Leaflet No. 15

Study on Consumption of Fuelwood, Causes of Forest Degradation and Deforestation in the Taungyi District

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တောင်ကြီးခရိုင်အတွင်း ဇီဂလောင်စာစွမ်းအင်သုံးစွဲမှုအခြေအနေ သစ်တောအတန်းအစားကျဆင်းခြင်းနှင့် သစ်တောများပျက်စီးရခြင်း အကြောင်းအရင်းများကိုလေ့လာခြင်း

ဒေါက်တာချောချောစိန်
ဦးစီးအရာရှိ
သစ်တောသုတေသနဌာန

စာတမ်းအကျဉ်းချုပ်

ရှမ်းပြည်နယ်တွင် နေထိုင်ကြသော လူတို့၏ နေ့စဉ်အဓိက စွမ်းအင်လိုအပ်ချက်မှာ ထင်းလောင်စာပင် ဖြစ်ပါသည်။ မြန်မာနိုင်ငံတွင် လူဦးရေသည် နှစ်စဉ်လျင်မြန်စွာ တိုးပွားလျက်ရှိပြီး မြို့ပြနှင့်ကျေးလက်နေ ပြည်သူလူထု၏ လူနေမှုအဆင့်အတန်းမှာလည်း နှစ်စဉ် မြင့်မားလျက် ရှိပါသည်။ တိုးပွားလာသောလူဦးရေနှင့် ဖွံ့ဖြိုးတိုးတက်လာသော လူနေမှု အဆင့်အတန်းအလိုက် နှစ်(၃၀)စီမံကိန်းတွင် ခန့်မှန်းထားသော မြို့ပြနှင့်ကျေးလက်နေ ပြည်သူလူထု၏ တစ်နှစ် ဇီဂစွမ်းအင် လောင်စာသုံးစွဲမှု အခြေအနေကိုလည်း ပြန်လည် လေ့လာသုံးသပ်ရန် လိုအပ်လာပြီ ဖြစ်ပါသည်။ ဤစာတမ်းတွင် တောင်ကြီးခရိုင် အတွင်း၌ အိမ်ထောင်စုအလိုက် နှစ်စဉ် ထင်း၊ မီးသွေးနှင့် အခြားလောင်စာသုံးစွဲမှုပမာဏ၊ အကြီးစား၊ အလတ်စားနှင့် အသေးစား အိမ်တွင်းမှုလုပ်ငန်းများ၏ နှစ်စဉ် ထင်း၊ မီးသွေးနှင့် အခြားလောင်စာသုံးစွဲမှုပမာဏ၊ သစ်တောပြုန်းတီးခြင်းနှင့် သစ်တော အတန်းအစား ကျဆင်းရခြင်း အကြောင်းရင်းများ၊ ထင်းလောင်စာ လိုအပ်ချက်အတွက် ဖြည့်ဆည်းပေးနိုင်မည့် နည်းလမ်းများအား လေ့လာထားပါသည်။

Study on Consumption of Fuelwood, Causes of Forest Degradation and Deforestation in the Taungyi District

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Abstract

In Shan state, wood-fuel remains the main energy source for the majority of the people. Though more than half of the total land area of the country is covered by forests, the forest cover is generally very sparse in the densely populated areas where rapid rates of forest degradation and depletion have occurred due to the heavy demand on forest products, including wood-fuel, and other causes associated with population pressure. The result is an acute fuelwood scarcity problem. Therefore, it is necessary to review (30) year plan of fuelwood consumption according to the increasing population pressure in the Taungyi District. The necessary data was collected by Rapid Rural Appraisal (RRA) and Focus Group Discussion with households of the villages and quarters in the study area. The data was analyzed with Spearmann Correlation and Statistics. This study reports on the per household consumption and cottage industry consumption of fuelwood, the alternative ways for the fulfillment of fuelwood consumption, the percentage of deforestation and forest degradation due to fuel-wood consumption in the Taungyi District.

Keywords: Increased population, Fuelwood scarcity, Forest Product, Household, Rapid Rural Appraisal

Contents

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1. Introduction

Biomass energy is an important source of energy in most Asian countries. Substantial amounts of fuelwood, charcoal and other biomass energy such as agricultural residues, dung and leaves are used by households and industries. The main household applications are cooking and heating whereas industrial applications range from mineral processing (bricks, lime, tiles, ceramics), food and agro processing, metal processing, textiles (dyeing, etc.) to miscellaneous applications like road tarring, tyre retreading, and ceremonies. Besides these 'heating' applications, biomass fuels are also used for power generation. A lot of biomass fuels are available as by-product from other activities, such as saw milling and agricultural crop production. In many of the developing countries, forests are the main source of fuel wood, timber for house construction and fodder for livestock. Consequently, any depletion of this resource base can erode living standards as well as ecosystem stability (Shah, 1982; Pant and Singh, 1987). In Southern Shan state, wood-fuel remains the main energy source for the majority of the people. Though more than half of the total land area of the country is covered by forests, the forest cover is generally very sparse in the densely populated areas where rapid rates of forest degradation and depletion have occurred due to the heavy demand on forest products, including wood-fuel, and other causes associated with population pressure. The result is an acute fuelwood scarcity problem. Therefore, it is necessary to review the fuelwood consumption according to the increasing population pressure in the Taungyi District.

