



## Developing the fuelwood economy of Papua New Guinea



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### ABSTRACT

This paper describes the fuelwood economy of Papua New Guinea (PNG) based on a survey of domestic users ( $n = 3994$ ), commercial and industrial users ( $n = 66$ ) and fuelwood vendors ( $n = 157$ ). The survey period (2009) covered urban and rural, coastal and highland districts of known fuelwood-stress. The survey region represents 11% of the national population. It reveals that the fuelwood economy has a relatively flat structure with a very short and direct supply chain. Fuelwood is regularly or occasionally used by 85% of the population for domestic and commercial cooking, even in urban areas where there is good access to electricity and other energy sources. Proportions of the population selling fuelwood at some time in the survey period were 3% and 10% of urban and rural populations respectively. Those generating an income using fuelwood were 26% and 58% respectively. Fuelwood consumption is estimated to be  $1.8 \text{ m}^3/\text{person}/\text{year}$  which is 6 times greater than the average of south and south-east Asian countries. It is estimated that 2.08 million  $\text{m}^3/\text{y}$  of fuelwood is freely collected for domestic use in the survey region, while the amount traded was USD7.14 million. The survey provides details of regional variations in fuelwood consumption, gender relations, income generation, and conflict associated with fuelwood, tree planting activity and attitudes to the need for woodlots. It describes and quantifies fuelwood flows from various sources to users and argues the point that the impact of fuelwood collection on forests is only localised. The fuelwood economy is largely informal with no public engagement in supply, marketing, distribution, pricing, and taxation. This paper argues the case for a national fuelwood policy which will encourage the private sector to invest in fuelwood trade and create economies of scale while still protecting smaller informal actors.

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### Introduction

Papua New Guinea (PNG) is a country with great potential for economic and social development based on its natural resources. Its export income of approximately USD 4.8 billion/y is largely generated from mineral wealth (75%) followed by agriculture (19%), forest extraction (4%) and marine products (2%) (PNG, 2014). Yet the average annual income of the waged population is USD 4244/y and the minimum wage is only USD40/week (USDS, 2013). The vast majority of the population do not benefit directly in terms of employment in these sectors and about 85% still live in rural areas and depend on customary land for their livelihoods (Vegter, 2005). While many people have access to land for farming and growing trees for profit, these sectors are poorly developed resulting in under employment for much of the population.

There is a need to improve the livelihood opportunities based on the forest and land resources available to rural people. Fuelwood is the primary energy source for cooking and heating especially in the highlands where over 40% of the population lives (Allen et al., 2001). It is a crucial component of the domestic energy market; it is also a very easy market to enter as a small business. While alternative energy sources are

available (electricity, kerosene, gas) they are not universally available and affordable. Fuelwood will continue to play a major role in the domestic energy economy of PNG for the foreseeable future. Apart from an unsuccessful attempt to establish the common use charcoal stoves in the 1980s (Harris, 1979; Gamser and Harwood, 1982; Gamser and Harwood, 1983) there has been no attempt to develop the fuelwood-based energy sector in PNG.

While there have been comprehensive studies of fuelwood flows and markets of 16 Asian nations under the Regional Wood Energy Development Programme of the FAO in the 1990s (FAO, 1997; FAO-RWEDP, 1999), there have been few attempts to understand the fuelwood economy of PNG. Such attempts have been as part of a broad national economic analysis (e.g. World Bank Poverty Assessment Program cited in (Bourke, 1997)), FAO assessment (Brown, 1997), regional analysis of livelihoods (Hanson et al., 2001), or a small focussed studies on urban household energy use (Gamser, 1980) or rural household fuelwood use (Murphy, 2006).

The casual visitor to PNG might be forgiven for believing that there is an abundance of fuelwood naturally available. 72% of the country is under forest or other wooded land. There are approximately 4.5 ha of forest for each person in PNG, and about 97% of land in PNG is under customary tenure (FAO, 2010). However the population is not evenly distributed across the landscape. There are large aggregations around

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Port Moresby and Lae, and the 40% of the population in the highland provinces are largely clustered in the cleared valleys. The fact that fuelwood vendors are a common feature of urban and rural market places indicate that many people do not have access to these trees for fuel. Even that fuelwood that is collected for “free” is a diminishing and highly contested resource (Murphy, 2006).

PNG has the problem of many resource-rich developing countries; a two-tiered economy where a small proportion of the population benefits from the extractive industries (mining and forestry), plantation industries and the public sector that is supported by them, while the majority have few opportunities at income generation beyond cash cropping and opportunistic service sector (e.g. market place hot food vending). Hanson et al. (2001) estimated that about 10% of the population also engage in selling fuelwood at some time and that it is a relatively easy market to move into. Apart from sawmill-offcuts there is no fuelwood available from forest logging or plantations. The market appears to be entirely informal and based on collected wood; i.e. not specifically purpose-grown. It is proposed that the fuelwood sector can be developed with more efficient, value-adding supply chains that provide livelihoods for small entrepreneurs. Much more knowledge about this sector is required to test this proposition.

