strong taste preferences of Cebuanos for wood charcoal in general, and charcoal of certain species in particular, that coal briquettes will be adopted to any significant extent by this category of user.

2.3.4 Poso Making

Poso is an old Southeast Asian way of preparing rice in woven coconut leaves. In Cebu, *poso* is jokingly referred to as “hanging rice” since barbecue vendors and eateries usually display this product by hanging bunches of them on the wall or from the ceiling for customers to see. Although a few barbecue vendors and eateries prepare their own *poso*, most supplies originate from vendors who specialize in this product, with the largest number concentrated in four low-income districts of the city. Local government listings report only six *poso* makers operating in the city but we estimate, based on ocular assessments, information from woodfuel traders, and the household survey, that there are approximately 200 such establishments, with the largest producing up to 4,000 pieces/day and the more numerous household-based vendors usually making only 50 to 100 pieces a day.

Overall, *poso* makers are consuming 1,167 tons of fuelwood annually, or around 1.7% of the total fuelwood consumption in the city. Their fuelwood use, as was the case with eateries and food vendors, is largely in the form of *palwa*, with significant amounts of split bamboo trunk and scrap wood being utilized as well. Only a few *poso* makers, typically small in scale, were found to be using kerosene stoves. The preference for fuelwood in general, and *palwa* in particular, is a result of the way in which *poso* is cooked, often times boiled in large vats or 55-gallon drums filled with water. These drums are usually too heavy for use on standard kerosene stoves and so most *poso* makers were found to be utilizing some form of stand made out of either cinder blocks, iron reinforcing rods, or just large stones. *Poso* makers were not too particular about the *type* of fuelwood they used either, as long as it brought the water to boil and was relatively cheap. As a result, the urban fuelwood dealers in those areas where *poso* makers are clustered were found to be stocking bundles of *palwa*, bamboo trunks, coconut lumber off-cuts, and other forms of scrap wood which, as mentioned above, typically sell for 20-30% less on a per unit basis than *primary* fuelwood. Mainly because of lack of space and financial capital, *poso* makers tended to purchase fuelwood daily from urban traders, obtaining 98% of their supplies in this fashion.

Given the way in which *poso* is usually prepared, and the generally low-incomes of the *poso* makers themselves, it's not likely that this type of business will begin making greater use of conventional fuels at any time in the near future. As with the barbecue and prepared food vendors, *poso* makers also report an increasing demand for their product, presumably for many of the same reasons. It appears then that fuelwood use by *poso* makers will remain constant or even increase in the future, with much of this use in the form of scrap wood and non-woody biomass as long as these fuels remain available.

2.3.5 Commercial Food Processors

A variety of business types were placed under this category because, for the most part, their products were being sold out of retail outlets or from market stalls rather than by the individual producing the product. In addition, most of these businesses *are* registered with the local government and are thus more a part of the “formal” sector. The most important commercial food processors, from the standpoint of woodfuel consumption, are those producing *chicharon* (fried pork rinds), a variety of noodles (*bijon, pancit, miki*), dried fruit, sausages and other meat products, and a variety of snacks such as chips and pies for retail and institutional sale. With the exception of *chicharon* and noodle producers, few of the other commercial food processors were found to be making use of woodfuels, but for the few who are, consumption was significant enough to warrant discussion. Overall, this category of users consumes 542 tons of fuelwood and 10 tons of charcoal annually, or 0.8% and 0.1% of the total fuelwood and charcoal consumption in the city, respectively.

There are close to 50 *chicharon* makers in Cebu City, only five of which are large enough to be registered with the city while the others are usually household-based operations. *Chicharon* is typically prepared in deep wok-like pans, and as was the case with *poso*, the weight and size of these pans makes the use of kerosene or LPG stoves somewhat impractical. *Chicharon* makers alone consume 60% of the fuelwood used in this category, with slightly over half of their fuelwood coming from urban wholesalers and retailers and the rest from rural traders. Charcoal consumption by these businesses is minimal, limited to a few operations that use this fuel for drying the finished product in the rainy season.

Cebu City has only four registered noodle factories, but there are perhaps as many as 30 more in the adjacent city of Mandaue. Two of the four located in Cebu were found to be using fuelwood, and combined they account for 27.7% of the fuelwood used by commercial food processors. The wood is used in fairly efficient brick and cement ovens with large cylindrical holes in the top for holding the kettles within which the noodles are boiled. The fuelwood used consists mainly of logs of *Leucaena, Gliricidia* and branches of fruit trees delivered directly to them from rural traders, supplemented in part by scrap wood purchased from local lumber yards. A number of noodle factories in Mandaue, however, were found to be making extensive use of waste lumber, wood chips and shavings, and coconut shells and husks in addition to *primary* fuelwood supplies.

There are five registered dried fruit producers in Cebu City, three of whom claim to be using no woodfuel at all and two who won't divulge any information. There are another ten or so dried fruit producers in Mandaue City who, again, either report no woodfuel use or who will not give us information. We were informed, however, by a rural woodfuel trader who formerly supplied one of the businesses in Mandaue City that this particular company, as well as a number of others, once made extensive use of fuelwood and occasionally charcoal as a drying fuel. At this time we assume no woodfuel consumption by this type of business, but this assessment could change in the future as new information becomes available.

There are upwards of 30 producers of snack foods in Cebu City who sell their products directly to retail outlets such as supermarkets or to school and factory canteens. Very few of these establishments were found to be using any woodfuel at all, but two of them who are producing chips and “squid rings” were found to be receiving four to five jeepney loads of fuelwood every month, delivered directly to them by rural woodfuel traders. This consumption amounts to around 9.2% of the fuelwood used in this category.

Finally, approximately 20 makers of smoked sausage and other preserved meats were found to be making limited use of charcoal, fuelwood and even sawdust in their production process. Their consumption accounted for only 3.7% of the fuelwood but nearly all of the charcoal used by commercial food processors.

Overall, the commercial food processors discussed above account for only a small percentage of woodfuel consumption in Cebu City. Our consumption estimates, however, are based only on those businesses located in Cebu City proper, and exclude a large number of noodle and dried fruit producers located in the adjacent and more industrialized city of Mandaue. As a result, if one were to look at woodfuel use in the greater Cebu metropolitan area, commercial food processors might account for a more significant share of overall consumption.

2.3.6 Snack Food Vendors

Snack food vendors differ from commercial food processors and prepared food vendors in a number of ways and will therefore be discussed separately. For one, the products they sell are generally not intended to substitute for foods cooked in the home, unlike the case with prepared food vendors. Second, and in contrast with the commercial food processors, snack food vendors tend to operate out of their home at a very small scale, typically marketing their products right from the residence or resorting to itinerant vending. The most common types of snack foods being prepared with the use of woodfuels are steamed rice cakes (*puto*), baked rice cakes (*bibingka*), glutinous rice cooked in coconut milk (*bico*), fried bananas (“banana-cue”), peanuts, and boiled chicken eggs with the embryo partially formed inside the egg (*balut*), a favorite among evening beer drinkers.

Since virtually none of the snack food vendors are registered with the local government, and since the majority of them operate from household premises, we've again made use of information obtained from our household survey to estimate both their numbers and their woodfuel consumption. As a result, we estimate that there are probably between 2,500 and 3,000 household-based snack food vendors operating in the city. In all, these vendors consume approximately 2,228 tons of fuelwood annually and a negligible amount of charcoal. Their fuelwood usage represents 3.2% of the total fuelwood consumption in the city, with approximately 20% of this originating directly from rural traders while the rest is purchased from urban wholesalers and retailers.

Depending on the product being sold, and the income of the proprietor, snack food vendors were found to be making variable use of kerosene and LPG stoves. *Puto* is usually prepared in large steamers (see Figure 3), favoring fuelwood use. Fried bananas and peanuts can be cooked in ordinary sized pans, and the majority of vendors selling these products utilize simple kerosene stoves. In general, the type of cooking being done is less of a constraint on the fuel-choice decisions of snack food vendors than was the case for barbecue vendors or *poso* makers. Instead, the determining factors in fuel choice for this category of user are rather similar to those discussed for households, namely, equipment costs, taste preferences and availability in small quantities. Therefore, fuel-switching behavior could be expected to a greater degree in this category of business than for some of the others, although this could be offset somewhat by an increase in the absolute number of snack food vendors in the city.

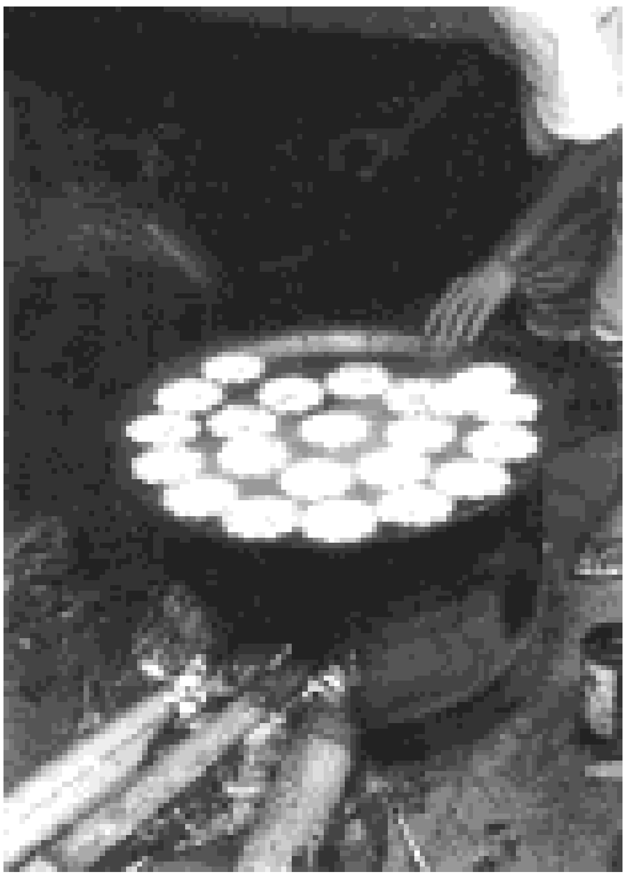

Figure 3: *Puto* making using split bamboo trunks as fuel

2.3.7 Industrial Establishments

The two major industrial users of woodfuels in Cebu City are rattan furniture and fashion accessory manufacturers. These businesses have a combined annual consumption of approximately 3,898 tons of fuelwood, or about 5.7% of total fuelwood consumption in Cebu City overall. Local government listings show less than 30 such establishments in Cebu City itself, but if we were once again to include Mandaue City the picture would change tremendously. Mandaue is home to over 100 rattan furniture and fashion accessory factories, as well as scores of other fuelwood-using industries such as feed manufacturers, producers of carrageenan, mosquito repellents, rubber products, and grain mills. Preliminary surveys of some of these establishments indicated that their fuelwood consumption is substantial, perhaps close to 20,000 tons annually, but that much of this consumption is in the form of wood wastes and a variety of non-woody biomass fuels. Wood wastes are either self-generated, as is the case with rattan furniture and fashion accessory manufacturers, or purchased from lumberyards, construction companies, or furniture factories with surplus wastes or oil-fired boilers. Usage of non-woody biomass fuels is generally limited to coconut shells and husks which are purchased directly from rural suppliers. In some cases, *primary* fuelwood is also purchased directly from the province, although this is usually found to be more expensive compared to wood wastes or coconut fuels. These various forms of fuelwood are used in the above-mentioned industrial establishments as either a boiler fuel or in bin dryers.

The larger rattan furniture factories are usually self-sufficient in wood wastes, but the small to medium-sized factories tend to supplement their wood wastes with a variety of purchased fuelwood and non-woody biomass. These fuels are burned in boilers to produce steam for pressurized tanks where the rattan poles are placed for approximately 30 minutes in order to be made pliable before being removed for bending and shaping (see Figure 4). Some of the boilers in use are quite ancient and inefficient, suggesting some possibility for fuel savings in a number of these plants. The fashion accessory manufacturers are also able to utilize a fair amount of self-generated wood wastes in cases where costume jewelry is being manufactured out of wood or coconut shells. These manufacturers use fuelwood as a boiler fuel for heating dyes and bleaching, but their overall consumption is significantly less than that of rattan furniture producers.

Figure 4: Rattan furniture factory using wood wastes in industrial boilers

Apparently, there are only a few grain mills, producers of animal feeds, and carrageenan manufacturers that still make use of fuelwood as a boiler or dryer fuel, but their level of consumption can often be substantial. We were unable to obtain much direct information from either the grain mills or the feed manufacturers, but a rural woodfuel trader informed us that a few of the mills utilize fuelwood to dry grains before milling while the feed manufacturers use it for both a boiler fuel and in bin dryers. We had better luck in assessing the fuelwood consumption of producers of carrageenan, a food additive produced from seaweed. Two carrageenan manufacturers were identified as using fuelwood in their dryers, with a combined consumption of perhaps as much as 1,000 tons a year for these two factories alone. Both businesses, however, are reportedly in the process of phasing out the use of woodfuels, with each offering a different set of reasons for this decision. The smaller of the two has decided to upgrade to an oil-fired dryer because of difficulty in obtaining adequate supplies of fuelwood on a regular basis, a difficulty they attribute to stricter enforcement of forestry laws. The larger company is phasing out fuelwood mainly because of quality control problems and because wood no longer holds a clear price advantage over oil fuels. In addition, a vice-president of this company also mentioned that a final factor in their decision to phase out fuelwood was criticism they received from Japanese and European buyers that they were “destroying the environment” through their use of this fuel. It should be noted that we later encountered and interviewed suppliers of these firms and found out that most of the wood they were using consisted of off-cuts from coco lumber operations, portions of fallen fruit trees, and wood from trees grown and coppiced on farmland on a regular basis, leaving little basis for any claim that their fuelwood use was environmentally destructive.

One of the largest companies in the Metro Cebu area produces mosquito repellent coils for both domestic markets and for export. We were unable to obtain any information directly from this company but we did interview a number of woodfuel traders supplying them and one official of an affiliated company. From these interviews we estimate that this one factory alone consumes upwards of 1,500 tons of wood annually, although there is some uncertainty as to whether all of this wood is used as fuel or if some of it is pulverized and used as a raw material in the production of the coils.

In general, the large industrial establishments were found to be quite flexible in their choice of fuels and appeared to only use wood if they could obtain supplies for free (as was the case with self-generated wood wastes), if fuelwood was found to be less expensive than oil, and/or if oil fuels were in short supply, a situation most recently encountered during the Persian Gulf Crisis. At present, industrial fuelwood use appears low precisely because oil prices are relatively moderate and supplies are stable. A number of the companies currently phasing out fuelwood indicated, however, that they intend to retain their wood-fired boilers and bin dryers and should these conditions change they would consider using fuelwood again. From an environmental standpoint such a move back to increased fuelwood usage on the part of industrial establishments need not be too great of a problem due to the widespread utilization of wood wastes, scrap wood and various forms of non-woody biomass in the majority of these firms.

A final point on consumption of woodfuels by industrial firms relates to the scope of this study. As mentioned above, the figure of 3,898 tons of fuelwood consumed annually by industrial firms refers only to those establishments located in Cebu City proper. Future estimates of woodfuel use in the greater Cebu City metropolitan area would undoubtedly show a much higher figure because of the large number of woodfuel-using firms located in Mandaue City.

2.3.8 Institutions

Three types of institutions were identified as potential woodfuel users, schools, hospitals and prisons. Overall, information on energy use was collected from 56 different institutions, indicating that this sector utilizes approximately 598 tons of fuelwood and 4 tons of charcoal annually. This translates into only 0.9% and .03% of the overall consumption of fuelwood and charcoal in the city, respectively. This low level of woodfuel use seemed surprising at first, but appears to be mainly a result of the fact that many of the schools no longer undertake any significant food preparation on the premises, instead they contract with outside caterers or allow students to patronize food vendors and eateries off of school grounds.

For those schools that do use fuelwood, quantities consumed ranged from as little as 10 kg. a day in schools with small feeding centers where *lugaw* (rice porridge) is served in the mornings but otherwise no cooking is done, to over 200 kg. a day for a few with canteens on the premises. Only about 60% of the fuelwood being used in the schools is actually purchased, the remainder is *primary* fuelwood collected from school grounds or scrap wood from school renovations or other projects. In addition, a small amount of charcoal (2.6 tons a year) is consumed in school canteens and home economics classrooms.

There are only a handful of hospitals in Cebu City making use of woodfuels and these tend to be located in less-crowded, suburban districts. The largest of these, in terms of fuelwood consumption, is the station hospital at the army camp in *Barangay* Lahug. The bulk of the fuelwood being consumed in hospitals is being delivered directly from rural traders, but hospitals, like schools, also make some use of scrap wood from construction work on the grounds.

To our knowledge there are only two large prisons in Cebu City, both of which make use of fuelwood for cooking. These prisons receive their supplies directly from rural traders, with one making use of 73 tons of *primary* fuelwood a year while the other utilizes 110 tons of coconut fronds annually.

2.3.9 Others

The consumption estimates presented above are only for commercial establishments located in the 49 urban *barangays* of Cebu City proper that are known to be consumers of woodfuels. As already mentioned, woodfuel-consuming businesses in adjacent Mandaue City were not included in the consumption estimates for the moment since these were outside the scope of the study and only limited information could be gathered on their fuel-use patterns. In addition, a number of other business types, located both within and outside of Cebu City, were also not included at this time, either because of a lack of information on their numbers and location, or only a limited indication that they might be using woodfuels. Some of these business types are blacksmiths, lime-making, brick kilns, pottery making, poultry farms, soap making, wax factories, rubber factories, activated carbon manufacturing, and match factories. In the future, as new data become available, we hope to expand our estimates to cover both residential and commercial woodfuel usage for the greater Cebu City metropolitan area and perhaps even for Cebu Province as a whole.

2.4 Summary Discussion

In 1992, fuelwood and charcoal consumption in the 49 urban *barangays* of Cebu City amounted to an estimated 68,635 tons and 13,485 tons, respectively. Assuming an energy content of 14 megajoules (MJ) per kg. for fuelwood (all types), and 25 MJ/kg. for charcoal, these figures translate to approximately 221,000 barrels of oil equivalent (BOE) worth an estimated $4 million (P100 million) at 1992 prices. The residential sector accounts for 62% of the fuelwood and 51% of the charcoal consumed, with the rest being used in a variety of commercial, industrial and institutional establishments. The motivations for using woodfuels, the sources of and prices paid for these fuels, and the potential for switching from woodfuels to conventional sources, were all shown to vary both between the residential and commercial sector as well as *within* the commercial sector itself, depending on the type of establishment being discussed.

In the residential sector there is an unmistakable trend away from the use of fuelwood and towards greater use of kerosene and LPG. However, the impact of this trend on absolute levels of fuelwood demand is being offset by population growth and continued widespread usage of wood as a secondary or supplemental cooking fuel. Charcoal usage also remains high because of a number of specific end-uses for which this fuel is most appropriate. Charcoal appears to possess a number of advantages over wood as a cooking fuel for many low-income families, such as being less bulky, less smoky and cleaner to use than the latter. However, fuelwood, unlike charcoal, can often be obtained for "free" by a variety of scavenging and collecting activities, even in a highly urbanized setting like Cebu.

Both households and commercial establishments were found to be making extensive use of a variety of scrap wood, wood wastes, and non-woody biomass fuels. These fuels are often collected by households or self-generated by industrial establishments, but they are also increasingly being commodified and traded in the urban woodfuel marketing network. This trend towards increasing commodification of wood wastes and non-woody biomass appears to be due less to shortages of regular fuelwood than to a recognition of these resources as a salable commodity that can usually be marketed for less than *primary* fuelwood because they are merely a by-product of other activities taking place within the city.

Based on the findings of the household and commercial sector energy consumption surveys, we are of the opinion that fuelwood and charcoal will continue to be a significant source of energy in the economy of Cebu through the year 2000. In the event of future instability in world oil markets resulting in some combination of higher prices and/or reduced supplies, an event no longer considered improbable, woodfuel use could even increase substantially since both households and businesses in Cebu have shown a remarkable capacity to alter their fuel-use patterns in response to changes in prices and availability. Given the current state of the environment in Cebu, and the already high population densities and intensive land-use practices, such a development might imply a need for policy efforts aimed at either holding down levels of woodfuel demand and/or encouraging increased tree planting and management in order to increase supplies. The discussion above illustrates that woodfuel use is already fairly efficient in urban Cebu, probably as a result of the highly commercialized nature of this consumption. The potential for improvements on the "demand-side" still exist, however, and local universities and NGOs could play a big part in researching and promoting this potential. The discussion below looks at the "supply-side" of the commercial woodfuel system in Cebu and suggests that Cebuano farmers long ago recognized the presence of commercial woodfuel demand in the urban areas and have responded to this with a number of innovative and creative tree management schemes. To what extent this level of adaptation can be maintained or even expanded to meet increasing demand is open to question and would depend to a large extent on whether policy-makers, NGOs, and government extension efforts in the forestry and energy sectors view the production and marketing of woodfuels as a problem or an opportunity.

3 WOODFUEL SUPPLY AND DISTRIBUTION SYSTEMS IN CEBU

3.1 Overview

The discussion in this section will focus on the ways in which woodfuel-producing trees are grown, harvested, converted, transported and finally traded in the commercial fuelwood and charcoal markets of Cebu. Unlike the previous section in which our discussion of woodfuel use in Cebu City was based largely on results of a random sampling of households and commercial establishments using highly structured survey instruments, the findings presented below are far more qualitative in nature and derive mainly from survey techniques more akin to those employed in Rapid Rural Appraisal studies (such as semi-structured interviewing, recording of oral histories, group interviews, extensive use of secondary data, etc.). The purpose of this aspect of the study was to explore the broader patterns of woodfuel production and trade in the province in order to draw some initial inferences about the impact of this trade on rural environments, farming systems and economies. In addition, knowledge gained from this research is intended to form the basis for more focused inquiries in the future of the supply side of commercial woodfuel markets in Cebu. Overall, eight woodfuel-producing regions of the province were visited for a period of from one to four days each. A more detailed description of how these sites were chosen and what transpired during the site visits can be found in Appendix A of this report.

From what we've been able to determine, the commercial trade in fuelwood and charcoal appears to be a long-established industry in a number of areas of the province, dating back to at least 1920 in mountain *barangays* just west of Metro Cebu. Initially, much of this trade centered around the extraction of native shrub and secondary forest species such as *Vitex parviflora*, *Buchanania arborescens*, *Psidium guajava* and *Pithecellobium dulce*. Over time, however, these species have been largely replaced by exotic fast-growing leguminous tree species like *Gliricidia sepium* and *Leucaena leucocephala.* In many places these trees have been intentionally planted in small woodlots and plantations or as part of a number of agroforestry approaches, in other areas they constitute a form of tree fallow which often results from the spontaneous spread of these species from adjacent areas. The fast-growing trees are typically harvested on a two-year coppice rotation and regenerate well from the stump with little or no effort required on the part of the wood-cutter once the trees are established.

Woodfuel harvesting and transport in Cebu is regulated by the Department of Environment and Natural Resources (DENR). The most fundamental rule in force regarding the woodfuel trade stems from DENR Administrative Order Number 26, promulgated February 22, 1990, which amends Administrative Order Number 86, Series of 1988, and states, “no permit is required in the cutting of *planted* trees within *titled* lands or tax-declared alienable and disposable lands....*provided* that a certification [referred to as a certificate of origin or transport permit] of the Community Environment and Natural Resources Office concerned to the effect that the forest products came from a titled land or tax-declared alienable and disposable land is issued accompanying the shipment” (DENR 1991a, emphasis added). In order to be able to harvest and sell “naturally-growing” species found on titled lands a special “cutting permit” is first required in addition to the transport permit, even though as recently as 1992 a temporary ban on the issuance of cutting permits was in effect. Technically speaking, a landowner interested in harvesting trees for sale as woodfuel or for other purposes must first approach the DENR, show land titles and/or tax declarations, and indicate to the DENR the potential volume of trees on their land, origin (planted or naturally-growing) and species, with the latter requirements to be accomplished through an initial inspection of the lands by an official of the DENR. In reality, and for reasons which will be dealt with in more detail below, the system only occasionally works this way and much of the trade goes unregulated by the DENR. This does *not* necessarily imply that much of the trade consists of banned species originating from public or government lands, for in fact most of the fuelwood and charcoal sold in Cebu does come from *planted* species grown on *titled* lands. Instead, the problem lies with the regulatory system itself, suggesting a possible need for revisions in how woodfuel harvesting and transport is regulated.

Table 8 provides information on the volume of *primary* fuelwood and charcoal originating from different areas of the province and intended for sale in the commercial woodfuel markets of Cebu City. Figure 5, a map of the province, shows the location of these cities and towns in relation to Cebu City. The hillyland *barangays* of Cebu City produce 12.4% of the fuelwood and nearly 30% of the charcoal being traded in the commercial markets. The wider Central Cebu hillyland area, including the mountain *barangays* of Cebu City as well as those of Toledo City, Balamban, San Fernando, Naga, Minglanilla, Talisay, Consolacion, Lilo-an and Compostela, produce 49% of the fuelwood and 65% of the charcoal traded. These are the areas that have the longest history of involvement in the commercial woodfuel trade, but over time the trade has expanded as far north as Borbon and Tabuelan and as far south as Argao and Dalaguete. The figures presented for fuelwood in Table 8 *do not* account for commercially traded coconut fronds, bamboo and other forms of non-woody biomass fuels which are shipped in significant quantities from a number of municipalities including Barili, Carcar, San Fernando, Lilo-an and Compostela. In general, most of the fuelwood and charcoal is originating from localities within 50 km. (by road) of Cebu City, although a fair amount of charcoal is shipped from distances as far as 90 to 100 km. away from downtown.

The discussion below will provide more details on the supply side of the commercial woodfuel markets in Cebu. Section 3.2 illustrates the various land use categories from which woodfuels originate and the species most commonly harvested for woodfuel purposes. Section 3.3 discusses the ways in which woodfuel producing trees are harvested and converted to either fuelwood bundles or sacks of charcoal, and the contribution of these activities to the local economy. Section 3.4 deals with the network of rural traders and transporters and their role in moving woodfuels from producing areas to urban markets. Section 3.5 discusses the woodfuel trade in the urban setting and the role of urban traders in providing woodfuels to residential and commercial sector consumers in the forms and quantities desired. Finally, Section 3.6 presents some concluding remarks on the commercial woodfuel trade in Cebu and assesses the overall competitiveness of the trade.

