

Contribution of dry forests to rural livelihoods and the national economy in Zambia

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Abstract

This paper analyses the extent to which dry forests contribute to rural livelihoods and the national economy in Zambia. We used case studies drawn from the literature, data collected from a household survey conducted in eight sites in three of the nine provinces, and secondary data from the Central Statistical Office and the Forestry Department. From the analysis, forest products contribute on average 20.6 percent of total household income (subsistence and cash) in the eight sites, and are the second or first ranked source of income in five of the eight sites. There are large differences among poor and not so poor in total household income and in forest income share. Several products contribute significantly to rural livelihoods and the national economy. Most notably, charcoal and firewood provide 70 percent of the country's energy needs. A wide range of wild foods are common in rural diets, providing essential vitamins and minerals; more than ten leafy vegetable species, twenty-five mushroom types and thirty-five edible species of caterpillars. At the national level, forests provide revenue for the government from taxes, fees, royalties and other charges levied on forest-based activities although the relative importance is small given that the majority of forest users extract low-value products mainly for subsistence uses and only a small part of the trade is recorded. From our analysis, we find that forests are recognized to have an important poverty mitigation function but are not a means alone to move most people out of poverty.

Key words: Forests, Caterpillars, rural livelihoods, national economy, Sub-Saharan Africa, Zambia

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1 Introduction

In sub-Saharan Africa, forest goods and services are extremely important for rural livelihoods, providing food, medicine, shelter, fuel and cash income (Kaimowitz, 2003). It is estimated that more than 15 million people in sub-Saharan Africa earn their cash income from forest-related enterprises such as fuelwood and charcoal sales, small-scale saw-milling, commercial hunting and handicraft. In addition, between 200,000 and 300,000 people are directly employed in the commercial timber industry (Oksanen and Mersmann, 2003). For some countries, the forestry sector is an important foreign exchange earner. For example, between 1993 and 2002, the value of net exports of various wood-based products from countries in sub-Saharan Africa amounted to more than US\$2 billion (FAO, 2003). However, the national statistics on the contribution of forest products to the countries' economies are extremely poor (Vincent, 1998; Mabugu and Chitiga, 2002; FAO, 2004). Only in few countries are there comprehensive government programs of environmental accounting where forestry contributions to the national accounts, especially from commercial forest exploitation are captured such as South Africa (FAO, 2004; World Bank, 2006).

Zambia has vast forest resources covering about 42 percent of the total land area (FAO 2005). The country's forests can be classified into three main categories: closed forests in south-western Zambia; dry woodlands of the large valleys; and the extensive miombo woodlands dominated by *Brachystegia* and *Isobertinia* found on the plateaus throughout the rest of the country. These indigenous forests are rich in biodiversity and are home to approximately 5,500 species of flowering plants, 88 species of mosses and 146 species of ferns (GRZ, 1997). About nine percent of the forests in Zambia are gazetted as protected forest areas or local forest reserves, although encroachments in forest reserves are a major problem (GRZ 2006b). The rest of the forests are ungazetted, mainly found on traditional or state land and within municipalities. These ungazetted areas fall under the jurisdiction of the Commissioner of Lands, Municipal Councils or Traditional Rulers. The country has about 50,000 hectares of plantation forests that are being managed by the Zambia Forestry and Forest Industries Corporation (ZAFFICO) in the Copperbelt Province, as well as about 10,000 hectares of local and regional forest plantations in most provinces, established mainly to ensure a continuous supply of raw wood materials to the industrial sector for pulp and paper, furniture and processed wood (GRZ 2006b).

Zambia has approximately 3.5 hectares of forest land available per capita, compared to only 0.2 in Malawi, 1.7 in Zimbabwe and 1.6 in Mozambique (FAO, 2003; 2005). Nevertheless, the annual rates of deforestation in Zambia are tenfold higher (estimated at 851,000 ha/year) compared to most of the other miombo countries with the exception of Malawi (FAO, 2001). These alarmingly high deforestation rates have been partly attributed to macro-level policy changes in the past twenty-five years (Culas, 2006; Holden 1998). The effect of

structural adjustment programmes initiated in 1986 which was followed by a quick and massive closing and privatization of state controlled industries in Zambia resulted in massive retrenchments and large numbers of urban unemployed people returned to the rural areas. Like in other countries in the region, the number of rural households in Zambia has increased rapidly in recent years (FAO, 2003; 2005). In a rural economy based on natural resources, most households depend on forest resources for their livelihood. The economic liberalization has also resulted in the removal of government subsidies for farm inputs such as fertilizers. As a result, most rural households are forced to find alternative sources of income including returning to their traditional shifting cultivation practices (Holden, 1998; Sprague and Oyama, 1998) and selling forest products, charcoal and timber in particular (Chidumayo, 2001; Puustjärvi *et al.* 2005). The Zambian Government has acknowledged deforestation to be the country's major environmental problem, and attributes it mainly to clearing land for agricultural expansion and settlements (GRZ, 2006b). However, both the lack of proper forest management regimes and limited institutional capacity in the Forestry Department have also been identified as important factors underlying the destructive extraction levels (GRZ, 1997; Shitima, 2005).

In general, the forestry sector contributes significantly to both national and rural economy in Zambia. For example, forests are a source of energy in the forms of charcoal and firewood providing 70 percent of the country's energy needs. In addition, a wide range of non-timber forest products such as wild foods, game and caterpillars are common in rural diets, providing essential vitamins and minerals. Many people in rural Zambia are involved in selling forest products such as firewood, timber and non-timber forest products providing an important source of income. At the national level, forests provide revenue for the government from taxes, fees, royalties and other charges levied on forest-based activities

Although the importance of forest goods and services to the national and rural household economies have been documented in literature (Clarke *et al.*, 1996), the statistics are poor and largely based on a few case studies (e.g. Cavendish, 2000; Campbell *et al.* 2002). This paper therefore seeks to examine what role forests play in rural livelihoods, and whether the dry forest resources are important engines for growth and poverty reduction, and the extent to which they provide the subsistence needs of forest users and their role in poverty prevention or avoidance in Zambia. The work draws on a literature review of specific forest products used in Zambia and a sample of households from eight villages in three provinces to determine the relative contribution of forest products to rural households in various agro-ecological and socio-economic settings. The remainder of the paper is organized as follows: in the next section, we lay out the methods. In section 3, we examine some household forest use patterns, using the literature review and survey data, as well as explore the role of the forestry sector in the Zambian economy. The main conclusions are presented in Section 4.

