

FUELWOOD REQUIREMENT IN THE NORTHERN AREAS OF PAKISTAN*

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INTRODUCTION

Northern Areas covers 7.04 million ha in the extreme north of Pakistan, forming the upper limits of the Indus basin. It is dominated by jagged granite, snow-covered Hindu Kush mountains in the northwest, the Karakoram mountains in the northeast and the great Himalayan mountain range in the centre east. Great expanses of rocky desert, bare of vegetation, dominate the landscape at 5,000 to 6,000 m elevation in this tract. Over half the territory is glacier, rock and scree. Mountain ranges form a natural barrier to summer monsoons, making the climate dry. Most of the precipitation falls as snow and the climate undergoes extremes of temperature - dry and hot (Upto 35°C) in summer and dry and cold in winter.

Valley bottoms are at an elevation of 1,200 to 1,500 m. Precipitation here is only 120 to 150 mm per year, which increases with elevation. At 3,000 m there is enough snow (equivalent to 750 mm of rainfall) to support grasses, scrub and coniferous forest.

The population of Northern Areas was estimated at 800,000 in 1993. Most people live in small villages and towns in the valleys and lower foothills. Cultivated and orchard land is nearly all

irrigated. Recently, Forestry Sector Master Plan used satellite imagery to determine land use in this area (FSMP, 1993). Its data are reproduced below. Since, 4.7 million ha were not classified, so its estimate of irrigated farmland (44,000 ha) is an under estimate. A 1985 census estimated that Gilgit alone, one of five districts in Northern Areas, had 20,000 ha of farmlands (World Bank, 1990).

Northern Areas is an important exporter of construction timber to the industrial centres in NWFP, the Punjab and Sindh provinces. Due to its climate, local people also rely mostly on fuelwood for space heating and cooking. They used to collect dead, fallen material or small branches in the past from forests in the vicinity of habitation but such material is becoming scarce. They now cut timber trees instead. The local Forest Department presently estimates that recorded outturn of timber from commercial forests is about 50,000 m³ annually. Fuelwood outturn is reported by Amjad and Khan (1990) to be about 25,000 m³ annually. According to FSMP this total 75,000 m³ official outturn is only 18% of estimated 425,000 m³ wood consumption which is not sustainable as far as existing forest/tree resources are concerned. Further, it estimates that wood consumption is expected to increase from

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Table 1. Forest Cover and Land Use Classes

Forest cover/ Land use class	Area 000 ha	Percentage
Forest/Trees		
Conifer/scrub	660	
Farmland trees	6	9.4
Total	666	
Agricultural		
Irrigated	44	
Rainfed	4	0.7
Total	48	
Rangelands		
Degraded	896	
Alpine	705	22.7
Total	1601	
Barren Land		
Snow/Glacier	27	0.4
Total	27	
Water Bodies		
Lake	1	
Total	1	
Unclassified		
Above 3,650 m	3161	
Below 3,650 m	1536	66.7
Total	4697	
All Land Classes	7040	

(Source: FSMP Data Base)

425,000 m³ in 1993 to 724,000 m³ in 2018 which is almost equal to current annual forest growth. Most of the existing forests are however, inaccessible, because considerable deforestation and denudation has occurred near human habitations over the years and bare rocky hills are a common site. This has also resulted in ecological and environmental degradation. It is feared that this process will accelerate in future

and wood and especially fuelwood would become a very scarce commodity which is so essential for survival of local people under harsh climatic conditions. This situation will also have a direct adverse effect on social and economic well-being of the people.

This study aims to determine fuelwood requirement in the Northern Areas of Pakistan.

Sampling Procedure

In order to carry out the study, primary data was collected in the summer of 1993 as it were not available from secondary sources. On demand side, data was collected on fuel consumption and its consumption pattern in the household sector. For this purpose, a sample survey of randomly selected house-holds was undertaken. The survey focussed primarily on determining household size, land holding, income level and seasonal fuel consumption pattern both in rural and urban areas. The Northern Areas was stratified into three climatic zones: cold, mild and hot. Each zone was further sub-divided into urban and rural areas. There are five administrative districts in Northern Areas: Gilgit, Ghizer, Diamer, Baltistan and Ghance. Keeping sampling plan in view, the following localities were selected for collection of data.