It will become apparent that the widespread perception in the urban areas of Cebu and among most government and NGO officials that woodfuel harvesting is one of the major causes of environmental degradation in the province, if not *the* major cause, cannot be substantiated. The vast majority of commercially-traded woodfuels in Cebu originate from planted trees grown on private lands. For the most part, these trees are harvested by the coppice method, the root system is left intact, and the trees regenerate rapidly. The continued slow degradation of Cebu's remaining shrub and secondary forest regrowth areas is a result of cutting for woodfuels *as well as* for other wood products and occasionally for expanding agriculture. This degradation is a cause for concern and needs to be remedied, but placing wider restrictions on the woodfuel trade should not necessarily be the approach taken. The existence of an established market for woodfuels and other wood products in urban Cebu is one of the major factors inducing upland farmers in the province to

Table 8: *Primary* Fuelwood and Charcoal Originating from Different Localities of Cebu, 1992

Locality	Fuelwood Production (tons/year)	% of Total	Charcoal Production (tons/year)	% of Total
Cebu City Hillylands	4,518	12.4	4,020	29.8
Balamban	1,263	3.5	3,266	24.2
Sogod	1,550	4.2	1,325	9.8
Danao City	2,147	5.9	839	6.2
Toledo City	2,957	8.1	515	3.8
Carmen	2,171	5.9	343	2.5
Tuburan	620	1.7	811	6.0
Minglanilla	1,911	5.2	321	2.4
Catmon	1,532	4.2	388	2.9
Argao	1,607	4.4	351	2.6
San Fernando	2,526	6.9	neg.	-
Compostela	1,819	5.0	101	0.7
Talisay	1,154	3.2	322	2.4
Barili	1,239	3.4	185	1.4
Pinamungahan	1,234	3.4	29	0.2
Aloguinsan	1,048	2.9	neg.	-
Lilo-an	930	2.5	24	0.2
Carcar	829	2.3	13	0.1
Tabuelan	289	0.8	197	1.5
Consolacion	624	1.7	86	0.6
Borbon	842	2.3	neg.	-
Medellin	792	2.2	neg.	-
Others	2,898	7.9	364	2.7
TOTAL	36,500	100.0	13,500	100.0

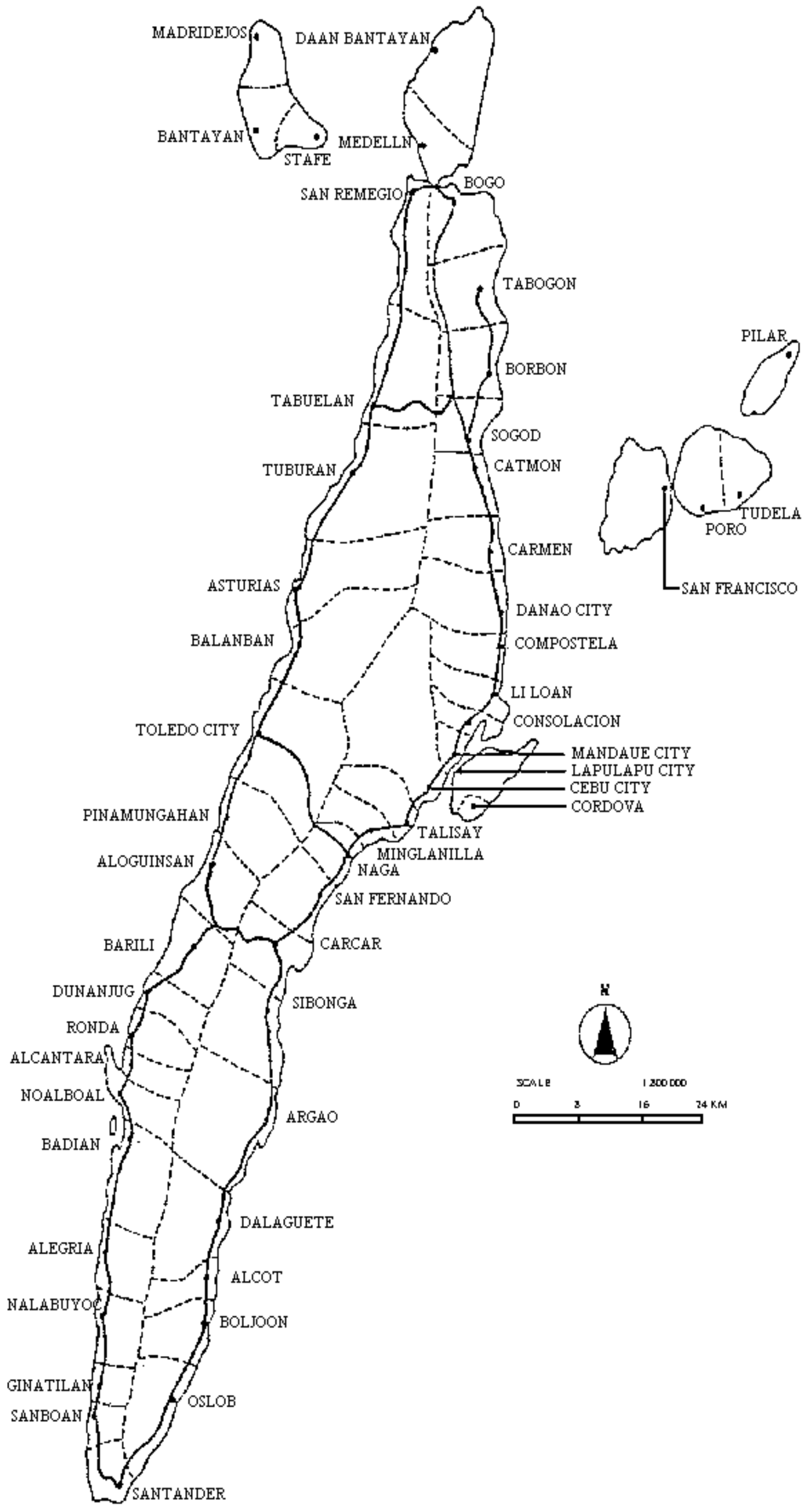

Figure 5: Map of Cebu Province, Showing Major Road Network

undertake tree-planting activities. In addition, off-farm employment opportunities and the difficult natural conditions facing Cebuano farmers (including steep slopes and irregular rainfall and water supplies) combine to make tree "farming" a rational use of available land, labor and financial resources. This is the case since the propagation and management of fast-growing tree species like *Gliricidia* and *Leucaena* require little effort on the part of the farmer once the woodlot or tree fallow is established, and these trees can be harvested when there are no conflicts with either on- or off-farm labor demands. For the most part, the commercial woodfuel trade in Cebu can be described as a system that helps to stabilize upland environments while simultaneously providing income to rural dwellers and an accessible source of energy to residential and commercial consumers in the urban areas of the province.

3.2 Woodfuel-Producing Land Use Systems and Tree Species

In order to begin to understand the ways in which woodfuel-producing trees are grown and managed in rural areas of Cebu, and to make at least an initial assessment of the sustainability of these practices, we sought out and interviewed tenant farmers, smallholders, landowners, rural and urban woodfuel traders, fuelwood-cutters, charcoal-makers, local government officials, and DENR and NGO officials working in woodfuel-producing regions of the province. The manner of the interview was semi-structured, and the focus was shifted depending on the respondents' knowledge of the subject matter. For example, DENR and NGO officials were asked to provide us with information on any extension work or reforestation projects in the area, local government officials were probed on social and economic conditions in the area, and traders, wood-cutters and charcoal-makers were asked to comment on matters more directly related to the conduct of the local woodfuel trade. Where possible, this information has been supplemented by secondary data gleaned from maps, project reports, articles, and DENR records of transport and cutting permits.

From the oral histories related to us by a number of informants, there is clear indication of a commercial trade in woodfuels going back to at *least* 1920 in a number of areas of Central Cebu. Much of the early trade centered around the harvesting of naturally-growing shrub and secondary forest species in the hillyland *barangays* of Cebu City, Talisay and Toledo City, as well as in lower elevation *barangays* of Consolacion, Lilo-an, and Compostela. Not only naturally-growing species were harvested, however. Farmers at the turn of the century are reported to have been planting tree fallows of *Gliricidia sepium* and a "native" variety of ipil-ipil (*Leucaena glauca*) on steep and badly eroded hillsides previously cultivated in corn (APAN 1992, p.8). Writing in 1935, Pendleton reported "plots and groves" of *Leucaena glauca* and other planted species "doing very well" in the hillylands of Cebu City, as well as intensive cutting of a variety of trees for sale as fuelwood and timber (p. 830). Apparently, Cebuano hill farmers have long appreciated the value of fast-growing leguminous tree fallows as both a source of income and a form of erosion control. Older informants were able to point to specific areas of steeply sloping hillsides that had long ago undergone a transformation from natural shrub/secondary forest to corn, followed later by fast-growing trees alone or inter-cropped with corn once soil erosion made corn mono-cropping intractable. The fast-growing trees were usually planted, but sometimes a field would simply be abandoned and left to spontaneous regrowth of weeds, original shrub species, or spread of planted species from adjacent plots.

In spite of these positive tree-planting practices, wood-cutters, charcoal-makers, woodfuel traders and other informants regularly bemoaned the widespread depletion of secondary forest species like *tugas* (*Vitex parviflora*), *malatamban* (*Cyclostemon bordenii*), and *pangantoan*

(*Pittosporum pentandrum*), all said to have been more abundant in the “old days”. While the common perception among urbanites is that this state of affairs has resulted mainly from over-cutting for charcoal, rural residents report a far greater number of uses for these species, and thus give more varied explanations for their decline. According to them, *tugas* or molave has been widely cut for home building, woodcrafting, charcoaling, and in a number of places (like Argao, Sibonga, Compostela, Catmon and Sogod) to be sold primarily to underground coal mining companies for use in the mines as props and shaft supports. Elderly respondents in Sogod and Tabuelan mentioned over-cutting of molave in their region as far back as the 1920s, with trees being shipped across the Tañon Strait to Negros for use as ties in the rail network being built around the sugar plantations of that island. These species can still be found in scattered plots of regenerated shrub forest located in interior portions of the island, but they become increasingly less noticeable the closer one moves to more settled locations.

Although we are not yet in a position to report a highly precise quantification of the volume of woodfuels originating from various land use categories as of 1992, the discussion below will make it evident that the great bulk of these fuels are coming from intensively and extensively managed agricultural lands and consist mainly of a few fast-growing exotic tree species. These trees are grown as part of a number of land use systems and incorporated into such an extraordinary variety of agroforestry practices so as to make categorization difficult. For purposes of discussion, however, we can delineate six broad land use systems or practices in which woodfuels are produced, including tree fallows, woodlots, tree plantations, agroforestry systems, isolated/scattered tree plantings, and shrub/secondary forest areas. These categories are managed to varying degrees of intensity and for different purposes, they also fall under different ownership and use rights regimes, but they all produce woodfuels as either the primary product or as a by-product of other land use and tree-growing activities. An additional land use category not explicitly addressed in this section is lands planted solely to coconut or to a crop/coconut combination. These lands cover over 150,000 hectares in the province, 57% of the area under cultivation, and produce abundant quantities of fronds, husks and shells. Much of this biomass resource is freely gathered by rural residents for use as fuel, but increasingly these fuels are being traded in urban markets where, as indicated in Section 2, they meet a significant portion of residential and commercial sector woodfuel demands.

Tree fallows are widespread in a number of mountain *barangays* of Cebu City (such as Toong, Pamutan and Pulangbato) as well as in parts of Talisay, Toledo City, Naga, Balamban, Minglanilla, Lilo-an and Compostela. Fallows typically cover very steep hillsides, sometimes exceeding 50% in slope, and have reportedly been long-established in a number of these locations. Respondents claim that some of these fallows came about as a result of an intentional effort to plant trees, either from cuttings, as is common with *Gliricidia*, or through the broadcasting of seeds (*sabud*) in the case of *Leucaena*. In other cases, slopes were simply abandoned in the face of severe erosion and reclaimed first by weeds, grasses and shrubs, and then by spontaneous spread of planted species from adjacent areas. Fallows are more commonly found on lands belonging to absentee owners and claimants who are now residing in the city. These lands are only extensively managed, with a common arrangement being for a wood-cutter or charcoal-maker to harvest the trees on a coppice rotation of two or three years, giving the landowner either a lump sum cash payment or a share of the product. Landowners are apparently satisfied with this arrangement since they usually earn enough to pay land taxes and since their primary motivation for holding these lands appears to be for speculative purposes. Tree fallows also appear to be an effective and sometimes profitable way to keep lands out of corn cultivation, which has the dual benefit (from the landowners' perspective) of minimizing soil erosion as well as preventing the area from falling under the aegis of land reform legislation. Considering that tree fallows are perhaps the single most important land use category in terms of the volume of woodfuel production, recent trends in land speculation and development in certain foothill *barangays* of Cebu City (such as Busay, Budlaan and Kalunasan) might have a serious impact on future levels of woodfuel production from these areas.

The second land use category, woodlots, appear similar to tree fallows but can be distinguished from the latter in terms of size and ownership patterns. Whereas tree fallows can often cover large areas (up to 12 has.) and tend to be owned by absentee claimants, woodlots are usually smaller in size (less than 1 ha.) and are typically established by smallholders on their own property. As with tree fallows, the most common species planted in woodlots are the fast-growing leguminous varieties, with *Leucaena leucocephala* generally the most popular. Some farmers are even planting small stands of longer-maturing species like *Gmelina* and mahogany (*Swietenia mahagoni*), especially in areas with active government or NGO forestry extension projects. Smallholder tree planting in general, and establishment of woodlots in particular, often appear to be in response to the presence of off-farm employment opportunities on construction sites or in factories around the Metro Cebu area. Once established, woodlots require little in the way of maintenance and can be harvested when the smallholder has available labor or needs the cash income. Some smallholders even allow others to harvest their woodlots, settling only for a share of the proceeds from this activity. Similar patterns of smallholder tree-farming in response to a combination of urban demand for wood and labor shortages or off-farm employment opportunities have been reported in other areas of the Philippines and the developing world (Olofson 1985; Dewees 1989; Hosier 1989; Godoy 1992). While typically much smaller in size than tree fallows, the large number of smallholder woodlots we observed throughout much of the province must surely produce significant quantities of woodfuels. Smallholders will continue to see benefits in keeping portions of their land in woodlots as long as a strong market exists for woodfuels and other wood products, and off-farm employment opportunities exist. Another important factor will be regulations on the cutting and harvesting of trees under such circumstances. Far too often we encountered respondents who indicated little interest in growing trees on their lands, even if they knew it was profitable, because they were uncertain if they would be allowed to cut and sell them in the future.

A third land use category, tree plantations, can be distinguished from the first two in a number of ways. To begin with, plantations differ from woodlots in their size and ownership patterns. Like tree fallows they tend to cover large areas and be owned by more successful landowners residing in urban areas. Unlike tree fallows, however, plantations are usually found on reasonably good (i.e. flat) lands, they are more intensively managed, and they are usually intended to produce higher-value wood products from longer-maturing tree species. Some of these plantations have been established as part of the DENR's contract reforestation or Industrial Tree Plantation (ITP) programs while others, like the reforestation project of the Atlas Mining Co. in Toledo, were established as part of a land reclamation effort or to produce good quality mine supports. While the focus of these tree plantations is usually on higher-value wood products from species like *Gmelina*, mahogany and even teak, there is evidence that the “lops and tops” as well as off-cuts from these trees are finding their way into urban woodfuel markets as charcoal or to be marketed directly to large-scale commercial and industrial fuelwood-using establishments. Tree plantations in Compostela, Carmen and Sogod were found to be using both fast-growing and higher-value tree species, with the former being harvested for fuelwood on a two-year coppice cycle while the latter were allowed to grow for longer periods before being cut (see Figure 6). It's not yet clear whether intensively managed tree plantations are profitable or not in Cebu. Plantation owners we spoke with indicated that they undertook these activities as more of an experiment.

Although a market certainly exists for the products being produced on these plantations, success will probably depend more on matching species with site conditions and finding a cost-effective way of managing these lands.

Figure 6: Tree plantation of *Leucaena leucocephala*, Compostela, Cebu

While tree fallows, woodlots and plantations produce large numbers of trees with woodfuel potential, probably the most widespread tree-planting activities undertaken by Cebuano farmers involve the simultaneous propagation and management of tree and food crops on their lands. Some of these agroforestry practices, like the planting of giant ipil-ipil as hedgerows, have come about mainly through the efforts of NGOs working in the uplands. Others, such as the inter-cropping of corn and *Gliricidia* on steep slopes, are apparently long-established practices in some hillyland *barangays* of Cebu City as well as in Naga, Compostela, Catmon and other places. In addition to hedgerows and inter-cropping, smallholders were observed to be managing trees with good woodfuel potential as live fencing and as boundary markers (see Figure 7). Following Nair (1985), these practices can be described as exhibiting varying zonal and temporal arrangements. *Leucaena* hedgerows with alley-cropping of corn or other food crops can be described as a concomitant strip arrangement. Coppiced harvesting of dense stands of *Gliricidia* followed by one or two plantings of corn around the stumps is a type of improved fallow practice with a sequential time element. The actual types of agroforestry practices undertaken, and the enthusiasm with which these are adopted, appears to depend to a large extent on tenure conditions, access to extension materials, need for fodder, and the presence or absence of a local trade in woodfuels. In general, those farmers with secure tenure, some access to training and/or other extension materials, some livestock, and/or ready access to a woodfuel trader, are more likely to adopt the types of agroforestry practices discussed above. These conditions are met to varying degrees in different parts of the province, but the issue of tenure often proves to be the most intractable obstacle in the way of more widespread adoption of agroforestry approaches in rural Cebu.

Figure 7: Agroforested lands in Compostela, Cebu with boundary market of *Leucaena leucocephala* (center, right) and tree fallow of *Gliricidia sepium* (upper, including a recently harvested portion to the left showing coppice regrowth)

In addition to the types of trees and land use practices described above, woodfuel-producing trees can also be found singly or in small clusters throughout the agricultural landscape. Many of these trees are fruit-bearing and were planted mainly with that end in mind, others were planted for shade or for decorative purposes. Rarely are such trees felled solely for woodfuel purposes, but fallen branches and trees uprooted in storms can often provide good quality fuelwood or be mixed with other species in charcoal kilns. As recently as November 1990, large numbers of fruit trees in Central Cebu were uprooted by a super typhoon dubbed “Ruping”. These trees were subsequently carved up for sale as timber, packing crate material and/or for woodfuels in the months following the storm.

Finally, as mentioned above, some of the woodfuels being traded in the commercial markets of Metro Cebu still originate from areas of shrubland or secondary forest regrowth. This is the case even though the DENR has placed much stricter rules on the harvest of “naturally-growing” species, and even banned cutting of these species outright for a period in 1991-92, regardless of whether these were growing on private lands or not. The naturally-growing species most commonly found in the woodfuel markets are *Buchanania arborescens*, *Psidium guajava*, *Pithecellobium dulce*, and *Vitex parviflora*. It appears as if these species are more widespread the further one moves from the city. For example, we found it more common for the above species to be included in shipments of woodfuels originating from places like Argao and Sogod, over 50 km. to the south and north of the city, respectively. In contrast, woodfuel shipments originating from areas in Central Cebu, within 20-30 km. of the city, were more likely to consist solely of fast-growing planted varieties. Apparently, the naturally-growing varieties have been largely replaced with introduced species like *Gliricidia* and *Leucaena* in many parts of Central Cebu because these areas have long been involved in the commercial woodfuel trade. Respondents in the more distant locales indicated that the woodfuel trade in their areas was more recent and sporadic, and so the benefits of intentionally propagating fast-growing varieties on a wide scale may yet to be realized.

The above discussion indicates that much of the woodfuel traded in Cebu consists of fast-growing exotic varieties grown on private agricultural lands and coppiced on a short rotation cycle. In an effort to more precisely quantify the species composition of the woodfuel trade in Cebu we compared and combined information gathered from three different sources. First, we interviewed 81 urban woodfuel traders on a range of subjects, including the types of woodfuel species they sell. Some of the traders were unable to comment very specifically on types of species sold, but many of them showed a keen understanding of this topic and were even able to comment on gradual changes in species composition over time. Second, records of transport permits granted by the DENR to woodfuel traders for a 12-month period from August 1991 to July 1992 were scanned, and information contained in the permits on origin, destination, volume, and species being shipped were recorded, tabulated and analyzed. The third and final source of information derived directly from our field work in woodfuel supply areas of the province and was based on discussions with farmers, fuelwood-cutters, charcoal-makers, rural traders and transporters, as well as on our own observations. For a number of reasons, none of these sources alone could be relied upon to provide a totally accurate picture of the species being traded. For instance, DENR records show little indication of any shipments of molave charcoal, probably because cutting of this species is, for the most part, prohibited. Discussions with rural and urban traders, however, indicated that molave charcoal is still being traded on a fairly significant scale. More significantly, transport permits issued by the DENR were found to only account for approximately 20% of the fuelwood and 34% of the charcoal actually traded for reasons to be discussed in Section 4. Despite this, data obtained from the three different sources tended to coincide fairly well. The results of this exercise are presented in Table 9.

Four types of fast-growing tree species account for 58% of the *primary* fuelwood and 71% of the charcoal traded in the commercial woodfuel markets of Metro Cebu. *Gliricidia sepium* and *Leucaena glauca* are the most common species found in the tree fallow systems, and have a long history of propagation and management in the province. *Leucaena leucocephala* was only introduced on a significant scale around 1970, but today is the most widely utilized species in small woodlot and agroforestry systems. *Cassia siamea* is apparently long-established in some northern municipalities but until now has not enjoyed widespread propagation in other areas. All four of these species provide good quality fuelwood, with *Gliricidia* and the native variety of ipil-ipil preferred for charcoal making. All are easy to establish from either cuttings (*Gliricidia*) or through direct seeding (*Cassia* and *Leucaena*), they all coppice extremely well and are easy to harvest and split. Furthermore, all four species are tolerant of long dry spells and are generally well-suited to the topographic, soil and climatic conditions found throughout Cebu (NAS 1980; Davidson 1987). With the exception of *Cassia siamea*, these species are all nitrogen-fixing legumes and provide both high-quality green manure and/or fodder for cattle and other ruminants. *Gliricidia* is widely used as a form of living fence, and all these species can be effectively used as hedgerows . NGO projects in the uplands of Cebu are actively encouraging the planting of *Leucaena* as hedgerows, instructing farmers to spread the leaves of these trees on cultivated areas as green manure and to bunch trimmed branches at the base of each row (wattling) in order to minimize erosion. Studies conducted in the Philippines show this approach to be nearly as effective at reducing surface runoff and soil loss as more permanent structures like terraces and rock barriers, while at the same time proving more acceptable to farmers

Table 9: Species Composition of Commercially-Traded Woodfuels in Cebu City, 1991-92

Local/Common Name	Scientific Name	Percent of Total: Fuelwood	Percent of Total: Charcoal
Biateles/Giant ipil-ipil	*Leucaena leucocephala*	32.6	29.3
Madre de Cacao/Kakauati	*Gliricidia sepium*	17.1	27.9
Kabahero/Native ipil-ipil	*Leucaena glauca*	7.0	12.0
Robles/Yellow cassia	*Cassia siamea*	1.3	1.7
Manga/Mango	*Mangifera indica*	7.4	5.1
Caimito/Star Apple	*Chrysophyllum cainito*	4.7	4.1
Lomboy/Java Plum	*Eugenia cumini*	2.2	0.3
Nangka/Jackfruit	*Artocarpus integra*	2.1	1.5
Sambag/Tamarind	*Tamarindus indica*	1.9	1.0
Santol	*Sandoricum koetjape*	0.8	0.4
Abocado/Avocado	*Perseas americana*	0.6	0.9
Other Fruit Species	–	3.2	1.1
Anan/*Balinghasai*	*Buchanania arborescens*	4.1	-
Bayabas/Guava	*Psidium guajava*	2.2	0.9
Tugas/Molave	*Vitex parviflora*	-	6.3
Kamanchilis/Manila tamarind	*Pithecellobium dulce*	1.7	0.3
Bagalnga	*Melia dubia*	0.9	-
Manga-Manga/*Malatamban*	*Cyclostemon bordenii*	0.8	0.4
Dita	*Alstonia scholaris*	0.5	-
Agoho	*Casuarina rumphiana*	0.3	-
Cha	*Ehretia microphylla*	-	0.5
Other Secondary Forest Species	–	5.6	3.3
Mahogany	*Swietenia mahogoni*	2.0	1.5
Gmelina/Yemane	*Gmelina arborea*	1.0	0.9
TOTAL		100.0	100.0

because they are less expensive to establish and maintain, and they provide supplemental fuel, fodder and soil enhancing benefits (Daño and Siapno 1992).Over-reliance on so few species could, however, lead to problems in the long run, a point brought home by the psyllid infestation of *Leucaena* throughout the Philippines in the mid-1980s which reduced the usefulness of this tree as a source of fodder and inhibited growth or even killed some trees. Nevertheless, these species appear so well-suited to the natural and economic conditions in Cebu that it should come as little surprise that they are so widely propagated. Future extension work in forestry and agroforestry in Cebu should start from an understanding of what makes these trees so popular, namely that they are easy to propagate, require little maintenance, are fast-growing, regenerate well from coppice or seedlings, and provide multiple benefits, and then try to broaden the species base by promoting other varieties with similar characteristics (possible candidates would include *Calliandra calothyrsus*, *Casuarina equisetifolia*, *Sesbania grandiflora*, *Pithecellobium dulce*, and some *Prosopis* spp.).

The second most significant category of woodfuel-producing trees are the fruit-bearing species which account for around 23% of the fuelwood and 15% of the charcoal traded. As mentioned above, these trees are rarely, if ever, felled for woodfuel purposes. However, stocking rates for these trees are exceptionally high in some parts of the Central Cebu hillylands and so there is usually a fairly steady supply of dead branches and fallen trees to be used for woodfuel. Larger portions of most fruit trees and even the roots can sold *as is* to large-scale industrial and commercial users or converted to charcoal. The softer wood of the star-apple tree is often chopped up and bundled for sale to household consumers. And certain fruit species, especially tamarind and *lomboy*, are said to make excellent charcoal and to impart a pleasant aroma to grilled foods.

Species commonly found in areas of secondary forest regrowth or in shrub forests still account for around 16% of the fuelwood and 12% of the charcoal being commercially traded, in spite of the fact that as recently as mid-1992 cutting of these species was technically banned. *Anan* and *kamanchilis* make for excellent quality fuelwood and both coppice fairly well, although regrowth is generally slower than that of the fast-growing exotics. Molave is almost always converted to charcoal and fetches a premium price in urban markets. These species become less noticeably in shipments of woodfuels originating from areas closer to the city which, as suggested above, may indicate that they tend to be gradually replaced with the fast-growing exotics the more an area is integrated into the commercial woodfuel trade.

Finally, at least two species popular in government and NGO reforestation projects are beginning to appear in the woodfuel markets of Cebu. Mahogany and *Gmelina* are grown primarily for higher-value purposes, but after harvest the lops and tops and even roots can be sold as fuelwood or converted to charcoal. For example, private tree plantations in Balamban and Argao, and a reforestation project owned by a mining company in Toledo City, were found to be simultaneously applying for permits to transport log bolts, sawn lumber, mine poles and charcoal from mahogany and *Gmelina* trees. At present, these species only account for 3% of the fuelwood and 2.4% of the charcoal being traded, but these numbers could increase significantly over the next ten years as trees planted in reforestation projects of the late-1980s and early-1990s begin to reach harvestable age.

From the above discussion of woodfuel-producing land use categories and tree species in Cebu, it becomes apparent that much of the fuelwood and charcoal production in the province is occurring on something approaching a sustainable basis. The upland areas of Central Cebu have a long history of intensive settlement and cultivation, and natural woodlands in these areas were apparently overexploited long ago. In place of these natural woodlands, and in response to urban demands for woodfuels and other wood products, Cebuano hill farmers have propagated and managed a variety of fast-growing tree species solely or in combination with food crops. Oftentimes severe erosion on steep slopes left them little choice but to cease regular cultivation, in other cases urban employment opportunities created a situation where tree fallows or woodlots provided a suitable ground cover and a flexible source of cash income. The nature and extent of these adaptations vary from one locality to the next, with actual land use patterns and practices resulting from a confusing admixture of social, ecological and economic factors present in each place at a particular point in time. In some hillyland *barangays* of Cebu City, like Busay, Taptap and Pong-ol Sibugay, cash cropping of cut flowers, ginger, string beans, tomatoes and other crops is widespread. In others, such as Budlaan, Kalunasan and Sapangdaku, fruit production combined with subsistence corn cultivation and widespread shrub and tree fallows are a more common land use practice. The conditions that combine to create these patterns are constantly changing, especially so in Central Cebu due to increased land speculation and the general pace of development in the region. As a result, it is difficult to forecast the long-term sustainability of woodfuel production in these areas. What is important to realize, however, especially for projects intended to promote “development” or “sustainable agriculture” in the uplands of Cebu, is that woodfuel production has formed an important part of land use practices in many parts of the province, providing both suitable ground cover to minimize erosion as well as a source of cash income to residents of the area.