2 Methods

2.1 Review

A literature search and review was undertaken to identify some key products that could be used to illustrate the role of forests and forestry in rural livelihoods. An attempt was also made to document the contribution of forests to the national economy. Unfortunately, there are no comprehensive national datasets for examining the role of forests for subsistence and cash income, but we used case studies and data from the Central Statistics Office (CSO) and the Forestry Department on volumes formally traded and revenues collected by the Government.

2.2 Household survey

2.2.1 Study sites

To gain an overview of the contribution of specific forest products to the rural economy, the main source of data was collected through a household survey conducted in 2005. A total of 435 households were randomly selected in eight villages sampled from four rural districts in three of the nine provinces of Zambia, as shown in Table 1 below. To ensure that the most visible and important forests products are captured and analyzed, we first itemized the key forest products harvested by households in different parts of the country and then selected three of the nine provinces for a detailed study. The villages surveyed in each of the sampled provinces were purposefully selected to capture diversity in the availability of forest products as well as the access to markets. Although, miombo woodlands are dominant in all the study areas, species composition varies according to the level of disturbance of the vegetation and the prevailing land-use systems. Table 1 below presents the sampled provinces, districts and study areas.

Table 1: Study area and sample distribution

Province	District	Study area	Main Selection feature		No. of households interviewed	Percent
			Geographical location	Main forest product		
Northern	Kasama	Paul	Rural, poor market access	Charcoal	80	18.4
		Kalembe Nseluka	Rural, poor market access	Caterpillar	71	16.3
	Mpika	Kopa Main	Rural, good market access	Caterpillars & tubers	73	16.8
		Lwitikila	Rural good market access	Caterpillars & tubers	37	8.5
Copperbelt	Ndola Rural	Katanino area	Peri-urban, good market access	Charcoal & mushrooms	41	9.4
Central	Mumbwa	Lutale	Rural, poor market access	Timber	38	8.7
		Nalusanga	Rural, poor market access	Timber	55	12.6
		Chibuluma	Rural, poor market access	Timber	40	9.2
Total					435	100

In the Northern Province, we surveyed two villages in Kasama, namely Paul Kalembe and Nseluka. The former is an important charcoal producing area whereas the latter was previously important for caterpillar harvesting, but now the caterpillars are scarce due to land-use changes. In the past decade, the customary forestland in Nseluka area was converted into private leaseholds and commercial agriculture expanded rapidly to the detriment of available forest resources. In the same province, two other villages in Chief Kopa's area in Mpika district were sampled, where forests are predominantly on customary land and caterpillar trade is an important source of income for the rural households.

Markets and access to markets influence the value and utilization of forest products for commercial purposes. Therefore, we included households living around the Katanino Local Forest Reserve, which is a more urban province (Copperbelt). These households supply most of the charcoal and mushrooms in the Ndola urban markets. Mumbwa district in Central Province is relatively close to the country's capital, Lusaka, and a lot of land has been converted to agricultural fields. Here, three villages were surveyed (Lutale, Chibuluma, Nalusanga), mainly to capture information on small-scale timber operations (pit-sawing). Because most timber operations were unlicensed and therefore illegal, most respondents were reluctant to disclose production figures. We did, however, collect information enough to permit good statistical analysis. Medicinal plants could not be captured in the survey.

2.2.2 Data collection

A pre-designed questionnaire was used to collect information from respondents on all sources of income, both cash and subsistence in all areas of activity: forestry, subsistence agriculture, cottage industries, formal and informal wage employment, transfers and remittances. Households were randomly selected within each village. The total number of households sampled in each area was determined by the size and spatial distribution of the villages, but the sample size was always large enough for statistical analysis. Undergraduate students from the University of Zambia were recruited and trained as enumerators. They were selected based on their fluency in local languages, and their knowledge and prior experience with research on rural livelihoods.

In addition to face-to-face interviews with local households, we conducted focus group discussions with district forest extension officers and local communities, and a snapshot survey of local forest prices. To obtain information on incomes derived from products that are used throughout the year, respondents were asked how much they harvest per week. Values of products collected or cultivated seasonally are more difficult to capture and respondents were asked how much they had produced during the previous season. The total incomes were calculated using actual market prices in the villages. The surveys conducted are limited by their single household visit (as compared to the PEN methodology – Angelsen *et al.*, in prep), but were deemed suitable given the wide geographic coverage that was desirable.

3 Results and Discussion

3.1 Main forest products collected by rural households

Forests play an important role in rural livelihoods, providing a wide range of products and services for both subsistence use and cash income. Forest-based activities such as carpentry, beekeeping and timber and rattan sales provide more than 50 percent of the average household income, but the types of forest products traded vary between areas (Puustjärvy *et al.* 2005). Mushrooms, fruits, leafy vegetables, tubers and insects collected from miombo woodlands are widely consumed by rural households and enrich their starch-based diets with important vitamins and minerals. These foods are often available at the start of the rainy season and thereby serving as an important gap-filler when food stocks are low (Packham, 1993; Chileshe, 2005). Most forest product harvesting and sale is seasonal, providing cash income at different times of the year. Moreover, whereas collection and trade of high value forest products such as honey and charcoal is controlled by men, mushrooms, fruits, vegetables and insects are considered activities for women and children (Chileshe, 2005). In the following sections, we discuss some specific forest products in more detail, drawing on those for which there are significant sources of data.

3.1.1 Charcoal and firewood

As expected, there is little variation across the study sites in terms of firewood collection, which is mostly done for home consumption. In communities where forests are not heavily degraded, households collect deadwood, whereas where deadwood is scarce, households fell live trees. In these areas, markets for firewood are slowly emerging. The latter may explain why the average percentage of households collecting firewood in our survey (73.3%) is slightly lower than the reported national average of 86.6 percent households using firewood (CSO 2004), though it could also reflect the particular villages we sampled. Our estimates indicated that on the average, a household consumes 100 kg of dry wood per month.

In many areas, charcoal production is an important source of cash income for many households in Zambia. In 1997, the Government estimated that 41,000 rural households were full-time employed in charcoal production and an additional 4,500 people were involved in transportation, marketing and distribution (GRZ, 1997). Few rural households specialize in one full-time activity and it is therefore likely that the total number of households benefiting financially from the charcoal industry is much higher. Many people became charcoal producers during the previous decade, because of decline in the profitability of crop production and lack of capital for farm inputs and machinery. The average per capita income from charcoal production was 4.8 times higher than that from farming (Chidumayo, 2001). Charcoal is a source of cash income for almost half of the households in Katanino, which is near large urban centers such as Ndola and Kitwe (Table 3). In Paul Kalemba, only 10 percent of the households sell charcoal earning on average ZMK1,889,250 (US\$ 423) per annum. In the other study sites, less than 10 percent of households produce charcoal for sale and the farm-gate prices are lower due to the distance to urban markets. About 20 percent of all the households interviewed use charcoal mainly for domestic heating, cooking and baking.

