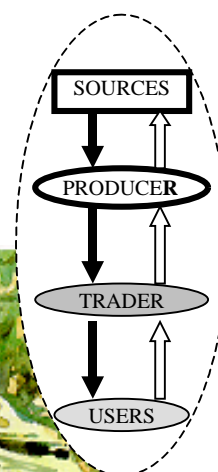


## WOOD ENERGY FLOWS, RRA STUDY IN POKHARA, NEPAL

By

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## 1. INTRODUCTION

### 1.1 Country Background

The Kingdom of Nepal is a landlocked country bordered by the Tibet Autonomous Region of the People's Republic of China in the north and by the Republic of India in all other directions. It is situated between the 26°22'N and 30°27'N latitudes and 80°4'E and 88°12'E longitudes. The land area of this country is 14.75 million hectares. Its altitude varies from 80 meters above mean sea level in the southern Terai to 8,848 meters above mean sea level in the north.

The population of Nepal was about 17.5 million in 1988. The annual population growth rate is about 2.7 percent. The population is unevenly distributed, with fairly high densities in the lower elevations in the south and in valleys in the midlands and very low densities in the uplands. The bulk of the population is fairly evenly distributed between the lowlands and the midlands.

About 95 percent of the people live in rural areas and agriculture is the main occupation of 90 percent of the population. The agricultural sector accounts for about 60 percent of the GDP. The contribution of the industrial sector to the GDP is about 6 percent, of which about 30 percent comes from cottage industries. The agro-based and forest-based industries account for more than 80 percent of the manufacturing enterprises, of which wood-related industries account for about 8 percent. Per capita GDP is only about US\$160 per year.

Nepal is predominantly a Hindu nation, with a small Buddhist minority and other even smaller ones, and the caste system remains a significant element in social organization. As we shall see, both caste and class, which are highly correlated but not identical in Nepal, are significant factors in the human dimension of the wood energy system. Non-Hindu minorities are, from a theoretical point of view, outside the caste system. In effect, however, they are often at the bottom of it.

In order to reduce regional disparity and to achieve equitable distribution of the fruits of development to the entire people of the country, Nepal has been divided into five Development Regions: Eastern, Central, Western, Mid-Western, and Far Western. Administratively, the country is further divided into fourteen administrative zones and 75 districts.

Physiographically, Nepal can be divided into five zones (see Figure 1, page 14).

(1) High Himal: This zone includes the great Himalayas and the regions above the forest line at about 4,000 meters. It occupies about 23 percent of the total area of Nepal, but contains only about three percent of its total forest area.

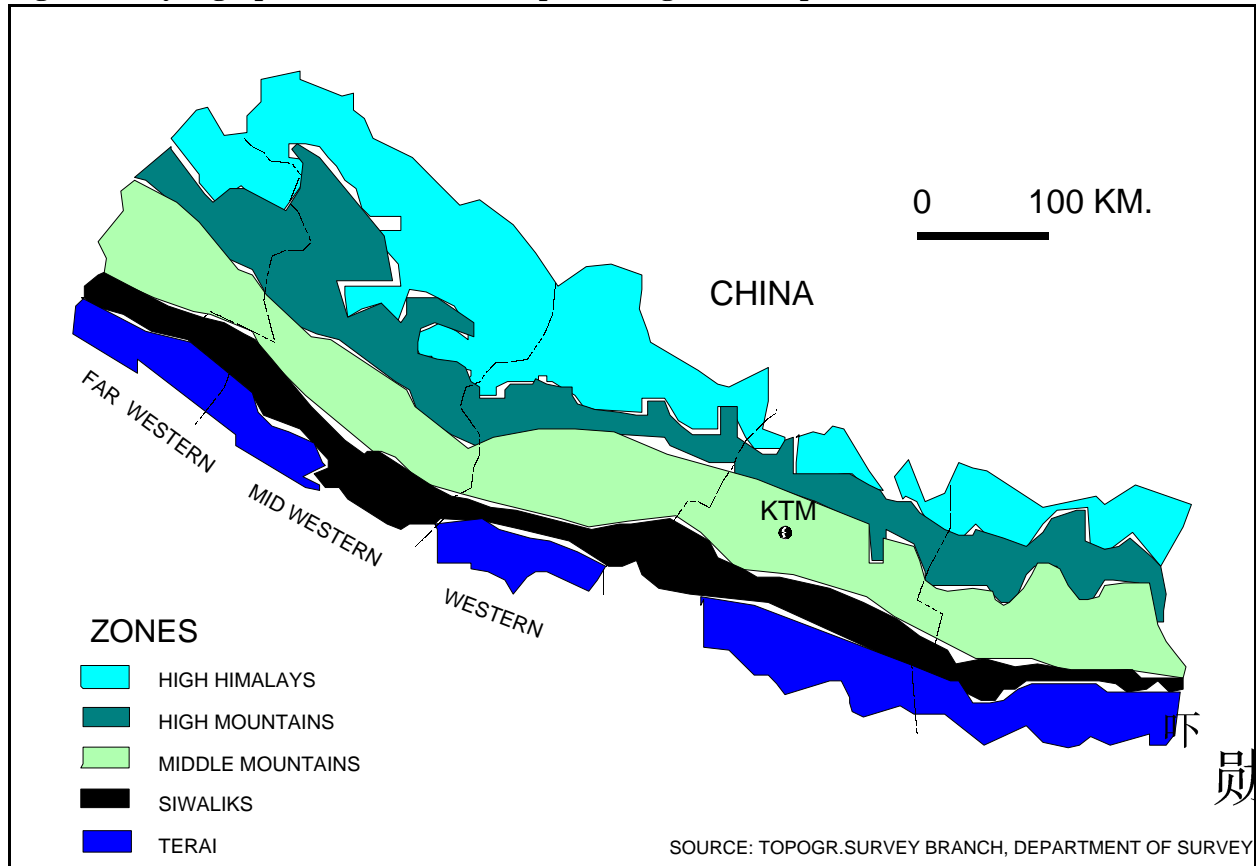
(2) High Mountains: This zone lies between the forest line at about 4,000 meters and a somewhat diffuse line at 2,300-3,000 meters on ridges and 1,000 meters in valleys. It occupies about 20 percent of the total area, and contains 30 percent of the natural forests of Nepal.

(3) Middle Mountains: This zone lies between Siwaliks to the south and the forest-covered slopes of the High Mountains to the North, corresponding to the river bottom at about 200 meters and the highest points at about 3,000 meters (on ridges). It occupies about 30 percent of the country, and contains about 33 percent of the country's natural forests.

(4) Siwaliks: This zone lies between the Gangetic plain to the south and the southern edge of the Middle Mountains to the north. It occupies about 13 percent of the country and contains about 26 percent of the natural forests of Nepal.

(5) Terai: It lies between the Siwaliks on the north and the Indian border to the south. It occupies about 14 percent of the country and contains about 8 percent of Nepal's natural forests.

**Figure 1 Physiographic Zones and Development Regions of Nepal**

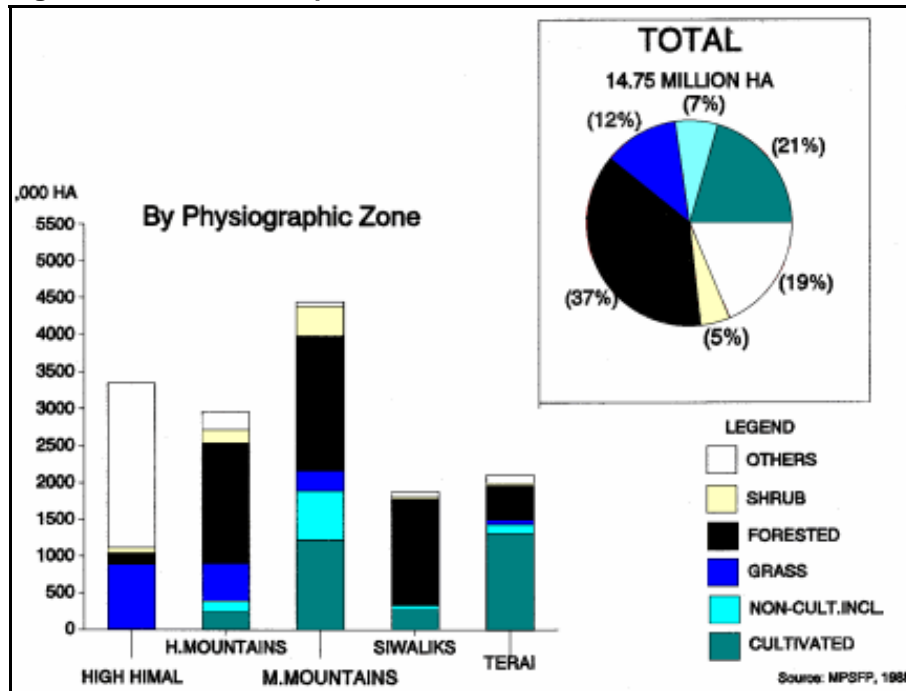


Nepal's climate varies widely, due to great variation in topography. Summer is from June to September; winter, from October to May. The High Mountains and High Himal have lower temperatures throughout the year. The annual rainfall ranges from a low of about 250 millimeters to 4,500 millimeters at some places. June to October is the rainy season, with July and August receiving the heaviest rainfall. The rainy season accounts for about 80 percent of all rainfall, with the rest falling during the winter.

The Land Resources Mapping Project (LRMP) has in 1985-1986 categorized land use in Nepal, as presented in Figure 2.

"Non-cultivated inclusion" refers to small pockets of land close to cultivated lands, too small to be mapped at a scale of 1:50,000. Not mapped separately but measured as a distinct category, "Forested Land" is that which has at least 10 percent crown cover. The "Other Lands" category may include rocky areas, lakes, ponds, waterways, or settlements.

Figure 2 Land Use in Nepal



Forests cover about 37 percent of Nepal's total area. Various types of natural forests exist in Nepal, due to its diverse topography: hardwoods (59 percent), conifers (17 percent), and mixed forests (29 percent). Siwaliks and the Terai have predominantly *Shorea robusta* (*sal*) forests, sometimes with mixed hardwoods. Chirpine stands exist mainly in the Middle Mountains. Mixed forests of chirpine mixed with *Shorea robusta* and other hardwoods are distributed over the Middle Mountains and Siwaliks; oak forests are located in the Middle and High Mountains. Above these, shrubby vegetation composed mostly of mountain pines is found. These mark the gradual transition from forest to alpine pasture and barren areas.

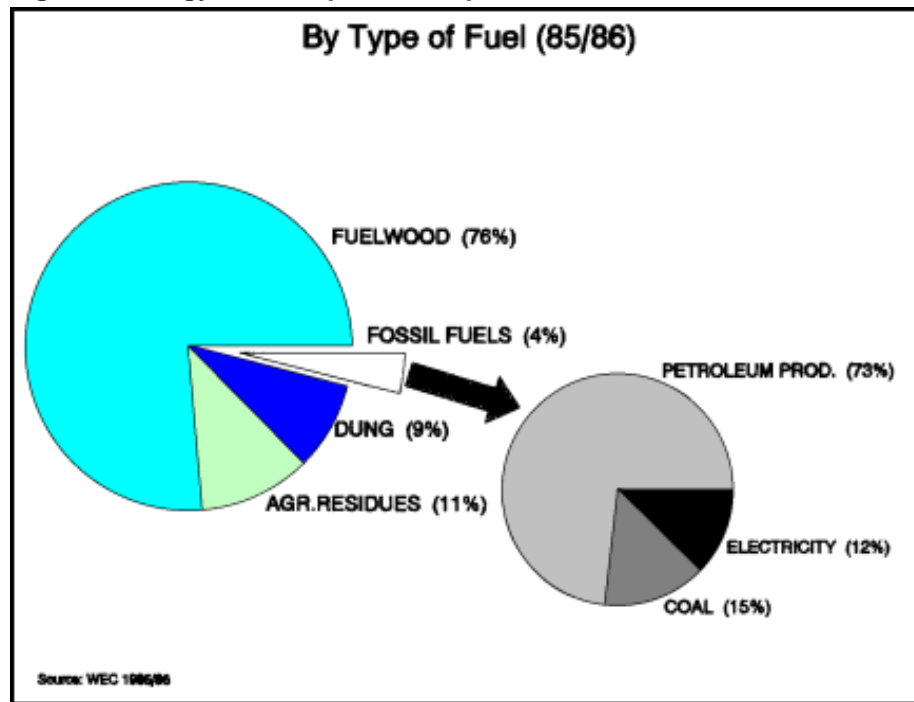
The total area of forests and shrublands was 6.7 million hectares in 1963-1965. By 1977-79 the total area had declined to 6.3 million hectares. Thus, the loss of area under forests and shrublands during the period was 0.4 million hectares, corresponding to an annual loss of only 0.4 percent. But these figures do not reveal the full extent of decline of forest resources. The rate of conversion from forests to shrublands/degraded forests was immense.

Prior to 1957, a vast tract of Nepalese forests was protected and managed by local user groups. In 1957, forests were nationalized, with negative results. The government experienced serious difficulties in protecting and managing the forests. The people came to think that the forests belong to the government and began treating them as open access resources.. This led to overexploitation of the forests, resulting in a serious depletion of forest resources. During the mid-1970s, the government realized the vital role played by people's participation in the protection, conservation, and management of forests in Nepal. A new National Forestry Plan, introduced in 1977, recognized the importance of involving local communities in forest management. Under the Panchayat Forestry Acts of 1978 and 1980, a portion of the national forests was set side for participatory management. In 1988, a Master Plan for the Forestry Sector was drawn up with the formulation of a 25-year master plan for developing the forestry sector of Nepal.

## 1.2 Overview of Energy Use

Per capita energy consumption in Nepal is relatively low. In 1985-86 traditional fuels accounted for an estimated 95.9 percent of energy consumption and commercial fuels for only 4.1 percent. Most of this energy (95.5 percent) was used in the domestic sector for cooking and heating. The rest was used by the industrial sector (2.3 percent), the transport sector (1.4 percent), the commercial sector (0.5 percent), and the agricultural sector (0.3 percent).

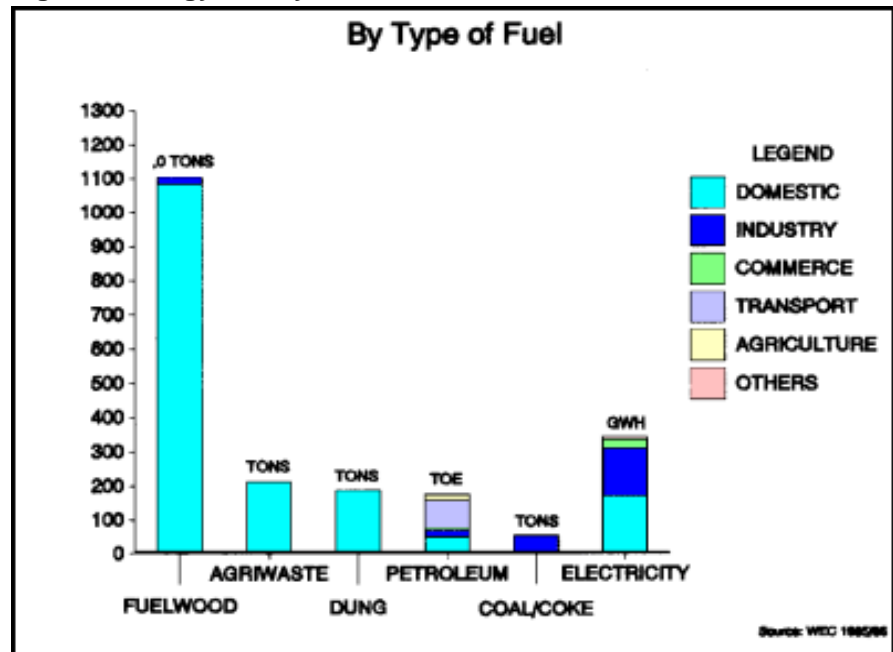
**Figure 3 Energy Consumption in Nepal**



As shown in Figure 3, fuelwood is the main source of energy consumed in Nepal. Most of this energy comes from split fuelwood, small branches, and twigs burned in stoves. Many of the agro-based and forest-based processing industries and many small-sale manufacturing industries that require heat in processing rely wholly or partly on wood fuel for energy. The sectoral energy consumption by type of fuel for 1985-86 is presented in Figure 4.

The industrial and commercial sectors also use wood fuel for energy, along with other commercial fuels. Industrial development is in its infancy in Nepal, with more than 80 percent of the industries being agro-based or forest-based. The traditional and commercial energy account for 54.5 percent and 45.5 percent respectively of energy consumed in this sector. Major source of traditional energy consumed in this sector is fuelwood and this is mainly used for firing bricks. In the commercial

**Figure 4 Energy Use by Sector**



sector 49.3 of the energy consumed came from traditional energy sources and 50.7 percent came from commercial sources. The major source of traditional energy consumed in this sector is also fuelwood. Most of the industries and commercial establishments are located in or near urban areas. With the increasing price and unavailability of traditional energy, especially fuelwood, most of the industries and commercial establishments are shifting toward the use of commercial energy.

Wood fuel, the main source of energy, is derived from 8.85 million hectares of productive forests, shrubs, and grassland covering 60 percent of the country. Of the total supply of wood fuel in the country, 18% comes from farms. Nepal has no identified source of commercial energy feasible for commercial exploitation, but the country has enormous hydropower resources, although less than one percent of the existing potential has been utilized because of the high cost of hydropower generation and distribution. Partly because of problems of distribution, imported commercial fuels are costly in the hills and mountains. So wood fuel will continue to be the main source of energy in this country for most of the people for the foreseeable future.

It should be noted that the fieldwork for this study was conducted during the summer of 1990. The recent history of wood energy systems in Nepal was markedly influenced by international events beyond the control of the inhabitants of the study area. On March 23, 1989, a trade crisis between India and Nepal led India to completely stop petroleum products from entering Nepal. This crisis caused severe shortages and steep inflation of all commodities in land-locked Nepal. But of particular significance for the wood energy system, the government of Nepal instituted a strict rationing of kerosene. Many households, restaurants, tea shops, and other consumers who normally depended upon petroleum products for energy suddenly had to shift to fuelwood use. This, of course, triggered a shortage of fuelwood, and the price of fuelwood soared. This situation lasted until July, 1989, about 10 months before the fieldwork upon which this report is based was initiated.