Therefore, the aim of this paper is to present a quantified description of the fuelwood economy of PNG, with a view to understanding the potential for developing a sustainable domestic energy market that provides livelihood opportunities for a broad section of the population. This description is based on analysis of results of a large survey of domestic and commercial fuelwood users, fuelwood vendors and other stakeholders in the fuelwood sector.

The survey was undertaken in 2009 and focussed on regions that were known to be fuelwood-stressed; i.e. where there are strong fuelwood markets and where it is known to be conflict arising from competition for gathered wood. While fuelwood is used across the whole nation, in both urban and rural settings, the main rural districts where it is recognised as a significant part of the local economy are found in the highland provinces of Chimbu, Enga and the Eastern, Western and Southern Highlands. Many of these districts have been assessed to be under significant agricultural pressure and overall relative social disadvantage (Hanson et al., 2001).

The survey had 3 components: a large questionnaire survey of domestic users and vendors, a case-study monitoring activity; and semi-structured interviews of industrial and commercial operations using fuelwood and other fuelwood stakeholders. The complete results of the survey can be found in Nuberg (2013b).

## Method

A set of three questionnaire surveys were undertaken over two periods October–December 2008 and March–May 2009 of 2673 domestic urban users of fuelwood, 1321 domestic rural users and 157 fuelwood vendors. In addition the fuelwood use of 36 urban and rural case study households was monitored over a 2-week period and semi-structured interviews undertaken with 66 commercial and industrial users of fuelwood.

The survey was designed in a facilitated participative process at the PNG Forest Research Institute (FRI) in Lae. The survey design focused on areas where there is known fuelwood stress in PNG. These areas were determined to be the National Capital District (NCD) around Port Moresby, the city of Lae and its rural hinterland, the city of Mt Hagen and the rural areas of Mt Hagen District of the Western Highlands Province, Chuave District in Chimbu and Henganofi District in the Eastern Highlands (Fig. 1). In terms of populations, the provinces from which these districts are selected represent 36% of the national population of 5,190,000 (NSO 2000). The actual districts represent about 10.6% of the national population.

## Questionnaire sampling strategy

The stratification of the survey population was based on information from the most recent national census (NSO, 2000). Within each of the survey districts the appropriate sample size for each Local Level Government unit (LLG) or ward was determined on the basis of relative population. The census unit is the finest level in the census hierarchy and represents entities such as roads, hamlets, villages, compounds, barracks etc. Each of these wards had different numbers of census units. It was not feasible to survey all census units in a district so a further level of sample discrimination was necessary. For each district the key indicator used to segregate census units was “Proportion aged 10 years and over economically active”. This indicator includes both males and females. The distribution of this indicator was separated into three equal thirds. An equal number of census units were randomly selected from each third of this distribution. The selected census units were allocated a sample size and identified on maps to be surveyed. In all, there were 55 sampling strata. Some of these were at the level of LLG/ward some were at the level of census unit.

## Survey data collection and collation

The questionnaire surveys and case-study monitoring were administered by the Foundation for People and Community Development (FPCD), a national NGO with experience in survey work. Six professional FPCD staff were involved and they trained a further 35 interviewers to assist with the questionnaire surveys. The surveys were undertaken in the lingua franca *Tok Pisin* but recorded on survey forms in English. The interviewers worked in pairs for security reasons. They worked on either side of a road and called upon every third dwelling along the road. If no-one was home or declined the survey, the interviewer moved to the next house until a willing interviewee was found. The interviewers continued through the sample stratum like this until the requisite number of interviews were made for that sample stratum.

The Fuelwood Vendors survey was undertaken opportunistically during the second round. Vendors were generally approached as they were encountered on the street in the progress of the user surveys. The interviewers also visited all the known fuelwood markets in each sample stratum.

On completion of each round, the questionnaires were shipped to Adelaide and entered into a database in Microsoft Access 7.

## Questions asked in the survey

The nature of the questions asked are summarised in Table 1. Question 7 in the domestic user's surveys was critical for aggregated estimates of fuelwood consumption. Interviewees were asked to estimate how much fuelwood they had used in the week prior to being interviewed, and the week before that. They were shown a 5 or 10 kg bundle of firewood (or photograph equivalent) and asked how many of these they would have used.

Such re-called information provides ‘guestimates’ at best, so a sub-sample of 36 urban and rural households interviewed in the questionnaire survey was invited to participate in the case-study monitoring exercise. This exercise involved two 1-week periods of direct weighing, and recording of species, of all fuelwood consumed on a daily basis. This survey was undertaken by FPCD staff in April 2009.

The diversity of small commercial and industrial users of fuelwood, and stakeholders in the fuelwood economy, was such that semi-structured interviews were a more appropriate survey tool. The interviews were directed to gather: quantitative information about fuelwood use, in which case physical measurements were sometimes taken; qualitative information about problems and opportunities associated with fuelwood. These interviews were undertaken by FRI staff and included 42 hot-food vendors and bakeries along the Highlands Highway, 11

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