3.1.2 Construction materials and timber

Following wood-fuels, construction materials (i.e. thatching grass and poles) are the most widely used forest products collected by more than 40 percent of the households in all the sites (Table 2). However, these are collected mainly for subsistence (>90%). According to the National Statistics, 68.5 percent of the rural households live in traditional dwellings, which use thatching grass and poles (CSO 2004).

Miombo woodlands are not generally rich in commercial timber species with the exception of a few hardwoods (i.e. *Baikiaea plurijuga*, *Tectona grandis* and *Pterocarpus angolensis*) with stocking rates ranging from 0.5 to 2.0 tons per hectare (GRZ, 1997). Due to the need to pay concession fees, few households in the study sites are involved in pit timber sawing. Lutale is the main commercial

timber production area where 16 percent of the households earn on average ZMK606, 250 (US\$135) per year from timber sales. However, households in Paul Kalemba and Nseluka obtain even higher returns from timber production, thus, ZMK4.5 million (US\$1008) and ZMK1.4 million (US\$314) respectively, though only a few households are involved.

3.1.3 Crafts

Selling reed mats is the most profitable forest-based activity in Nalusanga and Kopa, where households involved in this enterprise earn, on average, between ZMK913,000 (US\$205) and ZMK450,000 (US\$101) per year, respectively, although very few households are involved (Table 3). Similarly, woodcarving may be quite profitable (i.e. in Nseluka and Chibuluma) but it is not practiced on a large scale.

Table 2: Average value of forest products collected per user households in eight villages (Zambian Kwacha¹. Values in brackets are the percentages of user households in the total population)

Forest product	Paul Kalemba (Kasama)	Nseluka (Kasama)	Kopa (Mpika)	Lwitikila (Mpika)	Katanino (Ndola)	Lutale (Mumbwa)	Nalusanga (Mumbwa)	Chibuluma (Mumbwa)
Timber	1,957,500 (4%)	980,000 (4%)	77,813 (11%)	0 c vf	0	565,313 (21%)	562,667 (11%)	145,000 (8%)
Poles	103,654 (49%)	77,063 (34%)	79,107 (58%)	65,906 (43%)	69,250 (59%)	53,109 (84%)	55,134 (75%)	69,362 (73%)
Charcoal	835,890 (25%)	42,000 (15%)	119,813 (38%)	21,375 (11%)	713,045 (54%)	259,286 (37%)	314,500 (18%)	192,000 (13%)
Grass	95,673 (69%)	176,962 (73%)	78,576 (90%)	52,121 (89%)	68,414 (71%)	55,781 (84%)	58,435 (84%)	85,406 (80%)
Mushrooms	56,485 (71%)	93,840 (65%)	38,986 (71%)	19,266 (51%)	135,509 (56%)	14,619 (68%)	16,482 (62%)	13,559 (70%)
Firewood	194,043 (86%)	283,903 (87%)	225,600 (89%)	166,121 (33%)	370,800 (85%)	189,000 (95%)	231,176 (93%)	248,788 (83%)
Tubers	45,540 (26%)	79,380 (14%)	45,190 (51%)	52,500 (76%)	71,360 (15%)	46,240 (63%)	51,985 (60%)	29,593 (58%)
<i>Mumpa</i> caterpillars	721,950 (15%)	45,000 (1%)	144,205 (30%)	136,688 (22%)	54,000 (5%)	0	0	0
<i>Chipumi</i> caterpillars	102,000 (14%)	150,000 (1%)	349,552 (79%)	299,893 (76%)	750,000 (2%)	0	0	0
Other caterpillars	76,075 (29%)	32,676 (28%)	12,460 (4%)	31,500 (5%)	64,960 (7%)	0	12,852 (9%)	17,080 (8%)
Fruits	282,633 (54%)	34,278 (42%)	53,108 (63%)	54,766 (57%)	39,086 (39%)	59,675 (63%)	44,940 (67%)	48,235 (65%)
Woodcarving	14,400 (13%)	75,000 (6%)	11,250 (5%)	24,000 (5%)	93,000 (5%)	43,500 (21%)	24,000 (2%)	58,500 (5%)
Reed	16,500 (4%)	14,625 (6%)	139,500 (8%)	36,750 (16%)	0	0	929,250 (4%)	9,000 (3%)
Honey	73,333 (8%)	200,000 (1%)	82,813 (11%)	62,143 (19%)	204,091 (27%)	415,833 (47%)	216,667 (38%)	292,500 (40%)

¹ US\$1.00 = Zambian Kwacha (ZMK) 4,463 as of 2005

Table 3: Average value of sales of forest products per trading household in eight villages (Zambian Kwacha¹. Values in brackets are the percentages of households trading each product in the total population)

Forest product	Paul Kalembe (Kasama)	Nseluka (Kasama)	Kopa (Mpika)	Lwitikila (Mpika)	Katanino (Ndola)	Lutale (Mumbwa)	Nalusanga (Mumbwa)	Chibuluma (Mumbwa)
Timber	4,500,000 (1%)	1,432,500 (3%)	105,000 (3%)	0	0	606,250 (16%)	600,000 (9%)	300,000 (3%)
Poles	0	0	69,000 (3%)	0	0	61,875 (11%)	237,000 (4%)	52,000 (8%)
Charcoal	1,889,250 (10%)	62,400 (7%)	293,850 (7%)	18,000 (3%)	743,921 (46%)	103,750 (11%)	806,667 (5%)	30,000 (3%)
Grass	80,000 (1%)	20,000 (1%)	66,000 (5%)	40,000 (3%)	60,000 (5%)	32,500 (8%)	85,125 (7%)	16,500 (5%)
Mushroom	166,320 (4%)	38,640 (6%)	47,568 (7%)	19,080 (8%)	300,000 (7%)	3,600 (3%)	0	14,400 (3%)
Firewood	0	0	360,000 (1%)	12,000 (3%)	92,000 (5%)	10,000 (3%)	0	25,000 (3%)
Tubers	54,852 (6%)	33,600 (4%)	99,840 (10%)	51,660 (11%)	168,000 (5%)	79,360 (8%)	7,200 (4%)	14,880 (5%)
<i>Mumpa</i> caterpillars	No data	0	119,040 (21%)	170,400 (8%)	0	0	0	0
<i>Chipumi</i> caterpillars	103,875 (5%)	0	328,429 (58%)	309,522 (62%)	0	0	0	0
Other caterpillars	27,216 (6%)	0	0	42,000 (3%)	78,960 (2%)	0	0	0
Fruits	55,800 (5%)	108,000 (1%)	40,000 (8%)	67,520 (8%)	74,480 (7%)	0	0	0
Woodcarving	0	150,000 (1%)	0	30,000 (3%)	0	41,400 (13%)		105,000 (3%)
Reed	0	18,000 (1%)	450,000 (1%)	22,500 (3%)	0	0	913,500 (4%)	0
Honey	63,333 (4%)	200,000 (1%)	77,917 (8%)	31,250 (5%)	356,000 (12%)	438,462 (34%)	324,750 (18%)	334,889 (23%)