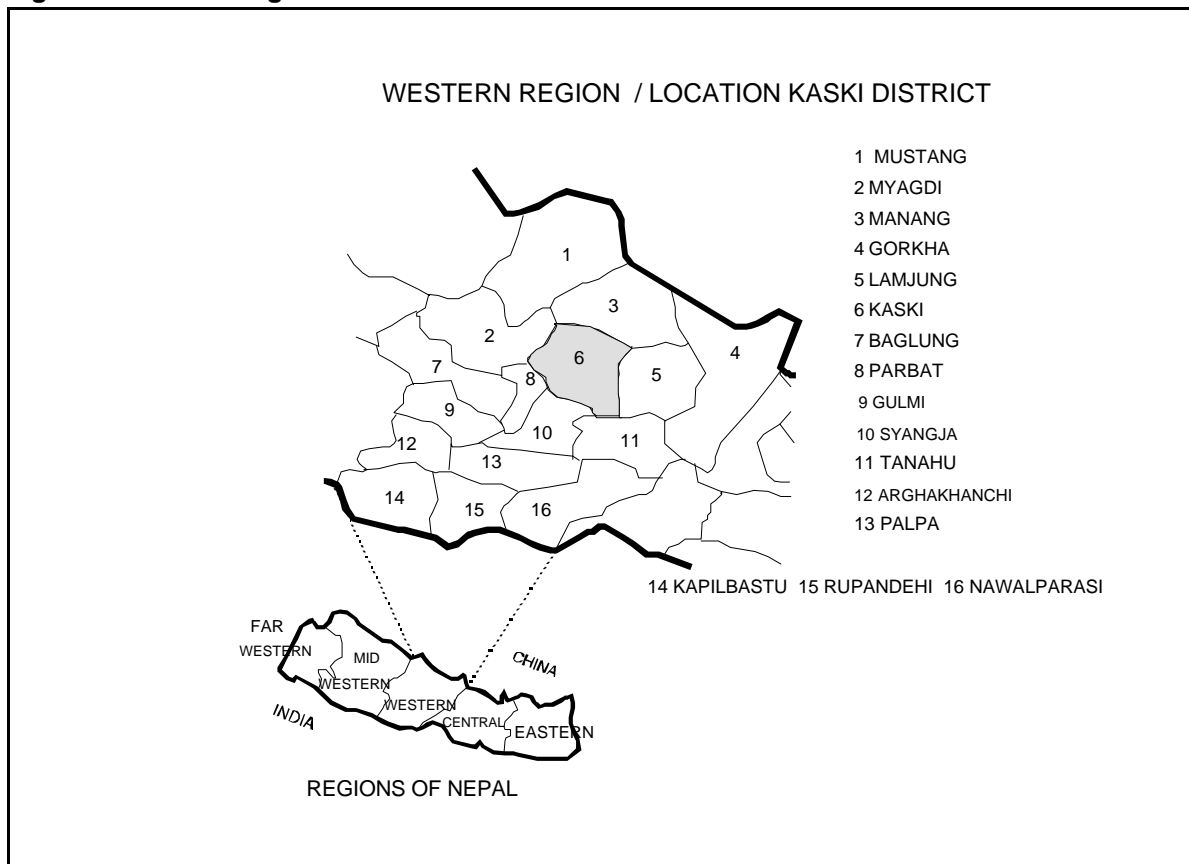
The effects of this dispute, referred to as the INTT crisis, will be mentioned many times in the pages that follow. More recent fluctuation that may have occurred in the availability and price of petroleum products would not be reflected in this data. But the systemic nature of our analysis will make it clear, we hope, that local wood energy systems do not exist in a vacuum. They influence, and are in turn affected by, a wide range of conditions and processes that extend to the national and even the international level.

### 1.3 Previous Studies of Wood Fuels in Nepal

Prior to 1975 studies of wood energy in Nepal were few in number and limited in scope. After 1975 some more substantive studies began to appear. For example, field research by Bajracharya provided considerable insight into the significant role of wood energy in rural areas, especially for the rural poor (Bajracharya, 1981; Donovan and Bajracharya 1980). But most studies were still either highly focussed or very general.

During the past five or six years research into wood energy systems in Nepal has increased in quantity and quality. Paudyal (1986), in his study of non-commercial cooking energy in urban Nepal, made a preliminary effort to understand the wood energy flow from producers to consumers. But no detailed studies have been conducted that describe, analyze, and evaluate the wood energy system in terms of the acquisition, transformation, and final uses of wood as it flows from rural producers to urban consumers.

**Figure 5 Western Region and Location of Kaski District**





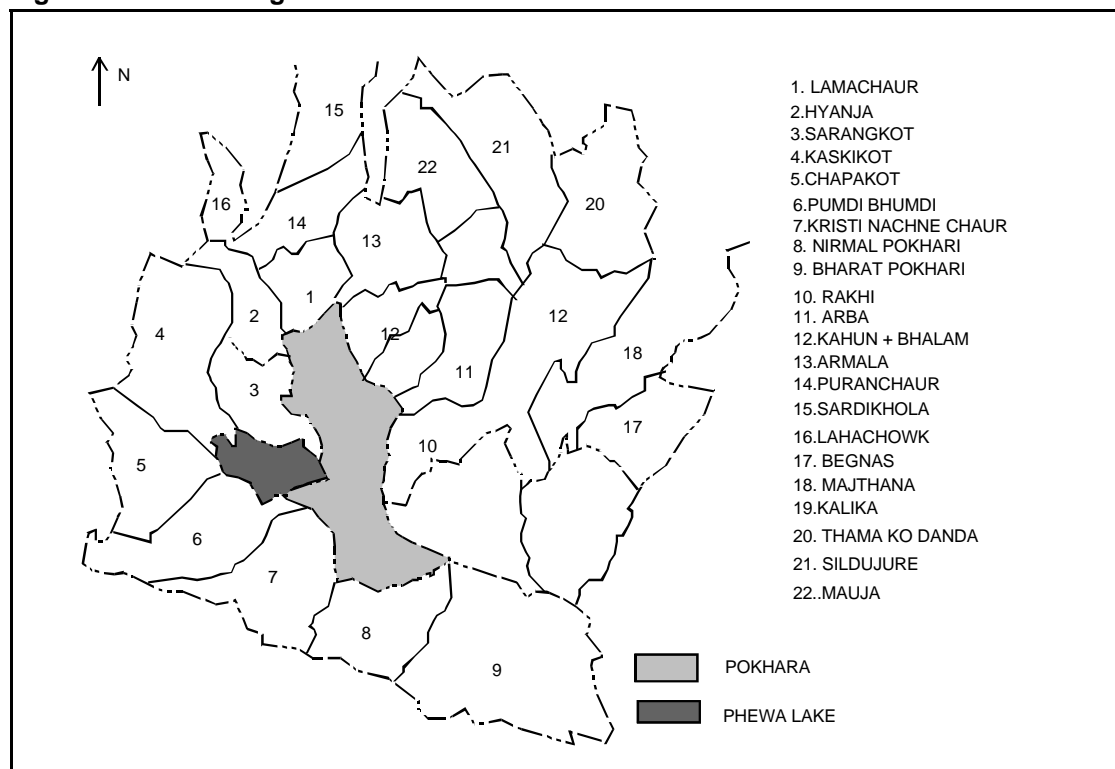
#### 1.4 Description of the Study Area

The study area is located in Kaski District in the Western Development Region of Nepal (See Figures 5 and 6). The district is administratively divided into one municipality (Pokhara, the district seat) and 47 villages. The total population of Kaski District is 286,206, including 67,521 urban inhabitants. The annual population growth rate averaged 2.75 percent in rural areas and 8.91 percent in urban areas for the decade 1971-1981.

Until 1972, the Pokhara valley was relatively isolated and goods had to be carried in by porters. When Pokhara was connected by road to Bhairahwa (176 km to the south) in 1972 and to Kathmandu (200 km to the east) in 1974, the town began to experience rapid growth in all sectors. In addition to large and small-scale industries, in 1987 there were 1,062 cottage industries in the district, with about 80 percent of them located in Pokhara town. There were also 2,644 registered commercial establishments: 36 wholesalers, 1493 retailers, 828 hotels and inns, and 287 service businesses (ranging from shoe repair shops to photocopy facilities).

High caste Brahmins and Chhetries constitute about 35 percent and 17 percent of the district population, respectively. Lower castes "untouchables" make up seven percent. Another 30 percent are ethnic Gurungs. Various smaller groups make up the remaining 11 percent.

**Figure 5 Western Region and Location of Kaski District**

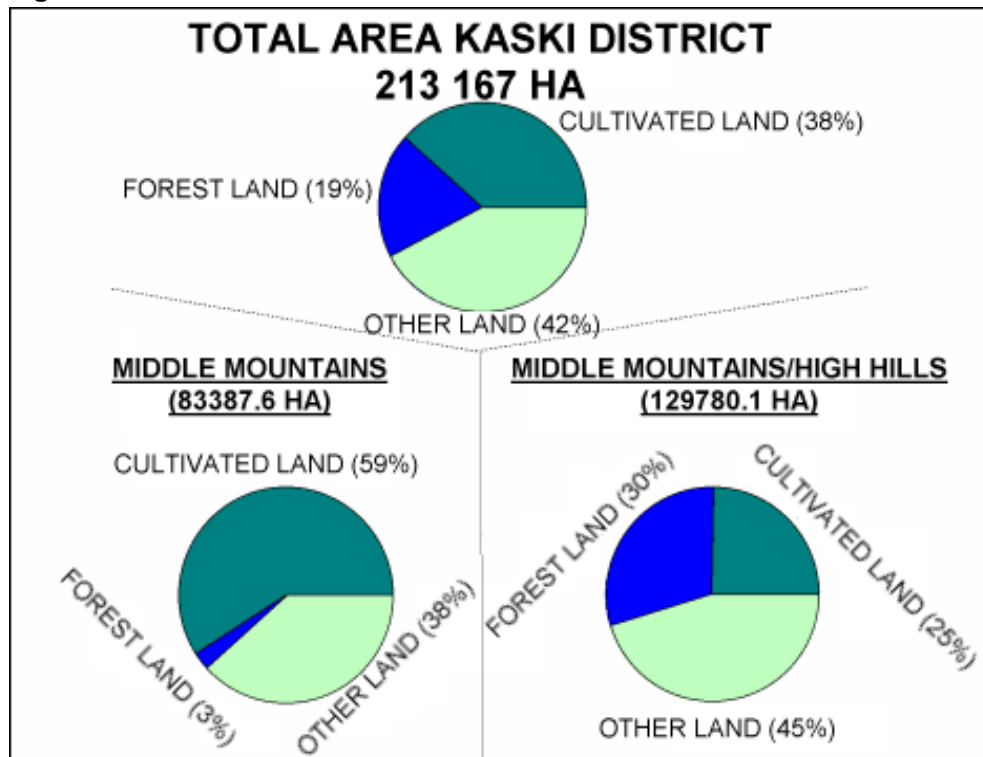


The main occupation of over 90 percent of the population is agriculture. About 38.3 percent of the district's 213,167 hectares are under cultivation. Rice, corn, wheat, and millet are major crops. Oranges, guavas, bananas, and pears are also grown. Tourism is second only to agriculture as a source of income for the district. Over 25,000 tourists visit Kaski District every year.

Forests and shrublands account for another 42.2 percent of the land area and grasslands and other land uses account for the rest, about 19.5 percent. Most of the forested area consists of *Schima-Castanopsis* forest.

The climate in Kaski District ranges from subtropical in the lower part of the middle mountains to alpine in the high Himal zone. Annual rainfall varies from 3,974 mm in Pokhara (altitude 850 m) to 5254 mm in Lumle (altitude 1500 m). The study area is located in the middle mountains.

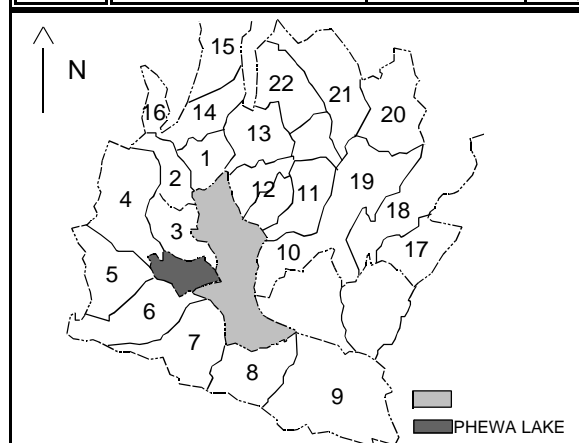
**Figure 7 Land Use in Kaski District**



The study area consists of the municipality of Pokhara and 21 surrounding villages. Pokhara has grown in population from 20,611 in 1971 to 46,642 in 1981 to an estimated 70,984 in 1987. The 21 villages in the study area are located from 5 to 16 km from Pokhara town, which is the district capital. Village populations vary from 2,151 to 7,558. The number of households in a village varies from 477 to 1,483. Detailed information about village committees was not available in district offices. Table 1 provides available data: distance from Pokhara, population, number of households, and hectares of lowland paddy fields (*khet*) and upland fields (*pakho*).

**Table 1 A Profile of Village Committees Around Pokhara Town**

Map No.	Village Council	Distance (mile)	Population	Household	Cultivated Land (ha)	
					(Khet)	(Pakho)
7	Kristi Nachne Chaur	7	5,629	1,023	33.4	24.9
8	Nirmal Pokhari	9	3,935	766	25.4	22.9
9	Bharat Pokhari	13	7,028	1,483	26.8	48.5
2	Hyanja	7	5,382	1,103	29.7	13.6
13	Armala	7	7,558	1,444	32.8	18.0
16	Lahachowk	16	4,143	816	23.6	13.7
12	Kahun + Bhalam	5	4,015	713	13.9	8.1
11	Arba	6	2,943	532	11.3	9.6
19	Kalika	11	4,490	853	11.5	6.7
10	Rakhi	9	2,896	565	16.9	27.0
22	Mauja	10	2,454	477	13.1	7.1
18	Majhthana	14	3,811	723	23.2	12.8
17	Begnas	10	5,318	969	18.9	13.2
5	Chapakot	10	2,562	495	33.6	13.4
4	Kaskikot	10	5,638	1,065	37.0	18.1
3	Sarangkot	8	4,201	819	27.2	14.9
6	Pumdi Bhumdi	8	5,925	1,060	38.7	24.9
21	Sildujure	15	3,808	772	29.8	16.4
20	Thuma Ko Danda	16	4,174	807	26.6	5.0
15	Sardikhola	13	3,028	611	14.9	12.6



## 2. WOOD ENERGY ENTREPRENEURS

Work in the production and distribution of wood energy is considered to be low status activity in Nepal because it has been the domain of poor people, mainly from the lower castes. But recently the scenario has been changing. The wood energy business has become very profitable, so even though exploitation of the government forests is illegal, many urban people and the well-to-do have begun to participate in it.

These entrepreneurs have helped many poor people to earn a living, while providing entrepreneurial middlemen with an opportunity to increase their capital, enabling them to invest their profits in other businesses. A shop owner from Tharpu Bazaar (43 km from Pokhara), for example, was reportedly involved in charcoal entrepreneurship as a middleman, earning about Rs. 100,000.00 (US\$3333) within four to five months before quitting the business because it was illegal and he was afraid of getting caught by vigorous enforcement activities.. The soaring price of fuelwood and charcoal has made selling wood fuel more attractive than ever before for the rural poor who depend on wood energy sales for their livelihood and for small landowners to whom it is a supplementary income generating activity.

In the Pokhara urban and the countryside around it, major participants in the fuelwood production and distribution system include: fuelwood producers, market travelers, roadside vendors, bus and truck operators, and middlemen. Similarly, in the charcoal production and distribution system, the participants involved are: producer, market travelers and middlemen. Attempt has been made to describe these participants in detail below.

### 2.1 Fuelwood

#### 2.1.1 Producers

The participants in the fuelwood system appear to be mostly from the low income group (*nimna star*) and from the low caste "untouchables" (*nimna jat*), such as Kami (blacksmith), Sarki (cobbler) and Damai (tailor). Most of them are landless laborers or very small land owners who depend on the sale of fuelwood for earning their livelihood or to supplement their income from other work.

Some households in these categories are found in each village surrounding the Pokhara urban area. There are also some households of higher caste (i.e., Brahmin and Chhetri) which are socioeconomically of lower class status and depend on the income from selling fuelwood. These people are landless or have very little agricultural land which barely produces enough food to last for two or three months. Such people have very few economic alternatives because the traditional occupation associated with their caste is already overcrowded, generating intense competition. Too many people of their caste already work as blacksmiths, cobblers, tailors, and musicians.

Some people living in suburban areas outside the core town area go to the nearby forests to bring back loads of fuelwood on their backs. Most of these are from medium-low income group of families who use fuelwood for home consumption. Such types of incidences have been reported from people of Pardi exploiting the forests of Kristi Nachnechaur and Banjhapatan exploiting forests in Sunpadeli and Patlepakha.

In fact, groups of 300-400 people from Banjhapatan and Kundahar, most of them recently migrated Gurungs and Muslims respectively, exploit forests occasionally during winter in Patlepakha, Thama, and Kafalghari to bring back *bhari* loads of firewood. A *bhari* load is the amount that can be carried by one person on his or her back. It was reported that these people even used trucks to transport the fuelwood from the point where it could be driven along the bank of the Bijaypur Khola river.



*Bhari*

Competition is fierce and feelings sometimes run high. In one incident, Muslims carrying *bhari* loads of firewood were stopped by forest office personnel and the local people in Arba. In retaliation, Muslims burned unthreshed stacks of rice in the fields of the local people.

Some 50 to 60 households, mostly Sarkis, with a few Damais, Kamis, and people from higher castes, were found to be involved in the fuelwood business in Nirmal Pokhari. The common feature of all these households, irrespective of caste, is that they have low incomes. They are either landless or own only a small patch of land that barely produces enough to eat for three months. Most of these households have been involved in the fuelwood business for a long time.

They gather dead branches and twigs, cut dead and dying trees, gather leftover branches and twigs of trees felled with permission from the forest office (or sometimes without it) for house construction. It is mainly women who collect dead branches and twigs and leftovers of felled trees. Men cut large trunks into pieces and then split the pieces into smaller ones for use as fuelwood (*chiruwa*), because this type of activity, which involves wielding heavy axes, requires strength and endurance.