Gilgit district:	Gilgit urban area Hunza valley rural area
Baltistan/ Skardu districts:	Skardu rural area Skardu urban area Skardu rural area
Diamer district:	Chilas urban area Chilas rural area

The quota sampling design was used to collect data on fuel requirements for cooking and heating in the household sector. In order to select sample households in urban areas, lists of households in their electoral wards were obtained from the election offices. For rural areas, the household lists maintained for villages were also obtained from election offices. Sample urban wards and rural villages were selected at random. In each selected ward and village, 100 households were visited both in rural and urban areas by the investigators to collect the data. Table 1 shows the total number of sampled households in urban and rural areas.

Table 1. Total Number of households in the sample areas

District	Location		Total
Chilas	100	100	200
Gilgit	100	100	200
Skardu	100	100	200
Total	300	300	600

Data collection

A pre-designed questionnaire was used to collect data from the sample urban and rural households. The questionnaire was pre-tested and modified in the light of difficulties experienced

during pre-testing. Six M.Sc. Forestry students were employed as investigators to collect the requisite information with the help of questionnaire. The investigators personally visited

the sampled households and collected the data.

The questionnaire

The questionnaire was brief. It had two parts; the first part contained questions on household size, profession, number of earning members, education level, monthly income from all sources while the second part related to fuel consumption during summer and winter seasons, mode of fuels procurement and preferences of wood species used as fuelwood. The filled questionnaires were then edited to remove the discrepancies and the data were processed on computer using SAS for statistical analysis.

Data Analysis and Results

In Northern Areas, wood is a traditional fuel for cooking and heating purposes. In recent years, however, the situation has considerably changed on account of improvement in transportation facilities over Karakoram Highway. At present LPG is imported from China for domestic use. At first, the import was low but now it is increasingly being imported with the passage of time. Introduction of oil stoves has also motivated people to switch over to other commercial fuels such as kerosene. The

developmental changes brought in recently, have greatly influenced the choice of fuels. The ease in availability and high efficiency of the commercial fuels has facilitated substitution of wood fuel at a high rate in recent years.

Before giving results of data analysis, it would be worthwhile to mention that most of the socio-economic statistics, especially those relating to income and land holding appear to be on the high side as respondents wanted to project a high social status for themselves. The analysis showed that the average household size in the Northern Areas was 10.9 persons in rural area and 9.2 persons in urban areas, average household size being 10 persons. the number of earning members per household in the rural and urban area averaged at 1.4 and 1.5 persons respectively while the overall average was 1.5 earning members per household. The average monthly income per household in rural and urban areas was Rs.7000/- and 9000/- respectively and the average monthly income for the whole area was computed as Rs. 8000/- per household. The monthly income distribution of the sampled households is given in Table - 2.

Table 2. Monthly household income distribution in Northern Areas

Monthly income (Rs)	Rural %	Urban %	Total
Upto 3000	34.0	19.0	26.5
3001-6000	26.3	39.0	32.7
6001-9000	15.0	23.0	19.0
9001-12000	12.3	8.7	10.5
12001-15000	3.7	4.7	4.2
Above 15001	8.7	5.6	7.1

The above table shows that 59 percent of the sampled households were in income group upto Rs. 6000/-, 30 percent in the income group upto

Rs. 12,000/- and 12 percent of the sampled households had more than Rs. 12000 as income.

The distribution of sampled households according to education level is given in Table 3.

Table 3. Distribution of households according to education level

Education level	Rural %	Urban %	Total
Illiterate	59.0	30.3	44.7
Primary	11.7	17.7	14.7
Middle	11.7	9.7	10.7
Matric	7.7	18.3	13.0
F.A.	7.7	10.0	8.8
Graduate	2.3	14.0	8.2

The literacy rate of the sampled households in rural and urban area was 41 and 70 percent respectively. The overall literacy rate in the Northern Areas was 55 percent.

The average household land holding size in rural and urban areas was 0.6 and 1.4 ha respectively, whereas the average land holding in the whole area was 1 ha. The land holding distribution is given in Table 4.