¹ US\$1.00 = Zambian Kwacha (ZMK) 4,463 as of 2005

3.1.4 Honey

Northwestern Province is the main beekeeping area in Zambia with an estimated 70 percent of the country's beekeepers living in this province (ITC/DTCC, 2007). They produce between 90 and 95 percent of locally traded and 100 percent of the exported honey. Nearly all beekeepers are males who use the traditional bark hives suspended from branches high above the ground (Mickels-Kokwe, 2006). There are two main seasons for harvesting honey in Zambia. The flowering of *Brachystergia* species stimulates the flow of honey between October and December across the country. This provides farmers with cash at the start of the planting season to buy agricultural inputs, and pay for school fees. A second honey flow occurs in May-June in areas with an abundance of *Julbernardia* and *Marquesia*. Collecting wild honey or keeping bees is practiced, on average, by about 20 percent of sampled households, with most honey produced in Mumbwa district, where up to half of the households are involved (Table 2). Revenues from honey sales at household level are highest in Mumbwa district and Katanino: between ZMK325, 000 (US\$73) and ZMK450, 000 (US\$101) per year (Table 3). Trading income from the selling of a popular local brew made from honey is very important for households in Nalusangu.

3.1.5 Wild fruits

Wild fruits contribute to food security and nutritional diversity at the household level. More than fifty species bearing edible fruits are found in the miombo woodlands. Farmers often retain and protect high-value indigenous fruit trees in their fields (Akkinnifesi, 2006). Selling of wild fruits is not common in most villages (<10%) due to the long distance to markets and short shelf life of the fruits. Households Nseluka earn on average ZMK108, 000 (US\$24) from selling indigenous fruits (Table 3).

3.1.6 Roots and tubers

The prices offered for tubers in village markets are higher around Kasama and Mpika than in Ndola Rural and Mumbwa. This is mainly due to differences in tuber species preferred and sold by households in these areas. *Chikanda*⁶ is the most commercially valuable tuber preferred by rural households in Kasama and Mpika, while households in Mumbwa prefer *busala* for own consumption and sale in local and district markets.. Because of the high demand and over-exploitation, *chikanda* has been depleted in most wetlands where they occur. As a result, the

⁶ *Chikanda* is a favourite snack prepared from the roots of orchids from *Disa*, *Habenaria* and *Satyrium* genera. The roots are pounded mixed with peanuts and boiled to make a meat-like cake, which is eaten in a sandwich or as a relish with maize, sorghum or cassava (Bingham, 2004)

local and urban price of *chikanda* has increased significantly over the last decade and this trend is expected to continue to increase. Apart from *Chikanda*, roots of various species such as *Rychnosia*, *Eminia* and *Vigna* are harvested to make *munkoyo*⁷, a fermented non-alcoholic beverage (Zulu *et al.*, 1997). The roots are sold fresh or dried, but no specific data was collected on the trade of *munkoyo* in the selected study sites.

3.1.7 Mushrooms

Mushrooms are collected by more than half of households in all sites, but few households sell them (<10%). Approximately 25 different edible mushroom species have been documented in Zambia (Pegler and Pearce, 1980). In Chiulukire local forest, Eastern Province, eleven species are commonly collected during the rainy season (Mutale and Haamukwanza, 2000). Women are responsible for collecting the mushrooms usually when returning from their maize fields. At the rural household level, only a small proportion is consumed fresh. Ninety percent is dried, after which they are wrapped in leaves of *Uapaca kirkiana* and tied with fiber for later use (Mutale and Haamukwanza, 2000). The local trade in mushrooms is common though the volumes and value traded are unknown at the national level. One company in Lusaka packages dried *ubowa* mushrooms for sale in grocery shops and supermarkets. Selling mushrooms is most profitable in Katanino, where they fetch ZMK30, 000 (US\$6.70) per 25 kg bag and households earn on average ZMK300, 000 (US\$67) per season from selling mushrooms. This is likely to be related to the access to urban markets in Ndola and Kitwe.

3.1.8 Edible insects

Different species of insects are consumed in Zambia to provide an important source of protein as well as income (Illgner and Nel, 2000). More than 60 species of insects from at least 15 families and six orders have been reported as food (DeFoliart, 1999). According to Silow (in DeFoliart, 1999) termites (*Macrotermes* species) are considered to be more delicious than the meat of mammals and birds. Caterpillars are rated second best. Nevertheless, the most important edible insects in terms of total consumption and trade are caterpillars belonging to the giant silk moth family *Saturniidae*. The most well known species in the Southern African region is *Gonimbrasia belina*, which is locally known as *mopane* worm. Thirty-one species of edible caterpillars are found in Zambia of which seven are marketed (DeFoliart, 1999). Among the Bisa people in the Northern Province, the majority of people prefer *Gynanisa maja*, locally known as *chipumi* (Mbata *et al.* 2002). It is large, spineless and tasty, and fetches the highest price in the market. In November and December, people collect these caterpillars mostly

⁷ *Munkoyo* is a popular local soft drink, in particular amongst women and children, and also used during traditional ceremonies (Malungo, 2001).

from regenerating woodlands that had previously been cleared and then left to fallow.

Amongst our study sites, caterpillar collection is limited to Kopa and Lwitikila areas, where more than three quarters of the households collect *chipumi* caterpillars (Table 2). The market for these edible insects is very large in all Zambian cities and even extends to Zimbabwe and the Democratic Republic of Congo. In 2000, the farm gate price for one *meda* (or gallon) was more than US\$4 (Mbata *et al.*, 2002). When the bush is rich with caterpillars, harvesters can collect up to 20 liters a day (DeFoliart, 1999). *Chipumi* caterpillars provide cash income for 58 percent and 62 percent of the households in Kopa and Lwitikila, respectively (Table 3). Caterpillars are very seasonal and are only collected in November and December, providing households on average more than ZMK300,000 (US\$67) per season in cash. In the other villages, few or no households collect caterpillars such as *chipumi*. Urban traders travel up to one thousand kilometers to buy caterpillars. In Kasanka National Park, Northern Province, trade in caterpillars has always been a main source of income, and local chiefs receive a handsome share of this revenue, which encourages them to promote caterpillar breeding. Nonetheless, villagers have reported a decrease in availability of these insects during the past decades due to a decline in overall tree cover (Eriksen, 2007). Sometimes trees are cut to facilitate the harvesting of caterpillars, but caterpillars may also provide an incentive for people to regulate bush fires, thereby protecting caterpillars and enhancing woodland regeneration (DeFoliart, 1995).