In Nirmal Pokhari a middle-aged woman with a 12 year old son lives entirely upon money she earns selling fuelwood for nine months in a year (from late August until early May), when opportunities for working as a laborer in the village do not exist. She gets Rs 25-30 (US\$ 0.83-1.00) per day as hired labor. She has had to do this for 12 years, since her husband left home 13 years ago, being unable to repay loans taken from rich neighbors against some land mortgaged as guarantee. She started selling fuelwood from her own three *ropani* (0.15 ha) of forest. She has been collecting only dead branches and twigs from her forest for household use, conserving the trees for her son. So for selling fuelwood she has been collecting dead branches and twigs with the help of a sickle in Saraundi Khola Forest in Syangja District, an hour's walk from her home. Similarly, villagers in Begnas have allowed two women aged about 52 years from Kami and Lama castes to collect dead branches and twigs in the forest situated about three kilometers from the village. The Kami woman has a son, but the other woman is alone. These two women earn their livelihood by selling fuelwood year round.



*Chiruwa*

Most of the people around the Kali lekh forest are involved in the fuelwood business either directly or indirectly. They sell butter (*ghee*), buffaloes, local wine and minor forest products (such as bamboo shoots), as well as fuelwood, in Pokhara City. In fact, people used to keep their cattle within the forest for about two weeks every August to feast upon the grasslands before bringing them into the village to feed them cornstalks.

Because of these activities, people have small bamboo huts in the forest. The herdsman makes butter and collects fuelwood. Other family members carry it back to their home and then it is carried to market, mostly by women.

Some people of the Gurung community make local whiskey and sell that in the market. One schoolteacher told the team that the people of this community cannot survive without the forest. "We are willing to have our heads cut off," he said, "but we cannot be separated from the forest. It has always been the single most important part of our entire livelihood system."

Two to three years ago about 15 or 16 households were involved in this business in Begnas. But due to the formation of the Forest Conservation Committee and implementation of the Begnas Tal Watershed Management Project by CARE/Nepal in that area, these people have shifted to agriculture and work as hired labor in the villages and elsewhere.

Although poor and/or low caste people are commonly most involved in the production and sale of fuelwood, they are not the only people who sell fuelwood in urban Pokhara. The majority of the households in the surrounding villages gather fuelwood themselves for house consumption. A few of the richer households, shopkeepers and operators of small cottage industries may have hired labor to collect fuelwood or may buy some from full-time fuelwood traders. Fuelwood may also be bartered for other goods or given to relatives to fulfill the obligations of extended families.

We found very few persons in rural villages who are involved in the fuelwood business throughout the year to make a living. But apparently there are many households heavily involved in it to earn a living during the nine month off-season in agriculture and to supplement their income from time to time.

Most of the people engaged in the production and distribution of fuelwood do this work mainly in the winter months when there is nothing to do in the fields, although they are engaged in it to some extent from late August until late April. Households with lands are fully occupied with the cultivating, planting, and harvesting of crops like corn, millet, and rice during the summer growing season from late May to early August. This also happens to be the busiest season for festivals and marriages. Smallholders and landless people can easily find work as hired labor in their village or villages nearby. In the fuelwood business, these three months thus constitute the slack season. Usually, one backload of fuelwood can be collected from the forest by one person in one day. Selling it in Pokhara town takes another day. These two days of effort bring in about Rs. 50-60 (US\$ 1.66-2.00).

This is about the same as two days of wages for working in the village. Besides, there is always some risk of being caught by forest officials. So some people in the fuelwood business have opted for other opportunities. Some fuelwood workers have been able to reduce this type of tradeoff by selling their backloads of fuelwood to middlemen at key entry points to town early in the morning and thus being able to get to some other kind of work by around 9:00 a.m.

One important aspect of the fuelwood business is culturally influenced. According to traditional belief, working in the field on the days of the new moon or the full moon is inauspicious. Therefore, villagers usually utilize these days either to collect fuelwood or to sell it in the market. Similarly, both the collection and sale of fuelwood increases during the week before major festivals. This is true in part because then neither government forestry officials nor community forest watchers try very hard to stop people from sneaking into the forests and obtaining a backload of wood to carry to market for sale. This type of attitude, in fact, encourages villagers to take backloads of fuelwood to the market and in return buy food, clothes, and other necessities.

Private tree owners are another source of fuelwood. Most of them own upland fields where trees, mostly of fodder species, are grown on bunds. Old trees whose productive capacity is substantially reduced are removed and replaced by new ones. Saw mills, furniture factories, or other wood-using industries are contacted for selling these trees. Usually the buyers must cut down the trees and take the wood away themselves.

We observed a huge amount of branches, bark, cull wood, and waste wood piled up in the courtyard of one furniture factory. The owner explained that he had purchased several old fodder trees from owners, had gotten lumber from them to use for making furniture, and the potential fuelwood remained unused because it was so easy to get kerosene and cheap fuelwood elsewhere.

Medium level households in Pumdi Bhumdi, Hyangja, Armala Sunpadeli, and Arba villages find opportunities to make extra income by selling their old fodder trees. In some cases, villagers in need of money--to construct houses, to clear land for house construction or in case of business failure--were found selling private fodder trees. This actually started after the government passed a bill in 1987-88 that allows people to buy and sell the trees on their homestead, home garden, or farm land with permission from the forest office.

### **2.1.2 Market Travelers**

The market travelers are occasional fuelwood traders who take backloads from the surrounding villages to urban Pokhara. These people usually do not depend primarily on fuelwood to earn their living, but occasionally engage in fuelwood sales to get some extra money to buy something they want or need but cannot otherwise afford. These rural people may be from any socioeconomic status and caste, but are usually from middle and lower income groups of the Brahmin and Chhetri castes.

Almost all the households in rural areas gather enough fuelwood during the winter months for use throughout the year. Usually when an individual needs some money, he or she takes a back-load of fuelwood to sell in the market in Pokhara. The elders in the family give permission to carry the wood from the stack of fuelwood in the household. Sometimes, however, the individual has to collect additional fuelwood when there is not enough storage in the house. These individuals are usually women and students.

Women depend on this type of income from sale of fuelwood, for example, to buy cosmetics before major festivals and important household ceremonies, such as a marriage. Students find selling backloads of fuelwood in the urban area an easy way to earn money to buy stationary supplies and books. Like the women, they take backloads of fuelwood from the house with permission of the elders or gather fuelwood from the forests themselves.

### **2.1.3 Bus and Truck Operators**

Bus and truck operators driving to Pokhara from distant places act as fuelwood middlemen. They find buying a few small bundles of split fuelwood (*bitas*) from roadside vendors or middlemen and reselling them in Pokhara to be a profitable business to supplement their salaries. The amount of wood they can carry in the vehicle depends on the availability of wood on the road sides and how much extra space is available on their vehicle. Transport operators can carry more fuelwood (if it is available) during the rainy season, when people usually travel less.

Rainfall plays a critical role in the availability of fuelwood. Fuelwood may not be available on the roadside when it is raining. But most of the time, drivers are able to buy fuelwood from the middlemen on the roadsides. Naturally, these cost a few rupees more than those purchased from the roadside vendors.

Our findings suggest that this type of fuelwood entrepreneurship started about five or six years ago. It increased in 1989 because of the INTT crisis, which led to severe fuel scarcity and the relaxation of forest protection activities by the government officials.

At present, buses and trucks going to Pokhara from Kathmandu, Narayanghat and beyond, and Bhairahawa and beyond do carry small bundles of fuelwood. On an average, 40-50 buses ply the roads to Pokhara daily. No exact information could be acquired regarding the transport of fuelwood by truck/bus operators.

But the relatively full load each truck normally carries allows truckers to carry fewer bundles of fuelwood as piggybacks than the bus operators. A considerable quantity of split fuelwood, amounting to 4,000-5,000 kg, comes into Pokhara daily as piggyback bundles on trucks, buses, and other vehicles (New Era 1990).

These entrepreneurs usually buy small bundles of fuelwood for Rs. 7-10 (US\$ 0.23-0.33) per bundle from the roadsiders or middlemen and sell them to middlemen in Pokhara for about Rs. 20 (US\$ 0.66) per bundle or directly to consumers in the town for Rs. 25 (US\$ 0.83) each. They usually give some discount to relatives, neighbors, and regular customers, charging them about the same price as the middlemen. Because the profit margin of this business is very high, the general tendency has been to bring an increasing number of bundles of fuelwood into the city.

When we approached a bus driver in the office of the bus operation committee, he and an official of that office assured us that the drivers carried only the allowable amount of five bundles per trip, as advised by forest officials. This strongly suggests that most of the transport operators are aware of the government rules. The bus drivers, however, are making good profits. They usually operate using their own money and seldom reveal their income from this business to the transport owners.

### **2.1.4 Middlemen**

We found two types of fuelwood middlemen in the Pokhara area. One group consists of shopkeepers at the entry points in suburban Pokhara through which villagers have to travel to get into the Pokhara urban area. The share of business from this activity is less in the case of most of the middlemen at the Arba-Kahun entry point. There are about eight middlemen involved there,



as and when they get opportunities to buy backloads of fuelwood from villagers at cheap rates. Other middlemen operate at the entry points of Mahendra Gupha, Pame, and Chhorepatan.

Some middlemen in Mahendra Gupha are able to make their fortune through this work. People in need of fuelwood, even from the core town area, are reported to buy fuelwood from middlemen at these entry points, especially Mahendra Gupha. In most cases, customers live near the entry points, toward the core area. These middlemen on an average make a profit of Rs. 5-10 (US\$ 0.17-0.33) per backload of fuelwood, depending on its quality.

The second group consists of shopkeepers on the sides of the highway leading to Pokhara Town and some at the bus park who also serve as middlemen in the fuelwood business. Transport operators drop their purchases of fuelwood at the middlemen's shops. This fuelwood trade is a secondary business that supplements the income from their shops. Middlemen sell fuelwood with a profit of Rs. 3-5 (US\$ 0.10-0.17) per small bundle (*bita*). But they often make an additional profit by taking a piece of firewood from each bundle and making extra bundles out of them. They usually get their supplies from incoming buses and trucks in the late afternoon and early evening and early in the morning from day service and night service respectively.

## **2.2 Charcoal**

### **2.2.1 Producers**

As in the fuelwood system, participants in the charcoal production system are from low income or low caste groups. People from the Kami (blacksmith) and Sunar (goldsmith) castes, especially landless workers and smallholders, are often involved in the production of charcoal. They not only sell charcoal to fellow villagers and elsewhere, mainly in the city of Pokhara; they often use the charcoal themselves by working as blacksmiths or goldsmiths.

The Kamis and Sunars are traditionally the charcoal producers. Some produce mainly for their own use in ironworking and goldsmithing, their traditional occupations. Others, because they are landless or near landless and are not established in these occupations, have very few economic alternatives and must sell charcoal outside their village, mostly in the Pokhara urban area.

Most of them, being landless or near landless, produce barely enough food to eat for two or three months. To buy food and other necessities, these people work as hired labor, they do ironsmithing and goldsmithing, and they produce and sell charcoal. Some Kami households have abandoned their traditional occupations because of competition within the caste. The most economically attractive alternative is the production and sale of charcoal in Pokhara, but this is illegal and carries a great risk of being caught by government forestry personnel. A 50-year-old Kami with a family of 10 from Bharatpokhari compared the income from charcoal sale in Pokhara and income as a hired laborer in house construction/repair. He and his son earn Rs. 120 (US\$ 4.00) a day in house construction and repair, whereas selling two boras of charcoal brings them Rs. 300 (US\$10.00) a day.

There are about 30 households of Kamis and Sunars in Bharat Pokhari and almost all of them are involved in the charcoal business. No households from other castes are involved in the production of charcoal. During the course of interviewing, one low-caste Kami man was excited to learn that anybody could do any job now. He called out to a high caste Brahmin woman: "Did

you hear? Anybody can do any job. You, too, can make charcoal." "I would better die," she retorted, "than make charcoal." This clearly indicates that though it is a profitable business, among people of higher caste in that village it is distasteful to enter into traditionally lower caste occupations. It was reported that even a few households of other castes (Magar and Chhetri) as well as Kamis are involved in this business in other nearby villages in Tanahun District adjacent to Kaski District.

The seasonal pattern of the production and sale of charcoal is similar to that of fuelwood. Winter months are a peak time for making and selling charcoal. At this time of year people have no work to do in the fields, so they scour the woods for dead branches and wood left over from the felling of trees with permission from the district or area forest office personnel. Also, at this time of year the demand in the Pokhara urban area is high.

The charcoal entrepreneurs in Bharat Pokhari usually carry sacks (*bora*) of charcoal (18-25 kg) on their back to the nearest marketplace along the highway, i.e., Gagan Gaunda and Talchowk. These points are 13 km and 10 km to the east of Pokhara town respectively. They then use public minibuses and buses to transport the charcoal to Pokhara.

Once in town they have to carry the sacks on their back again for sale to consumers in the market. The big consumers are the metal workers (Bandas). Most of them are located at Nalamukh area, some at Bagar and Ram Bazaar. The small consumers are goldsmiths located at most of the places in Pokhara. The consumers in great need of charcoal may be waiting for the producers at the bus stop. Once the deal is finalized, the producer carries the sack to the consumer's place if it is not far away.



Sack of Charcoal (*bora*)  
(18-25 kg)

Usually, the men make charcoal in the forest, because it is hard labor to collect and cut the wood into pieces and to dig the pit of 60-90 cm deep and 90 cm to 1.5 m across. Both men and women, but usually women, are involved in taking the sacks of charcoal for sale in the market. The women are treated more leniently if caught by Forest Office personnel.

### 2.2.2 Middlemen

Charcoal makers sometimes sell charcoal to middlemen at the nearest point on the highway, e.g. Gagan Gaunda and Talchowk. They sell their produce to the middlemen to save time, to evade being caught by the Forest Officials, and sometimes to repay money they have borrowed from them. A goldsmith at Talchowk is supplementing his income by buying and selling sacks of charcoal. He said "I do not take the sacks of charcoal to Pokhara Bazaar. Kamis and Sunars from nearby villages and sometimes workers of rich metalworkers come from Pokhara to buy charcoal from me." He has been making a profit of about Rs. 20 (US\$0.66) per sack of charcoal.

Another middleman from Tanahun District seems to sell charcoal in Pokhara in a well-organized way. He takes orders from consumers and after one to two weeks supplies the number of sacks ordered. He transports sacks of charcoal in a minibus, many at a time, to make deliveries to the consumer's door. It seems that this middleman has been dealing with the producers from Tanahun district.

One metalworker reported that when charcoal was scarce, he brought a few sacks of charcoal from Butwal (about 155 km. from Pokhara). Charcoal can be supplied from distant places, but there are problems. The government does not issue licenses for this and there is always the risk of being caught by forest officials along the way. Moreover, it is a complex and difficult task to transport charcoal to Pokhara from Butwal or other distant places. The role of market travelers in charcoal entrepreneurship is the same as firewood entrepreneurship except that only Kamis are involved in it.

### **3. ACQUISITION OF WOOD AND CHARCOAL**

The principal sources of wood energy for Pokhara are fuelwood for most commercial and household uses and charcoal for certain commercial uses. The acquisition, sale, and distribution of fuelwood and charcoal are major enterprises. Wood energy is obtained from both primary sources (forests, private trees) and from secondary sources (by conversion to charcoal, and the residues and wastes of certain commercial/industrial enterprises, livestock yards, and some business establishments).

There are three primary sources of raw woodfuel energy, corresponding to three types of tenurial niches for tree and forest products (Bruce 1989): government reserve, commons (community and communal forests) and private holdings. Secondary energy resources come from the conversion of wood into charcoal, and the residues and wastes from various industrial/commercial enterprises and businesses (factories, distilleries, livestock yards, and small businesses). Each of these categories of primary and secondary sources is discussed in turn.

#### **3.1 Government Forests**

The main source of wood energy, both fuelwood and wood for conversion into charcoal, is government forest. By law, all non-private holdings are considered government land in Nepal. Some government forests are protected and managed by villagers, and are known as community forests (discussed below under Forest on Local Commons).

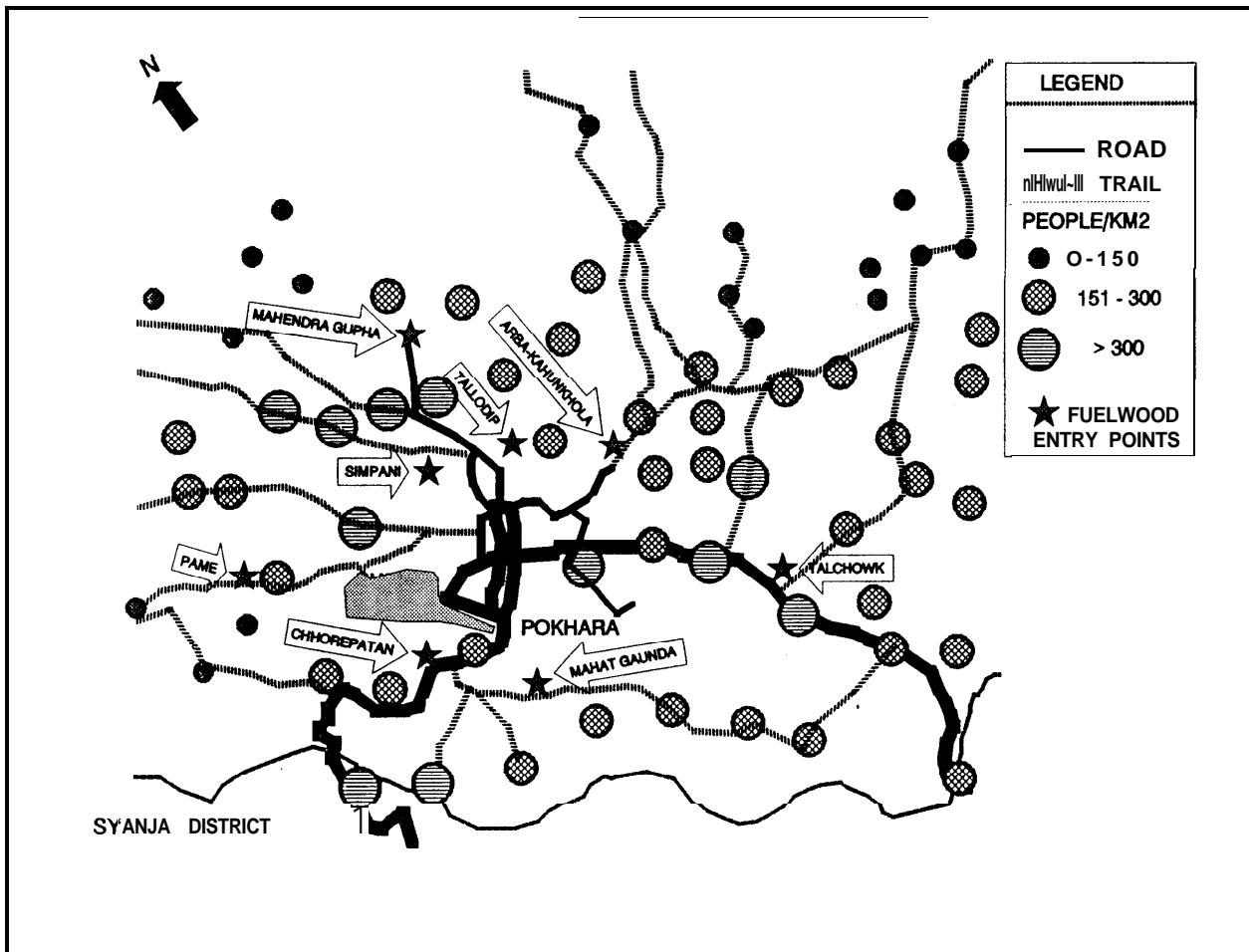
Most fuelwood and charcoal producers exploit government and, to a lesser extent, local community forests. Exploitation of government resources for cutting either fuelwood or timber is prohibited by law. The law states that no person can enter the forest with an axe or a sickle. Hence, all cutting is banned except by official permit issued by the District Forest Office. But the collection of twigs and fallen branches for fuel, of leaves and some other minor forest products (fruits, nuts, and other edible items) for household use is allowed. In practice, villagers make extensive use of the forests and considerable illegal cutting is common in the hills surrounding Pokhara (as it is throughout Nepal). Illegal cutting may have contributed to the reduction of forest resources in recent years, which in turn has led to diminished access. Producers must travel greater distances and spend more time to find, cut, and transport wood.