Table 4. Land holding size distribution

Land holding size	Rural %	Urban %	Total %
Landless	-	31	15
Upto 1	38	63	51
1-2	41	4	23
2-3	15	1	8
3-4	2	-	1
Above 4	4	1	2

31 percent of all households in the urban area were landless. The sampled households who owned more than 4 ha of land in rural and urban area was 4 percent and 1 percent respectively. However, the percentage for the whole area was 0.8 ha. Table 4 also shows that in rural, urban and in the entire area 38.63 and 51 percent of households lie in land class of one ha. However, as mentioned earlier, this data could be highly exaggerated.

Percentage distribution of sample households according to source of fuelwood is given in Table 5. It shows that 62 percent and 67 percent households purchased fuelwood from the

market in rural and urban areas respectively. However, in the entire area the percentage of household buying fuelwood from the market was 67. This is rather a high figure and shows absence of wood resources of forests and tree growth on the farmlands in the vicinity of towns and rural areas. But fuelwood available in the market for sale is mostly from natural forests. On the other hand, the percentage of the sampled household collecting fuelwood directly from forest in rural, urban and entire area was only 3, 15 and 5 percent respectively; a very large majority indirectly using forest resources for procurement of fuelwood through market mechanisms.

Table 5. Distribution of household by source of fuelwood

Source	Rural (%)	Urban (%)	Total (%)
Market	62	72	67
Ownland	35	23	29
Forest	3	5	4

The percentage distribution of sampled household using different fuels are given in table 6.

Table 6. Distribution of household by different kinds of fuels

Kind of fuel	Rural (%)	Urban (%)	Total (%)
Fuelwood	58	48	53
Kerosene	6	2	4
LPG	-	2	1
Wood + kerosene	5	17	11
Wood + LPG	-	9	5
Wood + LPG + kerosene	5	22	13
*Other fuels	26	-	13

*Wood + LPG + Kerosene + Woodwaste

According to above results 53 percent of the sampled household use only fuelwood in the entire area. However, percentages of the households in rural and urban area using fuelwood were 58 and 48 respectively. Further, although, percentage of households exclusively using kerosene and LPG is low, still, these fuels in combination with fuelwood and wood waste are used by a large number of households. The quantitative consumption of kerosene is however, much higher than LPG.

Variation in household energy consumed during winter and summer was significant. For obvious reasons, on an average, monthly energy consumption was greater in winter as compared to that in summer. The consumption of kerosene and LPG also increased significantly during winter as compared to summer. The seasonal consumption to various kinds of fuels is given in Table 7. Additional energy consumption in winter is attributable to needs for water and room heating during cold season.

Table 7. Seasonal monthly household consumption of fuel.

Kind of fuel	Season	
	Summer	Winter
Fuelwood (Kg)	26	23
Kerosene (Liter)	6	32
LPG (Kg)	12	18
Wood waste (Kg)	3	6

The figures for kerosene consumption in winter appear to very high and therefore may indicate inadequacy of data and limitation of

survey. On the basis of above data annual household fuel consumption was also estimated. The average annual fuel consumption per household is given in Table 8.

Table 8. Average annual household fuels consumption

Kind of fuels	Rural	Urban	Total
Wood (Kg)	325	275	300
Kerosene (Liter)	240	145	385
LPG (Kg)	171	189	180
Wood waste (Kg)	53	48	50

The average fuelwood consumption per household in the entire Northern Areas was computed at 300 Kg, which was 325 and 279 Kg, in the rural and urban area respectively. It may be of interest to note that the consumption of kerosene is much higher as compared to other fuels.

The present study also estimates that the per capita fuelwood and wood waste consumption in the area is about 0.07 m^3 . Thus the total annual fuelwood consumption in the Northern Areas is $0.056 \text{ million m}^3$. On the other hand if we take consumption of all fuels, in terms of fuelwood the per capita requirement works out to be 0.37 m^3 . This figure may appear to be low, but it includes fuel data of kerosene and LPG, which not only have higher calorific value but also burn more efficiently than fuelwood. On this basis, the total fuelwood consumption would be 0.3 million m^3 for the entire area. Forestry Sector Master Plan (1992) reported that the per capita fuelwood consumption in Northern Areas was 0.9 m^3 . Based on their estimates, the total fuelwood consumption for the population of 0.8 million would be 0.72 million m^3 . This study shows that Forestry Sector Master Plan over estimated fuelwood consumption for fuelwood alone and including all fuels by 0.66 and 0.42 million m^3 respectively.