3.1.9 Medicinal plants

Roots, shoots, leaves and bark of many plants, as well as animal products are used for healing diseases and protective purposes. Plant-derived medicines are used in self-treatment of common ailments, such as coughs, headaches and stomach problems. For more serious diseases, it is common for people to get medical help from traditional healers. Between 30 and 50 plant species are used for medicinal purposes and there is a flourishing market in urban areas, where traditional healers sell both plant extracts and remedies (Puustjärvi *et al.* 2005). On average, a healer can earn a monthly income of US\$147 (Nswana, 1998). In Chiawa chiefdom, a total of 19 different indigenous plant species such as *Strychnos cocculoides*, *Musa* species, *Solanum delagoense*, *Ximenia caffra*, *Diplorhynchus condylocarpon* and *Croton megalobotrys* are used to treat sexually transmitted diseases. All these species were found within easy reach of the villages (Ndubani and Höjer, 1999). No quantitative data on medicinal plant use and trade in Zambia were captured in our survey.

3.1.10 Chitemene agriculture

Miombo woodland provides a crucial environmental service to agriculture in parts of Zambia, through the so-called *chitemene* system. *Chitemene* (meaning to cut) is practiced by the Bemba people of Northern, Central and Luapula Provinces. Burning woody biomass from forests forms the basis of this farming system and is intended to fertilize the acid, nutrient poor soils in the region. Compared to other forms of shifting cultivation, the *chitemene* is unique in several ways. Trees and branches are cut on an area 2-20 times the size of the cultivated garden (Stromgaard, 1985, 1989). These are piled on a central field where they are burnt. This practice may increase soil NH₃-N content by 40-50 percent, as well as increase the content of other major nutrients such as P, K, Ca, Mg and Na (Chidumayo, 1987). Farmers cultivate crops on the ash circles for 3-4 years and then move to a new field.

Although, theoretically there is enough forestland for rotations of sustainable duration, people only use a fraction of the available land. In general; ninety percent of the *chitemene* fields are found within a distance of about 5-6 km from the main roads (Sprague and Oyama, 1998). Due to increasing population pressure, more and smaller trees being felled, less area left to fallow, and less woodland available as a potential source of ash. Sprague and Oyama (1998) argue that *chitemene* is probably less destructive than other forms of shifting cultivation, because often branches rather than whole trees are cut and only a relatively small field is burnt. In the area west of Mpika, Northern Province, the total area under *chitemene* decreased between 1984 and 1992, due to an increase in the use of fertilizers. However, the average distance from *chitemene* fields to roads had increased. This is likely the result of most farmers using bicycles to move to more distant places and select better quality woodlands for clearing (Sprague and Oyama, 1998). Farmers are obviously well aware of the value of these woodlands for crop production. In areas with abundant woodlands, farmers deliberately choose to continue with the traditional *chitemene* rather than the modern, capital intensive fertilizer and hybrid maize technology (Holden, 1993). As agricultural inputs become more expensive, more farmers are returning to cultivating *chitemene* (Holden *et al.*, 1998; Culas, 2003).

3.2 Contribution of forests to the rural household economy

3.2.1 Livelihood income sources in the study areas

The household survey shows the variability in livelihood income sources across the study sites (Figure 1). On average, agriculture production is the main source of income accounting for 45 percent of total household income, followed by forest income (c. 20%) and trading in manufactured products (c. 20%). Income from trading includes the sale of products that households did not themselves collect or cultivate. For example, households producing the traditional honey beer do not

themselves collect or produce honey, but buy it from others. Therefore, this income is captured under trading. Formal and informal wage income together account for nearly 10 percent and the rest comes from remittances, gifts and transfers, including food-for-work programs. Agriculture is the main source of income in six study sites, with petty trading as the most important source of income in one site. Forest income is the first or second most important income source in five of the eight study sites, notably those with high value forest products or good market access. In Katanino, 47.6 percent of total household income is derived from forest products, predominantly charcoal. This is mainly due to the fact that markets for these products are well developed. Similarly, many households in Paul Kalemba depend on charcoal as their main source of income, while caterpillars are a major source of income among households in Lwitikila village. Our results are comparable with those obtained from case studies in some neighboring countries by Cavendish (1999), Campbell *et al.* (2001) and Fisher (2004), who reported forest incomes of about 20 percent of the total household income.

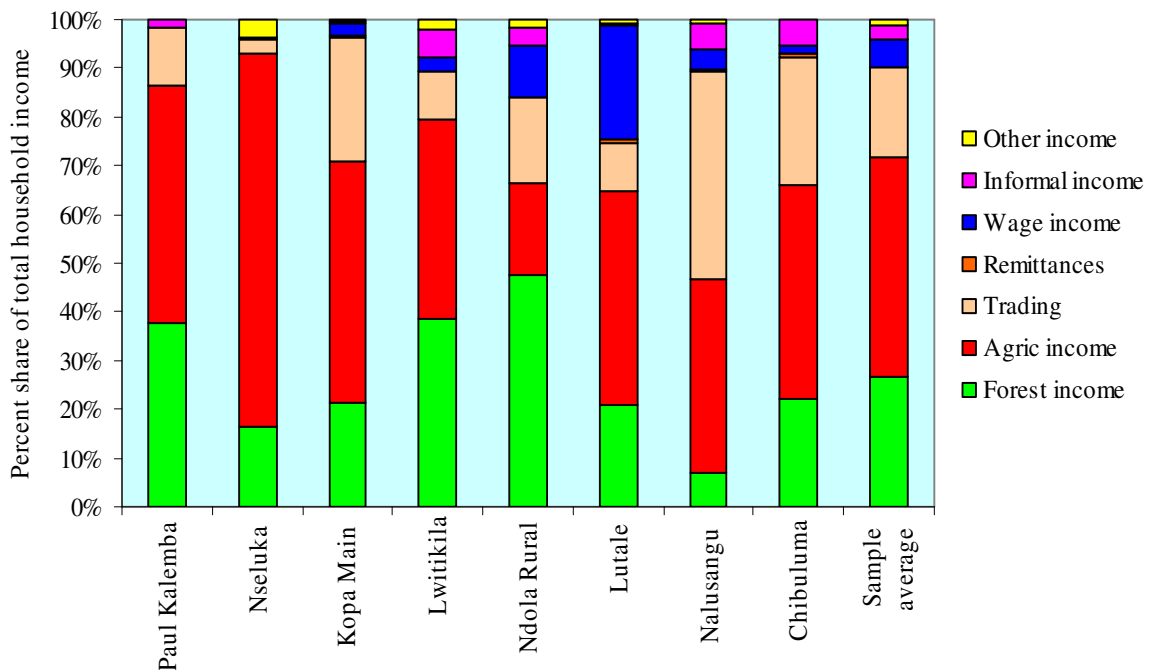


Figure 1: Source of total household income (including cash income and consumption) for eight sites in three provinces of Zambia