There are several interrelated reasons for the demise of the natural forest. The first is population increase, and resulting increased pressure on natural forest energy resources. Much of the current demand on the forest in Kaski District and neighboring Syanja District is for fuelwood (and timber) and charcoal for Pokhara city. Population growth rates for Pokhara and for Kaski District are 8.94 percent and 2.75 percent respectively. Such growth puts more pressure on

forest lands and eventually causes the clearing of marginal (and sometimes high quality!) forest lands for conversion into agricultural land.

Eight entry points for fuelwood have been identified for Pokhara. They are Mahat Gaunda (S), Chhorepatan (SW), Tallodip (N), Pame (W), Mahendra Gupha (N), Simpani (NW), Arba-Kahunkhola (E), and Talchowk (SE) (see Figure 9 and Figure 14, page 47).

**Figure 9 Entry Points for Wood Fuel Entering Pokhara, and Population Distribution**



The villagers of Nirmal Pokhari and Bharat Pokhari, for example, harvest wood both for sale as fuelwood and for conversion into charcoal, from the government forest in their vicinity. They transport the fuelwood and charcoal to Pokhara via the Mahat Gaunda and Talchowk (Prithvi Highway) entry points respectively. These villagers are very aware that nearby forest reserves are being depleted at an alarming rate. This has encouraged them to form forest conservation committees to protect and manage some of the resource as community forest.

Similarly, the forests in Begnas watershed area are protected by the Begnas Watershed Management Project, with the help of local villagers. No one (except two landless women with their small children) is allowed to collect even dead twigs and branches for sale.

Patches of good natural government forest still exist at higher altitudes, above the villages (e.g., Kalilekh in the north), far from settlement areas. The harvesting of these forests is minimal. This particular Lekh has a very unusual form of resource management practices.

The villagers have partitioned the area into strips in accordance with accessibility to the forest as a basis for management and use of resources. Each strip has its own management committee and a hired watchman (*heralu*) to protect against illicit woodcutting. The committee decides the number of backloads that may be cut by each household, and from what area they may take them. They open the area each winter for 30 days to villagers and 15 days to outsiders. They shift the area to be harvested each year and forbid the cutting of straight trees and seedlings and saplings.

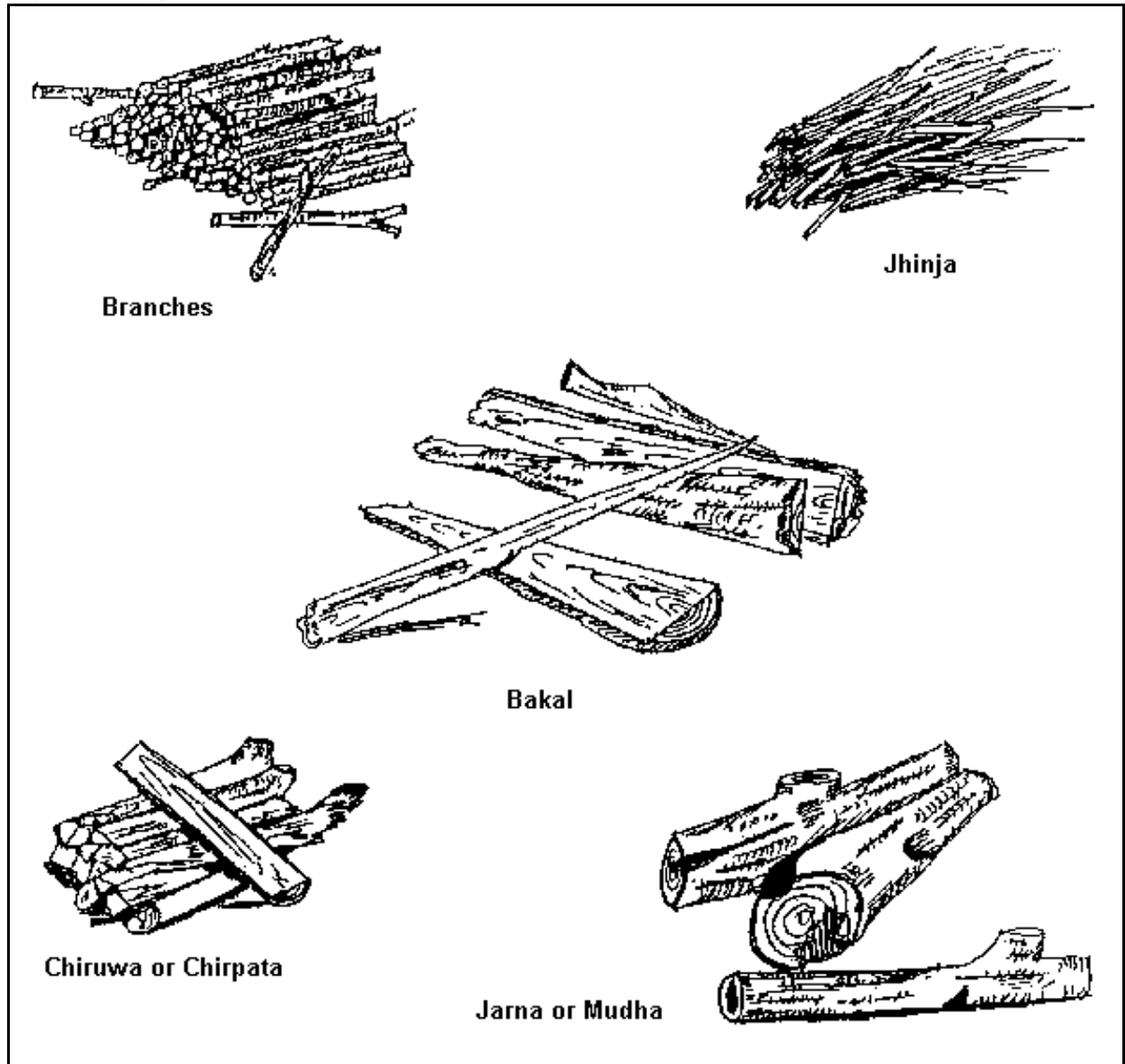
The committees say that they follow their perceptions and instincts rather than any formal method of silviculture. Generally, they allow the collection of dead branches and twigs all year round, charging outsiders one rupee per backload. One respondent estimated that this forest has been producing about four million rupees worth of forest products per year. This remote woodland provides the only reserve for future exploitation in the region.

The Timber Corporation of Nepal/Fuelwood Corporation is responsible for supplying the Pokhara area with fuelwood brought from the forest over distances of more than 150 km. The Corporation obtains its supply free from government forests and sawmills. The supply consists mainly of branches of trees (left over from lumber harvesting), damaged logs (*jarna* or *mudha*) and bark and cull wood (*baka*) (Figure 10).

The Corporation has four sales depots (at Bagar, Mustangchowk, Rani Pauwa and Bus Park) for selling fuelwood to mainly domestic consumers in urban Pokhara. The price of fuelwood sold by the Corporation is lower than that sold by villagers, middlemen or bus and truck operators. Therefore, usually it is difficult to get fuelwood at the depots. During the INTT dispute, the government managed to supply fuelwood on a quota basis, at the rate of one quintal per person per week. But the corporation could not meet consumer demand, because the supply of all types of fuel was limited during that period.

The bus and truck operators also bring fuelwood as piggy backs to make extra money. They get the wood from roadside fuelwood sellers, who come from low income households that exploit the government forest for fuelwood which they sell to earn their livelihood. Usually, they put a few backloads of fuelwood for display along the roadside and wait for the customers at a place a few meters away or hidden in the forest nearby. This is because they are afraid of being caught by forest officials. Most of the backloads are 15-20 kgs, mostly of *Shorea robusta* (*sal*), *Terminalia tomentosa* (*asna*), *Adina cordifolia* (*karma*) and *Lagerstroemia parviflora* (*botdhainro*). These roadside fuelwood sellers fell the trees, let them dry for some time, and then split the wood into pieces to sell as and when they need money.

**Figure 10 Types of Fuelwood**



### **3.2 Forest on Local Commons**

Some patches of forest still technically under government control have been set aside to be managed by user groups from nearby communities. Several varieties of forest management have been noted. There are regular "community forests" (*samudayik ban*) following a model that is being promoted by the government all over Nepal. These systems are managed by a forest committee made up of representatives of local users, in a neighborhood or ward, or the entire community, regardless of caste or ethnic identity. Another form noted in the Pokhara area is the communal or caste-based forest. This implies the exclusion of some groups within the community through restrictive rules of management, access and utilization (Messerschmidt, 1990).

In these systems, villagers typically hire a watcher (*heralu*) to protect the forest from intruders and to assure that legitimate users follow the rules established by the forest committee. These forest watchers are typically hired from among poor and landless households. Some communities manage the forest by rotating the watchman responsibilities among user households (the *ban pale* system). These techniques are neither traditional ones nor government-sponsored initiatives. They are recent local innovations that have emerged in response to the government's emphasis upon community forests.

After introduction of the forest nationalization act in 1957, HMG/N, the Department of Forestry experienced great difficulties in protecting and managing the forest in Nepal. By the mid-1970s, the Government realized a different approach had to be taken to involve local user groups in the protection and management of the forest. The National Forestry Plan (1977), introduced under the Panchayat Forest Acts of 1978 and 1980, recognized the importance of involving local communities in forest management. A portion of the national (government) forest was set aside for participatory management by user groups. The common forest is handed over to the concerned village committee, but it must be managed by the groups who have actually been using that forest. The operational plan for the forest has to be prepared by the user groups based on their needs and equitable benefits, in consultation with the village committee and District Forest Office personnel.

In Nirmal Pokhari, the forest watcher is paid Rs. 5.0 per household per month. The local forest conservation committee is made up of 19 members. There is a rule that the forest is opened for about fifteen days each winter to allow villagers to collect dead branches and twigs and to prune twisted and diseased branches at a rate not to exceed thirty adult backloads (*bhari*, approximately 35-40 kg for a man, 30-35 kg for a woman) per household. But this amount is not sufficient for even a small family. Villagers are forced to supplement this legal harvest of fuelwood by using small branches and twigs (*jhinja*) (See Figure 10) from lopped fodder trees on their private holdings, and various agricultural and barnyard residues (*jhikra*).

Under the national community forest system as practiced in many villages, the poor (the landless and near landless) members of the community ostensibly have equal access to forest resources under the local rules. Nonetheless, for them the rules are insufficient to their need, and those who depend on income from the sale of fuelwood for their livelihood must sneak into the forest during the night in order to cut wood to carry into the Pokhara bazaar for sale. All the while, they risk being caught by the forest watchers.

Among the most hard pressed are the poorest and usually the lowest caste people, such as the cobbler (Sarki), tailor (Damai) and blacksmith (Kami) castes. Under more archaic communal/caste-based forest management practices these people are the most likely to be excluded, since "ownership" of these forests tends to remain in the hands of the more powerful and affluent upper castes (e.g., Brahmins and Chhetris). As a consequence, some artisan caste people are forced to exploit the local forest by stealth, sneaking in at night when no one is looking. Blacksmiths are particularly inconvenienced by this inequitable use of the forest, as it is they who must have adequate hardwood and charcoal resources in order to make and repair agricultural implements.

For example, in Lahachowk village, the Brahmins and Chhetris do not allow people from other castes to use their communal forest, to which they claim prior and exclusive rights. Members of other groups, including the blacksmiths, are denied entry to these forests. Their only recourse is to use the equally restricted government forest (*sarkari ban*) in the mountains high above the village (Messerschmidt, 1990).

A dead tree being gradually cut down for wood and the pieces of waste wood from cutting and splitting of a *Schima wallichii* (*chilaune*) tree are indicators that the community forest in Nirmal Pokhari is being exploited by intruders.

### 3.3 Private Trees and Woodlots (Forest)

In some villages surrounding Pokhara, small patches of private and registered forests exist. These are natural forests. Twigs and branches are extracted from these forests. Permission must be obtained from the District Forest Office to fell trees other than fodder tree species. It was reported that no wood was allowed to be taken out of Nirmal Pokhari, even though the wood was from a private forest. But private forest owners can sell their wood products within the village area.

### 3.4 Agricultural Fields

Natural or planted fodder and fruit trees are grown on the bunds of upland fields. These are grown for other purposes, yet they are also a source of fuelwood and timber. The dead twigs and branches are used as fuelwood for household cooking. When the fodder trees get too old to yield a good quantity of fodder, they are usually sold to people in the urban area. Sawmills and furniture factories buy such trees and use the sawn trunks for making furniture and the branches as fuelwood.

Several common species of fodder are grown on the bunds of upland fields in the villages around Pokhara: *Ficus glaurolata* (*pakhuri*), *Garuga pinnata* (*dabdabe*), *Ficus nemoralis* (*dudhilo*), *Erythrina stricta* (*phaledo*), *Artocarpus lakoocha* (*badahar*), *Ficus sp.* (*khanyu*), etc. Similarly, a variety of fruit tree species are planted in the upland fields or on the bunds. These include guava, oranges, pears, peaches, plums, mangoes, and *Citrus sp.* (*nibuwa*), etc.

On the way to Bara village in Bharat Pokhari we observed corn and kodo millet being grown in a natural stand of *Acacia catechu* (*khair*) trees, one of the best species for producing charcoal. The potentiality of fetching a good price from the sale of these trees for charcoal-making is high in the future when no more *Shorea robusta* (*sal*) trees will be left in the government forest.

### 3.5 Charcoal as a By-product from Fuelwood Use

Fuelwood users are potential producers of charcoal. Charcoal is produced as a by-product of fuelwood burning. Most of the small-scale users of fuelwood do not bother to put out burning wood fuel. Some fuelwood consumers told us that if glowing embers of fuelwood are put out by sprinkling water on them, they produce a lower quality of charcoal than if put out by being covered with a pot. The charcoal thus produced as a by-product of burning fuelwood is of lower quality than that produced by professionals. Big and regular consumers of fuelwood like commercial home distilleries, bakeries, or tire retreaders, often produce some of their own charcoal.



Usually, bakery owners do not put out burning charcoal in the oven, but use its heat to bake for a longer time. At the end a very small amount of charcoal is left in the oven. The bakers usually do not remove it from the oven. Instead, they use it for easier starting of the fire the next morning.

A tire retreading industry owner told us that until recently he did not bother to save the charcoal created as a by-product by his boiler. But as the price of charcoal rose, he began saving it to sell it to people to use as grounding material in house construction. Similarly, charcoal created as a by-product by home distilleries is now being sold to charcoal users like ironsmiths and copper metal workers, even though they would rather not use charcoal produced from fuelwood use because the ash spreads all over when the air is pumped to start the charcoal burning and to make it glow.

### **3.6 Commercial/Industrial Residue**

Sawmills and furniture factories provide wood energy in the form of cull wood or leftover wood. These are produced as a result of sawing logs, making pieces for furniture, and smoothing the surfaces of cut pieces.

From 25 to 50 percent of this waste wood is produced in the form of off-cuts (*baka*) when logs (*jarna* or *mudha*) are sawn. Most of these logs come from the southern plains region (Terai) and some smaller logs come from the Timber Corporation of Nepal/Fuelwood Corporation depot in Pokhara. Wastage produced from trees of local species (i.e., *Ficus glaberrima*, *Schima wallichii*, *Castanopsis indica*) is as high as 75 to 80 percent, with the rest usable for making furniture. The wastage is less if proper sizes of sawn timber are available for making door and window frames. The pieces of wood wasted when making furniture constitute 15 to 25 percent of sawn timber. Furniture factories and sawmills also produce waste in the form of sawdust and wood shavings. This constitutes only a small percentage of the total waste. These wood waste products are usually piled up or stacked at the sawmill or furniture factory premises for sale. Users range from poor households to small scale industries and the uses include household cooking, commercial, industrial, and nonproductive uses (i.e., heating, bonfires, etc.).

Low income people living in the vicinity of a sawmill or a furniture factory depend on these waste products for their wood energy supply. They can buy small amounts of fuelwood and sawdust and thus avoid having to buy full backloads of fuelwood at a time. Some owners of these industries use the wood wastage, because of its availability. Also, they don't have to bother about getting other fuel. Similarly, laborers in these industries use the woodwaste for fuel because it is easy to get and often free. During the INTT dispute, when kerosene was in short supply, many people bought wood waste from sawmills and furniture factories.

Commercial use of this wastage includes use in restaurants, tea shops, etc. These users buy the waste products from nearby sawmills and furniture factories only when other forms of energy are in short supply and/or relatively expensive. A lodge and restaurant owner reported the purchase of one mini-tractor tiller load of waste wood during the period of fuel shortage. The price of it was comparable to that purchased from a middleman at Mahendra Gupha entry point.

Industrial use of the wood wastes includes use in tire retreading, bakeries, home distilleries, etc. The tire retreading industry needs high quality fuelwood for raising steam in the boiler. One

good source of wood for these people is the sawmill, where they find high quality wastewood. Other industries also buy it when supplies from other sources are limited. The price of this waste wood is higher than the loads of fuelwood sold by villagers and the bundles of fuelwood brought to town by bus and truck operators.