3.3 Woodfuel Harvesting and Conversion Practices

It was just pointed out that much of the fuelwood and charcoal traded in Cebu is produced on something approaching a sustainable basis. This is due in large part to the ways in which trees are managed and harvested. Fast-growing leguminous tree species such as *Gliricidia* and *Leucaena* are usually harvested on a two-year coppice cycle, typically being cut around 25 cm. from the ground (see Figure 8). Harvesting is done with simple hand-held machetes or *bolos*. Smaller branches are cut off and depending on the season and the number of livestock in the area, are either left on the slope or collected for fodder. In some areas, corn will be planted around the coppiced stumps while branches from the cut trees are bunched and placed in horizontal strips across the slope (wattling). Coppice shoots are then trimmed back until the corn is harvested and then left to regrow for another rotation period. Farmers report that once established, tree fallows of *Gliricidia* and *Leucaena* require little or no maintenance, replanting or reseeding. Harvesting of woodfuels in native shrub and secondary regrowth areas takes essentially the same approach, although coppice rotations are typically longer due to the slower growth of some of the species, and we found no evidence of inter-cropping with corn in these areas. On woodfuel plantations and in intensively managed woodlots, the straighter and healthier trees are left to grow for longer periods at which time they are cut for sale as timber or for underground mine supports with the tops and branches being sold for fuelwood or converted to charcoal.

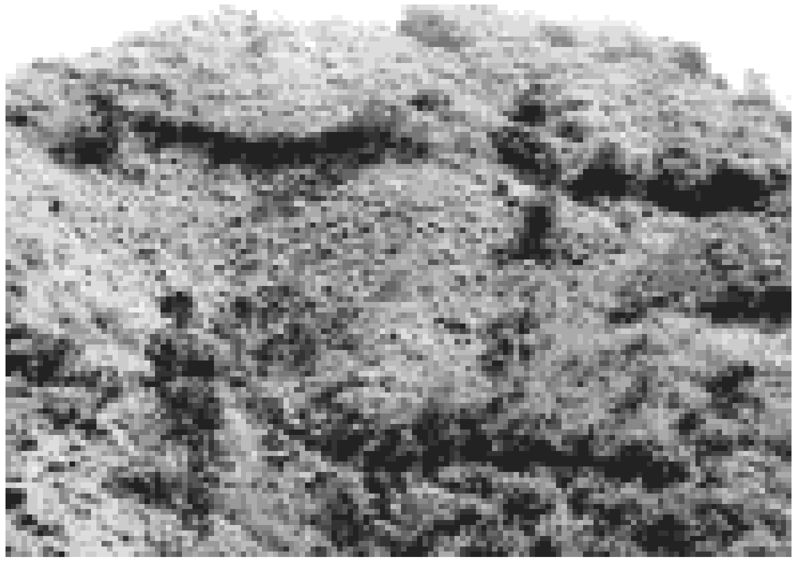

Figure 8: Recently coppiced tree fallow of *Gliricidia sepium, Barangay* Sapangdaku, Cebu City

Depending on conditions at point of harvest, the woodfuel trees are either sized, split and bundled immediately, converted to charcoal in a pit kiln built on the slope, or carried to another location for sizing and splitting or for charcoal-making. On very steep slopes near enough to a road or some other form of collection point (e.g. a riverbed accessible by truck), wood-cutters tend to simply *throw* tree poles down the slope, forming piles at points below and repeating this procedure as necessary to get the poles to the bottom of the hill. Once at the bottom the poles are sized, split, de-barked and bundled for later collection. In other areas, most of the sizing and splitting is done at the point of harvest, the wood is then carried to a collection point in large bundles of 150-200 sticks (weighing 40-50 kg.) where it is re-bundled into smaller units of 4-5 kg. each. In general, most of this hauling is done manually, although in some instances horses and/or water buffalo are also utilized.

Generally speaking, two types of fuelwood bundles are produced, referred to by cutters and traders as *raja* and *ukay-ukay*. The *raja* bundles contain sticks of fuelwood that have been carefully sized and split, with the bark usually removed, which are typically air-dried for a few days before bundling. Fuelwood cutters in *Barangay* Sapangdaku, Cebu City, even go to the trouble of placing split fuelwood sticks on a rack above smoldering coconut fronds, husks, cut grass and weeds, in effect "smoking" the fuelwood before bundling it. They claim this practice dries the wood faster and helps prevent infestation by *bok-bok*, a wood-eating weevil that is particularly fond of harvested *Gliricidia*. The resulting *raja* bundles are indeed an impressive sight, containing uniformly sized fuelwood sticks with surprisingly little variation in weight between bundles. In contrast, the *ukay-ukay* bundles contain un-split or only once-split logs and branches of trees, with the bark still intact and the wood still green. This wood is haphazardly bundled and shows large variations in the number of pieces and weight between bundles. While *raja* bundles are typically destined for sale to residential consumers and small commercial establishments, *ukay-ukay* bundles are marketed to bakeries, noodle factories and other large-scale consumers who actually prefer the larger pieces for use in their ovens and boilers.

Some charcoal-makers carbonize the wood they've cut very near the point of extraction and then haul the charcoal from there to a roadside collection point. This will usually be the case when trees are being cut in very difficult conditions some distance from the road, since the hauling of charcoal implies far fewer trips than if all the wood were first hauled out. When feasible, other charcoal-makers prefer to bring harvested wood to charcoal kilns near their homes so that they can better monitor the carbonization process. Before charcoaling, tree poles are cut to a fairly uniform size with larger diameter pieces being split once. Depending on availability, charcoal-makers will mix irregular shaped fruit tree branches and/or roots and stumps of a variety of trees with the straight sticks of woodfuel trees in order to increase output and fully utilize available wood resources. With the exception of a few *barangays* in the northern municipalities of Sogod and Tabuelan, where charcoal is made in above-ground piles, it appears that all of the charcoal-making in Cebu is done in earth pit kilns with capacities ranging from 100-400 kg. of finished product (see Figure 9). Although no direct measurements were made at this time, charcoal-makers in Cebu reported to us and to earlier investigators (Remedio 1991) conversion efficiencies of from 15-20% by weight, slightly higher than reported efficiencies in other areas of the Philippines (Hyman 1983a) but not inconceivable given the effort put into kiln construction (some walls were lined with rocks), the experience of many charcoal-makers (passed on from earlier generations), and the close tending and monitoring of the carbonization process that is typical. The practice of making charcoal in above-ground piles covered with a mesh of soil and coconut fronds appears to be fairly recent in Cebu. Informants in Tabuelan and Sogod report that this technique has only been practiced for a few years. No one is certain who introduced this technique or why, but many charcoal-makers in these places claim the pile method is preferable to pit kilns because piles are easier to construct, easier to monitor, and can be made large enough to produce upwards of two tons of finished product in one firing.

Figure 9: Charcoal making, *Barangay* Pulangbato, Cebu City (poles in foreground are from *Leucaena glauca*)

Throughout Cebu, the cutting of woodfuel-producing trees is managed by a well established system of harvest and use rights. Smallholders growing trees in woodlots or as part of an agroforestry approach usually do their own harvesting in times of lessened agricultural activity or when cash income is needed. Larger tree plantations and tree fallow systems, however, are typically owned by more successful and wealthy landholders who, more often than not, reside in urban areas. In these cases, tree management and harvesting is usually done by one or more tenants or local wood-cutters who serve as something of a caretaker in the landowners absence. Woodfuel harvesting is usually accomplished through some form of sharing arrangement between the landowner and the tenant or wood-cutter, or on a contract basis with the landowner receiving a fixed sum of money for a specified area to be harvested. The sharing arrangements are referred to locally as *bahin* and are common in cases where a tenant is doing the harvesting. The most common form of *bahin* is for the tenant to receive 2/3 of the product and the landowner 1/3, although this varies from only 1/2 up to 3/4 for the tenant depending on how far the trees are from the road and how much work the tenant has put into establishing trees on that property. In general, tenants will receive 1/2 of the product if the plantation, woodlot or tree fallow is close to a road and 2/3 if not. If the tenant did all of the work planting trees in that area they may receive up to 3/4 of the product.

In a contract arrangement, locally referred to as *pakyaw*, the landowner will be paid a fixed sum of money either before or after harvesting in exchange for the privilege of cutting all the trees located on a specified piece of land. *Pakyaw* arrangements are usually facilitated by rural woodfuel traders who, unlike wood-cutters, typically have the finances needed to approach landowners with an advance cash payment. The traders may then subsequently make *bahin* or sharing arrangements with a woodfuel cutter or hire woodfuel cutters to harvest the area on a daily wage basis (usually for P25 to P40/daily). Apparently, *pakyaw* arrangements are preferred by absentee landowners since they simply receive a lump sum cash payment and need not worry about haggling over the size of their share. Others, however, mentioned that in a contract (*pakyaw*) arrangement the wood-cutters have an incentive to remove every standing tree on a given piece of land, whereas under a sharing approach tenants can be instructed to spare certain species or straight-growing trees for other uses. It's interesting to note that regardless of whether a *pakyaw* or *bahin* arrangement is used, the returns realized by each party remain relatively consistent. For example, in one case a fuelwood-cutter promised to pay a landowner P1,800 ($72) for a .8 ha. tree fallow of dense *Gliricidia* which subsequently yielded 2,300 bundles of fuelwood sold for P2.50 each, or P5,750 overall ($230). The P1,800 payment received by the landowner represented 31.3% of the value of the product, just slightly less than the 33.3% they would have typically received in a sharing arrangement. We found a number of other examples like this in different locations throughout the province, suggesting an excellent understanding on the part of landowners, wood-cutters and rural traders of the resource with which they are dealing.

Another point of interest was the apparent lack of tree poaching or theft, even on lands of absentee owners. When probed on this subject, local wood-cutters, traders and other residents offered a couple of explanations for why this was the case. First, they explained, woodlots, plantations and tree fallows are regularly harvested by either a tenant or local wood-cutter on either a *bahin* or *pakyaw* basis. In the case of a tenant, keeping an eye on trees and crops is part of the implicit agreement with the landowner and is in their own best interest since they themselves receive a share of the product. Likewise, a local wood-cutter who regularly harvests a particular area has a strong incentive to adopt, as they put it, a “ranger mentality” towards trees growing there since they will usually be purchasing the “rights” to harvest those trees from the landowner at some point in the future. Second, as will be seen below, the woodfuel trade in most rural areas of the province is organized around a network of traders and transporters who reside in the areas where the fuels are originating from. A woodfuel-cutter poaching trees would rarely find it worthwhile to transport wood to the city on their own, instead relying on rural traders to handle all the exigencies involved. And woodfuel traders, as pointed out above, are often intermediaries in arrangements made between landowners and legitimate wood-cutters and so they would recognize the disadvantages involved in more widespread tree poaching. Naturally, some poaching still takes place, but given the volume of the trade it appears that proprietary rights over trees are well established and respected in most rural areas of Cebu.

Woodfuel poaching is more widespread on government-owned and reforested lands and where an absentee claimant makes no effort to monitor their holdings. The Buhisan watershed area above Cebu City is a 630 ha. forest preserve under the jurisdiction of the DENR. Over the years the authorities have had mixed success in keeping tree poachers out of the area, a task made difficult by active rebel presence there through much of the 1980s. An exceptionally motivated and well-respected DENR official was once able to reach a compromise with most of the community in the area, allowing them to collect fallen branches from within the forest provided no cutting implements were brought in with them. However, this agreement appears to have broken down with the transfer of this official to another post, and cutting is reported to be widespread again for lumber, mine props, woodcrafting material, fuelwood and charcoal.

The gathering of coconut fronds, shells and husks for use as fuel or for other purposes is governed by a different set of rules than that for primary fuelwood tree species. The traditional arrangement was that the person doing the harvesting of coconuts had claim on all fronds, husks and shells on that land. Some coconut harvesting is done by tenants, but in many cases this is a specialized task performed by non-tenants for a share of the primary product, copra. Increasingly, however, this arrangement is changing and landowners are claiming a share of the by-products as well. This appears more likely to occur in locations fairly close to the city (we especially noticed this change in parts of Lilo-an and Compostela) where the by-products are already widely traded as commercial fuels or for other purposes. In places further from the city, presumably too far to economically transport the by-products to urban markets, the traditional arrangement still survives. It's possible that this commodification of non-woody biomass material is an indication of increasing woodfuel scarcity in Cebu, but at least two other factors may also be responsible for this trend. First, restrictions on the harvesting and transport of primary fuelwood have been more tightly enforced in recent years. In contrast, coconut fronds have no restrictions placed on their transport and trade making them a more attractive commodity to rural woodfuel traders. Second, in addition to use as fuel, coconut shells and husks are finding increased usage for a variety of other purposes. For example, “good quality” shells of the right thickness can be sold to fashion accessory manufacturers in Metro Cebu to be used in making costume jewelry, while the “rejects” are sold for P.60/kg. to a manufacturer of mosquito coil repellents where they are ground into a powder and mixed with chemicals before being shaped into the coil itself. Coconut husks are sold to processors who remove the coir dust from the inside of the husk for use as pillow stuffing and packing material. Regardless of motives, the commodification of non-woody biomass implies both increased income opportunities for rural residents and the danger of denying disadvantaged residents access to what had often been a free resource.

The contribution of the commercial woodfuel trade to local employment and income generation varies tremendously throughout the province. In a number of upland *barangays* of Danao, Toledo and Cebu Cities as well as the municipalities of Minglanilla, Balamban, Carmen, Lilo-an and Compostela, the woodfuel trade is clearly one of the major sources of cash income for a large percentage of the population. As one *Barangay* Captain put it, “if we were not allowed to sell firewood and charcoal many of us would have to leave this place.” In an earlier study, Remedio (1991) reported that the average fuelwood gatherer collected 5.8 tons of wood a year, and that this activity accounted for a little over 40% of their total cash income. In addition, the average charcoal-maker was found to be selling 2.9 tons a year with this accounting for over 30% of their cash income. Taking our estimate of woodfuel consumption in the 49 urban *barangays* of Cebu City, deducting the portion of this consumption freely gathered, and then scaling this figure up to account for the (estimated) commercial woodfuel trade in the greater Cebu City metropolitan area and in municipal centers throughout the province, we arrive at a figure of 150,000 tons of fuelwood (including coconut fronds) and 22,000 tons of charcoal traded *commercially* in the Province of Cebu annually. Assuming a relatively low average price of P1.10/kg. for fuelwood and P4.00/kg. for charcoal, the commercial woodfuel trade in Cebu Province is worth an estimated P253 million ($10.1 million) a year. Given the average production levels it appears that an estimated 35,000 families, close to 15% of the rural household population, derive some cash income from the sale of fuelwood and charcoal in commercial markets, while at least another 5,000 households earn income as rural and urban traders, transporters, and helpers in the trade. After accounting for the share of the trade accruing to traders, transporters and landowners, the fuelwood-cutters and charcoal-makers still receive around P120 million, with the average family earning between P3,000-4,000 a year.

Perhaps more significant than estimating average annual incomes from the woodfuel trade is to point out the inherent *flexibility* of this trade as a source of livelihood. Flexibility in terms of *who* can do it (men usually do the actual cutting of trees but women and even children help with hauling, splitting and bundling), *when* it can be done and *how* it can be done. For example, a number of smallholders residing in interior *barangays* of Consolacion were found to be holding regular jobs in the factories of Mandaue City and returning to their farms on Saturdays and Sundays to harvest portions of woodlots earlier planted to *Leucaena*. Tenant cultivators in *Barangay* Sapangdaku, Cebu City, pass by a tree fallow area on the way home from their fields every day, cutting a few trees each time. Towards the end of the week the wood is sized, split, bundled and sold at a nearby *tabo* (weekly market), earning the family enough cash to purchase basic necessities like kerosene for lighting, sugar, dried fish and cooking oil. Woodfuel harvesting can be planned around farming and/or other income-generating activities and often serves as a critical source of cash income for grain purchases towards the end of the dry summer months. Indeed, DENR officials in the southern municipality of Argao occasionally adopt a hands-off policy on trade in small quantities of woodfuels (5-10 bundles of wood, 1-2 sacks of charcoal) realizing that this is often the *only* source of cash income available for grain purchases at certain times of the year.

While the above estimates of employment and income generation from the commercial woodfuel trade in Cebu are only preliminary, and are subject to numerous weaknesses associated with any discussion of the “average” wood-cutter, farmer, or charcoal-maker, they do serve to indicate the magnitude of the trade and its potential importance to local economies. Equally or perhaps even more important than the magnitude of the trade is the flexibility that woodfuel production offers to smallholders, tenant farmers and wood-cutters. Any discussion of further restricting the woodfuel trade, or of undertaking policy measures to reduce urban woodfuel consumption, needs to consider these points and factor them into the analysis.

3.4 Rural Woodfuel Marketing and Transport

The number of intermediaries involved in the rural woodfuel trading and transport network in Cebu varies greatly between locations. From the foothills just above Cebu City woodfuel-cutters carry down bundles of wood and sacks of charcoal which they display along the roadside or sell door-to-door, by-passing rural traders altogether. On the other extreme, charcoal originating from interior mountain *barangays* of Tabuelan, 80 km. north of Cebu City, can pass through as many as nine intermediaries (both rural and urban) before finally reaching the consumer. More common is to have a single rural trader purchasing supplies of fuelwood and charcoal from landowners, smallholders and wood-cutters, arranging for transport, and then accompanying these supplies for delivery to urban wholesalers, retailers or direct to large-scale consumers. However, there are a number of variations on this arrangement and often apparent duplication of effort.

There appears to be a general perception among urban Cebuanos in general, and government and NGO officials in particular, that the rural traders of commodities like woodfuels expropriate too large a share of the profit to be made in the trade, thereby exploiting both rural producers and urban consumers. Our research, however, indicates that this perception is far from accurate and that rural traders are generally viewed in a positive way by the wood-cutters and charcoal-makers they purchase supplies from. While it is true that woodfuel prices approximately double between point of extraction and final sale, and that woodfuel traders (both rural and urban) receive a portion of this mark-up, a careful assessment of all the costs involved in the trade indicates that the margins earned by traders are rarely excessive and that, overall, the industry is quite competitive. In assessing such costs one needs to be certain to include not just the obvious expenses associated with hiring transport, labor, and so on, but also many of the hidden expenses associated with the opportunity cost of the traders' labor and financial capital, as well as non-payment of debts and the need to pay bribes to abusive police and land transportation officials in many instances.

In the majority of cases a single rural trader is involved in getting a load of woodfuels from the point of extraction/conversion to an urban trader or large-scale consumer. In order to accomplish this delivery the trader will usually have to undertake the following activities; obtain supplies, secure permits, arrange transport, and accompany deliveries to the city. Obtaining supplies can be accomplished in a number of ways. To begin with, the rural woodfuel trader often serves as the go-between in *pakyaw* or contract arrangements between landowners and wood-cutters, paying the landowner an agreed-upon sum of money for the right to harvest trees on a specified parcel of land. Once this payment is made the trader will usually engage a wood-cutter in the harvesting of trees for either a daily wage, a share of the product, or for a specific price per bundle (or sack). It's quite common for the trader to provide cash or in-kind advances to the wood-cutter which are later deducted from the wage, share, or price being paid. Woodfuel traders also purchase supplies directly from smallholders harvesting trees on their own land, with the practice of providing advances again more common than not. Regardless of how supplies are obtained, the first step in preparing a load of woodfuel for delivery can involve a significant amount of cash outlay for *pakyaw* payments and cash advances, as well as a fair amount of the woodfuel traders time in acting as a go-between among the different actors involved. The extent of cash and time spent in this process does vary however, with some traders refusing or unable to make cash advances, while others simply wait for supplies of fuelwood or charcoal to come to them.

The rural trader is usually the one securing permits necessary in order for a delivery of fuelwood and/or charcoal to be made. As discussed above, in order to secure a transport permit from the DENR proof is needed that the wood being conveyed originates from planted trees on titled land or that a cutting permit was obtained for naturally-growing species harvested on titled land. The most common practice is for the woodfuel trader to collect the land titles or tax declarations from the landowners where the trees are being harvested, bring these to one of the eight DENR offices in the province which issue transport permits, complete the required paperwork and pay a sum of approximately P25 for processing fees. In order to save time and money on transport, many traders prefer to apply for permits at the DENR office in Cebu City, going there just after they've finished making one delivery and securing a permit for the next load. Overall, the cost and effort involved in securing permits for the transport of woodfuels is usually rather minor, but for traders operating at a small scale it can be significant enough to warrant inclusion in any assessment of the profitability of the trade.

The third step is for the trader to make arrangements for transport. While some of the larger and more successful traders have been able to purchase their own vehicle(s), the majority of them depend upon hired transport. The types of vehicles used range from passenger jeepneys with a maximum capacity of one to two tons, up to six-wheel drive cargo trucks capable of carrying anywhere from three to ten tons depending on the specific model and road conditions. The jeepneys and smaller cargo trucks tend to ply routes closest to the city, and traders in these areas usually have the option of either hiring a jeepney specifically for the transport of woodfuels or of paying a per bundle or per sack charge for a smaller amount of woodfuel to be carried with other passengers and commodities. The larger cargo trucks tend to ply the long distance routes and are typically hired for a fixed sum to carry a full load. These differences in transport patterns reflect variations in both road conditions and the scale that traders operate at in different parts of the province. Larger trucks carrying up to ten tons are a more efficient means of conveying fuels from distant locations (>50 km.) since as much as 90% of the distance traveled is on the paved coastal highway. In contrast, jeepneys and smaller cargo trucks are better suited for the short distances but often gruelling road conditions encountered in conveying woodfuels from the interior *barangays* of the Central Cebu hillylands. In the majority of cases the trader will end up hiring a vehicle for a fixed sum of money for a specified day of delivery, and as a result their main concern is to make sure that they can fill the conveyance with as much woodfuel as possible on that day in order to reduce the per unit transport costs. It is therefore imperative that the trader coordinate with the fuelwood-cutters and charcoal-makers to ensure that supplies are either delivered to the trader's home by that day or left along the road at specified drop-off points for loading on the way to the city. Naturally, some of the larger traders who can afford to keep enough stocks of fuelwood and charcoal at any given time are less concerned with timing, but such traders are few and they usually possess their own conveyance anyhow. For the typical trader it is often a mad scramble to assemble enough supplies by a certain date, secure permits and arrange for transport.

The hired vehicle, along with a driver and a number of “truckboys” or “helpers” (typically around three or four) will usually arrive at the trader's home the evening before delivery, and any stocks of woodfuel kept there are loaded at this time. While the trader is not responsible for paying the driver's salary, she is usually expected to pay each of the truckboys a daily wage of from P20-30, and to provide meals and cigarettes to all of them during the period when the delivery is taking place. In addition, traders report that it's usually necessary to give the driver a “tip” in order to convince him to deliver supplies to out-of-the-way customers and to ensure that he supervises the truckboys so that the maximum amount of cargo can be loaded. In the morning the truck will begin making its way towards the city, stopping to pick up more fuelwood and/or charcoal left at drop-off points along the road. The system of roadside drop-off points was another interesting aspect of the commercial woodfuel industry in Cebu. In general, woodfuel-cutters harvesting trees in areas "above" (*sa ibabao*) the trader's home are required to make some arrangements to have this wood brought down before delivery. In contrast, fuelwood or charcoal being readied in places "below" (*sa ubos*) the trader's home can usually be left along the road nearest to the point of extraction or conversion for later pick-up. In the latter case, traders will even pay for these fuels without first seeing them, relying instead on the notion of a *suki* (regular customer or supplier) relationship with the wood-cutter to ensure the quality and the quantity of the product. Few informants mentioned any problems with theft of fuels from roadside drop-off points, pointing out that what theft does occur is limited to very small quantities and is usually tolerated even when, as is usually the case, the culprit is known. The explanation offered for this lack of theft are similar to those given to explain the general absence of tree poaching from private lands. Namely, any significant theft would be easy to detect since outlets for these fuels are limited.

In addition to picking up supplies along the road, some traders will time their trips to the city so that they can pass by one of the weekly markets (*tabo*) that are held throughout rural areas of the province. At the *tabo*, smallholders and tenant farmers from scattered points within as much as a 10 km. radius will be selling a variety of agricultural produce and animals as well as occasionally marketing fuelwood and charcoal they've carried with them. Generally, charcoal is more commonly traded at a *tabo* since it is lighter to carry. A charcoal-maker bringing two sacks of charcoal to a weekly tabo can earn from P50-80 cash, enough to purchase necessities like cooking oil or kerosene, and perhaps partake of some coconut toddy wine (*tuba*) and/or a bit of wagering at one of the many impromptu cockfights that tend to spring up around the market area.

The final task is to transport the load of woodfuels from the rural area into the city and make delivery to urban traders or directly to end-users there. All deliveries are potentially subject to inspection at a DENR checkpoint, and while the DENR only mans one permanent checkpoint along routes entering the city they do field "roving checkpoints" on an irregular basis at a number of other major entry points (see Figure 10). Should the conveyance encounter a checkpoint, the trader is required to produce the transport permit and the volume of the load and species being transported are checked against the information listed. Problems arise when the permit understates volume shipped, when the permit being used is already expired, when non-authorized species are included in the shipment, and when no permit at all can be produced. Generally, the DENR is more tolerant towards the first two types of violations, although warnings will often be issued and the shipment may be confiscated for a few days time. However, in cases where no permit at all exists, or where unauthorized species are being transported (usually naturally-growing shrub or secondary forest species), the DENR has occasionally confiscated both the shipment and the conveyance used and held these until a hearing could be conducted. If the hearing is decided in the DENR's favor then the conveyance and its cargo "shall be declared forfeited in favor of the government [and].....may be used at the discretion of the DENR [or].....disposed of through public auction" (DENR 1991a). Most of the woodfuel traders we spoke with take this regulation quite seriously, inducing them to go through the process of regularly securing permits.

Generally speaking, rural woodfuel traders made little mention of ever receiving any undue harassment at the hands of DENR personnel manning checkpoints. Those who did have woodfuels confiscated agreed that they had violated regulations they knew and understood. In contrast, a number of rural traders in different parts of the province *did* report harassment by both the PC/INP

Figure 10: DENR checkpoint, Talisay, Cebu (in the foreground is confiscated fuelwood and log bolts)

(Police) Highway Patrol Group and the Land Transportation Office (LTO). These two agencies field their own checkpoints to monitor vehicle registrations, overloading of cargo trucks, and poorly maintained vehicles. Woodfuel traders coming from northern municipalities reported having to pay anywhere from P100 to P500 in *tong* (grease money) every time they enter the city with a load, regardless of whether any violation actually occurred. It appears that the police and the LTO are taking advantage of a memorandum of agreement between the DENR and a number of other government agencies on the coordinated enforcement of forestry laws in order to harass traders shipping woodfuels into the city. It would be ironic if the goodwill created by the generally legitimate enforcement of forestry laws by the DENR in Cebu was offset by abuses committed by police and LTO personnel who are, as the traders see it, also part of the "government".

Once in the city the woodfuel trader begins what is often a long and complicated delivery process. In some cases the whole load might be taken by a single urban wholesaler or commercial establishment, but more commonly the truck visits a number of urban traders and end-users slowly unloading the cargo in a process that can take nearly a whole day (see Figure 11). The degree of difficulty a rural trader encounters in disposing of a load of woodfuels will usually depend on how intensively she canvassed buyers in the days or weeks leading up to delivery. Some traders have a long-standing arrangement with a few *suki* to deliver a certain amount of fuelwood or charcoal on a certain day of the week. Others will only deliver if an explicit set of orders is received. Still others will simply bring a load in and make the rounds of market areas and low-income districts to try and sell their product. In most cases supplies are left on consignment, with payment being made at the time of the next delivery. Rural traders often complain that buyers in the city are never up-to-date on their payments, but deliveries still had to be made in order to collect debts owed from previous transactions.