3.2.2 Who benefits from dry forests?

Within communities, the value of forest product consumption and trade varies between individual households. Using the survey data, households in each study site were grouped into quartiles depending on their total income per capita. Within these income quartiles, the contribution of forests to total household income was calculated (Table 4). It is clear that per capita household income earned by the top wealth quartile from forest gathering is three times higher than that earned by poorer households. The top quartile also stands out in terms of much higher values for agriculture, wage employment and trading than the three lower quartiles. The share of income from employment and remittances to total household income was relatively small for all quartiles. It is particularly important that 64.5 percent of income is forest income for the poorest quartile but only about 12.1 percent for the richest quartile.

Table 4: Household income sources by quartiles (Zambian Kwacha¹. Values in brackets are percentages of total income)

	Household income quartiles ²			
	0-25%	25-50%	50-75%	above 75%
Total income per capita	113,750	262,832	462,828	2,021,277
Total forest income per capita	73,362 (64.5)	125,768 (47.8)	147,730 (31.9)	245,302 (12.1)
Total agric. income per capita	32,444 (28.5)	96,967 (36.9)	250,379 (54.0)	1,035,985 (51.3)
Total employ. income per capita	2,047 (1.8)	10,642 (4.0)	16,109 (3.5)	146,471 (7.2)
Total trading income per capita	5,242 (4.6)	28,140 (10.7)	46,929 (10.1)	588,843 (29.1)
Total remit. income per capita	655 (0.6)	1,315 (0.5)	1,681 (0.4)	4,676 (0.23)

¹US\$1.00 = Zambian Kwacha (ZMK) 4,463 as of 2005

The poverty line used by the Government of Zambia is typically a dollar per capita per day in nominal terms (Simler, 2007), which is approximately ZMK1,629,178 per year, using 2005 exchange rates. The survey data shows that only the per capita income of the top quartile is above this poverty line. The difference in total income between the two top quartiles is very high suggesting that only the wealthiest households are able to specialize in profitable forest-based enterprises. Nonetheless, neither the average agricultural nor forest income alone generates sufficient income for these households to be lifted out of poverty (Table 4). Thus, households employ a diversity of activities to earn a living in the rural areas. Forest products collected by the wealthiest households are those for which substitutes are unavailable, such as firewood or high value products. The annual household income from high-value forest products, for example charcoal and timber in Paul Kalemba, may be significantly higher than the average agricultural (Table 3). Furthermore, the share of income from petty trading to total household income is highest for the wealthiest households (29%). Chileshe (2005) describes how some wealthier households in Kamena Village,

Northern Province act as middlemen purchasing caterpillars from fellow households for sale in urban markets.

3.3 Contribution of forests to the national economy

3.3.1 Forest products contributing to the national economy

According to the official figures for Zambia, the forestry sector as a whole contributed 5.2 percent to total GDP in 2005 (Table 5). This is close to the estimated contribution of 6 percent for Africa (Oksanen and Mersmann, 2003).

Table 5: Contribution of various sectors to the Zambian economy in 2005

Sector	Contribution to GDP (%)
Forestry	5.2
Fishing	2.4
Agriculture	6.5
Mining & quarrying	8.6
Electricity & water	2.6
Manufacturing	10.6
Subtotal	35.9
Other	64.1
Total	100.0

Source: CSO (2006)

Like agriculture, the contribution of forestry to the GDP is low (6.5%) compared to mining (8.6%) or manufacturing (10.6%). Given that GDP estimates capture traded products and not from non-traded products, the value forest products used for subsistence are not captured in the national accounts. Our household data shows that forest product use and sale contribute significantly to household economies and these may even exceed those derived from agriculture, which is commonly considered the most important livelihood strategy for rural households (Figure 1).

In Zambia, forests make a major contribution to the to the country's energy needs, with dry forests providing about 70 percent of the energy needs (Ministry of Finance and Planning, 2002). Studies have shown that woodfuels (firewood and charcoal) are by far the largest energy source in Zambia and the major commercial forest product from indigenous forests. Annual consumption of woodfuel was estimated at more than 7.2 million tons in 2002 (FAO, 2005). Two thirds of this woodfuel is consumed in rural areas where households depend on firewood for domestic use. Charcoal is an important source of income for many rural households. Approximately 9,000 households in Chongwe district alone, were involved in charcoal production, supplying an estimated 61,000 tons of charcoal to Lusaka markets in 2000, with a total value of US\$ 2.1 million, or ZMK6.5 billion (Chidumayo, 2001). Approximately 72 percent of households in Lusaka use charcoal for cooking and heating while 10 percent use firewood (Kalumiana, 1997). Charcoal consumption increased from 174,000 tons in 1990

to 245,000 tons in 2000 and is projected to reach more than 500,000 tons by 2020 (Chidumayo, 2001; Frey and Neubauer, 2001). Most charcoal comes from Lusaka, Central and Copperbelt Provinces and is sold at municipal markets, by the roadside or at homesteads (Kalumiana, 1997).

Another important product is honey. Beekeeping first became a commercial activity in Zambia when Portuguese traders from Angola came searching for beeswax in the 1890s (Clauss, 1992). The beekeeping sector was recorded as the third largest employer in Kabompo district, Northwestern Province, in 2004 (Kaitisha, 2007). Two large companies export approximately 400 metric tons of certified organic honey per year, mainly to the UK (55%) and Germany (35%) (ITC/DTCC, 2007). Official export earnings from honey and beeswax have increased significantly since 2001 due to the growing global demand for organic honey (Figure 2). A significant amount of the beeswax is bought by informal Tanzanian traders to supply the cosmetics industry in Eastern Africa (Mickels-Kokwe, 2006). The local market is dominated by informal traders. Mulenga and Chizuka (in Mickels-Kokwe, 2006) estimate that, each year, between 600 and 700 metric tons of the honey is transformed into honey beer and sold by homestead traders in rural and urban areas. Two large companies target the national market supplying processed honey to retailers in urban areas. Additionally, the number of registered and unregistered smaller companies and individuals processing and packaging honey is increasing. Value addition for table honey is significant: farm gate prices range between US\$0.5 and US\$0.8 per kg while retail prices in urban areas in 2007 were approximately US\$3.80 and US\$5 per kg, for hawkers and shops, respectively (Husselman, unpublished data). Production and processing technologies for honey and beeswax are still very basic in Zambia and there is a huge potential for improving production levels and value addition. Moreover, honey has the reputation of being a health food, both locally and abroad, and the demand is expected to continue growing in both markets (SNV, 2005; ITC/DTCC, 2007).