A very small amount of wood waste is used in nonproductive ways. The use may be limited to space heating during winter, post-partum heating practices, and Shivaratri bonfire. One furniture factory owner recounted how seven families of laborers from the southern plains region burned waste wood all day long to keep warm.

### **3.7 Livestock Yard**

Livestock yards constitute another secondary source of fuelwood for some households who own livestock. These households are mostly located on the outskirts of Pokhara town. The small twigs left over after feeding fodder are used as fuelwood for household cooking. Dried dung cake (*guintha*) is another source of fuel.

### **3.8 Business Wastes**

Many types of goods, including fruits imported from India, come in packing cases made of cardboard or wood. Poor people working in the firms that receive goods shipped in these containers often get these cases free of charge and use them as fuel for cooking. Some retailers and traders use the wooden cases themselves as household fuelwood. The wooden cases are dry and burn very well. Poor laborers usually get cardboard boxes. They prefer Chinese cardboard boxes, because these burn well.

### **3.9 Preferred Tree Species**

People in and around Kaski District have always relied heavily upon local natural resources, especially in times of political crisis. Much forested land has been converted to agricultural purposes and the remaining forests near human settlements are badly degraded.

Some tree species that people prefer to use for fuelwood and for making charcoal have become scarce. *Shorea robusta* (*sal*) and *Acacia catechu* (*khair*), for example, have become difficult to find in the Pokhara valley and around the surrounding villages, except for some on private land. These and other hardwood species have been getting more and more scarce. They are unavailable in some areas, and virtually everywhere villagers must now travel further than before to obtain wood fuel of preferred species.

A few preferred wood fuel species are still available and being used. Some preferred fuelwood species (i.e., *Shorea robusta* and *Adina cordifolia*) are transported into the Pokhara urban area from the southern plains region. Preferred species among those now available locally include *Schima wallichii* and *Castanopsis indica*. These two species may still be found even though they are being overexploited for use as fuelwood. This may be due to their good coppicing characteristics and a suitable climate that promotes good growth. Table 5, page 49 presents the tree species that appear for sale as fuelwood at the various entry points to Pokhara town. Table 2, below, gives a general list of preferred species for fuelwood and charcoal-making.

**Table 2 Preferred Species for Fuelwood and Charcoal**

<b>Firewood Species</b>	<b>Charcoal Species</b>
<u>Best species</u> Sal <i>Shorea robusta</i> Chilaune <i>Schima wallichii</i> Karma <i>Adina cordifolia</i> Tinju <i>Dyospyros spp.</i> Katus <i>Castanopsis indica</i>	<u>Best species</u> Sal <i>Shorea robusta</i> Khair <i>Acacia catechu</i> Kafal <i>Myrica esculanta</i>
<u>Good species</u> Asna <i>Terminalia tomentosa</i> Mango <i>Mangifera indica</i> Jamun <i>Eugenia jambolana</i> Khanyu <i>Ficus cunia</i> Badahar <i>Artocarpus lakoocha</i>	<u>Good species</u> Chilaune <i>Schima wallichii</i> Katus <i>Castanopsis indica</i> Angeri <i>Lyomia ovalifolia</i> Khanyu <i>Ficus cunia</i> Bothdhainro <i>Lagerstroemia perviflora</i>
<u>Less (non) preferred species</u> Utis <i>Alnus nepalensis</i> Phaledo <i>Erythrina stricta</i> Simal <i>Bombax ceiba</i> Pipal <i>Ficus religiosa</i> Khirro <i>Sapium insigne</i> Pakhuri <i>Ficus glaberrima</i> Bar <i>Ficus bengalensis</i>	

In areas where fuelwood has become very scarce and local people are managing and protecting the forests, the range of species being used as wood fuel is increasing. Trees growing on the bunds of fields are used for wood fuel, for example, even though they are rarely species preferred for wood fuel. *Sapium insigne* (khirro) and *Bombax ceiba* (simal) are two species that are now being used even though they are not thought to be desirable species. Even species deemed to be sacred, such as *Ficus bengalensis* (bar) and *Ficus religiosa* (pipal), which people not long ago avoided using, are now being cut for use and even sale as fuelwood, even though they are not desirable wood fuel species. Poverty and scarcity have driven people to such practices.

Respondents mentioned a number of characteristics that they associate with preferred species of fuelwood. These are presented below in Table 3.

**Table 3 Characteristics of Preferred Fuelwood Species**

- Fast drying
- Easy splitting and cutting
- Efficient in burning
- Produces good quality charcoal
- Easy starting the fire with charcoal
- Burns easily
- Heat intensity is high
- Give off less smoke
- All parts burn simultaneously
- Brings in more money (expensive)
- Good storage characteristics

But preferences are not straightforwardly determined in particular cases, and not all species confirm neatly to all characteristics associated with preferred or non-preferred species. For example, *Bombax ceiba* (*simal*) has negative characteristics on almost all the above points, but splitting it or cutting it into pieces is not difficult. *Castanopsis indica* (*katus*) and *Dyospyros spp.* (*tinju*) are preferred species, but they are also more difficult to split or to cut into pieces than is, for example, *Schima wallichii* (*chilaune*).

Consumers prefer to buy good quality fuelwood, even though it is usually more expensive. The higher price is often offset by greater value per unit. Low quality fuelwood does not last as long, though it is cheaper. Some respondents believe that one unit of *Shorea robusta* is equivalent to 1.5 units of *Ficus bengalensis*, *Ficus religiosa*, or *Ficus glaberrima*.

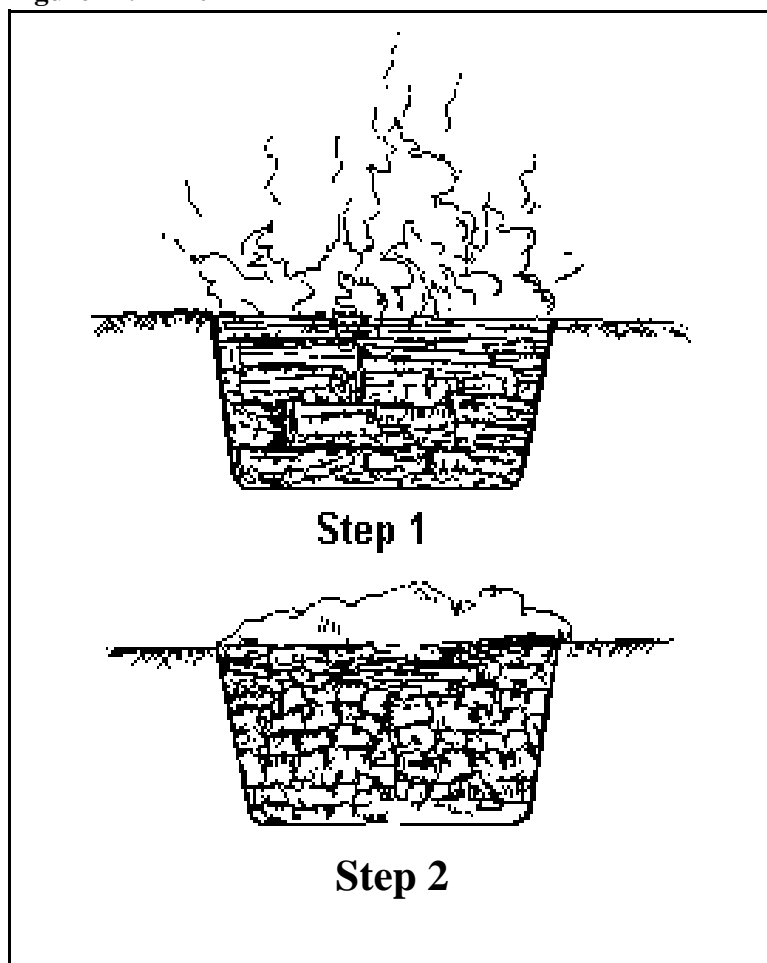
#### **4. TRANSFORMATION**

No agency or individual in Nepal seems to be authorized to produce or distribute charcoal to consumers on a commercial scale. The charcoal available in the Pokhara urban area is, therefore, produced and distributed on a demand basis, and illegally, mostly by rural members of the blacksmith caste (Kamis) who live in the surrounding hills. Kamis have been involved in the transformation of wood into charcoal since time immemorial for ironsmithing and for supply to goldsmiths (Sunars) and copper metal workers (Bandas). "Transformation" of wood refers to the process of converting wood to charcoal. Kamis usually transform wood into charcoal by means of traditional pit kilns.

##### **4.1 Pit Type of Kiln**

This method of charcoal production is usually referred to as the pit method (*khaldo tarika*). The pit kilns are constructed in the forests, the source of fuelwood. The construction of a pit kiln involves digging a pit in a high plain area. The size of the pit varies from 60 to 90 cm deep and 90 to 150 cm across, depending on the amount of charcoal to be produced, which in turn often depends upon the time available (Figure 11).

**Figure 11. A Pit Kiln**



The wood is cut into pieces of 60-75 cm and allowed to dry for one to two months in the forest itself. If dead branches or dry branches are available, no drying may be necessary. The small branches and twigs are placed at the bottom to use as starter. The larger pieces are stacked over it followed by small branches on top. The starter material in the bottom is lit and after six to seven hours of burning (or, according to one informant, one night's burning), the pit is covered with earth with some portion open on the side to allow the smoke to escape. After letting it burn for 24 hours, the earth is taken off and the charcoal is taken home.

According to one respondent, 60-70 pieces of wood are required to stack in a pit of 90 by 150 cm, which would produce about 80 kgs of charcoal per burning. Another respondent said that a pit of 60-75 cm deep and 90 cm across produced about 70 to 100 kg of charcoal from 1,000 to 1,250 kg of wood.

## 4.2 Social Aspects of Charcoal Production

Kilns are constructed in the forests about 4-5 km from the village. In Bharat Pokhari, the Kamis build kilns in the Paun Danda and Serung Forests. The number of persons involved in the collection of wood, digging of pits, and construction of kilns was found to vary from a single male to a group of two to four persons. Usually, when a group is involved, the members come from the same family or household.

Everyone helps in kiln construction and collection of wood, but usually the one who is most knowledgeable, skilled and experienced takes charge of charcoal-making. These people have learned how to build and operate kilns by observing their elders and assisting them. Thus the knowledge and skills of kiln construction and use have been passed down from father to son. There has apparently been no change in kiln construction and use, except in the size of the kiln, for a long time.

Most of the Kamis make charcoal in the winter months; but, depending on their need, they may make it in any season. If it rains during charcoal-making, it spoils the charcoal produced. Also, during the rainy season it is hard to find dry wood in the forest and also hard to get wood dried.

Since, many families make charcoal at about the same time, it is not unusual to find a number of pit kilns constructed side by side about 9-10 m apart. Last year 20-30 households used the same area in the forest to construct the kilns. One of the reasons the kilns are built so close to each other is that the kilns must be in a high plain area as a precaution against rain and the possibility of excessive soil moisture.

About 10 years back the Kamis of Bharat Pokhari constructed their kilns in a nearby forest only 20 minutes walking distance away. This forest is now in a degraded condition. They must shift to new locations in the forest each year, because there would be no dead branches, stumps, or trees left in the area after that. This has forced the Kamis to go farther and farther away from their village to make charcoal.

## 4.3 Tree Species and Charcoal Quality

Charcoal producers and consumers in Pokhara area are of the opinion that hardwood species such as *Shorea robusta* (*sal*) and *Acacia catechu* (*khair*) produce the best charcoal. Other good hardwood species for making charcoal include *Castanopsis indica* (*katus*), *Lagerstroemia parviflora* (*botdhainro*), *Schima wallichii* (*chilaune*), *Lyonia ovalifolia* (*angeri*), and *Ficus cunia* (*khanyu*). The producers in Bharat Pokhari village area did not mention the use of *Acacia catechu* (*khair*) for making charcoal, perhaps because it is not available in that area.

Both producers and consumers of charcoal have criteria for evaluating its quality. Table 4 lists some features most commonly mentioned as defining characteristics of good or bad charcoal.

**Table 4 Characteristics of Good Charcoal**

- Produces less ash; does not spread ash when air is blown
- High heat intensity saves amount of charcoal
- Having a hard texture and is not crumbly
- Lasts longer
- Produces less smoke
- Glowing makes metal working easier
- Does not spark ash or pop
- Large pieces
- Ignites easily and goes out by itself
- Large pieces can easily be broken at the point selected
- Has extremely black shining colour

## **5. DISTRIBUTION**

Both fuelwood and charcoal are produced in the villages around Pokhara. The fuelwood produced in these villages is either used by the producer, used by other villagers, or transported out of the village to Pokhara. Similarly, charcoal produced in some villages is either used by the producer, mainly Kamis, used by other Kamis in the same village, or transported out of the villages to Pokhara.

Fuelwood, sawdust, and charcoal produced as by-products in sawmills and fuelwood-using small scale industries in the town are also used either by the producer or by others elsewhere within the town. Thus, the practices of wood energy distribution and use vary according to distance from the source to Pokhara town and the local market area, accessibility and availability of wood fuel, the socio-economic conditions of the villagers, and the amount to be transported.

The dominant pattern in the flow of wood energy to Pokhara town from the surrounding villages and inter-village and intra-town distribution patterns are summarized in Figure 12, page 42.

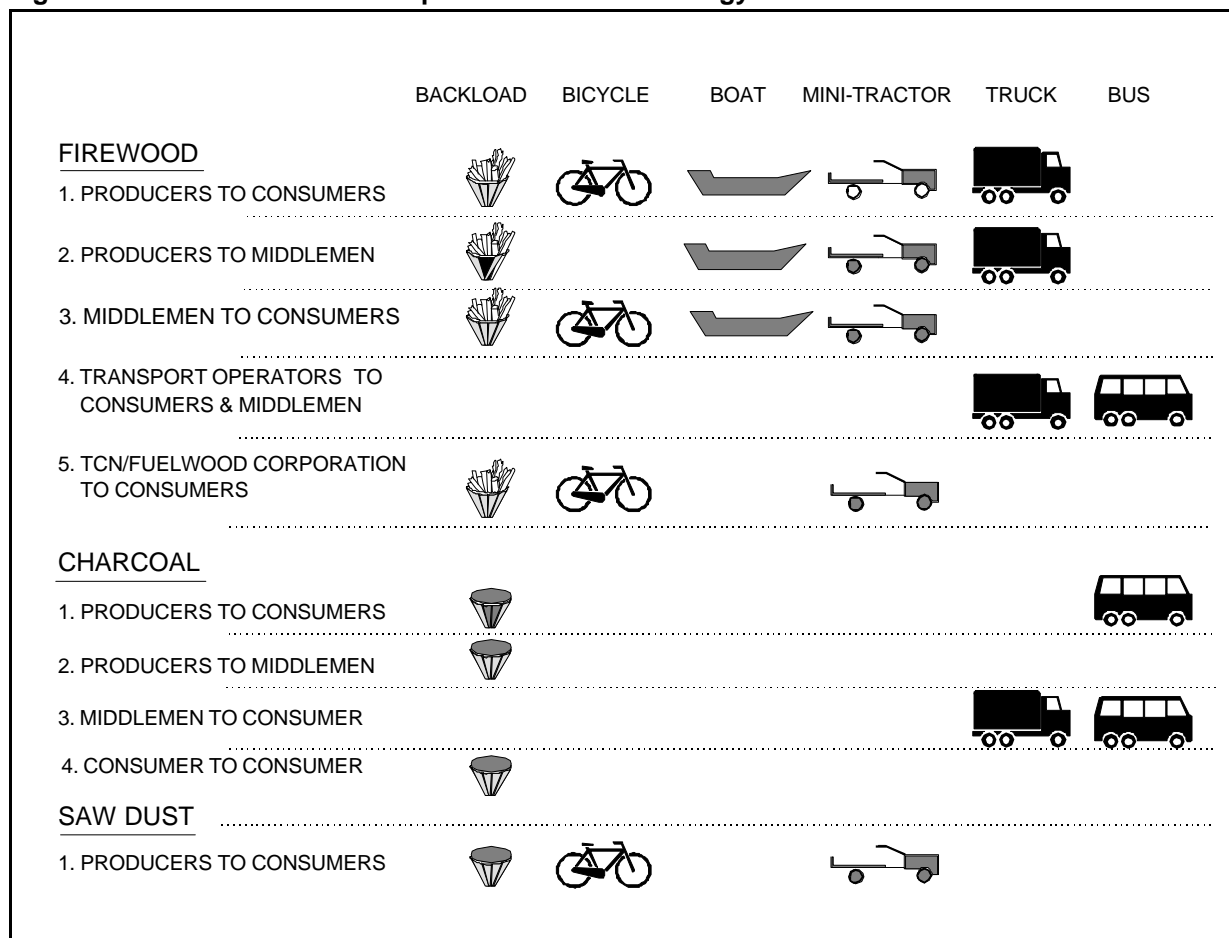
### **5.1 Inter- and Intra-Village Distribution**

The majority of the households in the village collect fuelwood for their own home consumption. They gather dead branches and twigs from the forest or from their own land and carry them home on their backs. Generally, fuelwood distribution within and between villages is limited, because each family can collect and store enough fuelwood to last for one year. Families usually stock up during the winter months.

Richer households may hire labor to collect fuelwood or may even buy it from fuelwood middlemen. Tea shops and cottage industries may in the same way hire laborers to collect fuelwood or to buy it from middlemen. This type of distribution may be within or between villages.

Fuelwood may also be exchanged for other goods among neighbors or borrowed. It can also be given to relatives, especially to aged parents, to fulfill the obligations and duties of extended families. Villagers rarely sell fuelwood or charcoal to local traders. But sometimes, if someone is ill in a household, a neighbor will carry a backload of fuelwood to the market to sell it and use the money to buy and bring back food, medicine, and other necessities for that household.

**Figure 12 Distribution and Transportation of Wood Energy**



Some producers who have developed the habit of drinking local whiskey and eating at tea stalls in the village or in the local market are involved in inter- and intra-village distribution of fuelwood. These producers supply fuelwood to the shops they patronize. They eat and drink or even take things home on credit. Then they either deliver fuelwood to the shops as repayment or sell fuelwood to raise the cash to pay their debts. In this case, the producer may not get full price for the fuelwood. The shopkeepers themselves also collect fuelwood from nearby forest during their spare time. It is important to emphasize here that villagers without jobs are often short of cash. Agricultural produce may be just sufficient for their livelihood. These people depend on the inter- and intra-village distribution of fuelwood to tea stalls or local markets for certain needs. We found this practice to be common at Dobilla, on the way to Nirmal Pokhari village. Other inter- and intra-village distribution of fuelwood to the local markets is done by producers who have other household chores to do, have limited time, and fear being caught by government forest officials carrying wood to Pokhara.