Figure 11: Unloading fuelwood and charcoal from a six-wheel drive vehicle in market area,Cebu City

Any appraisal of the competitiveness of the rural trading system in general, and the earnings of the traders in particular, should keep in mind the points raised in the discussion above. In carrying out the activities necessary to move a load of woodfuels from rural producing areas to urban consumers a trader will typically be required to spend a significant amount of time as well as tie-up large amounts of financial capital in the process. In addition, an obvious element of risk is involved due to the quasi-legal nature of the trade and the frequency of non-payment of debts. As a result, rural woodfuel traders typically need to possess both entrepreneurial know-how and a reasonable amount of financial capital to begin with. Many of them are considered wealthy and powerful individuals in their own *barangays*. This fact helps to partly explain the perception among urbanites that traders usually exploit the wood-cutters and charcoal-makers, thereby becoming rich in the process. But this confuses the facts altogether. For the most part these individuals become involved in the woodfuel trade *because* they are rich, they do not *become* rich because they are involved in the trade. It was not uncommon for rural traders to claim that they would prefer to give up the woodfuel trade altogether and instead devote their time to other business pursuits. They could not, however, simply leave the trade since people in their area were relying upon them as an outlet and a source of cash or in-kind advances. Wood-cutters and charcoal-makers we spoke with tended to support these claims, pointing to the advantage of not having to hassle with permits, transportation and urban buyers, even if they could earn larger *gross* margins by doing so themselves. None of this is meant to suggest that all traders are philanthropists devoting their time to help their less fortunate neighbors. Nevertheless, the fact remains that wood-cutters and charcoal-makers are generally satisfied with the arrangement and that many traders could just as well give up this trade without seriously jeopardizing their livelihoods. They stay in the business, however, because they are respected individuals in their community, oftentimes involved in local politics, and they are almost expected to put their financial good fortune and entrepreneurial ability to use in order to create opportunities for themselves as well as others in the community.

Naturally, not all rural woodfuel traders are even rich. There appears to be a loose correspondence between the average income of the trader and the distance they operate from the city, with the richest traders operating in the more distant locales. We can offer at least three possible explanations for why this may be the case. First, as mentioned above, woodfuels originating from the more distant municipalities north and south of the city usually need to be conveyed in larger six-wheel drive trucks in order to be economical. Hiring and filling such a truck requires a significant amount of capital, thus effectively excluding traders with limited finances. Second, larger shipments traveling the coastal highway from the north or south are more likely to encounter DENR checkpoints on the way into the city necessitating that the trader acquire a permit for each delivery. The time and effort required to secure a permit is rarely justified for small loads and so traders coming from points north and south will be more likely to assemble larger loads, once again requiring greater finances. In contrast, shipments originating from the hillylands of Central Cebu can enter the city from a number of points and often consist of only 50-100 bundles of fuelwood or 20-30 sacks of charcoal being carried on the roof of a jeepney and unaccompanied by any permit. Finally, and perhaps most importantly, the woodfuel trade is long-established in the nearby hillyland *barangays* of Central Cebu, whereas in more distant municipalities this trade is often only 10-20 years old. As a result there appear to be a far greater number of independent small-scale traders in the mountains west of the city, collecting woodfuels from their neighbors as well as from their own lands, making quick runs down to the city, and returning to pay for the woodfuels they received from others. In economic jargon, there appear to be increased financial and regulatory barriers to entry into the woodfuel trade the further one moves from the urban markets.

In the northern Municipality of Sogod, 60 km. from Cebu City, traders have overcome some of these barriers by dividing up the responsibilities of the rural woodfuel trade into a number of specialized tasks to be performed by different intermediaries. The first intermediary, whom we've labeled the “collector”, is responsible for purchasing charcoal from scattered smallholders in Sogod and adjacent Tabuelan and for bringing this charcoal by horseback to the house of the second intermediary, a wealthy female merchant who is referred to locally as the “stockholder.” The collector pays the charcoal-makers with money provided by the stockholder and receives a flat commission of P4 for each sack delivered. The stockholder, busy with other business pursuits, indicated that she does not have the time to secure permits, arrange transport and make deliveries. Therefore, she prefers to simply make charcoal available on credit to a group of other traders in the area who do have the time for these tasks but who lack the financial capital needed to pay the charcoal-makers in the first place. These traders usually share a truck and other expenses, repaying the stockholder after returning from selling the charcoal in the city. For her part the stockholder receives a mark-up of P4-5/sack. In this arrangement at least five intermediaries are involved before the charcoal even reaches the city, including the charcoal-makers, the collector, the stockholder, the traders, and the transporter. Such a high degree of specialization may seem wasteful at first glance but those involved, from the charcoal-makers through to the traders making the deliveries, claim that it's the only way to get supplies delivered. The above-mentioned stockholder even claimed, and others verified, that she had no intention of entering the trade to begin with. Instead, they claim, she was “recruited” by the group of traders because without her financial capital they could not operate.

All in all, the network of rural trading systems for woodfuels in Cebu is a complex and varied one. Our appraisal at this point, given the exploratory and open-ended nature of our enquiry on this subject, is that the system is generally a competitive and efficient allocator of woodfuel resources. Barriers to entry in the trade vary between regions, becoming more noticeable the further one moves from the city. But even in distant locales some competition exists and rural traders are unlikely to be overly exploitative in dealings with people who are, after all, their neighbors, friends, relatives and/or constituents.

3.5 Urban Woodfuel Markets

In order to gain a more thorough understanding of how the commercial woodfuel markets operate in the urban milieu, we identified and interviewed 81 wholesalers and larger retailers of fuelwood and charcoal in the Metro Cebu area between May and July, 1992. Interviews with urban traders lasted from 30 minutes to over two hours depending on their understanding of how the woodfuel market operates and their willingness to share this knowledge with us. Some traders had been in business for over 30 years and proved to be exceptional informants, providing us with a wealth of information on numerous aspects of the trade since as far back as the late-1940s. As was the case with the rural trading network, the urban trade proved to be more complex and specialized than we originally anticipated, and traders were found to be selling woodfuels in a variety of different forms and quantities depending on their location and usual clientele.

Figure 12 provides a simplified diagram of commercial woodfuel flows into and within Cebu City. Flows 1, 2, 3 and 4 represent deliveries of woodfuels from rural traders to retailers, residential consumers, commercial establishments and wholesalers, respectively. Annually, around 53,400 tons of fuelwood and 13,500 tons of charcoal are shipped into the 49 urban *barangays* of Cebu City in this way. Out of these totals, only 2.6% of the fuelwood and 5.7% of the charcoal is going directly from rural traders to residential consumers (flow 2). Another 17.8% of the rural-to-urban fuelwood flow and 12% of the charcoal flow go from rural traders direct to commercial and industrial establishments in the city (flow 3). The remaining 79.6% of the fuelwood and 82.3% of the charcoal coming into the city goes first to the urban retailers and wholesalers (flows 1 and 4) before reaching consumers. In reality, wholesalers and retailers are not always that easy to distinguish, but for purposes of discussion we've separated them based on the following differences in their operating patterns. First, wholesalers tend to specialize in woodfuels while retailers usually operate from a store or other business which sells woodfuels along with an assortment of other commodities. Second, wholesalers generally receive large shipments of woodfuels straight from rural traders, retailers carry fewer stocks and often purchase their supplies from the urban wholesalers (flow 7). Third, whereas retailers sell mainly to residential consumers and occasionally to household-based commercial establishments (such as food vendors), wholesalers include among their customers large-scale commercial users (such as bakeries, restaurants, noodle factories), re-packers of charcoal, households, as well as the smaller retailers. Fourth, wholesalers are more likely to sell woodfuels in bulk, which means charcoal is sold by the sack and fuelwood bundles are not further divided after being received. Retailers, on the other hand, typically sell charcoal in smaller cellophane bags and will also occasionally re-bundle fuelwood. Finally, wholesalers tend to cluster together in about six areas of the city, usually near to long-established market and warehouse areas (T. Padilla, Ramos, Tabu-an, and Carbon). By way of contrast, retailers are scattered throughout the city, operating out of their residence, from *sari-sari* stores, or from small *carenderias* or eateries.

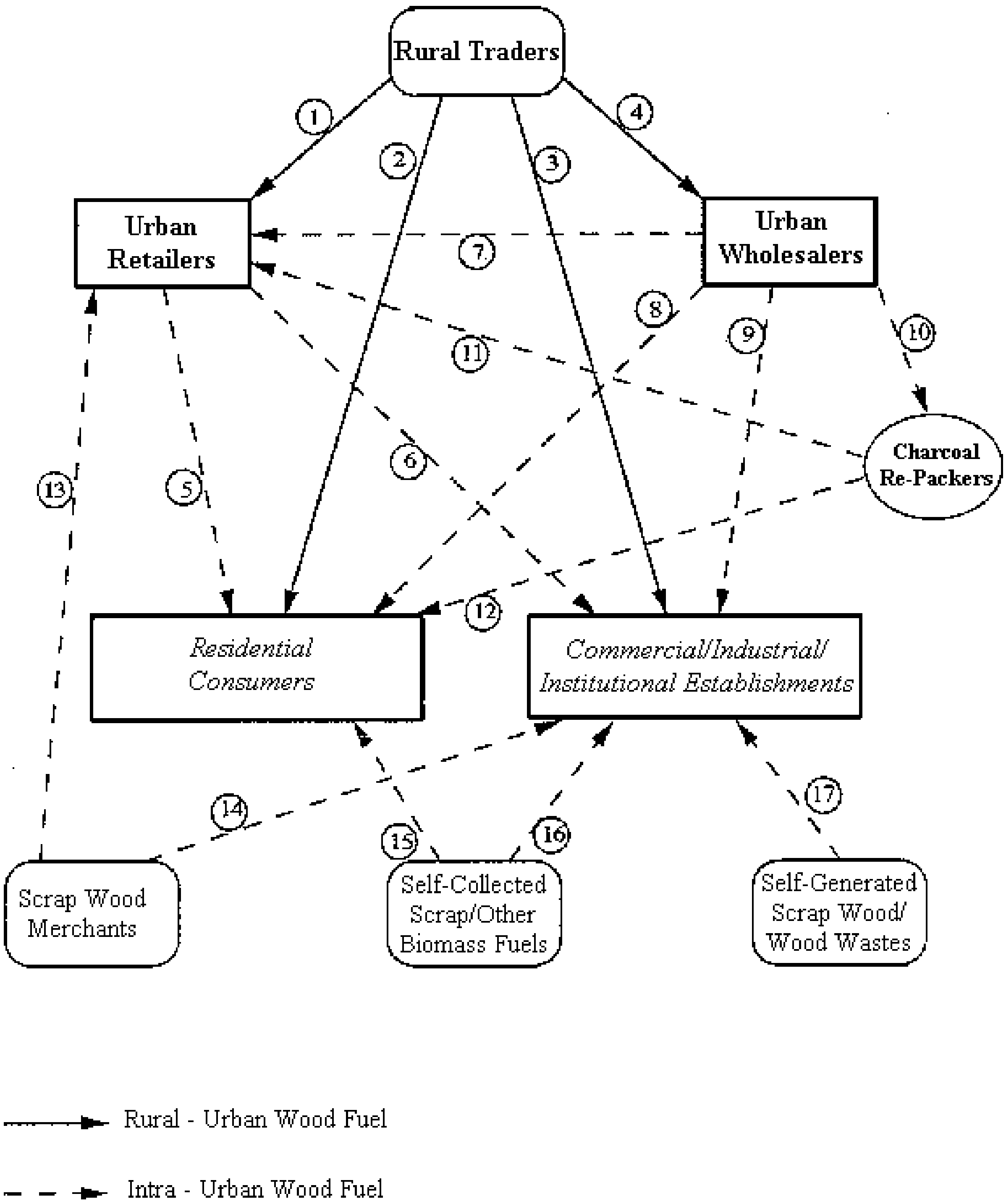

Figure 12: A Simplified Diagram of Commercial Woodfuel Flows in Cebu City

With these differences in mind we can return to Figure 12 and further analyze intra-urban woodfuel flows. Overall, commercial sector woodfuel users receive around 37.1% of their fuelwood and 24.5% of their charcoal direct from *rural* traders, represented by flow 3. In contrast, residential consumers receive only 3.2% of their fuelwood and 11.2% of their charcoal in this fashion, represented by flow 2. The remainder of commercial sector demand for woodfuels is met by urban traders and, to a lesser extent, by either self-generated, collected or purchased scrap wood (flows 14, 16 and 17). Table 7 in Section 2.3 reported that 14.7% of commercial sector fuelwood demand consisted of scrap, with most of this being self-generated or purchased from scrap wood merchants. Therefore, after accounting for the use of wood wastes, commercial establishments are estimated to receive 48.2% of their fuelwood (12,358 tons) and 75.5% of their charcoal (4,997 tons) from urban traders (flows 6 and 9), primarily the wholesalers. Much of this trade involves the smaller commercial establishments like restaurants, eateries, barbecue vendors, *poso* makers and snack food vendors, with the larger establishments such as bakeries, noodle factories and industrial users more likely to be supplied directly from rural areas.

Residential sector consumers purchase two-thirds of their fuelwood and 89% of their charcoal from urban retailers (flow 5), wholesalers (flow 8), and charcoal re-packers (flow 12). Household consumers are more likely than commercial establishments to purchase woodfuels from one of the hundreds of retailers located in residential neighborhoods throughout the city. These retailers receive their supplies directly from rural traders (flow 1), as well as from urban wholesalers (flow 7), charcoal re-packers (flow 11), and scrap wood merchants (flow 13). Fuelwood is generally sold in the same size bundles as the retailer receives, but some retailers in the low-income districts of Lorega, Villagonzalo, Ermita and Pasil were found to be re-bundling fuelwood into bundles weighing as little as .6 kg. each. Charcoal is generally sold to residential consumers in cellophane bags weighing from .2 to 1.0 kg. each at a per unit cost 20-50% greater than if purchased by the sack. Much of this price difference, however, can be accounted for by the fact that as much as 5-15% of the weight of a sack of charcoal consists of essentially unusable fines, while re-packed charcoal contains only whole pieces. Some wholesalers and retailers do their own re-packing, but in recent years a number of merchants have begun undertaking charcoal re-packing as a specialized activity. These merchants generally purchase sacks of charcoal from urban traders (flow 10) and hire others to re-pack the charcoal into cellophane bags at a rate of from P3-5/sack. The re-packed charcoal is then sold to small retail stores or ambulant charcoal vendors 100 packs at a time.

The commercial trade in scrap wood is also fairly new in Cebu, with approximately 1.1% of household and 8.9% of commercial sector fuelwood demand being met by *purchased* (as opposed to collected or self-generated) scrap and wood wastes. The largest scrap wood merchants, to our knowledge, operate in a low-income squatter community in *Barangay* Mambaling. These merchants purchase scrap wood from construction/demolition sites, lumber yards, and woodcraft and furniture factories and then dump this in an open area. At that point, nearby residents are paid on a piece basis to grade, size, split and bundle the wood, with the grading being done to separate pieces of wood suitable for manufacture of wooden packing crates (see Figure 13). Once ready, the bundles of scrap wood are either sold directly to commercial users in that area (especially *poso* makers), or to woodfuel retailers or ambulant vendors who hawk this wood from pushcarts in surrounding residential areas of Duljo, Suba, Pasil and Sawang Calero. Scrap wood destined for use in the boilers and bin dryers of larger commercial establishments (flow 14) is usually not even sized, with merchants simply securing transport and acting as the intermediary between the factory and the lumber yard or construction site where the wood originates from.

Figure 13: Sizing and bundling scrap wood, *Barangay Mamabaling,* Cebu City

As mentioned above, urban traders were found to be stocking fuelwood and charcoal in different "forms" and quantities depending on the particular needs of their regular customers (see Figure 14). For example, traders in *Barangay* Pasil were found to be stocking large bundles of less expensive scrap wood and non-woody biomass fuels like coconut fronds and bamboo for sale to the many *poso* makers and street food vendors located in that area. The veteran wholesalers in the areas around Ramos, Tabu-an and Carbon Markets stock *ukay-ukay* bundles containing large logs for sale to nearby bakeries who purchase from them on at least an occasional basis when supplies delivered by rural traders run out. And retailers in low-income districts re-bundle fuelwood into smaller sizes in order to make this fuel affordable to household consumers in that area. Occasionally, this specialization also extends to the species being traded and the means of purchase. Some charcoal wholesalers reported stocking sacks of molave charcoal for sale to regular customers willing to pay a higher price for this product. In addition, these wholesalers almost always owned a bicycle with side car (*trisikad*) which was used to deliver sacks of charcoal to restaurants, *lechon* vendors and households on an order basis. The self-proclaimed "king" of charcoal even goes to the extent of delivering charcoal to uptown restaurants in a motorcycle with side car after receiving orders over an electronic telephone pager.

Urban woodfuel traders generally reported increased sales during the rainy months of the year, offering a number of reasons for this situation. First, the dry months coincide with school vacation when students return home to the province, and this affects both residential and commercial sector woodfuel demand. Second, in the dry months urban households are better able to collect dry scrap wood, fallen branches and other forms of biomass from the surrounding environment. Finally, both urban and rural traders report significantly increased *supplies* during the dry months when farmers in the province have less work to do in their fields. Apparently, not all of this increased supply can be absorbed by urban traders and so rural traders will occasionally resort to roving vending, selling directly to households and commercial establishments that might otherwise purchase from the urban wholesalers and retailers.

Figure 14: Urban woodfuel trader, Tabu-an Market area, Cebu City

In addition to these seasonal fluctuations the urban traders also reported swings in day-to-day sales and specific events when sales were greatly affected one way or another. The day-to-day variations were usually a result of “jackpot” sales to a single customer such as a bakery which might unexpectedly purchase 100 bundles of fuelwood in order to avoid running out of this fuel before they receive their regular delivery from a rural trader. Woodfuel sales are also affected by exogenous events like the Persian Gulf Crisis as well as by natural disasters like typhoons, although the actual impact of these occurrences varied from one trader to the next. For example, during the early months of the Gulf War, LPG and kerosene were rationed in Cebu which tended to improve woodfuel sales. However, since diesel fuel was also rationed some traders reported problems securing adequate supplies of woodfuels from rural areas. A similar situation occurred in the aftermath of Typhoon Ruping in November 1990. LPG and kerosene were once again in short supply, but some urban traders could not obtain supplies of woodfuels because roads and bridges linking the city with rural areas were washed out. And in any event, according to other traders, “free” fuelwood from destroyed homes, buildings, and fallen trees was so abundant at that time that consumers had little need to purchase from them.

Generally, urban woodfuel traders were pessimistic over the long-term outlook of their business. Many reported declining sales which they attributed to a combination of increased competition, declining residential demand due to fuel-switching, and declining commercial sector demand as a result of these establishments obtaining supplies directly from rural traders. Others reported increasing difficulty in obtaining regular supplies of good quality fuelwood and charcoal. They generally believe that this is due to a combination of stricter enforcement of forestry laws on the part of the DENR and permanent changes in land use patterns in woodfuel supply areas with housing subdivisions, factories and poultry farms replacing areas formerly devoted to tree fallows and woodlots. Though not totally reliable, the historical price data that urban traders provided to us on a recall basis seems to indicate that *real* woodfuel prices (after adjusting for inflation using the Metro Manila consumer price index) have actually declined somewhat over the last 15-20 years, with *nominal* price increases generally occurring in a few discrete jumps simultaneous with increasing petroleum prices. These price jumps are probably more the result of increased prices for diesel fuel, used in the transport of woodfuels, rather than a result of increased demand for woodfuels in the face of higher prices for "substitute" fuels like kerosene and LPG.[8]

With a few notable exceptions, the urban woodfuel traders were generally of a lower socioeconomic standing than their rural counterparts. For most of them, woodfuel sales constitute the most significant source of household income, although with the exception of the largest wholesalers rarely was it the only source. *Reported* monthly profits from woodfuel sales ranged from P300 for a few retailers to over P20,000 for the above-mentioned "king" of charcoal and a nearby female competitor subsequently dubbed the "queen" of this trade. For the most part, profits ranged from P1,000 to 2,000 a month, but this is difficult to verify since traders were often evasive on the issue of income and since it was not always easy to get a good accounting of the expenses associated with the trade. Usually, fuelwood prices are marked up by P.50-1.00 per bundle over prices paid by the urban trader. Charcoal is marked up around P5-10 per sack when sold *as is*, with re-packed charcoal earning a trader P10-15 per sack less labor costs. These mark-ups do not, however, represent a clear profit since there are other expenses associated with the trade. For example, many traders were found to either be renting stall space in city markets or a small building from a private landowner, while a few avoided rent payments altogether by squatting on public or private lands. Labor typically came from within the household and so usually did not appear as a direct expense, although the opportunity cost of such employment needs to be considered. Additional expenses encountered to varying degrees by the urban traders were the purchase of city business permits (usually only if the woodfuel business is doubled up with an eatery), unloading fees for traders located in city markets, and losses due to theft, wastage, and non-payment of debts. In the end, these expenses usually do not amount to much, but even so they do reduce the already low margins earned by urban traders.

Despite this assessment, and the generally pessimistic outlook of the urban traders themselves, few of them indicated any inclination to leave the trade, citing a lack of other options as the main reason. Some urban woodfuel traders have re-invested earnings from their business back into the trade in an attempt to establish themselves as a reliable supplier with enough stocks to meet occasional "jackpot" demands from commercial consumers. Others have invested their profits into alternate business ventures or, as is commonly the case, into their children's education in the hope that they can earn enough in the future to enable the trader to retire from the business. As was the case with rural traders, the urban wholesalers and retailers of woodfuels appear to be earning reasonable financial returns commensurate with their efforts, certainly not excessive. The urban traders fulfill an important role in providing customers with the types of fuels needed at the

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[8] In other words, urban household fuel markets in Cebu are characterized by relatively low cross-price elasticities of demand.

right quantities. The presence of other traders, and the relatively low barriers to entry (urban traders can usually receive initial deliveries on consignment), ensure that the trade is competitive and that consumers pay no more than necessary for the woodfuels they purchase.

3.6 Concluding Remarks on the Commercial Woodfuel Trade in Cebu

There is a long and well-established history of commercial woodfuel trading in the City and Province of Cebu, dating back to at least the early part of this century. Initially, much of this trade consisted of fuelwood and charcoal produced from naturally-growing shrub and secondary forest tree species common in upland areas of the province. But even at the turn of the century Cebuano farmers were intentionally propagating a number of fast-growing tree and shrub species on steeper slopes in order to help control soil erosion while at the same time providing a flexible source of cash income. Today, fast-growing trees that have been planted or spontaneously established on private lands are the single most important source of fuelwood and charcoal for the urban markets. These trees form an integral part of a number of land use categories, each managed to varying degrees of intensity and under different ownership and usufruct systems. For many of Cebu's farmers, growing trees alone or in combination with food crops is often the most rational use of available land, labor and financial resources. Furthermore, fast-growing trees ideally suited for woodfuel production are often preferred over longer-maturing varieties since the former are generally easier to establish and maintain and provide quicker payback. Government and NGO reforestation and upland agriculture programs should build on and work to improve the techniques and adaptations already developed by farmers in Cebu rather than attempt to introduce new approaches altogether. These programs should also pay close attention to the somewhat unique combination of social, economic and natural factors extant in Cebu that have combined to bring about current land use and tree-planting practices.

The discussion in Sections 3.4 and 3.5 has served to illustrate the importance of the rural and urban trading and transport network for the commercial woodfuel trade in the province. However, among urbanites in general, and among government and NGO officials in particular, the perception is that these intermediaries are underpaying suppliers and overcharging consumers, subsequently earning excessive profits for themselves. In reality, the rural and urban traders operate in a fairly competitive market, and rarely if ever get to exercise any monopoly or monopsony[9] control over customers or suppliers. Even in the rare instances where a single rural trader is the only outlet available to fuelwood-cutters and charcoal-makers in a given area, it appears unlikely that the trader would be overly exploitive in dealings with suppliers for reasons that are still not totally clear to us. Before an assessment can be made on the competitiveness of the trade and the “fairness” of the returns earned by any one group of intermediaries, *all* the costs encountered need to be considered. This should include the less obvious costs associated with payoffs, incidentals, the opportunity cost of capital and labor, as well as actual cash outlays for supplies, labor and other expenses.

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[9] While a monopoly situation implies a single seller, monopsony refers to a single buyer, such as a situation where there is only one rural woodfuel trader in an area for wood-cutters or charcoal-makers to sell to.

In order to examine the competitiveness of the woodfuel trade in Cebu we regularly collected price and cost data on all aspects of the trade in rural as well as urban areas. Our original intention was to compile this data and develop a set of average costs encountered, and returns earned, by each group of actors in the trade. As it turns out, there is such an enormous amount of variability in these figures that we determined that the use of averages would be misleading at best. For example, fuelwood-cutters and charcoal-makers receive anywhere from 15 to 100% of the final selling price of the product depending on whether they are cutting trees on their own lands, whether they receive a share of the product or a daily wage, how many intermediaries are involved in the trade, and how far the fuels have to travel before reaching the urban markets. Rural and urban traders incur widely different expenses and earn a range of margins depending on their degree of involvement in arranging deals with landowners and wood-cutters, the transportation costs they face, the types of fuels being traded, and the customers to whom they sell. Therefore, instead of presenting simple averages that mask the variations resulting from differences in ownership patterns, harvesting practices and the numerous peculiarities of the trade, we've decided to offer details from seven actual cases of woodfuel trading in different parts of the province. These cases represent something of a spectrum for the commercial woodfuel trade in Cebu, differing in terms of where the fuels originate from, the form these fuels take, the number of intermediaries involved in marketing, and who the end-users are. Details of these seven cases are provided in Table 10, and the discussion below provides further explanation.

The first case involves a group of fuelwood-cutters harvesting giant ipil-ipil trees from a five hectare tree plantation owned by a wealthy landowner residing in the area. The trees are cut and the poles carried to roadside either manually or through the use of a sled pulled by a water buffalo. Once at the roadside the poles are sized, split, dried and bundled with the resulting *raja* bundles weighing around 4 kg. each. A local woodfuel trader pays P3 per bundle in advance, with 2/3 of this going to the wood-cutters and 1/3 to the landowner. This particular trader has his own vehicle, but other traders in the area would usually have to pay P1/bundle to have this wood transported to the urban markets. The rural trader brings this wood to the city and sells it to wholesalers and retailers in the Ramos and T. Padilla market areas for P4.50/bundle. Subsequently, the urban traders sell them for either P5 or 5.50 each. In the end, out of the final selling price of P5/bundle, the wood-cutters receive P2, the landowner P1, the rural trader P1.50, and the urban trader P.50. However, the rural trader's margin in this case should be adjusted downwards, perhaps by around P.50-.75/bundle, in order to reflect the fact that he used his own vehicle in transporting the fuelwood to the city.

Case 2 involves a wood-cutter and his family harvesting a mix of shrub, secondary forest and fast-growing species on idle lands belonging to a relative residing in the area. The trees are cut and hauled to the roadside at which time they are simply sized into logs of 70-80 cm. in length with no effort made to split the wood, remove the bark, or dry it. The resulting *ukay-ukay* fuelwood bundles were purchased by a local trader for P1 each, with the average bundle weighing around 2.5 kg. One-third of the price paid went to the landowner. The trader then hired a truck for P900 to have about three tons of fuelwood hauled 15-20 km. to a bakery in the adjacent municipality of Lilo-an. This particular bakery purchases fuelwood on a weight basis, paying P800/ton. The lower return earned by the fuelwood-cutters compared to the previous case is due in large part to the relative ease of preparing *ukay-ukay* fuelwood compared with *raja* bundles.

Table 10: Seven Case Studies of Estimated Gross Margins Earned by Various Intermediaries in the Commercial Woodfuel Trade (Pesos/ton and percent of final selling price)

Case 1: *Raja* fuelwood bundles from *Barangay* Basak, Compostela sold in urban markets for P1,250/ton.

Fuelwood Cutters	P500	40%
Landowner	P250	20%
Transport/Rural Trader	P375	30%
Urban Trader	P125	10%

Case 2: *Ukay-ukay* fuelwood bundles from *Barangay* Lupa, Compostela sold direct to a bakery for P800/ton.

Fuelwood Cutters	P267	33%
Landowner	P133	17%
Transport	P280	35%
Rural Trader	P120	15%

Case 3: Charcoal from interior *barangays* of Sogod and Tabuelan sold *by the sack* in Cebu City for P3,600/ton.

Charcoal Makers	P1,636	45%
Collector	P262	7%
Stockholder	P327	9%
Transport	P540	15%
Rural Trader (Urban Trader)	P835	24%

Case 4: Charcoal from *Barangay* Pulangbato, Cebu City sold in re-packed cellophane bags by urban retailers for P6,250/ton.