The estimate of per capita fuelwood consumption reported in Forestry Sector Master Plan was based on data provided by the Forest Department of Northern Areas. These figures appears to be an educated guess because no scientific study was carried out by the Forest Department to estimates actual per capita fuelwood consumption, as well as types and quantity of fuels consumed by the households. The present study was, on the other hand conducted on scientific lines with pre-tested methodology.

The analysis of the data also indicates that the use of commercial fuel is increasing and has so

far reached a level of 85 percent of the total fuel consumption. On the other hand consumption of fuelwood and other traditional fuels shows a declining trend. The change in fueltype can be attributed to scarcity of natural biomass resources in the area, which has resulted in increase in their collection time and higher prices. These fuels have low calorific value and inconvenient to use. All these factors taken together have made the use of traditional and non-commercial fuel uneconomical for both rural and urban population. In contrast commercial fuels of kerosene and LPG are highly preferred and LPG appears to be rather easily available as a result of open trade in this commodity across the border with China.

The average fuel market prices are given in Table 9. The increasing fuelwood prices have forced the population to look for better fuel with economic efficiency. As a result the consumption of kerosene and LPG has increased and led to development of trade for both the commodities. The demand for kerosene is presently being met from domestic supply whereas LPG is being traded from China at competitive prices.

This survey showed that the average fuel prices for wood and wood waste are Rs.58 per 40 Kg in the area. Kerosene is available at Rs. 6/- per liter and the price of LPG was Rs. 7.7 per Kg. The main preferred fuelwood species were apricot, oak, olive, and mulberry. The least preferred fuelwood was that obtained from coniferous trees.

Table 9. Average fuel prices

Type of fuel	Rural Rs.	Urban Rs.	Project area Rs.
Fuelwood (40 Kg)	55.0	60.0	58.0
Kerosene (Liter)	6.3	5.6	5.9
LPG (Kg)	7.7	7.7	7.7
Wood waste (40 Kg)	40.0	40.0	40.0

CONCLUSIONS

The per capita fuel consumption in the Northern Areas is estimated to be above 0.4 m³ equivalent of wood. The per capita energy consumption in rural areas is 68 percent higher than urban areas. The present study also estimates total fuel energy consumption for the population of 0.8 million of Northern Area to be about 0.3 million cubic meters per annum. This is well within the productive potential of existing forests. But all forests are not easily accessible. Therefore, accessible forests would continue to be heavily burdened with cutting of trees in them, thus depleting the resource. This study also shows that use of commercial fuels especially kerosene is increasing, which would contribute to forest conservation in coming years.

The consumption of kerosene in the Northern Areas was much higher than other fuels. The per capita kerosene consumption was estimated to be 39 liters equivalent to 0.2 m³ of fuelwood. Its consumption was almost double in rural areas as compared to urban areas. Seasonal variation in kerosene consumption was also highly significant. This increase is attributed to the need for room and water heating during winter season. The higher consumption rate of kerosene also indicates scarcity of wood and other fuels in the

area.

RECOMMENDATIONS

The main source of fuelwood supply in rural and urban areas is designated forests and trees on the farmlands. Therefore in order to meet future energy needs of rural and urban population of Northern Areas, special attention has to be paid for increased production of fuelwood through the following measures.

Designated forests have been over-utilized for fuelwood over a considerable period of time. This has resulted in their degradation, rendering them treeless over large areas near inhabited localities. Special efforts are needed their reforestation as well as for the conservation of remaining wood resource.

Farmlands have a very high potential for increase in fuelwood production and already supply 99 percent of the fuelwood consumption in rest of Pakistan. Therefore, intensive efforts have to be made to increase fuelwood production on the farmlands in Northern Areas.

Proper choice of fuelwood species with the objectives of their multiple use will increase the fuelwood production as well as yield a variety of other products and services for the economic benefits for local population.

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