The charcoal distribution system within and between villages follows a similar pattern, except charcoal is produced, used and distributed mainly by Kamis, who use it mostly in ironsmithing, and to some extent in cooking and warming food. The charcoal distribution pattern



among Kamis is similar to the fuelwood distribution system.

We found that only a few Kami households are involved in ironsmithing in most of the villages. These households, although not licensed by the government, are allowed by fellow villagers to produce charcoal for use in making agricultural tools for the community. But, in one village, Kamis, taking advantage of the facility given, produce much more charcoal than they need and sell the surplus in Pokhara town. People not involved in ironsmithing are also getting involved in the charcoal business because of rising prices.

## **5.2 Distribution to the Pokhara Urban Area**

Urban Pokhara has been the major market to which producers from surrounding villages sell fuelwood and charcoal. Different types of middlemen are involved in transporting wood energy to town from the surrounding villages and even from far away places. This distribution network includes: producers, market travelers, middlemen, bus and truck operators, sawmills/furniture factories, and the TCN/Fuelwood Corporation.

Villagers who live on the west side of Phewa Lake use boats to transport bundles of fuelwood to Baidam, where they sell directly to consumers as well as to middlemen. Sometimes, if they have just one backload to sell, they will carry it around the lake.

The producers from villages situated within a walking distance of four to five hours to town take their backloads of fuelwood to market very early in the morning, around 3:00 a.m. They may go to the market, or they may proceed directly to consumers, such as households and the cottage industries. Villagers say they have several reasons for doing this: to evade forest watchers and government officials and also to be able to get back home in time to eat and still have time to go to work in the field. Moreover, this is status-lowering work, so many men do not want to be recognized selling fuelwood.

Most producers carry their loads of fuelwood on their heads or their backs and walk along the market road. Consumers in need of fuelwood often wait for them by the side of the road. Bargaining is common before settling on the price of fuelwood. Occasionally, it so happens that the seller cannot get a good price, because many loads of fuelwood have been brought to town on the same day. Under such circumstances, some people choose to leave their fuelwood with relatives in town, to be picked up and sold at some later date for a better price. For a consumer, there is no distinction between a producer/seller and a market traveler. To him, both types carry backloads of fuelwood for sale in the market.

Industrial consumers of wood fuel, however, use mini-tractors or trucks to haul to town large amounts of fuelwood and logs, which have usually been purchased from private tree owners. Laborers bring the wood from villages up to the main road where it is loaded onto a mini-tractor or a truck.

Bus and truck operators also transport fuelwood into Pokhara town, functioning as middlemen. Their role in distributing fuelwood has increased in recent times, especially since the INTT dispute, because of loose control in protecting the forests and lax supervision of the transportation of fuelwood from distant forests.

These traders distribute their fuelwood in various ways. They sell to other middlemen. They sell directly to consumers by making house to house calls, usually in localities where they live. They take orders from big consumers like restaurants, home distilleries and other such industries and supply them with bundles of fuelwood. Sometimes, bus and truck owners and the relatives of operators ask them to bring a certain number of bundles of fuelwood when they are in need. In such cases, however, they are constrained to perform this service without making a profit.

The Timber Corporation of Nepal/Fuelwood Corporation has the obligation to supply fuelwood and timber to urban areas, including Pokhara, to reduce the heavy pressure of the urban populace on surrounding forests. It has set up several depots in different parts of Pokhara town. Its supplies come from government forests in the southern plains (Terai) region. It transports fuelwood in trucks. The distribution to consumers for household use is on a quota basis. Industries, boarding schools, barracks, and other large consumers can receive supplies with permission from the District Administration Office. These consumers use backloads, bicycles, mini-tractors, and often trucks to transport the fuelwood. Sometimes, a few individuals from the same locality hire a mini-tractor to transport the fuelwood (each person gets one quintal per week) sharing the cost of transportation.

Charcoal mainly moves to town from villages and rural markets in one of two ways: (1) The producers (mostly Kamis) bring sacks of charcoal from the villages to the roadside, transport them by bus to Pokhara town, and then walk around the market area, making door to door sales. (2) Middlemen from rural markets take sacks of charcoal in minibuses and deliver consignments to consumers (metal workers, goldsmiths, ironsmiths) who have placed orders.

### **5.3 Intra-Town Distribution**

Distribution of wood fuel within the town may take place in several ways. Fuelwood is sold by middlemen. Sawdust and wastewood are sold by sawmills and furniture factories. Charcoal made as a by-product of fuelwood use is sold by fuelwood-using industries to consumers. There is borrowing and exchange among neighbors and relatives. One consumer may sell to another consumer. And people sometimes make contributions of fuelwood to ceremonies and festivities.

Middlemen buy fuelwood from bus and truck operators and directly from villagers. Usually, people from poor households, restaurants, industries, and home distilleries buy bundles of fuelwood and transport it on their backs or on bicycles and mini-tractors, depending on the amount of fuelwood purchased and the distance it must be transported. During the INTT dispute, one consumer reportedly obtained fuelwood from a middleman at Amarsingh Chowk and transported it across town to Bagar, 7 km away, in a mini-tractor. This type of intra-urban distribution of fuelwood is unusual, because fuelwood producers/sellers enter the town through entry points on all sides of the city.

Sawmills and furniture factories sell sawdust and other wastewood, for use as a source of wood energy, to a variety of consumers: poor households, tire retreading enterprises, bakeries, home distilleries, etc. The laborers working in these industries get their wood fuels free. Poor and mid-low income group households are the regular customers, because they can buy small amounts of fuelwood or a sack of sawdust instead of having to buy whole backload of fuelwood from producers/sellers and middlemen. An owner of a tire retreading industry used to buy fuelwood from nearby sawmills and furniture factories because he could get high quality wastewood (i.e., *Shorea robusta*). Other industries buy wastewood only when they are in desperate need of fuelwood. This

is because they have to pay a higher price for this kind of fuelwood.

Fuelwood-burning industries (tire retreaders, bakeries, home distilleries and restaurants) produce charcoal as a by-product. The recent price rise of charcoal has led these heavy users of fuelwood to save the charcoal, which was formerly neglected. This type of charcoal may either be sold or given without charge to neighbors or relatives.

Other types of intra-urban distribution of both fuelwood and charcoal include borrowing and exchange among neighbors and relatives and even sales from one consumer to one another. The households in need of wood fuels may borrow some from neighbors and relatives who have kept enough in storage. They later repay in kind what they have borrowed. Similarly, wood fuels may be exchanged or sold to needy neighbors or relatives. Metal workers (Bandas) also buy and sell charcoal among themselves, although they are not middlemen. A metalsmith in need of charcoal may have to pay a higher price for the charcoal, depending on the degree of scarcity and price trends. This is to assure that the person who provides charcoal to another is able to acquire the same amount of charcoal that he has provided.

#### 5.4 Fuelwood Bundles

Fuelwood is transported by middlemen from the source to the consumers in two types of bundles. One type of bundle is called a *bhari*. A *bhari* is a backload, weighing about 25-40 kg. The other type of bundle is called a *bita*. This is a smaller bundle, weighing about 10-20 kg. Fuelwood is usually tied into a bundle with rope made of locally available grass or with a climber called *laharaa* which is available in the forest. Then the villager does not have to worry about saving good rope and taking it home for reuse. The backload is carried on the back with the help of headband (*namlo*) designed to serve that purpose.

The weight of an average size of backload varies depending on the type of fuelwood, the way it is tied, and the degree to which the fuelwood is dried. A backload of small branches and twigs (*jhinja*) will be much lighter than a load the same size of split fuelwood (*chirpaat* or *chiruwa*). The size and weight of backload of fuelwood is also determined by the capacity of the person carrying it. Usually, the backloads carried by females and boys are smaller than those carried by men. Therefore, backloads of adult males fetch higher prices.

Sometimes fuelwood is transported in a woven bamboo container (*doko*). This is typically used for carrying different goods on the back with the help of the special headband. Usually, split fuelwood is carried in a woven bamboo container since it can be loaded easily. A smaller amount of fuelwood is carried in such a container than in a regular backload. Villagers only carry fuelwood in a bamboo container if they have to carry other purchases back home from the market.



*Bhari, Bita & Doko*

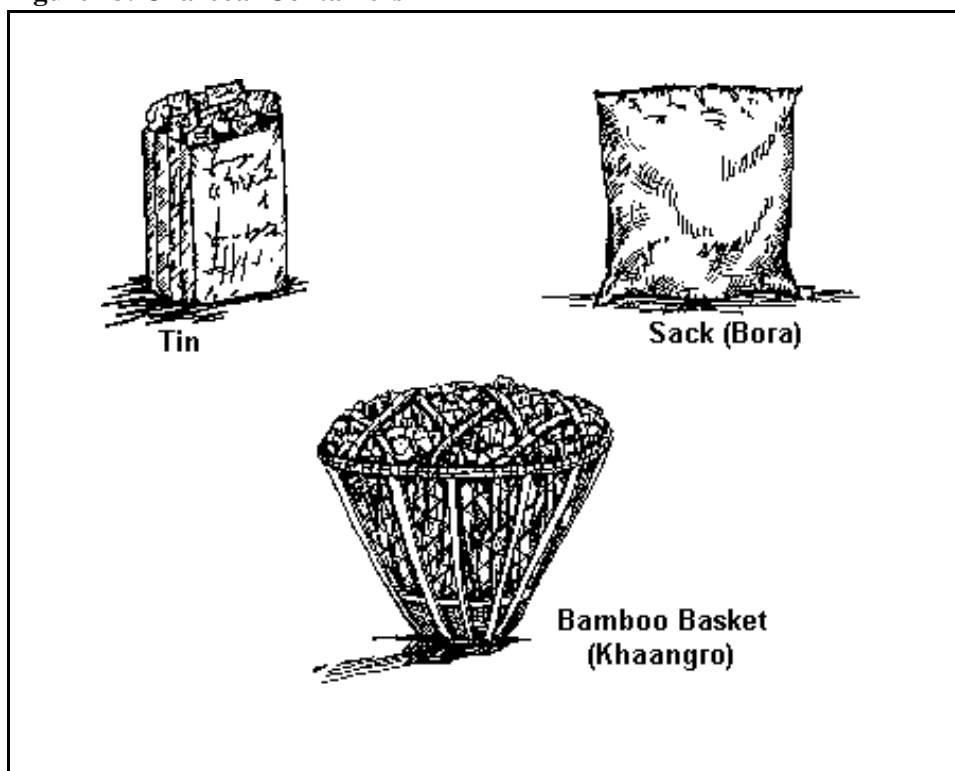
## 5.5 Sawdust Containers

Sawdust is usually transported in sacks or metal tin containers. Usually rice sacks are used to hold sawdust. The amount of sawdust a sack will hold depends on how well the sawdust is stamped down and packed into the sack. A well-packed sack holds more than 70 kg of sawdust, which sells for Rs 50 (US\$1.66). Sometimes, tin containers are also used by poor people to carry sawdust home from sawmills.

## 5.6 Charcoal Containers

Charcoal is stored and transported mainly in sacks, bamboo baskets, and tin containers (Figure 13). A rice sack, which holds about 20-25 kg of charcoal, is most commonly used, although sacks of various sizes are sometimes employed. The sack is tightly tied with string or rope. The actual weight of a sack depends upon the type of wood from which the charcoal was produced, the way the charcoal was made, and how it is packed in the sack. Rice sacks are used to transport charcoal from rural producers to consumers in the Pokhara area. Smaller fertilizer sacks are used to hold charcoal produced by small-scale, fuelwood-burning industries.

Figure 13. Charcoal Containers



A special kind of woven bamboo basket (*khaangre*) is used to carry charcoal home from the site in the forest where it is produced. This basket may vary in size, but it is usually smaller than the standard bamboo containers (*doko*) normally used to carry goods on the back. These bamboo baskets for carrying charcoal may also be used for intra- and inter-village transportation of charcoal. Upon reaching its destination, the charcoal is repacked into sacks or tin containers

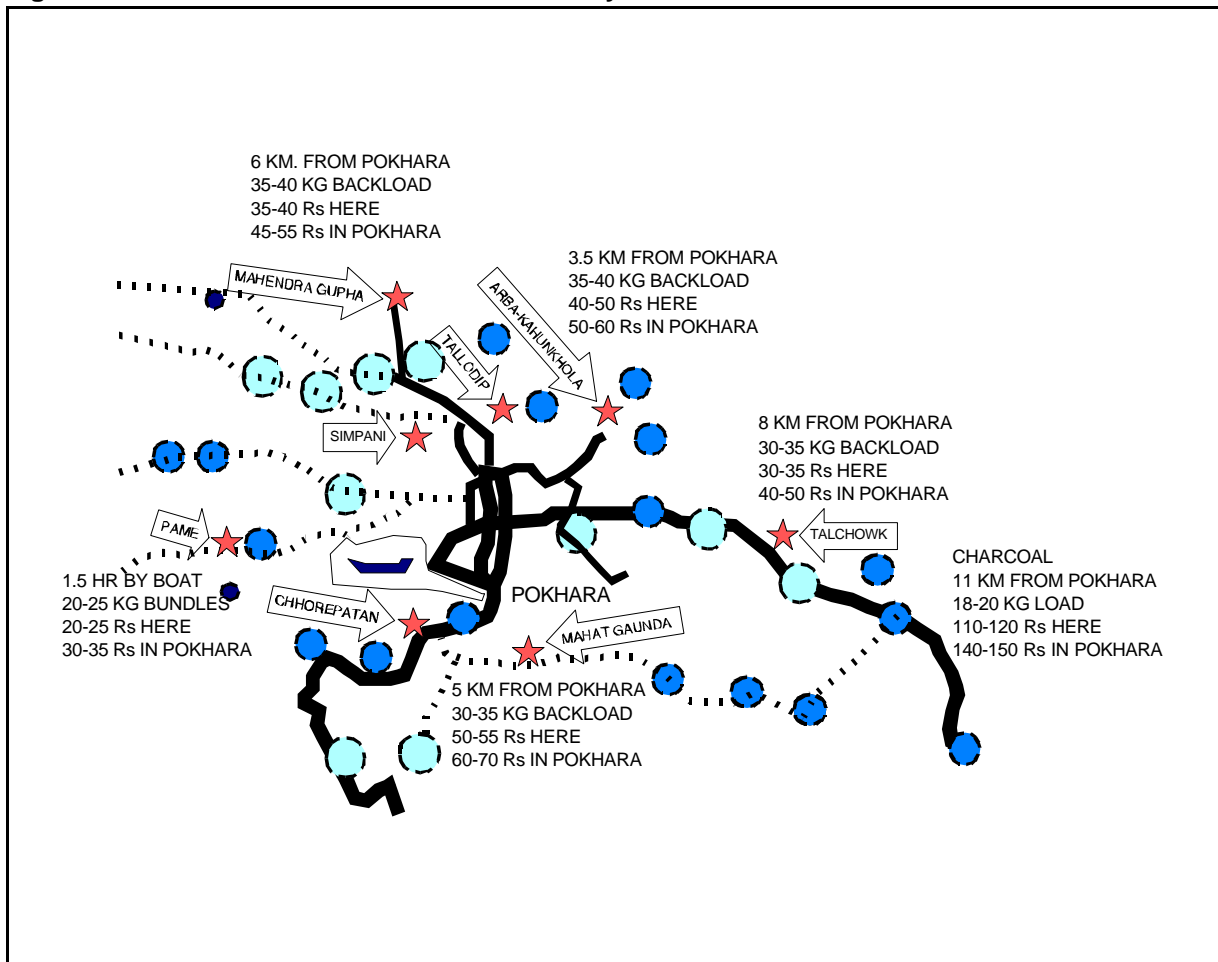
prior to sale or exchange.

Large tin containers, normally used 15 kg edible oil containers, are used in intra-village and intra-urban sale or exchange of charcoal among consumers. The tin cans are cut open on one side to hold the charcoal. Consumers involved in the sale or exchange of charcoal among themselves, in time of need, calculate that one rice sack equals five tin containers-full of charcoal.

### 5.7 Price of Wood Fuels

The price of both fuelwood and charcoal has been increasing. This general trend appears to transcend the effects of seasonality, variation in quality, shortages, and the bargaining skills of buyers and sellers, factors that will be discussed later in this section. The comparative increase in the price of fuelwood and charcoal at the entry points to Pokhara and at the Pokhara bazaar is presented in Figure 14. Our findings suggest that in general the price of a backload of fuelwood is cheaper at the entry points than it is in the bazaar by about Rs 10 (US\$0.33). Sellers tend to increase the price according to the distance from the entry points to the bazaar.

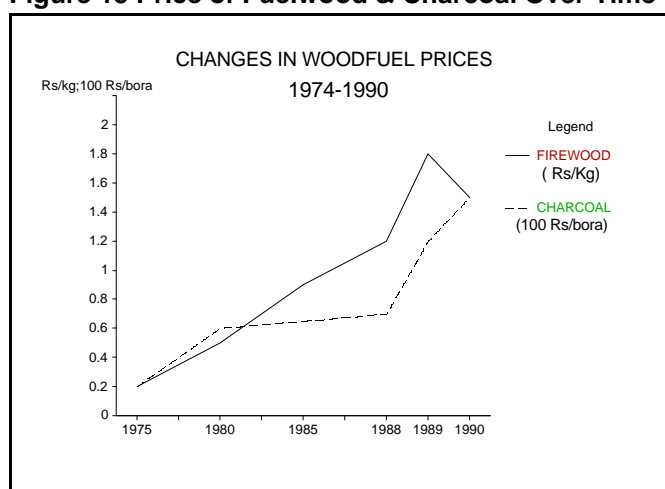
**Figure 14 Price of Fuelwood & Charcoal at Entry Points to Pokhara Area**



The price of fuelwood usually shoots up temporarily during the cultivation season by about Rs 10 (US\$0.33) per backload. During the INTT crisis in 1989, when severe kerosene rationing was introduced in all towns, a lack of adequate storage facilities meant that insufficient stocks were on hand to soften the blow. So most consumers who depended upon petroleum products for energy had to shift to fuelwood. Consequently, as fuelwood consumption abruptly increased, the price rose by 20-25 Rs (US\$0.66-0.83) per backload. Even though the government increased production from its own sources and sold it at a subsidized price on a quota basis, it could not meet the demand.