Charcoal Maker	P1,905	31%
Landowner	P952	15%
Transport	P357	6%
Rural Trader	P714	11%
Urban Wholesaler	P357	6%
Urban Re-packer	P714	11%
Urban Retailer	P1,250	20%

Case 5: *Palwa* from *Barangay* Jampang, Argao sold in urban markets for P830/ton.

Palwa Collectors	P332	40%
Transport	P208	25%
Rural Trader	P124	15%
Urban Trader	P166	20%

Case 6: *Ukay-ukay* fuelwood bundles from *Barangay* Binaliw, Cebu City sold directly to a factory in Mandaue City for P600/ton.

Fuelwood Cutter	P330	55%
Transport	P168	28%
Rural Trader	P102	17%

Case 7: *Raja* fuelwood bundles from a 2.3 hectare tree fallow clearing in *Barangay* Sapangdaku, Cebu City sold in urban markets for P1,100/ton.

Landowner	P220	20%
Fuelwood Cutters*	P170	16%
Haulers**	P110	10%
Transport	P110	10%
Rural Trader	P270	24%
Urban Trader	P220	20%

* hired for P35/day
** paid P.50/bundle to haul fuelwood approximately 1.5 km. from cutting site to roadside

The third case was mentioned briefly in the discussion above and revolves around smallholders producing charcoal from trees growing on their own lands. These charcoal-makers receive P25/sack from a "collector", with a typical sack weighing around 15-20 kg. The collector pays for this charcoal with money provided by a "stockholder" and then uses his own horse, and occasionally hired labor, to haul the charcoal anywhere from 2 to 10 km. to the house of the stockholder, receiving a flat commission of P4/sack for his efforts. The stockholder offers this charcoal on a consignment basis to traders in the area who have formed themselves into a loose association. These traders are nearly all women, and their primary occupation is farming, but once a week they team-up, fill a hired vehicle (to be paid for later) with charcoal picked up from the stockholder, and bring this to the city. Instead of selling the charcoal directly to urban traders, however, these women unload their cargo at an outdoor market which operates two days a week near the Provincial Capitol Building. For two days the traders camp out and sell charcoal for P55/sack to residential consumers, restaurants and retailers in the area. These customers occasionally pay an additional P3-5/sack to have the charcoal delivered to their home or business by any one of a number of "haulers" who wait around the market with pushcarts or bicycles for this purpose. At the end of the two day market period the traders return to Sogod by bus and pay the stockholder P34 for each sack received, and the truck owner P8 for each sack transported, earning a gross margin of P13/sack for themselves, or about 24% of the final selling price. This gross margin, however, has to account for the fact that in this case the rural traders double as urban traders and devote a considerable amount of time to marketing the charcoal.

Case 4 involves charcoal being produced from *Gliricidia* and *Leucaena* growing in a private woodlot in *Barangay* Pulangbato, 10 km. from downtown Cebu City. A local trader purchases this charcoal for P40 a sack, of which 1/3 goes to the owner of the land from which the trees originated. The trader pays P5/sack to have the charcoal delivered to wholesalers in the Tabu-an market, where it is sold for P55/sack. Wholesalers then sell some of this charcoal for P60/sack to petty merchants in the area who will re-pack it into smaller cellophane bags. The weight of a sack of charcoal and the number of bags this produces varies somewhat. However, a commonly reported figure was that one sack would yield around 35 packs of charcoal weighing on average .4 kg. each, with an additional 1 to 2 kg. of fines per sack which is either thrown away, given away, or sold to blacksmiths for P5-10/sack. The re-packed charcoal is usually sold 100 bags at a time for P2/each to small retail stores or ambulant charcoal vendors who then sell this product for P2.50 each. When purchased in this fashion, charcoal is significantly more expensive than if purchased by the sack. However, the smaller units of charcoal are generally preferred because of convenience, ease of purchase and the limited budgets of many households.

Case 5 involves the bundling and sale of coconut fronds (*palwa*) by coconut gatherers in an interior *barangay* of Argao, over 50 km. from the city. As mentioned above, the most common arrangement on coconut plantations is that the person or persons doing the harvesting of the fruit has claim on the by-product fronds, husks and shells. In this particular case, the coconut gatherers pile the fronds at points throughout the plantation and allow them to dry. These are later sized and bundled, with the bundles typically weighing around 6 kg. each. The *palwa* bundles are sold to a local woodfuel trader for P2.00 each. The trader will hire a truck for P1,000 a trip when she has *primary* fuelwood and/or charcoal to transport to the city, with *palwa* only being added if there is extra space in the truck. If the truck carried only *palwa* it could hold around 800 bundles, leading to an effective transport charge of P1.25/bundle. The rural trader will sell the *palwa* to wholesalers and retailers located in *Barangays* Mambaling and Duljo in Cebu City for P4/bundle. The urban traders then typically sell these bundles for P5 each. The low margins earned by the rural trader in this case (P.75/bundle) result from the fact that *palwa* is bulkier than primary fuelwood and had to be transported some distance. We see therefore, that most of the coconut fronds traded as fuel in the urban markets of Cebu originate from areas closer to the city.

Case 6 involves a smallholder harvesting a 1 hectare woodlot of giant ipil-ipil on his own land and carrying these trees a short distance to the roadside where they are simply sized and tied together into roughly equivalent *ukay-ukay* bundles. The wood in these bundles is still green, the bark is left intact, and the pieces are generally un-split. A local trader purchases these bundles for P1 each, with an average bundle weighing around 3 kg. The trader hires transport for P.50/bundle to bring this wood to a manufacturer of mosquito coil repellents in Mandaue City, only about 10 km. from where the wood is cut. The manufacturer purchases fuelwood at a price of P600/ton, or approximately P1.80/bundle. The smallholder in this case is satisfied with the P.33/kg. he receives from the fuelwood being sold even if he could get up to P.85/kg. for the same wood if he took the time to split it, dry it, and then remove the bark before bundling. According to him, this takes too much time away from his regular farming activities and is basically not worth the effort.

Finally, case 7 involves the harvesting of *Gliricidia sepium* growing in a 2.3 hectare tree fallow 15 km. from downtown Cebu. A local trader arranged with the owner of the land on a *pakyaw* (contract) basis to harvest this fallow for a cash payment of P5,000, exactly the same arrangement they had reached a couple of years earlier for the same piece of land. The trader then hired four fuelwood-cutters on a day-to-day basis for a daily wage of P35 plus one meal a day at noon. The wood-cutters worked for close to one month, cutting, sizing, splitting and bundling the wood into bundles weighing approximately 4.5 kg. each. As these bundles became ready, two other men were hired to haul the fuelwood 1.5 km. to the trader's home which is located along the road leading to the city. The haulers use an improvised backpack to which they would strap 10 bundles receiving P.50 for each bundle carried. When all the tree harvesting and bundling was finished the wood-cutters also took part in hauling. The trader arranged to have the fuelwood delivered by jeepney a short distance to urban traders in *Barangays* Guadalupe and Labangon at a charge of P.50 per bundle. In all, the trader claims that they produced around 5,000 bundles which she sold for P4.00 each, grossing around P20,000. From that amount, P5,000 went to the landowner, around P6,600 to the wood-cutters and haulers, and P2,500 to the owner of the vehicle used in transporting the fuels to the city. That leaves around P5,900 *net* for the rural trader, less incidental expenses associated with making arrangements with the landowner and urban traders, securing permits and transportation, and providing meals to the wood-cutters and haulers. Urban traders subsequently sold this wood for P5/bundle, earning 20% of the final selling price.

From the above discussion it is apparent that there is no single “system” for woodfuel trading on which to base a discussion of average costs encountered and margins earned by the various actors involved in the trade. Instead, we find that woodfuel trading arrangements are varied and flexible, with the form actually taken depending on a host of factors particular to that situation. The numbers in Table 10 do show, however, that fuelwood-cutters and charcoal-makers typically earn from 30 to 50% of the final selling price of woodfuels if they work on a sharing basis, 40 to 60% if they are cutting trees from their own lands, and much less if hired on a daily wage basis. In the four cases involving a landowner, the percentage earned of the final selling price was consistently close to 20%. Owners of transport earned from 7 to 35% of the final selling price depending on the type of fuel being conveyed, distance to the city, and the conditions of the road being travelled. Rural traders never earned more than 25% of the final selling price, usually only around 10%. If one factors in all the costs associated with the trade, which were discussed in detail above, then this finding leaves little room for concluding that rural traders are earning excessive returns. Finally, urban traders typically earned another 10-20% of the final selling price, a margin which is also not particularly substantial given the vagaries of their occupation.

Overall, it would be difficult to characterize the commercial woodfuel trade in Cebu as anything other than a highly organized, competitive and efficient allocator of biomass resources. For the most part the trade is based on the harvest and sale of trees grown on private lands on something approaching a sustainable basis. The harvesting, conversion, transport and marketing of these fuels provides income to thousands of rural and urban households in the province. Furthermore, wood-cutters and charcoal-makers turn to these activities at times of the year when labor is available and/or cash income is needed most. In the next section we conclude this report with a discussion of some of the policy conclusions that derive from the findings presented up to this point. In general, it appears that what is needed most for any discussion of “improving” the woodfuel situation in a place like Cebu is a more realistic assessment of how these fuels are produced and traded in the first place. Instead of assuming *a priori* that woodfuel use is detrimental to the environment, and that the transition to modern fuels should be speeded up, policy-makers should first find out what factors are creating a demand for woodfuels and how these might change with time. From there, efforts can be undertaken (such as revising regulations on tree harvesting and transport) that might further encourage the type of tree-planting and harvesting approaches already adopted by a large number of smallholders and tenant farmers in Cebu in response to commercial demand for woodfuels and other wood products.

4 POLICY AND RESEARCH ISSUES

4.1 Overview

The commercial woodfuel trade in the Philippines is subject to regulation by the Department of Environment and Natural Resources (DENR). The most fundamental means by which the DENR regulates this trade is through the issuance of so-called transport permits to cover shipments of fuelwood and charcoal sent from rural areas to the city. Permits are issued to applicants who can show that the wood being sold is from *planted* species grown on *titled* lands. Based on the discussion in Section 3, it would appear that for the case of Cebu these criteria are met most of the time since the bulk of commercially-traded woodfuels consist of fast-growing (planted) tree species originating from tree fallows, plantations, woodlots and agroforestry plots found on private lands. In spite of this, transport permits issued by the DENR account for only an estimated 20% of the fuelwood and 34% of the charcoal actually being shipped from rural areas, and the woodfuel trade is still widely perceived by many in Cebu as being mainly an illegal activity. This situation raises two areas for concern. First, the current system of transport permits is largely ineffective at regulating the woodfuel trade and may be having the effect of discouraging more widespread tree-planting among smallholders in the province. Second, the perception among urbanites in general, and within government and NGO circles in particular, that fuelwood and charcoal is primarily a product of “illegal logging” and that this activity is largely to blame for the destruction of Cebu's forests, may be leading to misguided policy and project decisions.

In this section we discuss possibilities for policy and project revision, as well as for future research, that have the potential for improving the sustainability and efficiency of woodfuel production and use in Cebu. We would like to add the caveat that at this point our comments are only meant to raise issues for discussion and debate. Our research suggested to us that improvements can be realized in the areas of woodfuel regulation, reforestation projects, and upland agriculture extension efforts if more attention were paid to some of the unique conditions and constraints faced by Cebuano farmers. At the same time, we realize that the DENR and various NGOs working in rural Cebu may also face their own constraints, and cannot necessarily be expected to, or even be able to, change their approach simply on the basis of one written report. However, it is hoped that the discussion below can form part of an on-going dialogue between those implementing woodfuel-related projects and policies in the field and researchers whose job it is to study these efforts and suggest areas for improvement and change. Section 4.2 focuses on the regulation of the woodfuel trade in the province and points out that the regulatory system currently in place, while fine on paper, is difficult to implement, is not being followed to any great extent, and may be discouraging tree-planting among smallholders and farmers with uncertain tenure. Alternative regulations are proposed, although the DENR in Cebu will probably not be able to adopt these at any time in the near future due to the need to follow national policy directives. Section 4.3 discusses project and research issues that also have the potential to improve the local woodfuel situation. It is argued that reforestation and upland agriculture projects in Cebu should pay closer attention to the production of woodfuels as a cash crop, and that research into farming practices and species performance, among others, can help to improve approaches currently being taken in the field. Finally, Section 4.4 summarizes our discussion and presents a beginning list of regulatory, project and research issues related to the woodfuel trade in Cebu for discussion and debate.

4.2 Regulatory Issues

As mentioned above, the cutting of planted trees on titled lands has been largely deregulated in the Philippines, the only exception being for certain premium hardwood species and Benguet Pine. In order to transport and sell these trees however, certification of origin or a transport permit is first required indicating that the wood has in fact originated from titled lands. If a landowner wishes to cut “naturally-growing” tree species found on his land then a special cutting permit is also required, although for much of 1991-92 the issuance of these permits was temporarily banned. Therefore, in order to obtain a permit to transport woodfuels and/or other wood products from titled lands in Cebu, a landowner must first visit one of the eight stations or sub-stations of the DENR's Community Environment and Natural Resources Office (CENRO) and provide an inspecting officer with proof of land ownership and information on the volume and types of wood to be transported. The inspecting officer is then supposed to visit the site and determine the total volume which can be transported. Following that, transport permits can be issued for some or all of this initial volume, and notation is made of any remaining balance in order to facilitate the issuance of future permits without the need for follow-up site visits. Suppose, for example, that a farmer with a 2-hectare woodlot of giant ipil-ipil growing on his lands wishes to harvest and sell these trees for fuelwood and mine poles. Since these trees are planted on titled lands he can harvest and prepare them for sale without having to obtain permission from the DENR, but he does need to secure a permit in order to transport them. After confirming title to the land, a DENR inspecting officer visits the site and estimates a total volume of 15 m^3 of fuelwood and 5 m^3 of mine poles, for which an initial transport permit of 5 m^3 fuelwood and 5 m^3 mine poles is issued, valid for one week. Notation is made of the fact that there is a remaining stock balance of 10 m^3 of fuelwood, and the farmer can obtain a permit for this balance at any time in the future without the need for further inspection of his lands.

In many ways this system is an improvement over previous regulations, and on paper it appears to be relatively well thought out, unobtrusive and conducive to only a limited amount of bureaucratic wrangling. In practice, at least in Cebu, it can only be described as having limited effectiveness, both in terms of encouraging more tree-planting and in stopping the shipment and trade of unapproved wood products. To begin with, one of the intentions of the current regulatory system was to “promote the planting of trees by owners of private lands and to give incentives to tree farmers” (DENR 1991a). Indeed, deregulating the harvesting of planted trees on private lands has probably contributed somewhat to the increased frequency of tree plantation establishment throughout the country. For a large landowner devoting five hectares or more to a tree plantation, the acquisition of a transport permit is a simple, straightforward and relatively inexpensive process. However, in Cebu as elsewhere, much of the woodfuel actually traded is likely to originate from lands other than those devoted to tree plantations, and these lands are often of questionable status in terms of title and ownership. For a smallholder harvesting trees from a backyard woodlot or cutting back *Leucaena* hedgerows on an agroforested plot, it is hardly worthwhile to go through the effort of applying for and securing transport permits in order to be able to sell this wood. This does *not* imply that smallholders are actually prevented from undertaking these activities as a result of the regulation (we saw above that a considerable amount of woodfuels do in fact originate from small woodlots and agroforested plots). However, it does imply that under current rules these practices are technically illegal, and that these regulations may be discouraging more widespread tree-planting activities on the part of smallholders and tenant farmers in particular. Furthermore, the deregulation only applies to titled lands or tax-declared alienable and disposable (A&D) lands,[10] but in Cebu a significant portion of the upland population is residing in either public domain timberland or on disputed or untitled A&D lands. The DENR is promoting a variety of innovative stewardship and contract reforestation programs on the latter land categories (Gibbs et al. 1990; DENR 1990), but progress is slow and for the most part cultivators in these areas continue to manage the lands as if they were squatters. As a result, the permit system intended to regulate the trade in woodfuels and other wood products may be having the unintended effect of discouraging more widespread tree-planting and management by farmers with either limited holdings and/or questionable tenure or title status.

Perhaps a more important issue to consider is the effectiveness of the permit system in actually regulating the transport and sale of woodfuel and other wood products in the province. Our research indicates that the regulatory system in place is largely incapable of keeping up with the volume and the nature of the trade, and that as a result the local DENR can only hope to restrict the more blatant forms of cheating and illegal cutting. To begin with, there is a huge discrepancy between the recorded volume of woodfuel transported and our estimates of the actual trade. According to local DENR records of transport permits granted for the period August 1991 - July 1992, there were approximately 7,300 tons of *primary* fuelwood and 4,600 tons of charcoal shipped to Cebu City from throughout the province. In contrast, we've estimated that annual demand for these products in the city is more like 36,500 tons of *primary* fuelwood and 13,500 tons of charcoal. As a result, only around 20% of the fuelwood and 34% of the charcoal actually being traded appears to be covered by transport permits. This discrepancy comes about for a number of reasons. First, some fuelwood and charcoal is simply shipped into the city without permits. This is usually the case for small loads originating from hillyland areas just west of the city. Traders entering the city with larger loads from the north and south, on roads more likely to be patrolled by the DENR, will usually not attempt this since they are well aware that it could result in seizure of cargo and conveyance if they are caught. Second, it appears that traders and landowners regularly under-report the volume they intend to ship since this allows them to maintain a larger remaining stock balance which they can use to obtain additional permits in the future. Finally, some traders reuse permits more than once since these are typically valid for anywhere from five to ten days. If a trader does not encounter a checkpoint while delivering woodfuels to the city then she can turn around and use the same permit again before the validation expires. Not all traders have the resources to be able to make consecutive deliveries like this, but a few of the more successful ones we spoke with admitted to using a single permit to cover as many as seven deliveries.

Even in cases where a shipment of fuelwood or charcoal is accompanied by a valid permit used for the first time, there is the possibility that the wood being transported did not originate from titled lands and perhaps was not even produced from planted trees. To recall, landowners or traders wishing to transport woodfuels or other wood products must first visit the DENR, show proof of land title, and have their lands inspected in order to arrive at an estimate of the initial stock

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In the Philippines, lands are divided into two broad classifications, alienable and disposable (A&D) and "timberland", although in places like Cebu these classifications mean little in terms of actual land use. The determination of whether an area is A&D or timberland is based on the Revised Forestry Code of 1975 which claimed all lands of 18% or more in slope, and mountainous land over 600 meters, as part of public domain unless these lands were covered by legal claims obtained prior to that time. As a result, approximately 55% of the country's land area falls under the category of public domain timberland (Poffenberger 1990).

balance. It's difficult to determine how thorough the DENR is with regards to these initial site visits, but discussions with landowners, traders and DENR officials suggests that low budgets and lack of personnel and transport sometimes prevents them from carrying out such inspections. Instead, permits are often granted on the basis of information provided by the applicant. Apparently, some traders take advantage of this situation by applying for permits to transport woodfuels presumably originating from their own lands. In reality, these lands may only contain small patches of trees and the permits are really being used to “cover” for woodfuels purchased from wood-cutters and farmers who harvest trees from scattered woodlots, tree fallows or shrubland found in both titled A&D lands and timberland areas. Even if inspections are carried out, under-reporting of volumes shipped and reuse of permits can also help facilitate this process. For example, suppose a trader applies for a permit to transport woodfuels from his own five- hectare tree plantation, and a DENR inspecting officer visits the plantation and determines that there is an initial stock balance of 100 m^3 of fuelwood, for which a permit for 10 m^3 is issued. If the trader actually ships 15 m^3 with this permit, does not encounter a checkpoint, and then uses the same permit again before it expires, he will have been able to ship 30 m^3 of his 100 m^3 total, but DENR records will show a remaining stock balance of 90 m^3. The extra 20 m^3 allowance can be used by the trader to obtain permits to transport woodfuels presumably originating from his land which may actually originate from others. This situation can also be exploited to transport and sell naturally-growing tree species like *Vitex parviflora* for which a cutting permit would be difficult to obtain. In doing so, coconut fronds or bundles and sacks of woodfuels consisting of planted species are often placed on top of and around the prohibited species in case a checkpoint is later encountered.

For the most part, the local DENR is aware of these deficiencies and shortcomings in the permit system. They rely on roving checkpoints and the threat of seizure of cargo and conveyance to discourage more blatant forms of cheating and smuggling. And since the DENR is often unable to determine the true origin of the woodfuels being traded they instead tend to focus on species, resulting in a *de facto* species-based enforcement mechanism. For their part, rural woodfuel traders have adjusted accordingly, preferring to deal in planted species like the fast-growing varieties or fruit-bearing trees. Given the shortcomings of the regulatory system that is currently on the books, and the adjustments that have already been made to it, it's worthwhile to consider if an alternative set of regulations could be developed that would meet the fundamental goal of protecting existing forested areas and government reforestation sites while at the same time encouraging more tree-planting by farmers and saving traders, landowners, and the government time and money. At this point we can only offer preliminary suggestions on how this might be accomplished. However, considering that these suggestions derive for the most part from discussions with local traders and DENR personnel, it's apparent that a regulatory system suitable to the conditions of the woodfuel trade in Cebu could be worked out among those most closely involved in the trade. The biggest stumbling block to this process is the limited ability of the local DENR to alter the regulatory mechanism already in place since they have to follow policies issued from Manila. At the same time, the regulatory changes discussed below are perhaps only suitable to Cebu and so should probably not be adopted on a wider scale in other parts of the country. Therefore, until provincial DENR personnel have more control over how the trade in woodfuels or other wood products is regulated, any discussion of developing new regulatory mechanisms will prove to be largely academic.

It was mentioned above that the DENR is often incapable of determining the true origin of woodfuels and other wood products being transported and that they have chosen instead to focus on the species being traded. Landowners and traders are still required to go through the process of securing “certificates of origin” (transport permits) for wood they intend to sell, but in terms of enforcement the critical condition is that the wood be from *planted* tree species such as *Gliricidia*, *Leucaena* or any of the fruit-bearing species discussed in Section 3.2. Most of the traders we spoke with had no problem with this *de facto* species-based regulation since they tend to deal mainly in planted species anyhow (the only exceptions were in places like Argao where much of the commercial woodfuel and charcoal is still produced from naturally-growing shrub and secondary forest species). Likewise, some of the DENR officials we interviewed recognized that fuelwood and charcoal can be produced in a fairly sustainable and non-destructive manner from regular coppicing of fast-growing planted varieties. It seems reasonable then to try and build on and refine the species-based enforcement approach in order to regulate the trade in woodfuels and other wood products in Cebu.

One variation on a species-based regulatory system that was discussed with both traders and DENR officials would involve the licensing of persons interested in transporting larger shipments of woodfuels from rural areas to the city. The details of such an approach would have to be worked out, but generally the idea would be for regular woodfuel traders to obtain a license from the DENR to transport woodfuels which would be valid for perhaps a 6, 12 or 24-month period. Traders would be required to pay a fee in order to obtain a license which would allow them to transport any wood products on the condition that these originated from planted species. Permanent or roving checkpoints would be set up at major entry points to the city, a task made easier by the topography and road network of the island. When a trader with a load of woodfuels encounters a checkpoint they would either be required then and there to pay a stumpage fee based on the volume of the load, or the volume would be recorded under the trader's name and they would have to pay a lump-sum fee for the cumulative volume of woodfuels transported at the time of license renewal. Money saved by the DENR in not having to certify origins, and funds collected in the form of stumpage fees, could be used for enforcement purposes and/or for reforestation efforts. Traders, wood-cutters, or charcoal-makers bringing in smaller loads of woodfuel, say less than .5 m^3 in volume, could be exempted from the licensing requirement but could be required to pay the stumpage fee. The common requirement is that the woodfuels being transported are produced from planted species.

A number of serious questions still remain in terms of how this system is to be implemented and enforced. First, how to determine the licensing and stumpage fees? Traders were generally agreeable to a licensing system where they would only be required to go to a DENR office once or twice a year, even if in the end it cost them more in fees. A one-time licensing fee of P100-200 and a stumpage fee of perhaps P20/m^3 would have little effect on gross margins earned in the trade and would end up providing significantly more revenue to the DENR than under the present system. Second, what “planted” species are to be allowed, and how difficult will it be to make a determination of these species at a checkpoint? Table 9 illustrated that a small number of planted species already make up the bulk of traded woodfuels in the province, but allowance would have to be made for those like *Cassia siamea* and *Acacia auriculiformis* which are not widely planted but are occasionally traded, and for those like *Pithecellobium dulce* which are both planted and also grow naturally. A more critical question is whether or not forest guards manning checkpoints can even determine species, especially in the case of charcoal. Knowledgeable traders and foresters are often able to do this, even after carbonization, but this is one difficulty of a species-based regulatory system that will need further refinements. Third, how should the cutting of naturally-growing species found on private lands be treated? The current system of requiring cutting permits for these trees still seems to be the best approach available in order to prevent over-cutting and poaching from remaining forested areas. Finally, how should the DENR define “small” volumes of woodfuel and at what point should traders be required to be licensed? The figure of .5 m^3 already mentioned derives from the current unwritten practice of the DENR in Cebu to let 5-10 sacks of charcoal or 10-20 bundles of fuelwood go through checkpoints without a permit. Requiring a license for everyone interested in conveying woodfuels might discourage smaller traders, increase barriers to entry, and make the trade less competitive than it currently is. Therefore, some allowance should be made for this minor trade, with the exact cut-off point best placed somewhere below 1 m^3 and the collection of stumpage fees on these loads only an option.

Our suggestion for a species-based/licensing system for regulating the commercial woodfuel trade in Cebu is still very preliminary in nature and would require a significant amount of revision and consultation between the DENR and those involved in the trade in order to make it workable. The underlying assumption or justification for pursuing this approach is that the current system, which is based on determining the origin of wood being traded, appears to not be working too well. Fuelwood and charcoal from *planted* trees grown on *titled* lands is regularly transported into the city “illegally” without permits while *naturally-growing* trees cut from *government* timberland areas are shipped “legally” with the use of permits obtained in a bogus fashion and covered with coconut fronds or planted species to make the shipment look legitimate. A species-based approach would allow the bulk of the woodfuel trade currently taking place in the province involving trees which *are* legitimately grown and harvested to go on with minimal interference and for a small charge. Money and resources saved in the process can be put to better use protecting areas that are critical and that are suffering from over-exploitation and illegal cutting such as the Buhisan Watershed above Cebu City. Woodfuel traders who regularly violate the conditions of the licensing system by transporting naturally-growing species could be fined or have their licenses revoked. The vast majority of traders who follow the rules could be enlisted to explain the new guidelines in their regions and promote more widespread tree-planting for woodfuel and other purposes regardless of whether this takes place on A&D lands or in already-cultivated timberland areas.

Regardless of how well-designed an alternative regulatory system is, there is no escaping the fact that in practice it will be subject to many difficulties and abuses by both the enforcers and the enforced. The regulatory system we propose is no different, and even under the best circumstances it cannot be expected to alter significantly current land use and tree-planting practices on the island. However, many traders we interviewed seemed to prefer an approach like the one described above, citing the inconvenience and cost of constantly having to apply for permits for each shipment of woodfuels they intend to market. Likewise, the current system appears to require of the local DENR manpower and financial resources beyond their means, resulting in only partial enforcement. Whatever the final shape of any regulatory reform reached for the woodfuel trade in Cebu or the Philippines, it is in the best interest of the DENR to consult closely with those involved in the trade, and to recognize that in the end incentives are often a more effective regulatory tool than restrictions.