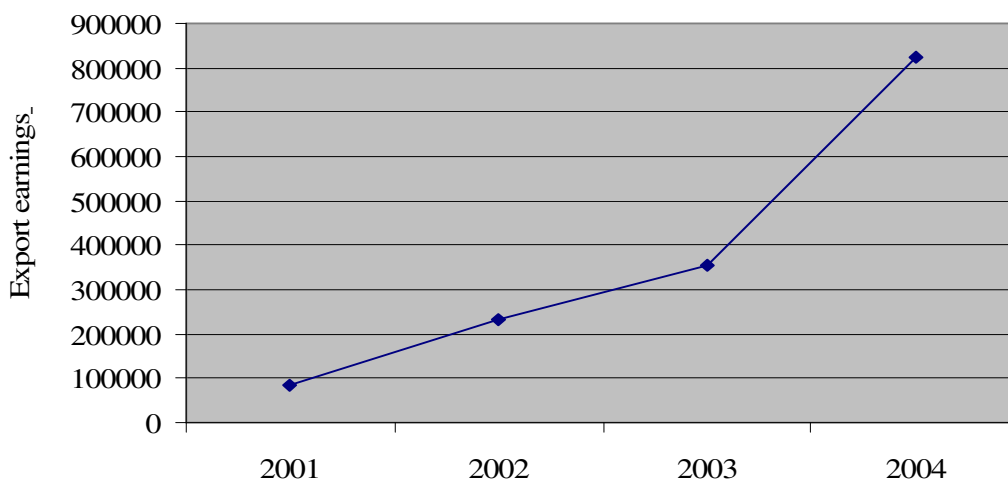


Figure 2: Export earnings from honey and beeswax, in US\$ (Kaitisha, 2007)

The value of different forest products collected and traded in Zambia are unknown, but the literature suggests that the size and impact on the natural resource, and the contribution to the national economy could be significant. However, Davenport and Ndangalasi (2003) estimated that between 2.2 and 4.1 million orchid plants consumed in Zambia come from Tanzania. Based on a survey at the Soweto wholesale market in Lusaka in 2000, Puustjärvy *et al.* (2005) estimate that the total volume of *chikanda* traded in urban markets across the country exceeded 214 tons. The added value from *chikanda* trade at the retail level was estimated at about US\$277,000. Further, taking into account the processing of *chikanda* tubers into “polony” (assuming that at least 50% is sold as “polony”), the added value from *chikanda* trading would be in the range of US\$375,000 per annum (Puustjärvy *et al.* 2005).

Fresh mushrooms are another forest product for which urban demand exceeds local supplies, particularly during the dry season. In 2001, about 25.5 tons were imported from South Africa (Puustjärvy *et al.* 2005). There have been several attempts to export wild mushrooms from Zambia. For example, in 1995, Amanita Zambia Ltd. exported 31.5 tons of chanterelles to Europe. More recent figures are from The Miombo Project in Mpongwe, which exported 1.5 tons of dried wild mushrooms in 2002 from an organically certified forest of 185,000 ha (Puustjärvy *et al.* 2005).

Medicinal plants make a major contribution to the Zambian economy, but data is generally scanty. There are approximately 40,000 traditional healers, locally known as *n'ganga* in Zambia. Healthcare may account for 35 to 60 percent of total household expenditure (Phiri and Tien, 2004) for which traditional medicines are the most accessible to the rural households than modern medicine. In addition, certain types of illnesses that are believed to be caused by witchcraft and can only be cured by a *n'ganga*. Again, traditional medicines are also believed to treat problems associated with fertility and potency (Spring, 1980). Commercial markets for medicinal plants are dominated by herbal material from dried roots and bark or bulbs and seeds. Aphrodisiacs derived from plants are sold as bottled preparations and a common sight in urban markets (Cunningham, 1993).

In general, the trade in medicinal plants and animals in Zambia is small compared to those of other countries with larger urban centres, e.g. South Africa (Williams, 2000; Dold and Cocks, 2001). As a result, overexploitation due to commercial harvesting is rare in Zambia. Although Christianity influences people's perceptions on modern medicine, traditional plant and animal-based medicine will continue to play a significant, and perhaps even increasing, role in Zambian healthcare especially with the advent of HIV and AIDS pandemic and the lack of available, affordable modern pharmaceuticals. (Ngubane and Höjer, 1999; Baskind and Birbeck, 2005). Natural forests contribute directly to rural income generation by providing formal and informal employment. For example, in the late 1990s, about 2,000 people were employed in the timber industry involved in

harvesting, transporting or processing saw-logs for timber (Puustjärvy *et al.* 2005). Between 1993 and 2003 the Zambia Investment Centre recorded 63 companies trading in wood and wood products during the period (FSP, 2004). Most of the sawn-timber traded in Zambia is sold to the furniture and mining industries, which consume approximately 15,000 m³ and 6,000 m³ per year, respectively (Puustjärvy *et al.* 2005). Export earnings from wood and wood-based products increased from US\$ 0.9 million in 1994 to US\$3.3 million in 1997. However it has been estimated that the recorded commercial timber harvest from native hardwood forests (0.2 million m³/annum) and from plantation forests (1 million m³/annum) accounts for only 14 percent of Zambia's total wood harvest (9 million m³/annum). Eighty-six percent of wood harvested is unrecorded fuelwood and commercial wood (Kokwe 2004).