The price of a sack of charcoal at Talchowk, a major road juncture about 10 km from Pokhara, was found to be Rs 110-120 (US\$3.67-4.00), compared to Rs 140-150 (US\$4.67-5.00) per sack in downtown Pokhara. It costs about Rs 12-15 (US\$0.40-0.50) to transport the charcoal and another Rs 5.00 (US\$0.17) for a municipal tax. An additional mark-up by the retailer to cover expenses and to make a profit raises the price to Rs 140-150.

**Figure 15 Price of Fuelwood & Charcoal Over Time**



Like fuelwood, the price of charcoal goes up when the supply drops during the rainy season. This is because most producers are busy with farmwork and it is also an unfavorable season for making charcoal in any event. The price of charcoal also increases as demand increases during the marriage season (roughly, January until March) because of a corresponding increase in the demand for jewelry and copper utensils which are traditional presents for a bride. Some consumers report paying as much as Rs 225-250 (US\$7.50-8.33) per sack of charcoal during such periods.

The price of wood fuels has been increasing at a rate somewhat exceeding that of most other commodities. The general trend of increase in the price of fuelwood and charcoal over time is shown in Figure 15. The relationships were drawn from the average values of fuelwood and charcoal based upon information given by a number of respondents. The sharp rise in the price of fuelwood in 1989 was the direct result of the INTT crisis, as explained above. As urban demand for fuelwood rose sharply, the price per backload increased from Rs 40 (US\$1.33) to Rs 60-70 (US\$2.00-2.33) (New ERA 1990). Our findings confirm this rate of increase.

In general, the increase in the price of charcoal is similar to that of fuelwood, but the INTT crisis had much less effect upon the supply and price of charcoal, because most charcoal is produced during the winter months and most consumers had already stocked up on charcoal for use during the coming rainy season. Some consumers did report a rise in the price of charcoal after the crisis, but this may be due to the general trend of reduction in supply at that time. Until a few years ago, sawdust piled up unused at sawmills and furniture factories. The rising price of fuelwood and commercial fuels and the introduction of sawdust stoves (*bhuse chulo*) has resulted in its growing use as a fuel and a continuous increase in its price. During the INTT crisis, the price of sawdust rose as high as Rs 60-70 (US\$2.00-2.33) per sack (about 70 kg). At present it sells for Rs 40-50 (US\$1.33-1.67) per sack.

**Table 5 Tree Species Used for Fuelwood and Charcoal in the Pokhara Region**

Entry Point to Pokhara	Origin	Species	
		Local Name	Scientific Name
<b><u>FIREWOOD</u></b> Prithi Highway and Sidhartha Highway	Terai Region and Other Districts	Asna Karma Sissau Botdhairo Dabdabe Mahuwa Jamun Aanp Rookh Katahar	<i>Terminalia tomentosa</i> <i>Adina cordifolia</i> <i>Dalbergia sissoo</i> <i>Lagerstroemia purviflora</i> <i>Garuga pinata</i> <i>Engelhardtia spicata</i> <i>Eugenia jambolana</i> <i>Mangifera indica</i> <i>Artocarpas heterophyllus</i>
1) Arba-Kahunkhola	Arba, Kalika, Rakhi, Ramdanda, Thuloswara, Dhadbesi	Sal Chilaune Katus Kafal Angeri Thaune Bar Pipal	<i>Shorea robusta</i> <i>Schima wallichii</i> <i>Castanopsis indica</i> <i>Myrica esculanta</i> <i>Lyonia ovalifolia</i> ? <i>Ficus bengalensis</i> <i>Ficus religiosa</i>
2) Talchowk	Begnas, Majhthan	Katus Chilaune Sal Simal Pakhuri Ginari	<i>Castanopsis indica</i> <i>Schima wallichii</i> <i>Shorea robusta</i> <i>Bombax ceiba</i> <i>Ficus glaberrima</i> <i>Premna latifolia</i>
3) Mahat Gaunda	Nirmal Pokhari, Bharat Pokhari, Kristi Nachne Chaur, Taksar (Syangja Dist.)		<i>Schima wallichii</i> <i>Castanopsis indica</i> <i>Ficus benjamina</i> <i>Sizigium cumnii</i> <i>Eugenia jambolana</i> <i>Michelia spp.</i> <i>Bombax ceiba</i> <i>Dyospyrus spp.</i>
4) Chhorepatan	Pumdi Bhumdi, Kalabang, Lukumswara Aru Kharka (Syangja District)	Chilaune Katus Utis Pakhuri Aanp	<i>Schima wallichii</i> <i>Castanopsis indica</i> <i>Alnus nepalensis</i> <i>Ficus glaberrima</i> <i>Mangifera indica</i>
5) Pame	Ainselu Kharka, Chapakot, Kaskikot	Utis Chilaune Katus Sal Khirro Chooletro Dudhilo Tinja	<i>Alnus nepalensis</i> <i>Schima wallichii</i> <i>Castanopsis indica</i> <i>Shorea robusta</i> <i>Sapium insigne</i> <i>Brassiopris hainla</i> <i>Ficus nemoralis</i> <i>Dyospyrus spp.</i>
6) Simpani (Tundikhel)	Lahachowk, Hyangja, Sarangkot	Chilaune Katus Utis	<i>Schima wallichii</i> <i>Castanopsis indica</i> <i>Alnus nepalensis</i>

(Continued Table 11)

Entry Point to Pokhara	Origin	Species	
		Local Name	Scientific Name
7) Mahendra Gupha	Harpak, Garlang, Meke, Armala, Thulokhoria, Khormukh	Utis Angeri Dabdabe Rato Chandan Bhalayo Phoolchiso Malato Phaledo Khirro	<i>Alnus nepalensis</i> <i>Lyonia ovalifolia</i> <i>Garuga pinnata</i> <i>Daphniphyllum himalayensis</i> <i>Rhus succedanea</i> ? <i>Macaranga denticulata</i> <i>Erythrina stricta</i> <i>Sapium insigne</i>
8) Tallodip	Atighar, Mauja, Kuragaun	Chilaune Katus Tinju Pakhuri Bar Pipal	<i>Schima wallichii</i> <i>Castanopsis indica</i> <i>Dyospyrus spp.</i> <i>Ficus glaberrima</i> <i>Ficus bengalensis</i> <i>Ficus religiosa</i>
<b>CHARCOAL</b>			
1) Talchowk	Bharat Pokhari, Bara	Sal Kafal Chilaune Angeri Katus Botdhainro	<i>Shorea robusta</i> <i>Myrica esculanta</i> <i>Schima wallichii</i> <i>Lyonia ovalifolia</i> <i>Castanopsis indica</i> <i>Lagerstroemia purviflora</i>

## 6. THE USE OF WOOD FUEL

The use of urban wood fuel can be divided into four major categories: (1) household cooking, (2) commercial use, (3) industrial use, and (4) social-ceremonial use. To these categories one must add a miscellaneous category that encompasses a wide range of minor uses.

### 6.1 Household Cooking

Two decades ago fuelwood and agricultural wastes were virtually the only sources of energy for cooking. The majority of households in the suburban areas still depend on fuelwood for cooking. But most urban households in Pokhara have shifted to using other forms of energy (LPG, kerosene, biogas, or electricity) as a substitute for, or to supplement, fuelwood.

The switch to kerosene for cooking began when Pokhara was connected by road to Bhairahwa in 1972, making kerosene cheaper and more readily available. Subsequently LPG and biogas technology were introduced; and the local electricity system was connected to the central



grid system, tremendously improving it and stimulating greater use. People also shifted to other sources of energy in part because of the increasing cost and scarcity of fuelwood. Meanwhile, they found other fuels to be a convenient, healthful, clean, and--for small families--quick means of cooking. Moreover, fuelwood supplies became unreliable. Also, some landlords refused to let tenants burn fuelwood in their houses, compelling a shift to some other fuel.

Fuelwood is mainly used for cooking two meals and one snack (*tiffin*, or *khaja*) per day. Some households that own livestock cook mash (*kundo*) with fuelwood and some others use it to make grain alcohol for home consumption. Suburban and urban households, especially from lower and middle level income levels, use fuelwood for household cooking. Some richer people who own land or have privileged access to a source of wood (i.e., sawmill owners, or merchants who receive goods in wooden packing cases) also use fuelwood in their households.

Low income households are compelled to use fuelwood or sawdust for fuel, because they cannot afford to buy kerosene stoves. They will instead buy two or three rupees worth of fuelwood at a time. As one sawmill owner observed, "Poor people have to distribute their earnings to buy commodities for cooking, including fuel, on a day to day basis." Some middle level households, especially those including older people, prefer fuelwood for cooking because they are used to it and believe that food cooked with fuelwood tastes better. A few households (i.e., illegal whiskey-makers) collect the charcoal produced as a by-product of burning fuelwood and use it for cooking food whenever a sufficient amount is collected. Some low and mid-low income households, especially those near sawmills or ricemills, use sawdust or rice husks to cook meals.

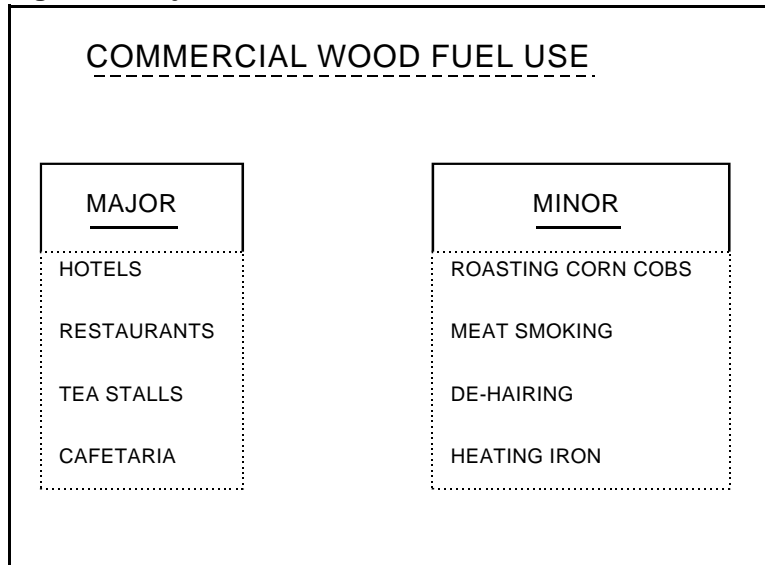
## **6.2 Commercial Uses (Hotels, Restaurants)**

Commercial establishments that use wood fuels may be divided into major and minor users, as shown in Figure 16.

In Nepal, the people call all eateries "hotel" (or *hotal*), including hotels, restaurants, tea stalls, etc. These can be classified into establishments serving Nepali meals and tourist establishments like hotels, restaurants and cafes. Most restaurants serving Nepali meals prefer fuelwood to other types of energy for cooking because larger quantities can be cooked at a time to serve people quickly. It is also easy to keep food warm. In addition, meat can be smoked for drying during and after cooking, and the ash produced can be mixed with detergent powder to wash dishes. Moreover, charcoal produced as a by-product can be used for space heating during the cool winter months.

Most restaurants and cafes catering to tourists have already switched from fuelwood to LPG or kerosene to cook dishes. These fuels make cooking faster, cleaner, and more hygienic. Moreover, the use of these fuels enables such places to cook and serve a variety of different dishes quickly, which is difficult with fuelwood. One respondent said that one could cook three times the number of dishes on a kerosene stove as on a wood stove in the same amount of time. Some restaurants catering to tourists use a special kind of charcoal oven to cook specialized items called "*tanduri*" dishes. They bake wheat bread and roast meat in these ovens. The use of charcoal by these restaurants depends solely on the influx of tourists from October until May. Once fired, these ovens must be kept warm, even though no cooking is taking place.

**Figure 16 Major and Minor Uses of Wood Fuels**



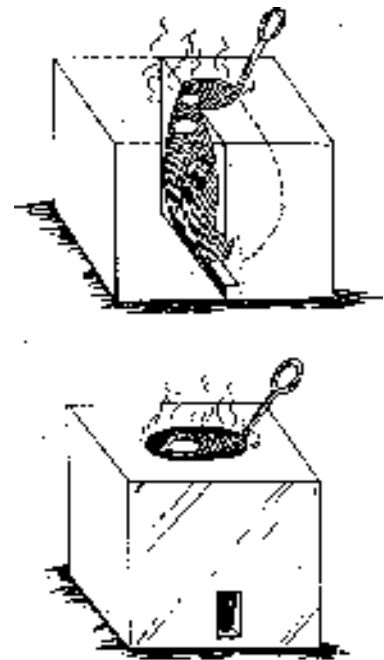
Small tea stalls outside the core area of Pokhara use fuelwood in traditional stoves. This is perhaps due to the easy accessibility and availability of fuelwood, especially on the roadsides leading to entry points for fuelwood sellers from surrounding villages. Also, these people are accustomed to using these stoves. Another minor commercial use of charcoal is for roasting green ears of corn. Poor people can be found at many busy spots roasting green ears of corn on charcoal in an iron pot.

Some butcher stalls also still use fuelwood to boil water for dehairing slaughtered goats and pigs. Most butchers, however, have begun to remove the skin of goats or to boil water for dehairing on a kerosene stove. So very little fuelwood is now used for this purpose. Some washermen (*dhobi*) still use fuelwood to heat washwater and some iron clothes with an iron heated by charcoal placed inside it.

### 6.3 Industry (Manufacturing)

Several types of small-scale industries in the Pokhara area still use wood energy, both fuelwood and charcoal. Industries using wood fuels for heat include blacksmiths, bakeries, food vendors, dyers, dairies, tire retreaders, and distilleries. These industries can be grouped in four categories (following Suwal 1988) according to the type of use: dry heat, boiling/heating, steam raising, and distillation.

**Dry Heat.** Goldsmiths, ironsmiths, and coppersmiths depend on charcoal for melting gold and silver and for making iron and copper red hot for easier fabrication and joining. Goldsmiths (Sunars) and copper workers (Bandas) working within their caste traditions use charcoal in a hearth (*gyasa*) which has a hole to be filled with charcoal. Air is blown in from below with a hand rotating bellows (Figure 17). Ironsmiths (Kamis) use a slightly different type of hearth (*aaran*), one that is open with three small stones arranged in a triangular fashion. Either a hand rotating bellows or a locally made leather bellows (*khalanti*) is used to blow air as needed (Figure 17).



Tandur Oven

Most bakeries have shifted to other types of energy, mainly electricity or diesel oil. Some small bakeries still use fuelwood because they cannot afford to buy modern equipment. They produce products such as bread, buns, biscuits, cakes, and crackers. Some small-scale industries use fuelwood to prepare deep fried products, both salted and spiced, potato chips, various kinds of beans, groundnuts, and flours. They suspend operations during the rainy season because their products get moist and soft, and also because the demand decreases.

**Boiling/Heating.** This category includes enterprises that dye yarn, candlemakers, and processors of dairy products. Huge amounts of fuelwood are used for dyeing cotton and woolen yarn. Fuelwood is used to boil water containing chemical dyes. As the traditional three stone stove needs more fuelwood, some small industries have constructed a closed version of the stove to use heat more efficiently and conserve fuelwood.

Most small-scale candle industries use kerosene stoves for melting wax, but one candle industry was found to use nothing but fuelwood as an energy source, because of easy access to it. The dairy industry uses fuelwood for heating a large volume of milk only when it becomes impractical to use kerosene stoves. The milk is boiled and fermented to make curds. The milk is also warmed up to 60-70 degrees centigrade so it will stay fresh longer.

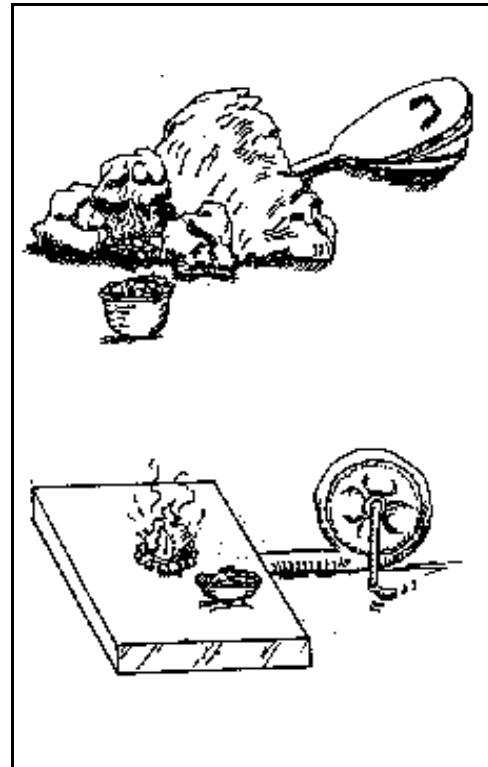
**Steam Raising.** The only industry that uses fuelwood for steam raising is that of tire retreading. Large pieces of fuelwood are burned to raise steam in a boiler, which is in turn used for heating the moulds for about three hours. These heated moulds are used for retreading worn-out vehicle tires which are placed in the moulds with rubber and other chemicals. Business is good during the summer season, because wear and tear on tires is high.

Thus fuelwood consumption is also higher than in winter for this purpose.

**Distillation.** Alcoholic beverages are brewed and distilled by licensed distilleries, but they are also made at home, both for private consumption and for sale. About 60 percent of all households made the local whiskey, *raksi*, for one or both of these purposes. Fuelwood is used for cooking millet, rice, and/or molasses, and after this mixture has fermented, fuelwood is used to boil it and distill whiskey from it. Although kerosene stoves can be used to brew this whiskey, and probably more economically, home distillers prefer to use fuelwood, which they claim produces a better tasting drink. Moreover, no kerosene stove is available that is big enough to cook large pots full of the grain or to boil fermented mixture for distillation.

One owner/manager of a licensed distillery reported that he made whiskey only during the winter, because both molasses and fuelwood were cheaper and more readily available then. During the rest of the year, he prefers to buy cheaper alcohol from sugar mills and mix it with water to make drinkable whiskey.

**Figure 17 Types of Metalworking Hearths**



## 6.4 Social-Ceremonial Uses

Social-ceremonial uses of wood energy include a wide range of activities: cremation, bonfires, post partum heating practices, merit-making, and so on. The Hindu religion specifies that a dead body must be cremated using fuelwood. The funeral pyre is prepared with fuelwood layered criss-cross in layers. An immediate relative, usually a male, fires the pyre. In Pokhara cremation usually takes place along the banks of the Seti River, where on an average one to three corpses are cremated every day. About 200-300 kg of fuelwood is required to cremate a dead body. A committee of the Gurung community manages a fuelwood depot inside the compound of a Buddhist temple near the river to supply wood for cremations. Certain communities bring the fuelwood required for cremation with them from their homes, sharing the burden of cremating one of their community members.