4.3 Project and Research Issues

The commercial woodfuel industry described in this report has developed over time without any significant policy or project interventions carried out on its behalf. Upland farmers and landowners have long recognized the potential market for woodfuels and other wood products in the urban areas and have undertaken a variety of tree-planting approaches in response. Rural and urban entrepreneurs have become involved as intermediaries in the trade and have developed a highly specialized network to move these fuels to consumers in the forms and quantities demanded. The result is a commercial woodfuel trade that appears to be operating on a fairly sustainable basis with only a limited number of market imperfections. Despite this, our research indicates that there are still some areas for concern in terms of the environmental impact of woodfuel extraction, and suggests that the overall sustainability and efficiency of the woodfuel industry could be further improved. The discussion below focuses on a number of project and/or research initiatives that hold some potential to improve the situation, and divides these into supply-side and demand-side categories. For the most part, the project and research initiatives we advocate would require only limited financial and technical resources since they are intended to either form part of existing efforts or to promote approaches that will be taken up largely by individuals and the private sector. For example, the supply-side project initiatives are based on revising existing reforestation and upland agriculture extension efforts. The shape of the demand-side initiatives would depend upon results of research already being conducted on an ongoing basis by the University of San Carlos Affiliated Non-Conventional Energy Center (USC-ANEC) in Cebu, and if justified would tend to involve mainly the private sector in efforts to more efficiently utilize wood energy in the province.

4.3.1 Supply-Side Initiatives

Supply-side project initiatives could involve any number of direct or indirect approaches to increasing the rate and extent of tree-planting and management activities in rural areas of the province. Academic, NGO and government research can help to identify the most promising species and management approaches given the economic and ecological conditions extant in these areas. At present, there are a number of government and NGO-sponsored reforestation efforts in Cebu that are already contributing to supplies of lumber, mine poles, woodfuel and other wood products. The DENR is promoting the establishment of private tree plantations on A&D lands as well as contract reforestation on government lands. Local NGOs like the Mag-uugmad Foundation, CARE-Philippines, the Ramon Aboitiz Foundation, World Neighbors and the Soil and Water Conservation Foundation are involved in efforts to assist upland cultivators obtain tenure and change from corn mono-cropping to multi-cropping and agroforestry systems intended to yield multiple products and increase productivity while simultaneously reducing soil erosion. Foreign-funded programs like the Central Visayas Regional Project (World Bank), Central Cebu Hillyland Development Program (World Bank), and the Cebu Uplands Project (German-funded) are also promoting a variety of soil conservation and agroforestry approaches with both direct and indirect potential for increased production of woodfuel and other wood products.

While we are in no position at this point to pass judgement on the effectiveness of any of these programs, we would like to point out that few appear to have fully recognized the potential for planting fast-growing trees alone or in combination with food crops *primarily* for woodfuel purposes. These trees *are* being promoted for soil conservation and soil enhancement purposes, and in some cases for fodder production. However, there appears to be little effort at more widespread promotion of these trees as a cash crop in and of themselves, even though many Cebuano farmers have already taken this approach on their own in recognition of the ease with which these trees can be established, maintained, harvested and marketed. In a similar fashion, some of the reforestation approaches currently being advocated intend to convert areas of "under-utilized" fallow and shrublands with "higher-value" tree species like *Gmelina* and mahogany, even though these lands are often producing abundant supplies of woodfuel from species like *Gliricidia* and native ipil-ipil with minimal effort required on the part of the landowner or farmer. The point is not to argue that woodfuel mono-cropping should replace agroforestry approaches, or that fast-growing trees should be promoted over higher-value species, but rather that in many cases the former may be more appropriate to natural conditions in the area and the land, labor and financial constraints faced by the farmer.

Agroforestry and reforestation projects undertaken in Cebu need to consider the limitations placed on farmers by a variety of natural, social and economic conditions present in most rural areas of the province. For example, upland agriculture extension efforts that call for the construction of semi-permanent soil conservation structures like rock walls and terraces will likely meet with limited success in many parts of the province even though such approaches are often called for given the steep slopes being cultivated. This is a result of uncertain tenure as well as an *economic* (as opposed to physical) scarcity of labor brought on by the existence of off-farm employment in the factories, stores and construction projects of the city. Even soil conservation measures that are less labor- and cash-intensive, such as hedgerows and alley-cropping, are not as widely adopted as they should be, due again to conditions of uncertain tenure and scarcity of labor. These conditions also appear to influence farmer attitudes towards the *types* of trees they establish on their lands. While higher-value hardwood species like mahogany and teak will usually provide greater returns in the long run, many farmers seem hesitant to put much effort into their establishment since this usually requires a fair amount of labor in the early years for weeding and maintenance and since these species take a long time to reach harvestable age.

Given these considerations, and the existence of a well-established market for woodfuels in the urban areas of the province, government and NGO officials should pay closer attention to the integration of woodfuel-producing trees into their agroforestry and reforestation projects. That this has not been done to a greater extent up to this point appears due in large part to the negative perception many people have of the woodfuel trade in the province. The cutting of trees for woodfuel purposes is still widely perceived as a problem to be discouraged rather than as an opportunity to be developed. In the urban areas it is usually not recognized that the bulk of woodfuels are actually produced from fast-growing trees coppiced on a short rotation basis, and that these trees regenerate rapidly after being cut (see Figure 8). Once these perceptions begin to change then agroforestry and reforestation designs can be made more flexible in terms of tree species and end-uses, with the actual approach taken in one area or by any particular farmer dependent on conditions specific to that case. For example, richer landowners and farmers with alternative sources of income may favor higher-value tree species that yield greater returns over a longer period of time. Smallholders and farmers with low incomes and/or uncertain tenure may favor fast-growing trees that are easy to establish and which provide income in a short period of time. Indigenous agroforestry practices involving long-term tree fallows and sequential inter-cropping of corn and *Gliricidia* should be recognized as a logical and effective adaptation to local conditions rather than be replaced with more intensive approaches that may produce a higher return per unit of land but which require cash and labor inputs beyond the reach of many upland cultivators. Planting of fast-growing tree species can also serve as a bridge to establishment of more permanent forest species in critical watershed areas managed by the government. Overall, there are still numerous opportunities for the promotion of fast-growing tree species for woodfuel and other purposes on private and government lands in the province. Farmers will be willing to undertake the planting of these trees *if* this does not strain available financial and labor resources, and *if* they are certain of their right to harvest and sell these trees at a time they feel is appropriate.

In order to further improve our understanding of farmer attitudes towards tree-planting, as well as how trees are currently grown and managed in Cebu and how these practices can be improved upon, a number of areas for research should be explored. To begin with, our study has not attempted to quantify sustainable *supplies* of woodfuels from various land use categories or to determine if a woodfuel “gap” between supply and demand exists in the province. Rather, our focus has been on the broader patterns of woodfuel production and trade combined with a quantitative assessment of woodfuel demand in Cebu City. To our knowledge, no serious effort has been made to estimate potential woodfuel supplies in Cebu, although a number of reports mention that the island has either an existing or impending woodfuel shortage (de Montalembert and Clement 1983; Seidenschwarz 1988; Aliño 1989; DENR 1989; DENR 1991b; DAP 1992). None of these assessments are actually based on a careful inventory of farm and forest biomass resources available in the province. Instead, they are usually derived from a combination of anecdotal evidence and a casual reading of forest cover and population figures for the province. The most comprehensive report (DAP 1992) combines provincial data on population density, forest cover and potential for *secondary* biomass fuel production (such as coconut fronds and rice husks) to develop a provincial categorization of woodfuel supply-demand conditions. Based on this approach, nine provinces including Cebu are categorized as having “very heavy woodfuel stress”, with Cebu exhibiting low *primary* biomass (fuelwood) potential and medium *secondary* potential.

This kind of typological approach is a good first step in identifying areas of the country with potential woodfuel problems, but it should not form the basis for specific policy and project actions until more localized and detailed assessments are undertaken. The discussion in Section 3 made it clear that forest and regrowth areas are of only limited importance in meeting woodfuel demands in Cebu, and so it is of little surprise that an assessment of potential supplies based largely on data for forest cover would place the province in a critical situation. In addition, Section 3 also illustrated that woodfuel-producing trees are grown and managed in large numbers throughout the extensive agricultural landscape of the province. At this point we cannot say for certain whether these tree-growing activities are widespread enough to meet future demands for woodfuels and other wood products, but our research has left us of the opinion that the woodfuel situation in Cebu is not yet “critical”, and that “very heavy stress” is surely an exaggeration of the present state. In order to better determine current and future woodfuel supplies in Cebu and other provinces with little in the way of forest cover the DENR should consider undertaking more thorough inventories of available biomass resources from *all* land use categories. These inventories can be carried out using a combination of fairly inexpensive approaches already tried in places like Nepal (Carson 1987; Schreier et al. 1991; Soussan et al. 1991), Pakistan (Archer 1993; Ouerghi 1993), and Kenya (Bradley 1988). A promising and low-cost approach is to combine remotely-sensed data from aerial photographs or satellite images with field surveys and rapid appraisals of local land use practices. One example of this approach comes from Kenya where a systematic sampling approach was used to conduct aerial photography of 1.3% of Kakamega District, an area considered to have potentially serious woodfuel problems (Bradley 1988). Woody biomass cover for the district was estimated based on this sample of photographs and subsequent field surveys and destructive sampling were used to convert ground cover estimates into volume and weight figures. The survey cost an estimated \$5 per km^2, implying an approximate cost for Cebu Province of around \$25,000 or less considering that aerial photographs of the region already exist. Combining estimates of available supply with rapid appraisals of how biomass resources are locally managed could provide highly useful information for designing policy and project initiatives in the area.

In addition to research on estimating current supplies, efforts should be made to examine the potential for increasing biomass production rates from existing lands through the use of different species and/or by altering farming and tree management practices. Table 9 in Section 3.2 illustrated that only three species account for 57% of the fuelwood and 69% of the charcoal traded in the province and argued that this is mainly a result of the rapid growth rates of these trees and their suitability to local conditions. However, over-reliance on so few species could potentially cause problems in the future (Bruenig 1987; Davidson 1987), and so alternate species should be researched and promoted if they are found to be similarly suited to local conditions and acceptable to farmers, since it is they who will ultimately determine how widely propagated a certain species becomes. In the meantime, government, academic and NGO extensionists and researchers should be testing species for suitability to natural conditions such as rain, soil and slopes as well as social and economic factors such as the need for fodder or for rapid growth to provide cash income in a short period.[11] Research should continue to be conducted into uses for *secondary* biomass fuels, although at least in Cebu there is only limited potential for increased utilization of agricultural wastes at this time. Coconut shells and husks are the most abundant, but these by-products are already widely commodified and sold for use directly as fuel and for other purposes.

Overall, there exist numerous possibilities for improving our understanding of current biomass fuel potential in Cebu and for increasing supplies through more widespread tree-planting and management practices. A critical requirement for this to take place is for government and NGO officials in particular to realize that woodfuel production can form an essential part of a *solution* to environmental degradation in the province, rather than being merely a cause. The woodfuel demands of rural and urban residents of Cebu have been increasingly met over the years from fast-growing trees planted by farmers as part of an adaptive approach to local environmental and economic conditions. These adaptations have come about largely in the absence of and often *in spite* of the presence of government policies or projects in the uplands. Large-scale, single-purpose tree plantations have only a limited potential to solve any real or imagined woodfuel problems in Cebu. Providing a better regulatory climate, and promoting reforestation and agroforestry approaches suited to local conditions will do much more to increase supplies of woodfuels and other wood products.

4.3.2 Demand-Side Initiatives

Demand-side project and research initiatives will focus on ways of reducing per capita woodfuel consumption by either encouraging fuel substitution or by developing ways to more efficiently utilize woodfuels in homes and businesses in the province. Oftentimes, programs intended to reduce woodfuel demand are justified on the basis of the environmental consequences of woodfuel extraction (Pitt 1985; Clarke and Shrestha 1989). In Cebu, the environmental justification for demand-side programs may not be as straightforward as that in other parts of the developing world since, as discussed above, most of the woodfuel being used originates from agricultural rather than forested areas. However, there may be other justifications for pursuing demand-side initiatives and research independent of concerns over the environment. For example,

[11] Some of the best examples of this kind of research are reported in the journal *Agroforestry Systems*. See, for example, Jama et al. 1989; Adejuwon and Adesina 1990; Dreschel et al. 1991; Pellek 1992; Rosecrance et al. 1992.

urban household fuel substitution programs that make safe LPG and/or kerosene stoves available to low-income families on an affordable basis could be promoted on equity grounds or as a means of improving household health. Development and promotion of charcoal kiln designs that improve carbonization efficiencies is a means of increasing incomes received by charcoal-makers and providing additional rural employment opportunities. As was the case with supply-side initiatives, any demand-side approaches should be grounded in a thorough understanding of the local conditions that have created the present situation in the first place.

Beginning with residential sector energy demand, we need to first assess the desirability, costs and benefits of any program intended to alter current patterns of household fuel use. Section 2.2 explained how and why households in Cebu City make their fuel-choice decisions, illustrating that many factors are involved in these choices. It was also pointed out that there is a long-term trend away from woodfuel use in the residential sector and towards greater use of kerosene and LPG. Given this, a strong argument could probably be made for a "policy" of having no policy at all, simply allowing current trends in fuel-switching and use to run their course. However, should it be determined that future levels of woodfuel production in the province cannot keep up with demand, and/or that woodfuel use should be discouraged in urban areas due to health and safety reasons, then what other policy options are available to achieve this objective?

Perhaps the most common approach tried throughout the developing world is to subsidize prices of kerosene and/or LPG in the hopes of making these fuels more affordable to low-income households. We saw above though that kerosene and LPG are already slightly less expensive than woodfuel on an end-use basis in Cebu, but that households continue to use wood and charcoal for reasons of taste, safety concerns or because they cannot afford to purchase the equipment needed to use modern fuels. In addition, kerosene and LPG are presently cross-subsidized in the Philippines, and the government is moving in the direction of eliminating these subsidies in an effort to promote privatization and price deregulation in the oil industry. Therefore, relative fuel price adjustments do not appear to be a serious demand-side policy option in Cebu at any time in the near future. A more promising approach would focus on the availability of the equipment necessary to utilize kerosene or LPG, and the widespread concern among many urban residents over the safety of using these fuels. Programs to make stoves and other equipment like LPG canisters affordable to low-income consumers combined with campaigns on how to utilize this equipment in a safe manner might, however, involve significant expenditures on the part of the implementing agency. An overall assessment of such a program should also account for the many *indirect* costs and benefits that may accrue from implementation, such as improvements in household health (benefit) and the loss of income and employment to rural wood-cutters and others involved in the woodfuel trade (cost).

A fundamentally different approach would start from a position of accepting urban residential sector demand for woodfuels in the foreseeable future and then attempt to improve the efficiency with which these fuels are used. Given the discussion so far this seems a more feasible and practical option than fuel substitution programs for a number of reasons. First, as already mentioned, the environmental justification for a fuel substitution program is not particularly convincing for the case of Cebu. Second, it is apparent that many low-income households will continue to rely on woodfuels even if fuel substitution programs were implemented due in part to increasing populations as well as preferences for cooking with wood and charcoal. Finally, the fuel-switching trend already noted still has the potential to stall or even reverse itself under conditions of significant increases in petroleum prices and/or supply cutoffs. Therefore, even under fairly normal conditions it appears that the residential sector in Cebu will continue to be a significant consumer of woodfuels for some time to come, and under certain conditions consumption could even increase in the long-run. What then, if anything, should be done to improve the efficiency of woodfuel use in Cebu and how can a program to achieve this be justified? The most direct option is to encourage more widespread use of improved cookstove designs. A somewhat different approach would compare the overall costs and benefits of fuelwood versus charcoal as an urban household cooking fuel, and should the latter show clear benefits then an effort could be made to encourage greater use of this fuel in conjunction with programs to improve both the efficiency of charcoal cookstoves and the carbonization process.

Improved cookstove (ICS) programs have a fairly long and somewhat checkered history in the developing world. The successes and failures of ICS programs are widely reported elsewhere in the literature and will not be repeated here (see, however, Manibog 1984; Baldwin et al. 1985; Gill 1987; Hyman 1987; Jones 1988; Jones 1989; Barnes et al. 1993). However, it should be mentioned that more successful programs have tended to involve private sector manufacture of small, portable and inexpensive metal stoves for sale mainly in the urban residential sector where woodfuels are already a purchased commodity. These stoves are typically designed for use with charcoal and are reported to reach efficiencies as high as 45% (Leach 1988). In addition to relatively better efficiencies, charcoal also holds other advantages over wood as an urban household cooking fuel such as compactness, cleanliness and the fact that it produces less smoke. Unlike wood, however, charcoal cannot be freely gathered, and so low-income households relying mainly on collected wood may hesitate to change to a fuel they have to purchase. Whether or not to "promote" charcoal as a substitute for wood is a difficult question and would depend upon some effort at calculating the overall costs and benefits of the production and use of each fuel and the resources required to alter current patterns of use. Bormann *et al* (1991) have developed a computer model that would help to answer some of the questions needed to make such an assessment. Their model compares a fuelwood and charcoal system under varying sets of assumptions and accounting for a number of direct and indirect benefits and costs such as reduced air pollution and health impacts. The primary determinants of which system are better are levels of carbonization and stove efficiencies. This model could be used fairly easily to measure the relative efficiencies of fuelwood and charcoal as urban household cooking fuels in Cebu. Additional estimates of the energy used in transport and distribution (see Keita 1987 for how these can be developed) could be added to see if there is a clear justification for any program to actively promote charcoal beyond current levels of use.

Regardless of whether charcoal holds clear advantages over fuelwood or not, efforts to research, design and promote the manufacture of improved charcoal *and* fuelwood stoves in Cebu are probably worth undertaking. At present, 45% of the fuelwood stoves and 21% of the charcoal stoves in use in Cebu City households are "home-made". These stoves range from simple three-stone varieties to fairly elaborate designs fashioned from scrap metal and tin. Some of the home-made stoves may even achieve higher efficiencies than models available for sale locally, and as already mentioned, the close tending of cooking fires that we observed in households throughout the city suggests that efficiencies of use in any of these stoves may actually be greater than often assumed. Nevertheless, improved stoves could potentially increase efficiencies by as much as a factor of two, and result in additional benefits to the user such as reduced expenditures on fuel, less indoor and outdoor air pollution, reduced cooking times, improved safety and a cleaner cooking environment.

The first step of any program to encourage greater use of ICS designs in Cebu would have to be additional research into local cooking practices and current efficiencies of use. The next stage would be to design and test stoves that have the potential to achieve higher efficiencies but which also meet a number of other important criteria. First, ICS designs need to be compatible with local cooking practices which could imply flexibility in the type of fuel used, portability, or capability of cooking at very high rates of heat. Second, improved stove designs should be producible from locally available materials and by local artisans at fairly low costs. This will ensure that private sector manufacturers can undertake the production of these stoves, that they will be available to low-income consumers at a reasonable price, and that they will not be so valuable so as to discourage residents in theft-prone areas from utilizing them. With this accomplished, a concerted effort can finally be made to encourage artisans and manufacturers to undertake production of ICS designs, while simultaneously promotion and dissemination programs in low-income areas can be implemented. Once again, any ICS or fuel substitution campaign should only be undertaken if research indicates that it holds clear advantages to society as a whole. Making such a determination is not always that simple, and accurately measuring some of the costs and benefits can often lead to intractable difficulties. At a minimum, direct program costs should be combined with some assessment of indirect costs and benefits such as potential loss of income to rural wood-cutters and traders, increased urban employment for stove manufacturers, improved household health and safety, household expenditure savings, and improved urban environments to develop financial and economic analyses of these programs.

Besides households, industrial and commercial users were found to be significant consumers of fuelwood and charcoal in Cebu City as well, and so attention should also be paid to how these establishments utilize woodfuels in their operations. There would appear to be a significant potential for improving the efficiencies of wood-fired ovens, boilers and dryers in these establishments, although factories utilizing mainly self-generated wood wastes may be less interested in conserving a “free” fuel. The expertise needed to undertake research into improving the efficiency of commercial woodfuel use is available locally in the form of undergraduate and graduate students from the engineering programs of local universities. An effort can also be made to look into the specific difficulties involved in utilizing *secondary* biomass fuels such as coconut shells and husks which have a definite, albeit limited potential for increased use as an industrial fuel in the region. One industrial establishment we surveyed was in the process of switching from *primary* fuelwood to coconut husks and shells but was encountering a problem with the amount of ash produced in the combustion of the latter. As was the case with improved household cookstove designs, the extent to which improved wood-fired industrial ovens, boilers and dryers are adopted will depend on the costs of these designs and their suitability to local production processes.

A final area for demand-side research and project initiatives is improving the efficiency with which wood is converted to charcoal (carbonization). As mentioned above, nearly all of the charcoal produced in Cebu is carbonized in simple earth-pit kilns. These kilns are reported to achieve efficiencies of anywhere from 9 to 25% depending on pit construction, the moisture content of the wood being carbonized, and how carefully the carbonization process is monitored (Leach and Gowen 1987). We are uncertain of actual efficiencies normally achieved in Cebu, although we did observe that charcoal-makers are generally highly experienced in this activity, that they typically place a significant amount of effort into kiln construction, and that they closely monitor the carbonization process. Nevertheless, it may be useful to examine whether improved charcoal kiln designs of a stationary nature are acceptable to local charcoal-makers and whether these can result in significant improvements in conversion efficiencies. The stationary nature of the improved kiln designs should *not* prove to be a drawback to their adoption in Cebu since pit kilns tend to also be long-established in one place and since charcoal-makers report obtaining their wood from an average distance of less than 1 km. from their residence (Remedio 1991). A more serious drawback would be the construction costs of improved kilns, a problem made more serious by the fact that many charcoal-makers do not have access to a regular supply of wood, instead relying on sharing or contract arrangements with local landowners. However, trial kilns could be established and tested by government agencies or NGOs in order to demonstrate the technology, and technical assistance could be provided to charcoal-makers who show interest in adopting these designs. Improved carbonization efficiencies could result in higher incomes for charcoal-makers and also create increased demand for rural artisans skilled in kiln construction. Increasing conversion efficiencies could also improve the overall efficiency of charcoal production systems in the province and increase the attractiveness of this fuel for meeting urban household cooking needs.

Overall, there are a number of demand-side research and policy initiatives that have the potential to result in improved efficiencies of woodfuel utilization in homes and businesses in the province. Whether or not these efforts should be actively promoted or simply encouraged through the provision of limited assistance to individuals in the private sector is a question that will need to be answered through a careful evaluation of costs and benefits involved in the process. Reducing woodfuel use in Cebu City to “save the forests” does not appear to be a convincing justification for any demand-side program. However, as mentioned above, these programs have many other benefits that also need to be considered. Whether or not improved efficiencies of woodfuel use in urban areas will prove detrimental to the incomes of rural wood-cutters is also open to question. The urban woodfuel market is just one outlet for trees grown by farmers in the rural areas, and reductions in demand for this product would likely not affect the incentives already in place to undertake tree-planting and management on private lands. Instead, adjustments can be made in species and rotation lengths in order to grow trees which produce wood suitable for mine poles, electrical poles, construction poles, lumber, packing crates, match sticks, paper pulp, and woodcrafting, and/or non-wood products such as fruits and leafmeal which can also be marketed locally. Therefore, demand-side policy options should be seriously considered, especially in cases where they can be largely undertaken by the private sector and where they yield unambiguous overall benefits. A good place to start would be to research the potential for more widespread dissemination of simple and inexpensive improved cookstove designs.

4.4 Concluding Remarks

The above discussion has illustrated that while commercial woodfuel trade and use in Cebu is already fairly efficient, there may be justification for undertaking policy, project and research initiatives to improve the situation still further. Any proposed initiatives would have to be compared with the obvious approach of doing nothing at all and letting current conditions, inclusive of already existent policy-induced market distortions, determine the allocation of resources and behavior of individual economic agents. However, at this point our analysis suggests to us that *at a minimum* the following should be seriously considered in an effort to improve the overall sustainability and efficiency of woodfuel production and use in the City and Province of Cebu.

1. *Regulatory Reform*: Regulations currently in place to manage the woodfuel trade in the province are largely ineffective and may be discouraging more widespread tree-planting. Alternative regulations are likewise subject to abuse and may also create disincentives, but discussions with woodfuel traders and DENR officials in the province suggest that a combination species-based/licensing approach to regulating the trade holds the potential

to improve on the current situation. Details of such an approach would need to be worked out, and the local DENR may be unable to implement any change since at present they are required to follow national policy directives. If this changes, however, policy formulation should involve close consultation between the DENR, researchers, and those actually involved in the woodfuel trade.

2. *Further Research*: A number of areas for further research were indicated in the above discussion. Starting with the supply-side, more effort needs to be made to examine current farming and tree-planting patterns in the province and suggest additional species and management approaches capable of meeting fuel, fodder, soil protection and enhancement objectives in a manner acceptable to local farmers and the conditions they face. Second, a more careful assessment of available woody and non-woody biomass fuels from *all* land use categories in the province should be undertaken in order to determine the true extent of a woodfuel shortage in Cebu. Third, on the demand-side research should be conducted into the potential for improving the efficiency of woodfuel use in homes and businesses in Cebu and for increasing the efficiency with which wood is carbonized into charcoal. Finally, an effort should be made to examine the relative benefits of a program to promote more widespread use of charcoal in urban households as either an outright substitute for fuelwood or as a "transition" fuel between wood and more modern cooking fuels such as kerosene and LPG.

3. *Supply-Side Projects*: Reforestation and upland agriculture and agroforestry approaches being promoted in the province should pay closer attention to the potential of propagating fast-growing trees *primarily* for woodfuel purposes. Such an approach is predicated on the realization that many Cebuano farmers are already growing these trees for woodfuel production in response to a strong demand for this product and the relative ease with which these trees can be established, maintained and harvested. Depending on the results of research and trial efforts, alternative species and/or propagation and management approaches can be promoted that will increase yields of woodfuel and other wood and non-wood products, provide soil erosion control and soil enhancement benefits, and which are suitable to natural, social and economic conditions present in rural areas of the province.

4. *Demand-Side Projects*: Programs intended to speed-up the fuel-switching transition currently taking place through adjustments in the relative prices of different cooking fuels do *not* appear to hold much promise at any time in the near future. Making kerosene and LPG stoves more affordable, and addressing safety concerns over the use of these devices are more promising approaches, although even these are not likely to significantly reduce overall woodfuel consumption in the urban household sector. Depending again on research, trial efforts, and analyses of project costs and benefits, programs which promote more widespread use of improved cookstove designs in households, improved ovens, boilers and dryers in commercial establishments, and improved kilns by rural charcoal-makers, may hold significant potential for increasing the efficiency of woodfuel use in the province and lead to additional benefits as well. These programs should work from a good understanding of local conditions and woodfuel use patterns, and aim for maximum involvement of the private sector in manufacture and dissemination of any improved designs that are developed.

APPENDIX A: METHODOLOGIES FOR WOODFUEL FLOW STUDIES

A.1 Overview

The demand for fuelwood and charcoal in urban areas of developing countries is often speculated to result in more serious environmental degradation than similar levels of rural demand since the former is generally more commercialized and concentrated, tending to result in over-cutting (Wood and Baldwin 1985; Bowonder et al. 1987; Soussan et al. 1990; Sagawe 1991; Mercer and Soussan 1992). On the other hand, it can also be argued that urban markets for woodfuels create incentives for rural farmers and landowners to earn money by growing and selling trees, and that urban woodfuel demand is more conducive to both supply- and demand-side policy interventions for the very reason that it is of a commercial nature (Goodman 1987; Dewees 1989; Cline-Cole et al. 1990b; Soussan et al. 1992b; Murray and de Montalembert 1992). In order to assess the accuracy of these claims for any particular urban area and determine the impact of urban woodfuel demand on both rural environments and economies, a woodfuel flow study that analyzes all or most aspects of a particular system can be of significant use.