3.3.2 Contribution of forests to government revenue

In Zambia, forests contribute to government revenue through taxes, charges, fees and extraction royalties levied on forest operations. Table 6 shows revenue collection from forest operations by the Forestry Department between 1996 and 2003 by province. The sources of forest revenue are mainly from major commercial forest products, such as timber, poles and woodfuels. Revenue from other forest products is minimal, and may be captured through income tax from registered traders, municipal market fees, or in the case of honey, for example, through export tax

Table 6: National Annual returns from sale of forest products and services (Inflation adjusted, Zambian Kwacha 2003¹)

Province	1996	1997	1999	2000	2003
Central	Na	155,649,402	332,330,893	619,946,624	181,671,922
Copperbelt	557,432,328	1,071,409,818	734,448,003	981,059,942	178,541,505
Eastern	210,848,807	412,469,892	253,702,743	188,618,827	81,358,801
Luapula	-	61,494,262	196,257,863	85,470,291	48,589,732
Lusaka	144,587,197	423,016,120	435,161,357	386,660,843	144,809,605
Northern	505,128,284	82,487,724	522,560,297	93,941,596	56,770,501
N/western	111,548,606	313,804,642	275,374,991	250,202,377	73,700,522
Southern	503,907,948	415,934,053	391,794,053	353,414,824	165,903,549
Western	2,999,368	549,845,408	1,023,298,958	1,240,200,529	404,992,433
Divisions (Research, Nurseries, etc)	1,347,581,927	35,664,600	57,899,977	22,557,042	2,470,000
TOTAL	3,384,034,465	3,521,775,920	4,222,829,136	4,222,072,896	1,338,808,570

¹ US\$1.00 = Zambian Kwacha (ZMK) 4,733 as of 2003

Source: Forest Department, (Various Years). Ministry of Tourism, Environment and Natural Resources, Lusaka

In general, low staffing in the relevant government departments have led to unsupervised logging and poor forest revenue collection (Ministry of Finance and Planning, 2002). In addition, the price of license fees discourages many

producers from reporting their activities to the Forestry Department. Kokwe (2004) argues that increases in taxes on forest products, which have been introduced by the government during the past eleven years have directly contributed to the decline in collected revenues. The introduction of Value Added Tax (17.5%) and a 2,500 percent increase in forest tree license fees in 1996 led to the closure of a number of reputable timber producing and processing firms as the price of raw materials did not match the market price of finished products. The increase in license fees did not, however, reduce the demand for timber and as a result the illegal trade increased. A few years later, the license fees were further increased a few years later which resulted in rapid increase in illegal logging. An officer quoted by Kokwe (2004) stated,

“I don’t think Lusaka is getting the monies they envisaged. People have stopped paying, they are just cutting illegally.”

A study conducted in 2000 estimated that only 35 percent of the potential revenues of the stated traded volumes are collected. Moreover, this may even be reduced to 3.4 percent, taking into account the assumption that actual volumes produced and traded are likely to be much higher (Ng’andwe *et al.*, 2006). It was estimated that in 2000 US\$103,858 collected through production and conveyance fees and penalties for illegal harvesting of forest products accounted for less than 20 percent of the total collectable revenue from charcoal and firewood (Ng’andwe *et al.*, 2006). Furthermore, it was reported that as little as one percent of the revenue from license fees from the harvest and processing of round wood was being paid (FSP, 2004). This suggests that the revenue collection system is weak. In terms of honey, only 400 metric tons of exported honey is accounted for in the official accounts, while the estimated 600-700 metric tons of informally traded honey used for traditional beer is not accounted for. The contribution of forest to the national economy is under-reported since the standard measures of national income such as gross domestic product (GDP) only considers traded commodities despite that large quantities of forest resources are used for subsistence. It is only recently that a number of countries such as South Africa and Norway have initiated activities to develop data systems to be used to adjust the measures of national income by integrating data on natural assets such as energy sources, fisheries, forests and minerals in their systems of national accounts (Hecht, 1999).

4 Summary and Conclusions

Forests provide important sources of livelihood income for rural people, and provide safety nets in times of need (Angelsen and Wunder, 2003; Coomes *et al.*, 2004; Takasaki *et al.*, 2004). In particular, rural households depend on forest and woodland resources to meet their energy needs, for construction and roofing materials, fodder for livestock, wild foods that support a healthy diet, and medicine. Moreover, forest product trade is an important source of income (Oksanen and Mersmann, 2003). The situation in Zambia is no different, where

forest income accounts for between 20 and 60 percent of the total household income (subsistence and cash) in the different study sites. Single forest products such as caterpillars, charcoal and honey may even provide more cash income than agriculture, although commercial forest product harvesting is determined by various conditions, including vegetation type and access to markets. Our results show that forest income is generally higher for richer than poor households, but the share of forest income to total household income is highest for poor households. However, neither the wealthiest nor the poorest households have diverse sources of income and do not therefore depend on agricultural or forest income alone.

This raises important considerations for assessing the role of forests to poverty alleviation. Sunderlin *et al.* (2005) specify two types of poverty alleviation, applied at the household level, in association with forest resources. These are:

- Poverty avoidance or mitigation: forests resources serve a safety net function, or as a gap filler, including as a source of petty cash; and
- Poverty elimination: forest resources help lift the household out of poverty by functioning as a source of savings, investment, accumulation, asset building, and permanent increases in income and welfare.

This distinction appears important in the Zambia context, where it is the poorest of the poor who are most reliant on forest resources. The dry forests do not appear to function as a means to poverty elimination, by themselves, but are crucial to poverty mitigation providing livelihood security to some of the poorest households. The key issue is how to preserve the role of forests as safety nets in locations where other forms of social insurance cannot take place. Two interrelated problems need to be solved: lack of security of access to the woodlands for the poor, and issues related to unsustainable harvests.

Urban demand for certain forest products (e.g. charcoal, caterpillars and honey) has created a vibrant trade, which provides cash income to thousands of rural households, often exceeding that from agriculture. This cash is often used to support other income generating activities, such as crop production. Households thus use forests to increase their investments in other activities and thereby their total income. As non-farm income increases, dependence on forest products decreases, but rich households continue to derive significant incomes from forest products. Cash income from a single product, such as timber in one of our study areas (Paul Kalemba), may be more than double that of the average total household income. Forests could thus also be seen as having a function of lifting people out of poverty, although not as a means alone.. Most forest products are traded as raw materials and value-addition could have the potential to increase incomes at the household and national levels. However, barriers that constrain rural enterprise development in general (e.g. poor infrastructure and market linkages) will need to be overcome. Private investment and access to financial services are therefore necessary. Moreover, a conducive policy environment is

necessary to support forest-based enterprises as well as increase direct government income at national level, although raising the collected revenue will, in essence, be a direct tax on the poor.

Official statistics suggest that forestry contributes 5.2 percent to the GDP. However, this figure underestimates the contribution of forests to Zambian households, given that subsistence use and much informal trade is not captured in GDP calculations. A number of forest products are important at national level, most notably charcoal and fuelwood. Dry forests are the primary source of household energy for more than 70 percent of the population. But there is also degradation and deforestation, as a result, for example, of charcoal production. Harvesting needs to be placed on a sustainable footing, but one of the only solutions may be the substitution of woodfuel with other sources of energy.

In summary, the high level of dependence on forest resources should be important in driving policy processes related to forestry and poverty alleviation. This has not generally been the case, with perhaps honey being the exception. The Zambian government acknowledges the importance of beekeeping and is now formulating a policy for the sector.

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