Among ethnic Gurungs, fires are used on auspicious social and ceremonial occasions. In one such religious ceremony, Arghaun, the Gurungs worship Buddha and eat a communal meal cooked in a community kitchen. About 15 to 20 such ceremonies a year are organized at that particular Buddhist temple, each one consuming about 500 kg of fuelwood.

Bonfires are lit at all intersections in the Pokhara area on the night of Shivaratri, the 13th night after the full moon in the month of Falgun, which falls sometime in February or March. Bonfires are also lit at some of the tourist hotels during the winter season in Pokhara. Most hotels and restaurants also light bonfires at Christmas. Post-partum heating practices are also common in Pokhara. After birth, the mother and the new-born child are kept warm for 12 to 15 days. Small pieces of fuelwood are burned in a pot made of metal or clay, and massage is given with mustard oil. Also, people of all castes and every socioeconomic status use fuelwood for cooking on special occasions of various kinds--festivals, marriage, etc.

## 6.5 Other Uses

Charcoal is used as an electrical grounding material in buildings to protect them from lightning. About one sack of charcoal is put into a pit to serve as grounding.

Both fuelwood and charcoal are used for space heating, especially by the elderly during the cold winter months. The amount used depends on the severity of coldness and the availability of wood. An owner of a sawmill/furniture factory complex reported that his workers, especially those who came from the plain to the south (Terai), burn waste wood all through the winter days. Thus even migrant laborers have an impact on local energy use. One restaurant owner saves charcoal from fuelwood burning throughout the year and uses it to help her parents keep warm during the cold winter months.

There are about 92 km of roads in Pokhara, of which less than 20 percent are in reasonably good condition (MSTPP 1987). Although there is no regular road maintenance program, except for one 10 km stretch maintained by the Highway Department, road tarring is occasionally done. Fuelwood is used to melt the bitumen, which is mixed with small stone aggregates when it reaches a molten state. This is placed on the road surface and pressed down with heavy rollers.

## 6.6 Adjustments Made by Users

In 1985/1986 fuelwood consumption accounted for about 76.3 percent of energy use in Nepal, whereas in Pokhara it was estimated at 63 percent in 1988 (WEC). In urban areas many more people have shifted to, or are currently making the shift to, cooking with other forms of energy: kerosene, electricity, biogas, and LPG. But some households still use only fuelwood and others combine fuelwood use with some other source of energy. The kind of energy used depends on the type of food to be cooked, the availability of fuelwood, and the socio-economic status of the household. Looking at energy substitution patterns, it appears that fuelwood consumption may be decreasing, or at least it may remain constant for a few years.

Adjustment practices differ according to the type of urban users and the uses of energy. Two decades ago, before Pokhara was linked by road with Bhairahwa, almost all households used wood energy because it was the only readily available and affordable source of energy. As the demand for energy increased with the accelerating pace of urbanization, a growing influx of tourists, and the establishment of new industries, there was a decline in forest resources in the vicinity. In recent years both households and industries have experienced uncertainty in the supply of fuelwood, shortages, and price increases.

This has led some industries to resort to using diesel oil in furnaces instead of fuelwood. One traditional Nepali paper industry has started using diesel oil to boil pulp, which required only minor changes in the furnace and the installation of pumps to get oil and air into the furnace. At this plant paper is produced from *Daphne spp. (lokta)*, a tree that grows naturally in high altitude forests in the midlands. The bark of the tree is beaten and boiled with caustic soda. Paper is then produced from the pulp using a mould frame.

Some other industries still using fuelwood are now compelled to buy and use any kind of fuelwood they can acquire. As noted above, people have even started cutting and using trees once considered sacred by Hindus (i.e., *Ficus bengalensis* and *Ficus religiosa*). Because supplies are so uncertain, users have to keep at least a 15 day supply of fuelwood on hand to ensure that their operations can be kept running without interruption.

Similarly, charcoal users such as ironsmiths, goldsmiths and coppersmiths must have charcoal to be able to work. They prefer high quality charcoal, especially that made from *Shorea robusta (sal)*, but sometimes they have to use low quality charcoal made from other, less-preferred species such as *Alnus nepalensis (utis)* or bamboo rhizomes. These people usually get their supplies in the downtown Pokhara bazaar. When in need of charcoal, they can buy or borrow some from neighbors or relatives. One owner of a copper metal industry reported that he had once traveled to a producer's house in a distant village to buy all the charcoal on hand. He then walked back to town early in the morning, with the producer carrying this illegal charcoal for him, to evade district forest officials. Such users say they have no alternative to using charcoal as long as it is available. But, for melting gold and silver, one person is combining coal and charcoal at a ratio of 7.5 to 1.

Some very low and mid-low income households use sawdust stoves. One respondent began doing this seven years ago. Sometimes, when sawdust is not available, people living near a rice mill use rice husks in their sawdust stove. Agricultural wastes, including corncobs, are also now being used as fuel, sometimes mixed with dust. Such materials were once thrown away, or at most used only to cook mash to feed to livestock.

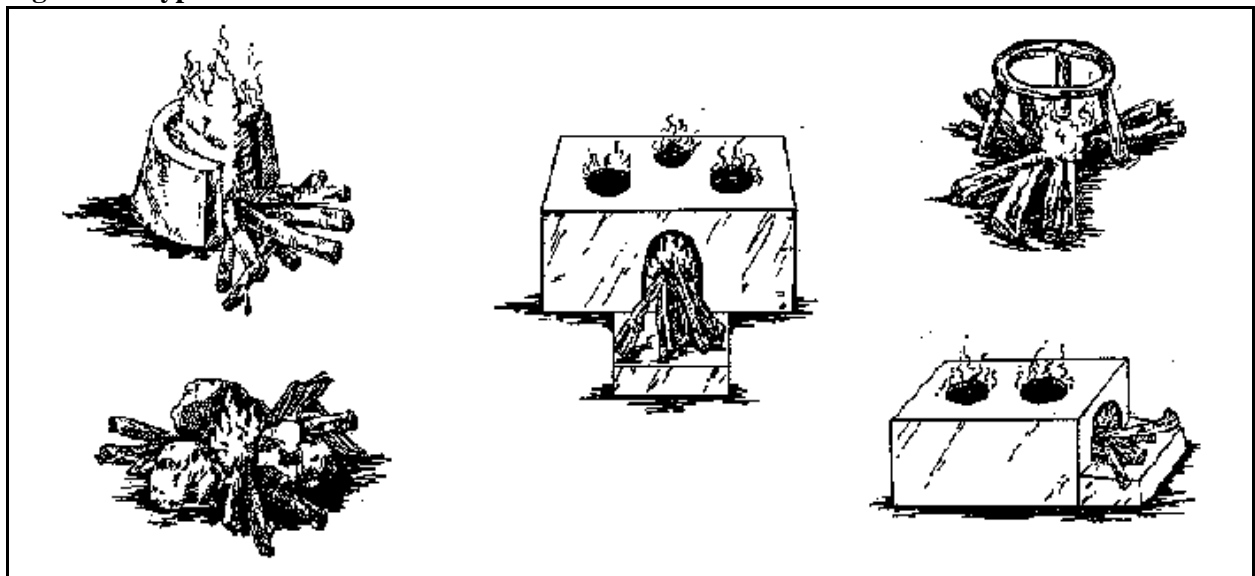
One maker of dried fruit products mixed seeds of the *Choreospondrias sp. (lapsiko geda)* tree with sawdust and burned this mixture in a stove to make food products with the pulp of the fruit. This worked very well. But her landlord refused to let her use the sawdust stove indoors because it produced so much smoke it made the house very dirty. And she cannot use the stove outdoors during the rainy season, so she now uses a kerosene stove year round, using the sawdust stove only as a back-up source of energy when kerosene is unavailable.

As noted above, restaurants serving several different types of food to tourists have been using kerosene and gas instead of fuelwood for a long time. Some restaurants have stopped offering *tanduri* dishes, which require charcoal-fired ovens, because of the scarcity and expense of charcoal. When restaurants were forced to use fuelwood and sawdust stoves during the INTT dispute, they reduced the number of items on the menu. People have modified their use of fuelwood even in the area of socio-cultural traditions. Because fuelwood has become so expensive, people now sometimes use a combination of old tires and fuelwood for cremation, even though the Hindu religion forbids this. Usually, the cremation ritual is begun using only fuelwood, and old tires are added as needed to cremate the body completely. Not only are tires cheaper, they burn well and reduce the time needed to complete the cremation.

## 6.7 Types of Stoves

Different types of fuelwood stoves are in use in Pokhara and its surrounding area. These stoves may vary from a simple three stone stove (*tin dhunge chulo*) to improved stoves (*bikashe* or *unnat chulo*). Most of the tea stalls and restaurants serving Nepali meals and many households in urban and suburban areas use a three hole stove (*tin mukhe chulo*) or a two hole stove (*dui mukhe chulo*) (Figures 18 and 19). These are preferred because two or three items can be cooked at once, making cooking faster and perhaps more fuel efficient. These stoves are not portable. They are constructed of mud or clay and stones or bricks.

Figure 18 Types of Stoves

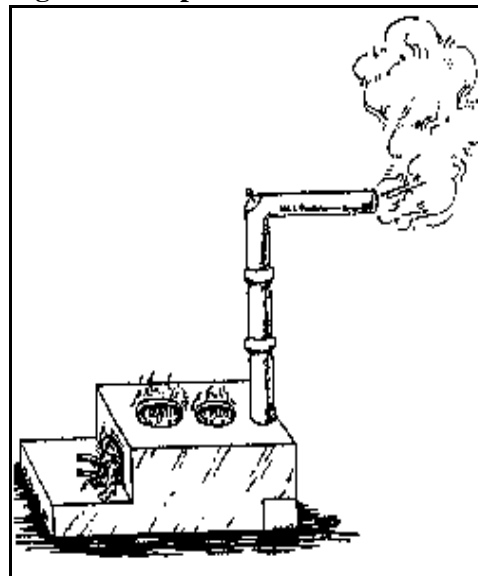


Three stone stoves are built by assembling three stones in a triangular fashion (Figure 18). They are often built outdoors to cook mash for livestock. Bigger stone stoves are similarly constructed temporarily for special purposes, like feasts, to cook food for a large number of people. Metal stand stoves (*odan*) and three stone stoves are also used inside rural households to keep the house warm, to keep the insects away, and to help preserve the timber of which the house is made.

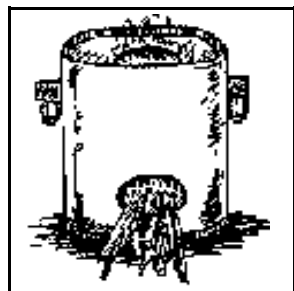
Another type of fuelwood stove, currently being promoted in both urban and rural areas by various projects, both government and NGO, is an improved stove constructed of pre-fabricated fired clay, with an exhaust pipe that emits the smoke outside the house (Figure 19). A total of 1865 such stoves have been distributed in Pokhara and 13 nearby villages. Eight of these villages are included in the study area.

Sawdust stoves are barrel-shaped and constructed of iron sheet (Figure 20). They have a closed bottom and a circular opening on the lower side. Sawdust is packed in the stove and compacted around a circular pipe in the middle. The circular pipe is then removed and the top which has a hole in the middle to accommodate the pipe is replaced on top of the compacted sawdust. The stove is then fired by inserting a few small pieces of fuelwood through the lower opening. It involves some initial investment, but it is cheaper to use for cooking. One filling of sawdust is sufficient for cooking two or three meals for an average family of five or six people.

**Figure 19 Improved Fuelwood Stove**



**Figure 20  
Sawdust Stove**



Most households, except the poorest ones, possess more than one type of stove, including a kerosene stove. Usually afternoon tiffin (*khaja*), a very light meal, is cooked on kerosene stoves, or even on electric burners. Illegal whiskey-makers have big three stone stoves outside the house, which are used only for this purpose. For cooking meals, they have other types of stoves inside the house.

## 7. CONCLUSIONS AND RECOMMENDATIONS

This study has revealed the overall picture of the wood fuel energy system in terms of fuelwood and charcoal systems and their respective flows from various sources to consumers in the Pokhara area. The findings suggest that the charcoal system is relatively small. Far fewer producers, distributors and consumers are involved in this system than in the fuelwood system. Fuelwood accounts for about 90 percent of the total rural energy consumption, and about 60 percent of urban consumption.

Besides wood fuel, LPG, electricity, biogas, and kerosene are available in Pokhara. The construction cost of establishing a biogas plant requires a high initial investment. The use of biogas as fuel is also limited by the need to have a certain number of livestock to keep it operating. Other sources of energy, such as LPG or electricity, are relatively more expensive. This, plus the initial investment needed to purchase costly equipment, has limited their use to the more well-to-do households, tourist class hotels and restaurants, and certain small-scale industries.

When we compare the heat efficiency and current prices of fuelwood and kerosene, however, kerosene appears to be cheaper. Also other factors, such as greater convenience, have contributed to its increasing use by better off households. Many households continue to use fuelwood and certain industries that require very high heat--i.e., tire retreading, baking, dying cotton and woolen yarn, both licensed and illegal distilling--continue to use fuelwood as a major source of energy. The continuing importance of fuelwood despite the recent increase in relative price/cost as compared to other fuels indicates that fuelwood will probably remain the most important source of energy in Pokhara in the future. The recent trade crisis has further underscored the risks of dependence on fuels that need to be imported.

If the situation in other urban areas in Nepal were found to be somewhat similar in this respect, to Pokhara (the references studied do not provide evidence to the contrary) then our first recommendation would be that concerted efforts to support the continuation of wood energy use must be more seriously considered.

For the various categories of users (households and small industries) assistance in the design and dissemination of improved devices should pay more attention to improve the convenience of wood fuel use. Investigations of the reasons for the limited adoption of the improved stove could yield useful information for such improved designs.

Another aspect that warrants more attention are the consumers' preferences for various species; the study has revealed that consumers are willing to pay more for better fuelwood. We recommend that this is better reflected in the forestry extension support that is provided around Pokhara (and increasingly all over Nepal) to improve the management of both private and community (managed) forest- and tree resources.

Efforts have been made to protect, conserve, and manage the forests through user groups in most village committees around the Pokhara area. Typically, watchmen have been hired from among low-income households. In most cases, these forest watchers are paid by members of the user group through a fixed amount of cash or goods contributed by each household. In some cases, these expenses are met through forestry project funds. The forest management systems of some villages are noteworthy. These systems may reflect distinct differences in the perception, management and use of forest resources by local users. The transfer of such indigenous knowledge to other communities might help planners to be more successful in implementing community forestry projects. It is not advisable, however, to interfere with effective local management systems.

Several important natural resource-based development projects are found in the Pokhara area. These include the Phewa Tal Watershed Management Project, the Beganastal/Rupatal Watershed Management Project, the Hill Forest Development Project, and the national Community Forestry Development Project. These projects exist to protect, conserve, manage, and better utilize land resources through encouraging greater community involvement.



The continuing urban need for wood fuel, the recent increase in prices paid for these fuels and the innovations in community forest management form the ingredients for our main recommendation: i.e. the identification of those forest areas that are significantly affected by wood fuel exploitation, followed by the type of community forestry planning and implementation that is being developed in the projects referred to earlier. Commercial wood fuel gatherers would have to be involved in the user groups responsible for management of the forest area, and silvicultural systems would have to be developed in which the regeneration of the species identified in the study would have to be included.

This type of community forestry-for-energy would have to be supported by a commitment at the national policy level to develop wood energy systems in the hill areas and to support the potentially important role of wood fuels in stimulating agricultural development and rural development in general.

It is hoped that the findings of this study may provide some baseline data and some fruitful hypotheses for future work. The methodology employed in this study may also prove useful to other institutions whose work would benefit from a better understanding of some important topics that could not be covered adequately in this study. We particularly have in mind an improved understanding of various local systems of forest management and an assessment of their relative effectiveness.

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## Appendix

**Table A1 List of Core Research Members Co-operating Researchers and Advisors in Regional Wood Energy Study**

<p><b>Core Research</b></p> <p>Mohan Krishna Balla (Team Leader) Sukhdev Chaudhary Thakur Babu Karkee</p>	<p>Forest Hydrology, M.F.R. General Forestry, M.S. Statistics, M.Sc.</p>
<p><b>Cooperating Researchers</b></p> <p>Ridish Kumar Pokharel Chiranjibi P. Upadhaya Suresh K. Shrestha Bhishma Subedi</p>	<p>Forest Management, M.S. Resource Economics, M.S. Botany, M.Sc. Rural Sociology, B.Sc. Ag.</p>
<p><b>Advisors</b></p> <p>Suriya Smutkupt Don Messerschmidt</p>	<p>Anthropology, M.A. Anthropology, Ph.D.</p>

**Table A2 Triangulation of Wood Fuel Producers, Distributors and Consumers**

Type of Users	Site	No. of Interviewees		
		KI	HH	Others <sup>1</sup>
<b>Producers:</b>				
1.Mahat Gaunda (Entry point)	Nirmal Pokhari Village	1	2	
2.Mahendra Gupha (Entry point)	Harpak, Chhaharepani Garlang, Khormukh	1	3	
3.Pame (Entry point)	Aiseluchaur, Pame	1 (group)	3	
4.Kahun (Entry point)	Bhainse, Sunpadeli	1	4	
5.Talchowk (Entry point)	Bharat Pokhari, Bara	1	3	3
6.Sawmill/Furniture Industry	PTWN 1,4,10			3
<b>Distributors:</b>				
1.Bus drivers	PTWN 8,9	1		2
2.Middlemen	PTWN 6,9,10, Talchowk	1		4
3.TCN/Fuelwood Corporation				1
<b>Consumers:</b>				
1.Sawmill furniture industry	PTWN 1,4,10			3
2.Tyre retreading	PTWN 8			1
3.Dalmoth	PTWN 3			1
4.Distillery industry	PTWN 5,17			2
5.Candle industry	PTWN 6			1
6.Dairy industry	PTWN 12			1
7.Mara industry	PTWN 4			1
8.Copper metal workers	PTWN 3,15			2
9.Goldsmith	PTWN 2,4			2
10.Home distillery	PTWN 4			1
11.Restaurant (Nepali food)	PTWN 4,9			3
Restaurant (Tourist class)	PTWN 6,7			2
12.Blacksmith/iron works	PTWN 8,10, Talchowk	1		3
13.Dying	PTWN 1,10			2
14.Bakery	PTWN 2,13			2
15.HH Cooking	PTWN 3,4,8,12	2	4	
	<b>Total</b>	10	19	34

Note: (1) Includes industries, distributors and other consumers, (2) PTWN = Pokhara Town Ward No.