The findings presented in this report derive from 18 months of preparation and field work conducted in Cebu City and Province from September 1991 to February 1993. The focus of the study was on the *commercial* woodfuel trade in Cebu City, although our research also involved visits to rural areas of the province where woodfuel-producing trees are grown and harvested for sale in urban markets. In order to gather the data necessary to understand the overall flow of woodfuels from rural producers to urban consumers a range of methodological approaches were employed, ranging from highly-structured questionnaires to exploratory rapid appraisal techniques. In choosing which methods to use we had to consider a number of factors including our data needs and research objectives, available budget, availability of information (such as census lists) needed to select respondents, and the likely willingness of respondents and other informants to provide us with information requested. As a result, the methods actually employed in any woodfuel flow study should vary depending on the particular circumstances encountered by the researcher. In the discussion below we will attempt to not only provide details of methods we've used, but also suggest alternative approaches. The discussion is broken into four sections based on the different areas of inquiry we pursued in the conduct of our research, namely, residential sector energy demand, commercial sector energy demand, the urban woodfuel trading network and the rural woodfuel supply and trading network. A concluding section will sum up the discussion and provide a partial list of additional readings that would be of value to researchers interested in studying wood energy systems.

A.2 Residential Sector Energy Demand

Since the residential sector typically accounts for anywhere from 50-95% of woodfuel consumption in developing country cities, a good understanding of household energy-use patterns should be an important component of any commercial woodfuel flow study. Household energy surveys are a proven and effective way of obtaining information needed to develop such an understanding, and usually focus on determining tendencies in fuel-choice decisions as a function of household income, size and other factors, levels of consumption, attitudes towards different fuels, actual fuel-use patterns and fuel-switching behavior. Surveys undertaken and reported in the literature vary greatly in methodology and scope depending on the particular objectives of the study and available budget. For example, surveys conducted by the World Bank ESMAP group in Indonesia, Yemen, Senegal and the Philippines, among others, have administered formal questionnaires to as many as 5,000 households, usually as part of a national energy strategy study. Localized studies conducted by academic or NGO researchers will often only interview as few as 30 households using a semi-structured questionnaire format, and yet still derive results useful for their purpose. Some of the more important decisions that need to be made before a survey can be conducted relate to issues of sample size, sample selection, survey instrument design, interviewing and measurement techniques, and methods for data tabulation and analysis. Once again, these decisions should be driven by the particular information needs of the researcher and the time, manpower and financial resources available.

For our study, the following approach was taken to generate data on household energy consumption patterns in Cebu City. First, it was decided to use a simple random sampling approach to select households for survey. This decision was made since we wanted a representative sample of the residential sector in order to be able to derive quantitative estimates of energy use by households, and since the recently completed 1990 Census of Population and Housing provided us with an accurate and up-to-date list of the population “universe” from which a representative sample could be drawn. Second, after consulting with statisticians and texts on survey methods it was determined that any sample size greater than approximately 500 households would provide us with results that were acceptably accurate based on initial assumptions of variances likely to be encountered for key variables. After obtaining permission from the National Census and Statistics Office we randomly selected 1,100 households in the 49 urban *barangays* of Cebu City, with the actual number of households chosen in each *barangay* reflecting its relative size (thus ensuring representativeness for each district). From this master list, 603 households were selected for interview with the remaining 497 to serve as replacements and/or additional respondents in case we later determined a need to expand our sample size.

Third, a 54-page questionnaire was developed and pre-tested including questions on household characteristics, fuel-use and purchase patterns, cooking practices and the fuel-switching history of the household (see Appendix B for a complete list of questions). Many of these questions already had pre-coded responses developed for them, but some required a numerical answer (such as fuelwood consumption or price) and others were left open-ended and post-coded during the editing process. The length of the questionnaire reflected a number of decisions made in advance that we believe increased the accuracy of the survey and hence the reliability of the results. For example, questions were listed in both English and Cebuano, since we determined that even trained enumerators proficient in English would tend to give varying translations for the same question. In addition, plenty of spacing was given between questions to minimize the possibility of recording errors, missed questions, and eventually, encoding errors. Despite its length, the questionnaire only took an average of 25-30 minutes to administer as a result of careful enumerator training and easy-to-follow skipping patterns.

Fourth, ten enumerators were hired and trained to carry out the actual interviewing. The enumerators were divided into five teams of two, with each team consisting of at least one female member since prior experience indicated that this would ensure better access and rapport with female heads of households, typically the more common respondents. The use of two enumerators allowed for one to focus on asking the questions directly while the other could listen for inconsistencies, record additional observations of the interview or surroundings, and assist with follow-up questions. Each survey team carried with them an interviewer manual, flash cards to aid the respondent in answering certain questions, portable weighing scales to make estimates of woodfuel consumption, and a small token of appreciation (such as a bar of soap) to be given to the respondent at the completion of the interview. Interview teams also carried with them a letter of introduction from the study leaders, picture ID, and a signed authorization earlier obtained from each *Barangay* Captain in order to reassure the respondent of their purpose. As a result, refusal rates were relatively low.

Lastly, completed questionnaires were "field-edited" by the enumerators the same day of the interview and subsequently "office-edited" by a full-time editor within a few days after being conducted in order to locate errors and inconsistencies that could still be straightened out by the enumerator without the need for a follow-up interview. Responses in the completed questionnaires were later converted to a format suitable for data entry. Two experienced encoders were hired to enter the data from the questionnaires into a D-BASE computer program with built-in variable ranges and automatic skipping features, and a sample of 50 questionnaires was later re-encoded a second time and compared with the data initially encoded for these 50 in order to determine the extent of encoding errors. Subsequent data analysis was done using the SPSS statistical software package. In addition to the encoded data, a 1-2 page written description of the information contained in each questionnaire was also produced during the editing process in order to make note of any peculiarities of the household situation and to provide more detail on particular areas of interest.

As already mentioned, the approaches we used in conducting the household energy survey were determined in large part by data needs and conditions specific to this study. Alternative approaches are available, and in may instances these approaches may be superior to those we used. For example, our decision to employ a random sampling approach was predicated on a desire to have results whose precision could be calculated and in order to be able to derive estimates of city-wide residential energy use on the basis of results from our sample. However, this decision necessitated that we field survey teams in all areas of the city and require them to seek out and interview pre-selected respondents, often on the basis of incomplete addresses. One alternative would have been to employ cluster sampling to reduce field costs, but clustering also tends to increase sampling error, and we were uncertain of how to define a cluster and the exact number to work with. Our decision to select a proportionate number of households from each *barangay* is actually a form of stratified random sampling with each *barangay* representing a strata and households within each being selected on a random basis. An alternative form of stratified random sampling could have initially divided the population on the basis of income or a different geographical breakdown other than *barangays*, but this still leads to problems in cases where a population is not understood well enough to develop the strata in the first place. In cases where, for instance, a researcher is mainly interested in fuel-use patterns of low-income households and not necessarily in measuring city-wide fuel consumption, then a simple approach would be to select one or more low-income districts and conduct intensive surveys in these areas on what might be called a "random walk" basis. The point to make is that there are a wide variety of sampling approaches available to researchers interested in conducting household energy surveys. Detailed discussions of the benefits and drawbacks of using each can be found in any number of texts on social science survey methods.

Our decision to employ a highly-structured questionnaire with pre-coded responses was dictated by the size of our sample and our intention to use computers for data storage and analysis.

Once again, however, other approaches are possible such as the use of open-ended questionnaires or semi-structured interviewing. It is important to point out that highly-structured, pre-coded questionnaires may not be appropriate in cases where the researcher has little initial understanding of the subject under study. This is so since developing pre-coded responses to survey questions requires at least a fair amount of knowledge of the subject beforehand. In those cases where there is limited understanding initially, rapid appraisal studies or reconnaissance surveys can often be a low-cost, quick and effective way of obtaining information needed for the design of more formal survey instruments (Beebe 1987). Another important issue in questionnaire design is to be careful not to include leading questions[12] and/or questions that require too much in the way of respondent recall (e.g. “how much did you spend on fuelwood last year?”). Finally, “double-barreled” questions, or questions that ask more than one thing at once should also be left out in favor of those that are broken down into their smallest possible components.

The issue of how to accurately measure woodfuel consumption in the household is also critical, and the generally shoddy techniques sometimes employed in residential energy surveys can give rise to questions over the accuracy of their results. Undoubtedly, the best approach is to conduct direct weighings with one option being to weigh a given pile of fuelwood on day 1, instructing the respondent to only use wood from that pile, and then returning in day 2 and/or day 3 at the same time of day and re-weighing the pile to determine daily fuelwood consumption. One weakness of this approach is that the day of the interview may not be a “typical” day for that household as a result of some event or events which alter the frequency and amount of cooking being done. In an urban setting like Cebu City a more fundamental difficulty with this approach is that households usually do not “stockpile” enough wood for a 24, let alone 48-hour period. Instead, fuelwood and charcoal are typically purchased once, twice, and even three times daily. As a result, our survey teams were instructed to determine daily woodfuel consumption by probing the respondent for details of woodfuel purchase and collection patterns and then taking measurements of representative units such as bundles of wood or packs of charcoal. For example, a respondent claims to purchase two bundles of fuelwood at P4/each every morning from a nearby *sari-sari* store, but at the time of the interview less than one bundle is left. In this case the survey team would generally go to that store after the interview and conduct sample weighings of a number of P4 fuelwood bundles being sold there, arriving at an average weight per bundle and multiplying by two in order to determine the household's daily fuelwood use. This approach is subject to its own drawbacks associated with respondent recall and consistency in the weight of units like fuelwood bundles. However, no other reasonable approach was available given the woodfuel purchase patterns of households in Cebu, and in any event, we observed that these purchase patterns were quite regular, and that bundles of fuelwood and bags or sacks of charcoal being sold by urban traders displayed remarkable consistency in weight, suggesting that the approach taken may not have been too inaccurate after all.

The most important elements that led to the successful completion of the household energy survey in Cebu were a clear understanding and agreement on the part of the researchers of the objectives of the study, the resources available to carry out the work, the difficulties that were likely to be encountered during the course of the actual field work, and the intended end-uses of the data.

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[12] For example, leading questions like “do you use LPG because it is a clean fuel?” should be replaced with something like “why do you use LPG?”

A.3 Commercial Sector Energy Demand

While the residential sector is typically the largest consumer of woodfuels in developing countries, commercial establishments can also account for as much as 40% of the total, and businesses are often a more important consumer of commercially-traded woodfuels. In Cebu City, our research indicates that the commercial sector accounts for 37% of the fuelwood and 49% of the charcoal consumed. Patterns of woodfuel use in commercial establishments differ in many ways, however, from those in households, and this dictated that we adjust our survey approaches accordingly. For example, whereas the residential sector is a fairly well-defined entity with limited variability among its individual components, the commercial sector contains an enormous range of business "types". These businesses vary considerably in terms of size, ownership patterns, products produced, end-uses for energy, quantities consumed, technologies and processes employed, and reasons for using certain fuels. Furthermore, the commercial sector is not as easy to define as the household sector in order to draw samples for survey. In Cebu there is both a formal, and apparently larger informal business sector, with no accurate listings available for the latter. As a result, a combination of approaches were employed to gather data on energy use patterns in the commercial sector. As was the case with the households survey, our primary objectives in this portion of the study were to accurately quantify energy consumption in the commercial sector, examine patterns of actual fuel use, determine reasons for choosing certain fuels, and measure the extent to which businesses have, or are likely to change the types and amounts of fuels they use.

At the start a decision was made to focus our inquiry on those types of businesses that were known to be, or suspected of, using woodfuels. The determination of which business types actually fit this category was made based on information from earlier studies conducted by the USC-ANEC (see Remedio and Bensel 1992), and from data collected from the urban woodfuel trader survey and the rural woodfuel supply survey which were conducted *before* this phase of the study in order to provide exactly this type of information.[13] Narrowing our inquiry down to woodfuel-using business types was predicated on a number of considerations. First, our primary objective was to measure *woodfuel* consumption and examine the ways in which these fuels are purchased and used, not necessarily to investigate commercial use of *all* forms of energy. Second, a more comprehensive survey including most types of businesses would have increased our costs considerably and would have resulted in a situation where only a small percentage of respondents would actually have been using woodfuels. *Within* the categories of businesses that were selected we tried to make our sampling as random as possible. For example, 78 bakeries were interviewed on a random basis, of which only around one in four was using woodfuels. In this way, we were able to make a fairly accurate determination of woodfuel use for each category, and since we surveyed most or all of the business categories actually using woodfuels, an overall estimate could be made for woodfuel use in the commercial sector.

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[13] In fact, considerations of the timing of each phase of the study was an important aspect of our research. We started with the household survey since this sector was already well-defined by the 1990 census. In order to accurately survey commercial establishments, however, we needed more information from urban and rural traders on which types of businesses used the most woodfuels. Likewise, in order to select rural areas of the province for the study of woodfuel production patterns, we found it helpful to first interview urban traders and ask them which parts of the province were most actively involved in the trade.

Once we determined the categories of businesses (and institutions) to be surveyed, the next step was to develop a list of actual respondents. In order to accomplish this we first approached the records division of the local government of Cebu City and made a formal request for a computer printout of the names and addresses of businesses that fall under each of the categories we had already selected. In some cases, such as that for bakeries, the lists provided proved to be accurate and nearly complete, giving us a reasonable sampling frame from which a sample for survey could be drawn. However, the far more numerous, and from the perspective of woodfuel consumption, far more important "informal" sector business establishments were usually not listed. In order to study the fuelwood and charcoal usage of the thousands of street food vendors, barbecue stalls, and food processors not listed with the local government a different approach was taken. To begin with, it was known to us that some of these businesses tend to "cluster" in certain areas of the city, such as *poso* makers in *Barangay* Pasil, barbecue stands around piers and schools, and food vendors around government offices, factories and low-income districts. Therefore, a sampling approach best defined as purposive in nature was employed, with enumerators instructed to roam around areas where these businesses are known to operate and interview, for example, every third barbecue stall on the left, or every other food vendor on either side of the street, etc. The size of the sample for each category of business was determined on the basis of an initial estimate of their numbers and the degree of variability in woodfuel use among businesses within that category. In general, the greater the variability the larger the sample needed in order to accurately determine levels and patterns of woodfuel use.

Developing an estimate of the number of informal sector business establishments in each category studied was a difficult and, by necessity, imperfect process. But such an estimate is needed if we are to be able to extrapolate the findings from our sample to this sector as a whole. Once again, different approaches were used. We approximated the number of sidewalk barbecue stalls by convening our field workers in the office and doing a district-by-district mental estimate of their numbers. Our final estimate of 3,000-4,000 proved to provide an accurate range for an estimate later made by a local NGO of 3,200 such establishments which they determined on the basis of an ocular tally from a moving car as part of an unrelated study they were conducting. Estimates of the number of food vendors, *poso* makers, and others were developed in a similar way and supplemented by findings from our household energy survey. Since many of these businesses were found to be operating out of the household, and since our residential sector energy survey used a random sampling approach, portions of the survey that focused on whether or not commercial activities took place within the household, and what types and amounts of energy are used for these activities, proved helpful in understanding informal sector energy consumption. Overall, our sampling methods for the commercial sector energy survey were less rigorous than those used in the residential survey, but these approaches were dictated by considerations of study objectives, budget limitations, and absence of data needed to develop an accurate and comprehensive sampling frame for survey.

The questionnaire design and interview methods used in this portion of the study also differed substantially from those employed in the household survey. To begin with, the above-mentioned variation in the types of businesses surveyed, their size, fuel-use patterns, production processes and motivations for fuel choice, made the use of a highly-structured, pre-coded survey instrument untenable. Instead, a simpler questionnaire containing more open-ended inquiries was deemed appropriate. This decision was made easier by the fact that our survey of business establishments involved fewer respondents than the household survey, and the number of variables being measured was also far fewer. As a result, open-ended questions would not prove to be as big of a problem in terms of data tabulation and analysis than would have been the case for the household survey of 603 respondents with over 200 questions asked of each. In the commercial sector survey, respondents were asked to provide us with general information on the business itself, types and amounts of energy used, and reasons for choosing certain fuels as well as plans to change fuels in the future (see Appendix B for a list of questions). In order to actually carry out the interview a number of approaches had to be taken. While a direct personal interview was the preferred approach, business owners and managers often proved less accessible and willing to cooperate than heads of households. This was due in part to the fact that these respondents were often very busy, but in a number of cases it was also due to suspicion on their part of our motives (were we tax collectors?, spying for other businesses?), and even to concern that the business may be criticized for using woodfuel and "destroying the environment", as was the case with the carrageenan manufacturer described in Section 2.3.7. As a result, we had to also allow for questionnaires to be left with respondents to be filled out by them and picked up later. We also found that in the case of larger manufacturing companies, telephone interviews with rank-and-file employees and mid-level managers was often the only way to obtain any information on that company's energy use. While not always as accurate and comprehensive as face-to-face personal interviews, telephone interviews were often able to provide us with the information needed and reduce our survey costs substantially.

As already mentioned, the questionnaire used in the commercial sector energy survey was, by necessity, far more open-ended in nature than that employed for the household survey. As a result, the data contained in these questionnaires had to initially be tabulated manually after responses to some questions were post-coded on the basis of groupings we developed at that time. Data tabulation and analysis in this case was made easier by the fact that the commercial sector questionnaire contained far fewer variables (27) and was administered to a smaller sample than the household survey. Findings from the commercial survey have been supplemented with relevant data from the residential sector survey for those households operating a business on the premises. It was pointed out in Section A.2 that highly-structured, pre-coded questionnaires should be avoided in cases where the researcher has limited initial understanding of the subject being studied. Instead, open-ended or rapid appraisal techniques are preferred. To some extent, this describes the situation we faced when designing our commercial sector survey. Now that our open-ended inquiries have provided us with an improved understanding of how this sector operates, it would be possible, if necessary, to develop a more formal and structured survey approach to further refine the knowledge already gained.

Overall, our commercial sector energy survey was characterized by a far greater variety of sampling and interview techniques than those utilized for the household survey. The approaches we took are not the only ones available, and could have been revised substantially on the basis of available budget, access to data needed to develop an accurate sampling frame of business establishments, and most importantly, the objectives of the study.

A.4 The Urban Woodfuel Trading Network

Section 3.5 discussed the workings of the urban woodfuel markets in some detail, pointing out the role of urban traders in meeting the specific woodfuel demands of different consuming sectors in the city. Much of the information needed to discuss the urban woodfuel markets came from a survey of 81 medium- to large-scale wholesalers and retailers of fuelwood and charcoal operating in Cebu City and vicinity. The urban traders proved to be a valuable source of information on how the industry operates, margins earned, employment generated, species preferences of certain consumers, seasonality in demand, and so on. In addition , the more experienced traders, including some who had been in the business for 30 to 40 years, were able to provide us with a thorough description of how the commercial woodfuel trade has evolved over time in Cebu, including details of price fluctuations, changes in species being sold, and shifts in areas of major supply. Finally, information provided by the urban traders on their primary customers and sources of supply proved valuable later for defining our sample for the commercial sector energy survey and for choosing study sites for the rural woodfuel supply phase of our research.

In choosing a sample of urban woodfuel traders to interview we were once again limited by the non-existence of any official listings or local government records of these businesses. However, since the primary objective of this phase of the study was to acquire a broad understanding of how the urban woodfuel trade operates, and not necessarily to develop precise quantitative estimates of volumes sold or profits earned, we decided to employ a non-probabilistic, purposive sampling approach. Initially, we knew of approximately 45 urban woodfuel traders as a result of an earlier study carried out by the USC-ANEC. In order to broaden our sampling frame we also conducted a three-day ocular inspection of the city, recording sitings of other woodfuel traders on a map. Eventually, 81 urban traders were actually interviewed, accounting for perhaps 50-60% of the traders whom we've defined as “medium- to large-scale” in size. This categorization is loosely employed to refer to those traders who receive the bulk of their supplies direct from rural areas, and was used to distinguish between these traders and the small-scale retailers who buy, for example, 10-20 bundles of fuelwood or 2-3 sacks of charcoal at a time from urban wholesalers for sale in neighborhood *sari-sari* stores.

Details of the questionnaire used in this aspect of the study are provided in Appendix B, but the general topics addressed included the socioeconomic background of the trader, description of their business, sales patterns, supply patterns, modes of transportation used, characteristics of fuels being sold, pricing patterns, and operating costs. All of the questions in the survey instrument were open-ended, allowing for any type and length of response the trader wished to offer. This approach was taken for a number of reasons. First, it was realized in advance that traders were operating at different scales and under highly variable circumstances, and that as a result pre-coded questions would prove too limiting. Second, the types of questions being asked (such as those relating to current and historical wood species being traded) were, for the most part, not conducive to pre-coded responses. Third, the sample was small enough that manual tabulation of the results was deemed feasible and even desirable given the variability in responses. Overall, since our objective in this phase of the study was to develop a broad understanding of the urban woodfuel trade, and since we felt that this could best be accomplished by letting the respondents dictate the flow of the interview, the questionnaire developed and used was only intended to provide an outline of the issues to be discussed.

Unlike interviews done for the household and commercial sector surveys which typically lasted only 20-30 minutes, it occasionally took as long as two hours to complete the questionnaire used in the urban woodfuel traders survey. The actual length of the interview usually depended on the number of years the trader had been in the business and on their willingness to cooperate with the interviewers. We found it extremely important to take a few minutes at the beginning of the interview to explain to the respondent the purpose of our survey and to reassure them of the confidentiality of their responses. The unease which many of them felt towards the survey team is due to a number of factors. First, some traders suspected that we would share certain information (such as their major customers or "*sukis*", volumes sold, prices charged) with other traders. Second, there was some concern over whether we would provide sales information to the local government in order to enable collection of taxes. Third, and perhaps most important, the woodfuel trade, even in an urban setting, is still clouded by uncertain legal status and traders are wary of the potential for the DENR to shut down the trade and endanger their livelihood. For these reasons, and also because of the value of the information provided by the urban traders, it was usually the case that one of the study leaders would form part of the survey team used in this portion of the study.

In addition to the question-answer portion of each interview, the survey team also took a few minutes at the end of the interview to conduct weighings of fuelwood and charcoal being sold. Two different hand-held spring scales were utilized, one with 20 kg. capacity for most fuelwood bundles and sacks of charcoal, and another one with a 100 kg. capacity for larger sacks of charcoal occasionally being sold. The usual procedure was to take from five to ten sample weighings of the different types (*primary* fuelwood, coconut fronds) of fuels being sold and the different sizes (cellophane packs of charcoal, sacks of charcoal). Weights were recorded with the respective prices and other notations were made such as the size of the fuelwood bundle, the diameter of individual pieces in the bundles, visual appearance of moisture contents, types of species, and other relevant characteristics of the fuels being sold.

The information contained in the completed urban trader questionnaires was analyzed in a manual fashion. In designing this questionnaire, and the one used in the household survey as well, an effort was made to arrive at answers to "sensitive" topics such as sales levels and income in at least two different ways, and in different parts of the questionnaire, in order to provide a means of cross-checking the accuracy of the information provided. For example, in the urban woodfuel trader questionnaire the respondent is asked in one question to estimate overall sales on a daily, weekly or monthly basis,[14] and later to provide a breakdown of sales on the basis of major customers or customer-types. In addition, sales data provided could be compared with information given on deliveries received, so if a trader claims to sell only 200 bundles of fuelwood a month but to receive 2,000 then we know to be careful in interpretation of their responses. This type of cross-checking occasionally revealed some minor inconsistencies, but for the most part the urban traders proved to be forthright and helpful respondents once we gained their confidence.

An important aspect of the urban trader survey was the open-ended nature of our inquiries. The questionnaire developed and used for this survey allowed those respondents with extensive experience in the trade and a loquacious nature to spend over two hours providing the survey team with relevant and useful information. On the other hand, the questionnaire also provided enough of an outline so that important data could also be obtained from less-experienced and/or reluctant respondents. Another key element, whose importance to woodfuel flow studies cannot be overemphasized, is the need to secure the trust and confidence of the respondent in order to reassure them of the purpose of the research.

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[14] We generally found it better to give respondents the option of reporting frequencies in the units they could most easily relate to, and then have the enumerators and/or editor convert these responses to a standard measure. For example, a household respondent might report fuelwood purchases on a *daily* basis which we could later multiply by seven if we were going to encode a figure for *weekly* purchases.

A.5 The Rural Woodfuel Supply and Trading Network

Section 3 of this report described in detail the ways in which woodfuel-producing trees are propagated, managed, harvested, converted and traded in rural areas of Cebu and the enormous degree of variation in these practices in different parts of the province. From the start of our research we were certain that the rural woodfuel supply network was going to prove to be the most complicated and difficult aspect of the study. Given the limited resources we had at our disposal, the time constraints, the lack of expertise of the study leaders in the fields of agriculture and forestry, the initial objectives of the study, and the scope of the area that would need to be covered in order to conduct a comprehensive survey, it was decided that we should approach this phase of the research in an exploratory manner, attempting only to develop a broad understanding of rural woodfuel production and trading practices in the province. In order to do this we employed methods similar to those generally used in Rapid Rural Appraisal (RRA) studies. Namely, the study team combined information obtained from semi-structured interviews of different categories of key informants (wood-cutters, rural traders, local officials) with available secondary data and our own field observations to arrive at a qualitative assessment of the rural woodfuel trade.

No explicit attempt was made at this point, for example, to measure yields of biomass from different land use categories or to develop precise estimates of carbonization efficiencies achieved in local earth-pit charcoal kilns. Instead, our focus was on issues such as farmer attitudes towards tree-planting as a function of tenure and available markets, ways in which trees are managed, harvested and converted to fuelwood or charcoal, the employment generated locally by these practices, trading mechanisms, and the general history of the woodfuel trade in the area. While this approach fits the objectives of this particular study we also realized the possibility that information gained from exploratory surveys at this time could form the basis for more focused and quantitative studies of woodfuel potential and/or trading practices in the future. For example, we know much more now about woodfuel production patterns from land use categories such as tree fallows, woodlots, agroforested lands and agricultural lands with scattered fruit-bearing and shade trees. This information will be needed if any attempt is made in the future to conduct an assessment of biomass potential in Cebu with the use of remotely sensed data from aerial photographs or satellite images.

Site selection for this phase of the study was determined on the basis of information obtained from two sources. First, as earlier mentioned, the urban traders were able to provide us with information on the major woodfuel-producing areas of the province, and even relate the names of rural traders operating in these areas. Second, records of transport permits issued by the DENR for woodfuel shipments contained detailed information on the origin of each load, including the names of the landowner where the trees were harvested and the trader handling the shipment. Overall, eight site visits were carried out, ranging in duration from one to four days and covering a total of 25 rural *barangays* in the province. Details of the study sites are provided elsewhere (Remedio 1993), but in general an effort was made to choose something of a cross-section with most sites displaying differences in topography, agricultural practices and primary crops, tree species harvested for woodfuels, and local trading practices. Study sites also varied in distance to the city (see Figure 5), with field work being done in Argao (67 km. from Cebu City), three separate areas of the Cebu City hillylands (10-15 km. in distance), Consolacion (13 km.), Compostela (25 km.), Catmon (57 km.) and Sogod (61 km.). Before the actual site visits were conducted, courtesy calls were paid to the Mayors of each municipality where surveying was to be done. Furthermore, when field work actually commenced, the survey team made it a point to first locate the *Barangay* Captain and/or a Councilor in order to inform them of our presence and purpose in that area.

It was mentioned above that our methodological approach for this phase of the research was similar to that typically used in RRA studies. For example, available secondary data was gathered and analyzed both before and after field work was conducted. Semi-structured interviewing was the primary mode of data collection, with a deliberate effort being made to seek out and interview respondents with different perspectives on the local woodfuel trade in order to "triangulate" their responses. Among the respondents were landless wood-cutters working for a daily wage, tenant farmers making charcoal on a sharing arrangement with a landowner, rural traders of divergent socioeconomic backgrounds operating at different levels of the trade, local government and NGO personnel familiar with the study site, and older residents of the area capable of providing a historical perspective on land use changes and the woodfuel trade in that location. The only survey instrument used in the field were sets of guide questions that were developed to address issues of interest to the researchers without limiting the pace or scope of the conversation. The survey team tried to avoid the tendency towards "development tourism" by doing, for example, all of the field work without a vehicle and utilizing foot paths to reach interior portions of *barangays* for study. The single biggest limitation of this part of our research, and the reason we hesitate to term it outright as an RRA study, had to do with the actual composition of the survey team. RRA studies typically call for survey teams whose members have a variety of backgrounds and technical expertise, but we were limited in this requirement by the fact that both study leaders are trained as economists. Most of the field work was actually carried out by one of the study leaders accompanied two research assistants with general social science backgrounds. These research assistants were, however, recruited on the basis of extensive field experience in earlier research efforts and therefore proved quite capable of conducting the tasks they were faced with.

In writing up the findings from the field visits an effort was made to use supplemental secondary data obtained, for example, from DENR records of transport permits issued in the province, various project reports, and maps of topography, soils, rainfall and land use patterns for the island. During the field work, extensive use was made of a camera (photo documentation) to record images of particular interest, and the resulting photographs later proved highly useful as both a recall and explanatory device. Overall, a wide mix of methods and approaches were employed in an effort to meet the exploratory objectives of this phase of the study. The survey team found that a thorough perusal of the RRA literature provided us with useful insights into techniques and approaches available in the field as well as pitfalls to be avoided in carrying out this type of research. While we did encounter some limitations in carrying out this portion of the study, every effort was made to accommodate these and ultimately acknowledge them in presenting the results of the research.

A.6 Concluding Observations

The research methods selected for use in the study were able, for the most part, to provide the types of information needed to meet the objectives of the research, while at the same time being compatible with the financial and technical constraints faced by the study team. Other approaches, or combinations of approaches, may also have been possible, and in hindsight we would probably reconsider at least some of the techniques we employed. As much as possible, any research effort should start with clear objectives, although these can and probably will be adjusted as the research progresses. Likewise, researchers should also be flexible in the methods they use to conduct a study, and attention should be paid to the cost effectiveness of each approach relative to the importance of the data to be collected. A good guiding principle in this process is to recognize what Chambers has termed as "optimal ignorance" and "appropriate imprecision" (1987). These terms suggest that some things are simply not worth knowing, and for those that are it's not always necessary to achieve such a high degree of accuracy.

Over the last 15 to 20 years there has been a substantial amount written about the issue of woodfuel production and use in developing countries of the world. The major themes in the literature, and relative assessments of the issues of most importance, have undergone significant change during this time. Earlier forecasts of woodfuel "gaps" between supply and demand, and hundreds of thousands of households over large areas unable to find fuel to cook with, have given way to more balanced discussions of highly localized shortages, inequity in access to biomass resources, and the dynamics of rapid change on both the supply- and demand-side of woodfuel systems. Although much has been written, it is still widely acknowledged that there is a dearth of reliable information available on the actual workings of woodfuel systems at a more local level (such as provinces, states, districts, cities or villages). Noticeably hard to find are comprehensive studies of local commercial woodfuel trading networks, or woodfuel flow studies. And yet these are exactly the types of studies needed most in order to meet the simultaneous objectives of assessing the impact of woodfuel production and use on local environments and economies, and for designing policies and projects to ensure that local woodfuel demands are met in a sustainable manner. Locally-relevant woodfuel flow studies need not be costly undertakings, and in most cases can be carried out by researchers based in the area under study.

In Asia, the FAO-Regional Wood Energy Development Programme is playing an essential role by encouraging and facilitating the conduct of research into woodfuel systems in the region, and making the findings of these efforts available to policy-makers and a wider audience. In this report, we have attempted to highlight the most important findings of our research into the commercial woodfuel system in the Province of Cebu, and based on that present some issues which we hope will impact on how the local woodfuel trade is perceived and regulated in the province. We also hope that our research can serve as something of a guide to others interested in conducting similar studies, although as pointed out numerous times already, the actual approaches taken in any study should be tailored to conditions specific to each case. This appendix gives a brief description of how we approached the study of the woodfuel trade in Cebu, a more thorough description can be found in a separate paper by Remedio (1993). Appendix B outlines the survey instruments we used in each phase of the study, and actual copies of these questionnaires can be requested from Bensel at the address provided in the front of this report. In addition, prospective researchers should also consider reviewing the literature on woodfuel production and use in developing countries in order to obtain background and specific information on woodfuel systems and methods available to study them. Though only partial, the following is a listing of some papers and books that this study team found of use.[15]

Other case studies of urban and rural household energy use in developing countries illustrate both the wide variation in woodfuel use patterns between regions as well as the number of potential approaches available for studying this subject. Written reports on this topic that we are aware of include Alam et al. 1985a; Alam et al. 1985b; Macauley et al. 1989; Hyman 1985; Prior 1986; Tibesar and White 1990; Soussan 1990; Fitzgerald et al. 1990; Cline-Cole et al. 1990a; Wijesinghe 1984; Hosier 1985; Barnes et al. 1984. In addition, the World Bank Energy Sector

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[15] Many of the papers cited throughout this report are available from the FAO-RWEDP library upon request.

Management Assistance Program (ESMAP) has published reports of household energy studies conducted in Indonesia (1990), Senegal (1989b), and Yemen (1991) among others, and are preparing results from recent studies done in the Philippines and Pakistan. A discussion of the broader issues of residential energy use in developing countries can be found in Soussan et al. 1990; Sathaye and Meyers 1985; Leach 1988; Leach and Mearns 1988; Sathaye and Tyler 1991; Leitman 1991; Mercer and Soussan 1992; Munslow et al. 1988. Further suggestions on how to actually design a residential sector energy survey can be found in Hyman 1983b; Leitman 1988; FAO 1983. Finally, the most comprehensive review of the health effects of residential sector woodfuel use is Smith 1987.

Studies of woodfuel consumption in the commercial sector include Hyman 1984; Hosier 1988a; Bawagan 1989; BEST 1988; Chomcharn 1993. Further discussion of woodfuel use in commercial establishments can be found in the proceedings of an FAO-RWEDP conference on the subject (FAO 1990).

Reports of the functioning of commercial woodfuel markets are somewhat more difficult to locate than household energy studies. A few of the published accounts that we are aware of that address how these markets operate include Hyman 1983a; Panya 1993; Soussan 1991; Stevenson 1989; Cline-Cole et al. 1990a. A broader discussion of the functioning of woodfuel markets in Africa can be found in Leach and Mearns 1988; Munslow et al. 1988. Excellent examples of how RRA methods can be used to study commercial woodfuel flows can be found in an RWEDP publication with papers from Nepal (Balla et al. 1991), the Philippines (Cruz et al. 1991), Indonesia (Hadikusumah et al. 1991), and Thailand (Polthanee et al. 1991).

In terms of accurate and site-specific reports of woodfuel supply potential, even less is written. Information on specific approaches to studying the issue of woodfuel supply systems in a particular area can be found in Soussan et al. 1991; Ravindranath et al. 1991; Archer 1993; Bradley 1988; FAO 1983; Fox 1990; Hosier 1988b. Once again, a broad discussion of some of the issues surrounding woodfuel supply and the environment can be found in Mercer and Soussan 1992; Dewees 1989; Hall 1991; Leach and Mearns 1988; Gregersen et al. 1989.

Researchers interested in conducting rapid appraisal studies of rural woodfuel systems or other subjects should consult the papers contained in the Proceedings of the 1985 International Conference on RRA held in Khon Kaen, Thailand (Khon Kaen University 1987). Additional reading on this subject and on woodfuel-related surveys in general can be found in FAO 1983. For those intending to conduct more formal surveys using probabilistic sampling approaches, any number of texts on social science survey methods can be consulted for information on the relative merits of different approaches. Finally, and especially valuable reference document already cited a number of times above is Leach and Gowen 1987.

APPENDIX B: SURVEY INSTRUMENTS[16]

B.1 Household Energy Questionnaire

Section A: Respondent Qualification/Enumerator Information

A.1 Does the respondent make most of the fuel purchase decisions for the household?
A.2 Does the respondent do most of the household cooking?
A.3 Is the respondent aware of the types and amounts of fuels used in the household?
A.4 Names of enumerators.
A.5 Date of Interview.
A.6 Time begun and time finished.

Section B: Respondent Information

B.1/B.2/B.3 Name/Sex/Age of respondent.
B.4 Highest level of education achieved by respondent?
B.5 Primary occupation of respondent?
B.6 Respondent/Household address.

Section C: Household Information

C.1 Names of household members (list).
C.2 Ages of household members (list).
C.3 Sex of each household member (list).
C.4 Primary occupation of household members (list).
C.5 Monthly income from each primary occupation (list).
C.6 Secondary occupation of household members (list).
C.7 Monthly income from each secondary occupation (list).
C.8 Other sources of income (pensions, remittances from abroad, etc.) for each household member (list).
C.9 How long has the household been residing in Cebu City?
C.10 Place of residence before moving to Cebu City (if applicable)?

Section D: Housing Information

D.1 Status of the dwelling (owned, rented, etc.).
D.2 If rented, what is monthly rent?
D.3 If owned, can respondent estimate imputed monthly rent?
D.4 Is the residence used only as living quarters, or as living quarters and work area?
D.5 If applicable, what kind of work is done on the premises?
D.6 Type of dwelling (single family home, duplex, apartment, etc.).

[16] Copies of the questionnaires used in this study can be requested from T. Bensel at the address listed in the front of this report.

D.7 How many rooms in the residence?
D.8 Is the place of meal preparation within the house, separate from the house, or both?

Section E: Fuelwood Usage

E.1 Does the household use fuelwood? (If yes, skip to E.5, if no, answer E.2-E.4 and go to Section F)
E.2 If no, what are your reason(s) for not using fuelwood? (open-ended)
E.3 Are any of the following also a reason for your decision not to use fuelwood? (list of pre-coded options)
E.4 Of the above reasons for not using fuelwood, what is the most important reason of all?
E.5 Does the household purchase fuelwood from a store or market?
E.6 How many times a week does the household purchase fuelwood?
E.7 What amount is usually purchased each time?
E.8 How far is the place of purchase from your residence?
E.9 Does the household have fuelwood delivered to it?
E.10 How many times a month is fuelwood delivered?
E.11 How much is usually delivered each time?
E.12 Who delivers fuelwood to the household?
E.13 Does the household collect its own fuelwood?
E.14 How many times a month do you collect fuelwood?
E.15 How much wood is usually collected each time?
E.16 Where is the wood usually collected from (own land, neighbor's land, garbage dump, riverbank, etc.)?
E.17 Which members of the household are usually responsible for collecting fuelwood?
E.18 Does the household use coconut fronds?
E.19 What share of overall household fuelwood use is in the form of coconut fronds?
E.20 Does the household use scrap wood/construction waste?
E.21 Where do you get the scrap wood from?
E.22 What share of overall household fuelwood use is in the form of scrap wood?
E.23 What share, if any, of overall household fuelwood use is for the preparation of animal feeds?
E.24 What share, if any, of overall household fuelwood use is for commercial activities?
E.25 Why do you use fuelwood? (open-ended)
E.26 Are any of the following also a reason for your decision to use fuelwood? (list of pre-coded options)
E.27 Of the above reasons for using fuelwood, what is the most important reason of all?
E.28/E.29/E.30 Do you plan on continuing to use fuelwood for the next one/three/five years?
E.31 Would you like to stop using fuelwood?
E.32 Why do you want to stop using fuelwood?
E.33 What is preventing you from discontinuing your use of fuelwood?
E.34 What was the price you paid for fuelwood the last time you purchased it?
E.35 Have you noticed any fluctuations or changes in the price of fuelwood during the past year?
E.36 Please explain these fluctuations or changes?
E.37 How much wood does your household usually consume in one day? (for E.34 and E.37 actual weighings are conducted)

- E.38 Are there times of the year or special occasions when your use of fuelwood increases or decreases substantially?
- E.39 What are those occasions and how does it affect fuelwood use (increase or decrease)?
- E.40 Do you think there are enough wood/trees in Cebu to meet woodfuel demand for the next 5 years?
- E.41 Do you think there are enough wood/trees in Cebu to meet woodfuel demand for the next 10 years?

Section F: Coconut Shell/Husk Usage

- F.1 Does the household use coco shells/husks? (If yes, skip to F.5, if no answer F.2-F.4 and go to Sec. G)
- F.2 What are your reason(s) for not using coconut shells/husks? (open-ended)
- F.3 Are any of the following also a reason for your decision not to use coco shells/husks? (pre-coded)
- F.4 Of the above reasons for not using coconut shells/husks, what is the most important reason?
- F.5 Does the household purchase coconut shells/husks from a store or market?
- F.6 Does the household have coconut shells/husks delivered to it?
- F.7 Does the household collect its own coconut shells/husks?
- F.8 What share, if any, of total household usage of coconut shells/husks is for preparation of animal feeds?
- F.9 What share, if any, of total household usage of coconut shells/husks is for commercial activities?
- F.10 Why do you use coconut shells/husks?
- F.11 What quantity of coconut shells/husks does your household usually consume in one day/week?

Section G: Charcoal Usage

- G.1 Does the household use charcoal? (If yes, skip to G.5, if no, answer G.2-G.4 and go to Section H)
- G.2 If no, what are your reason(s) for not using charcoal? (open-ended)
- G.3 Are any of the following also a reason for your decision not to use charcoal? (list of pre-coded options)
- G.4 Of the above reasons for not using charcoal, what is the most important reason of all?
- G.5 Does the household purchase charcoal from a store or market?
- G.6 How many times a week does the household purchase charcoal?
- G.7 What amount is usually purchased each time?
- G.8 How far is the place of purchase from your residence?
- G.9 Does the household have charcoal delivered to it?
- G.10 How many times a month is charcoal delivered?
- G.11 How much is usually delivered each time?
- G.12 Who delivers charcoal to the household?
- G.13 What share, if any, of overall household charcoal use is for the preparation of animal feeds?
- G.14 What share, if any, of overall household charcoal use is for commercial activities?

G.15 What was the price you paid for charcoal the last time you purchased it?
G.16 Have you noticed any fluctuations or changes in the price of charcoal during the past year?
G.17 Please explain these fluctuations or changes?
G.18 How much charcoal does your household usually consume in one week?
G.19 Are there times of the year or special occasions when your use of charcoal increases or decreases substantially?
G.20 What are those occasions and how does it affect charcoal use (increase or decrease)?
G.21 Do you use charcoal only for ironing, only for cooking, or some combination of the two?(If a combination provide an estimate of approximate usage for each)
G.22 Why do you use charcoal for cooking?

Section H: Electricity Usage

H.1 Does the household use electricity? (If yes, skip to H.5, if no, answer H.2-H.4 and go to Section J)
H.2 If no, what are your reason(s) for not using electricity? (open-ended)
H.3 Are any of the following also a reason for your decision not to use electricity? (pre-coded options)
H.4 Of the above reasons for not using electricity, what is the most important reason of all?
H.5 Do you receive electricity from a utility, a neighbor, a generator?
H.6 Do you use electricity for cooking?
H.7 If yes, which of the following electric cooking appliances do you use and what is frequency of use?
H.8 Why do you cook with electricity?
H.9 Do you use electricity for lighting?
H.10 How many of each type of electric lamps (fluorescent, incandescent) are used in the home?
H.11 Do you use electricity for other appliances?
H.12 Which of the following elec. appliances is used in the home and how many of each? (pre-coded list)
H.13 Do you use electricity for commercial activities?
H.14 Which appliances are used for commercial activities?
H.15 Can you estimate monthly electric charges for the household?

Section J (no Section I to avoid encoding errors): LPG Usage

J.1 Does the household use LPG? (If yes, skip to J.5, if no, answer J.2-J.4 and go to Section K)
J.2 If no, what are your reason(s) for not using LPG? (open-ended)
J.3 Are any of the following also a reason for your decision not to use LPG? (pre-coded options)
J.4 Of the above reasons for not using LPG, what is the most important reason of all?
J.5 Is LPG used for cooking?
J.6 Why do you cook with LPG?
J.7 How frequently do you cook with your LPG cooking device?
J.8 Do you use LPG for commercial activities?

J.9 Besides cooking, are there any other uses for LPG in the household (e.g. lighting)?
J.10 What size containers do you purchase LPG in?
J.11 How frequently do you usually need to refill these containers?
J.12 How much do you pay per container?
J.13 Do you pick up the LPG yourself or is it delivered?
J.14 If picked up, how far is the place of purchase from your residence?

Section K: Kerosene Usage

K.1 Does the household use kerosene? (If yes, skip to K.5, if no, answer K.2-K.4 and go to Section L)
K.2 If no, what are your reason(s) for not using kerosene? (open-ended)
K.3 Are any of the following also a reason for your decision not to use kerosene? (pre-coded options)
K.4 Of the above reasons for not using kerosene, what is the most important reason of all?
K.5 Is kerosene used for cooking?
K.6 What type of kerosene stove do you use (e.g. gravity-feed, pressure, wick-type)?
K.7 Why do you use kerosene for cooking?
K.8 How frequently do you cook with your kerosene stove?
K.9 Do you use kerosene for lighting?
K.10 How many of each type of kerosene lamp do you use?
K.11 Do you use kerosene for commercial activities?
K.12 Besides cooking and lighting are there any other uses for kerosene in the home (e.g. fire starter)?
K.13 What size containers do you usually purchase kerosene in?
K.14 How frequently do you have to refill these containers?
K.15 What is the price per container?
K.16 How far is the place of purchase from your residence?

Section L: Other Fuel Usage

L.1 Does the household use any other fuels (e.g. sawdust, corn cobs, wood shavings, etc.)?
L.2 Please list the other fuels used, modes of procurement, and prices paid?
L.3 What are these used for and how much is consumed?

Section M: Household Cooking Practices

M.1 What types of stoves does the household keep on the premises?
M.2 Which stove does the household use the most?
M.3 If applicable, how much did your wood stove cost?
M.4 How frequently do you utilize your wood stove?
M.5 If applicable, how much did your charcoal stove cost?
M.6 How frequently do you utilize your charcoal stove?
M.7 If applicable, how much did your kerosene stove cost?
M.8 How frequently do you utilize your kerosene stove?
M.9 If applicable, how much did your LPG stove cost?
M.10 How frequently do you utilize your LPG stove?
M.11 If applicable, how much did your electric stove cost?

- M.12 How frequently do you utilize your electric stove?
- M.13 If applicable, how much did your “other” stove cost?
- M.14 How frequently do you utilize your “other” stove?
- M.15 How many times a day does the household usually cook meals?
- M.16 On the average, how often does the household purchase cooked prepared off the premises?
- M.17 On the average, how often do household members eat meals out at *carenderias* and eateries?
- M.18 Does the household boil its drinking water?
- M.19 What stove is usually used for boiling drinking water?
- M.20 Does the household boil water for bathing?
- M.21 What stove is usually used for boiling water for bathing?
- M.22 Has the household changed its primary cooking fuel during the last five years? (excluding temporary switches of short duration due to stove problems or lack of supply)
- M.23 From which fuel to which fuel did you switch (list all switches)?
- M.24 What was the reason(s) for each switch?
- M.25 Ignoring prices, costs of stoves, and whether the fuel is available or not, which fuel do you think is best for cooking?

Section N: Conclusion

- N.1 For the purpose of our survey, we need to have a rough estimate of the income of your family from all sources. In which of these groups (display flash card) did your total family income fall for an average month in the past year? (Used to cross-check figures reported for C.5, C.7 and C.8)
- N.2 (For enumerator) How would you rate the respondent's degree of cooperation?
- N.3 (For enumerator) How would you rate the accuracy/validity of their responses?
- N.4 (For enumerator) If another survey were to be done would this be a good household to interview?

B.2 Commercial Establishment Energy-Use Questionnaire

Section A: Background Information

- A.1 Type of business and brief description.
- A.2 Ownership structure of business.
- A.3 Number of years in business.
- A.4 Number of branches or outlets.
- A.5 Number of employees, salary/payment arrangements and work status.
- A.6 Does the business experience much seasonality in production/sales?

Section B: Energy Use

- B.1 Does the business use any kind of fuelwood in its operations?
- B.2 If yes, how are supplies typically obtained?
- B.3 What is the amount and frequency of usual purchases?

B.4 What is the price per unit? (includes actual weighing if possible)
B.5 Give a brief description of how fuelwood is used by the business including types of devices used and products being produced with the use of these fuels.
B.6 Does the business use charcoal in its operations?
B.7 What is the amount and frequency of usual purchases?
B.8 What is the price per unit? (includes actual weighing if possible)
B.9 Give a brief description of how charcoal is used by the business including types of devices used and products being produced with the use of this fuel.
B.10 Does the business use electricity in its operations?
B.11 What are the primary end-uses of electricity?
B.12 What is monthly electricity charges?
B.13 Does the business use LPG in its operations?
B.14 What are the end-uses of this fuel?
B.15 Frequency and amount usually purchased?
B.16 Does the business use kerosene in its operations?
B.17 What are the end-uses of this fuel?
B.18 Frequency and amount usually purchased?

Section C: Conclusion

C.1 Provide reasons for the fuel-choice decisions discussed above?
C.2 Does the business intend to continue using the same fuels as listed above or does it intend to change?

B.3 Urban Woodfuel Trader Questionnaire

Section A: Description of Proprietorship

A.1 Address/location of proprietorship.
A.2 Physical description of establishment.
A.3 Nature of business including types of commodities being sold.

Section B: Proprietor (Respondent) and Business Information

B.1/B.2/B.3 Name/Age/Sex of respondent.
B.4 Educational attainment of respondent.
B.5 What is the ownership structure of the business and where does respondent fit in?
B.6 What is the primary occupation of the respondent and/or the owner?
B.7 What other family members are involved in the business and on what basis?
B.8 How long has the proprietor and/or respondent been living in Cebu City?
B.9 How long has the proprietor and/or respondent been engaged in the woodfuel business?
B.10 How did the proprietor and/or respondent get into the woodfuel business?
B.11 How long does the proprietor and/or respondent intend to stay in the business and why?

Section C: Sales Patterns

C.1 Does the respondent notice any seasonality to sales? If yes, explain.
C.2 Does the respondent have customers that only purchase woodfuels on special occasions but that otherwise they do not see?
C.3 Have there been any events in the recent past that have affected sales markedly? If yes, explain.
C.4 What are some "average" sales volumes for the establishment on a daily/weekly/monthly basis? How widely do these sales volumes fluctuate during the periods mentioned in C.1 and C.3?
C.5 What is the amount of stock on hand at present? Is this approximately the usual level? How widely do stocks kept on hand fluctuate?
C.6 Who are the regular customers of this establishment? Approximately how many of each and what are the volumes purchased by each sector as a percentage of total sales?
C.7 If the establishment sells to commercial/industrial users what are the names and locations of these businesses?
C.8 If the establishment sells to households what are some of the typical purchase patterns encountered?
C.9 Is the number of household customers and the volume they purchase increasing, decreasing or staying the same? What about commercial/industrial users? Why?
C.10 If charcoal is sold, who are the main buyers and what are the end-uses for this charcoal?
C.11 If the business sells woodfuel stoves what are the prices and characteristics of these?
C.12 (For enumerator) Would you classify the sales patterns of this business as mostly wholesale, mostly retail, or some combination?

Section D: Supply Patterns

D.1 What areas of the city and/or province are supplies being sourced from?
D.2 What is the approximate percentage of wood and charcoal originating from each area if more than one?
D.3 How are supplies usually delivered?
D.4 To what extent are supplies being sourced from *within* the city (e.g. from other traders)?
D.5 Can the respondent give names and approximate locations of their main suppliers?
D.6 How regular are deliveries and on what days of the week or hour of the day do they usually take place?
D.7 Do suppliers always deliver a regular amount or do traders "order" certain amounts?
D.8 Do suppliers sell on a cash basis only?
D.9 How long-term are relations between suppliers and the trader?
D.10 Does the trader know anything about how their suppliers obtain their stocks in the rural areas?
D.11 Does the respondent perceive any changes in the usual supply areas over the years, or do woodfuels still originate from the same areas as before?
D.12 Does the respondent perceive any changes in the ease of obtaining supplies over the years? If yes, explain when and how things changed.
D.13 Have there been any events in the recent past that have affected supply markedly? Any noticeable gluts or shortages?
D.14 Is there any seasonality to supply in terms of quantities, quality, prices, etc.? If yes, explain.

D.15 Does the respondent have any knowledge of the types of lands from which the woodfuels they sell originate?
D.16 Does the respondent have any opinion on whether urban woodfuel use has any environmental impact on rural areas? If yes, how will this affect future supplies?

Section E: Transportation Patterns

E.1 What is the usual mode of transport used in getting woodfuels to the trader?
E.2 How frequently are supplies delivered and what are the usual quantities delivered?
E.3 How would the respondent describe the type, size, and condition of the delivering vehicle?
E.4 Can the respondent estimate the maximum loads of the vehicles used?
E.5 Who shoulders the transportation expenses?
E.6 Are woodfuels delivered from the trader to other traders and/or customers within the city? If yes, what are the transportation modes used, who pays for these, and how much do they carry?

Section F: Fuel Characteristics

F.1 Can the respondent give an approximate breakdown of their sales on the basis of fuelwood "types" (e.g. coconut fronds, *primary fuelwood*, split bamboo)?
F.2 For *primary* fuelwood can the respondent give an approximate breakdown of the species being sold?
F.3 Are there any sales of "unusual" or "special" types of woodfuels (e.g. mangrove wood, molave)? Are there specific customers that have a preference for certain types of woodfuels?
F.4 Does the respondent use any particular terminology to distinguish between the different types and sizes of fuelwood bundles, sacks of charcoal, etc.?
F.5 Has the respondent perceived any changes in the quality of woodfuels over the years?
F.6 Has the respondent perceived any changes in the quality of woodfuels during different seasons?
F.7 Can the respondent estimate the percentage of a sack of charcoal that ends up as fines? Are there any uses for these fines?
F.8 (For enumerator) Weighings should be conducted of a sample of stocks on hand and recorded in conjunction with prices and other characteristics of the sample including sizes, species and general condition.

Section G: Pricing Patterns

G.1 Can the respondent give a historical recollection of woodfuel prices in relation to the fuels being sold?
G.2 What were the prices paid for stocks currently on hand? What prices are being charged?
G.3 Is there a "system" for price mark-ups, or do these vary based on customer, types of fuels sold, etc.?
G.4 Do prices vary based on quantities purchased, are there discounts for large purchases?
G.5 To what extent does the trader practice break of bulk, or re-packing and re-bundling of stocks?

- G.6 If they do practice break of bulk then how is this done? What are the relative price differences before and after? Are there any “tricks” to re-packing or re-bundling woodfuels?
- G.7 Has the respondent perceived any fluctuation in prices of woodfuels in response to changes for conventional fuels such as LPG and kerosene?
- G.8 Has the respondent perceived any seasonal fluctuation in the prices they pay and charge?

Section H: Operating Patterns/Costs

- H.1 What is the number of people working in the establishment and on what basis? How much are they paid? What do they do? How are they related to the respondent/owner?
- H.2 Does the business own, rent or squat on the land they are operating from? If rented, what is monthly rent? If owned, can the respondent estimate imputed monthly rental value?
- H.3 Does the establishment have to pay taxes or fees to the city government or others in order to operate?
- H.4 Are permits required from other entities like the DENR? Has the trader ever experienced any harassment from officials of any government agency?
- H.5 Are all of the stocks of wood and charcoal stored on the premises, or are there other storage areas? If yes, where are these and how much do they cost?
- H.6 Is there much loss of stock due to theft? Wastage? Other losses?
- H.7 If the establishment practices break of bulk, how much labor and material are put into this effort?
- H.8 What are the usual hours and days of operation and are they in business year-round?
- H.9 Is there a need for drying of wood at their stage or is wood delivered ready to be sold?
- H.10 Are there any other costs associated with the trade not covered above (e.g. purchases of tools, sacks for charcoal, etc.)?
- H.11 Where did the capital used to start the business come from?
- H.12 What percentage of the respondent's income comes from woodfuel sales as opposed to sales of other commodities or other occupations?

Section I: Conclusion/Miscellaneous Questions

- I.1 Can the respondent provide us with any information on other woodfuel dealers in their area, or the existence of a *tabo* or irregular market where woodfuels are sold?
- I.2 How intense does the respondent feel the competition is between traders and has this changed much over the years?
- I.3 Could the respondent give us an estimate of the average monthly income they derive from the sale of woodfuels (net)?
- I.4 Would the respondent be agreeable to regular monitoring of prices and weights of their supplies by staff members of the USC-ANEC in the future?

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