The study was conducted to achieve the following objectives:

(a) To estimate per household consumption and cottage industry consumption of fuelwood in the study areas.

(b) To find out the alternative ways for the fulfillment of fuel-wood consumption.

(c) To investigate the percentage of deforestation and forest degradation due to fuel-wood consumption.

1.1 Literature Review

1.1.1 Environmental implications of fuel wood consumption

It was estimated that in the late 1990s, about 3 billion people in the world (more than half of the global population at that time) relied on fuel wood for cooking and heating (Population Action International 1999). In addition, more than half of all wood harvested is used, not for products such as paper, building products, or veneer, but for fuel (Food and Agriculture Organization, 2000). Developing countries account for most fuel wood consumption and more than 75% of wood harvested in these countries is for fuel (Food and Agriculture Organization, 2000; Bearer et al., 2008). Deforestation and increasing demand for fuel wood have resulted in a looming fuel wood shortage crisis in many areas (Heltberg et al., 2000; Macht et al. 2007). Fuelwood harvesting has been linked to deforestation (Amacher et al., 1993), but critics argue that most wood collected for fuel is dead wood and, therefore, does not exacerbate rates of deforestation (Nagothu, 2001; Arnold and Persson, 2003). Recent research indicates that fuel wood consumption is rarely a primary driver of large scale deforestation (Arnold and Persson, 2003). Fuel wood extraction has also been implicated in

biodiversity loss. This occurs in at least three ways. First, fuel wood extraction destroys habitat for cavity-using birds and mammals (Du Plessis, 1995) and reduces habitat for other forest-dwelling species such as giant pandas (Bearer et al., 2008; Liu et al., 2001). Second, habitat for saproxylic species (those which rely on dead wood for survival, such as wood-decomposing fungi and certain types of beetles) is reduced by fuel wood harvesting (Jonsell, 2007). Third, the extraction of deadwood disrupts the nutrient recycling process in forests (Shankar et al., 1998). Given these environmental implications, it is important to understand the factors influencing fuel wood consumption.

1.1.2 Consumption of biofuel in urban and rural areas

The main source of fuel in both urban and rural areas within developing countries is biomass (FAO, 2012). Biomass is commonly available in two forms: charcoal and fuelwood. Charcoal is energy that is made from wood, while fuelwood is collected and used directly from the field (FAO, 2012). Fuelwood gathered from forested areas is the most important source of domestic energy for the developing world (Heltberg et al., 2000). There are two types of fuel used within the village: fuelwood and charcoal. Fuelwood is cut and collected mainly by women of the household. Charcoal is purchased either from neighbors or along the roadside.

Firewood gathered from forested commons is an important source of domestic energy in rural areas of many poor countries (Cecelski et al., 1979; Heltberg et al., 2000). It has been estimated that more than 2.4 billion people rely directly on traditional biomass fuels for their cooking and heating, and in poor countries biomass use represents over half of residential energy consumption (International Energy Agency, 2005). Demands for fuelwood by subsistence agricultural households may be the leading cause of world deforestation (Amacher et al., 1993; Amacher et al., 1996). Factors such as family size, cost of wood, season, type of cooking device, alternative energy sources and the type of wood determine the level of wood consumption (Hamed, 1990). According to FAO (1995), 2 out of 5 people worldwide depend on wood or charcoal as a source of domestic energy.

1.1.3 Degradation and deforestation of the forest due to fuelwood consumption

The collection of fuelwood from forests that exists sustainable yield causes degradation. Forest degradation in turn leads to fuelwood scarcity and a variety of adverse consequences including loss of biodiversity, deterioration of watershed functions, removal of carbon dioxide from the atmosphere and soil erosion. Degradation of the natural environment has become the subject of increasingly intense research over recent decades. This is just as true in the social sciences as in the natural, biological and physical sciences. The social sciences have been particularly concerned with the consequences of social organization and social actions on levels of environmental degradation. Human consumption of natural resources is generally identified as the key link between human behavior and degradation of the natural environment (Stern et al. 1997). Though social research has primarily focused on the total volume of human consumption, classical sociology points toward the importance of transitions in the nature of consumption as a fundamental change in the way people relate to their environment (Foster 1999).

Firewood gathered from forested commons is an important source of domestic energy in rural areas of many poor countries (Cecelski et al., Heltberg, et al., 2000). It has been estimated that more than 2.4 billion people rely directly on traditional biomass fuels for their cooking and heating, and in poor countries biomass use represents over half of residential energy consumption (International Energy Agency 2005). Demands for fuelwood by

subsistence agricultural households may be the leading cause of world deforestation (Amacher, Hyde and Joshee 1993; Amacher, Hyde and Kanel 1996).

In addition to the scarcity of fuelwood as a crisis per se, deforestation has numerous other harmful consequences such as loss of biodiversity and soil erosion (Heltberg et al. 2000; Palloni, 1994). Also, because women are the main gatherers of fuelwood, the depletion of forests forces women to spend more time looking for wood to gather and search farther from their homes, lengthening their working day (Agarwal, 1994). Finally, deforestation exacerbates conditions that could produce global warming, such as the release of carbon dioxide into the atmosphere (Heltberg et al., 2000; Palloni, 1994). Therefore the transition from fuelwood to alternative sources of energy is a key transition in how humans affect the environment. Substitution of fuelwood with alternative fuels can reduce pressure on natural forests. This is because alternative sources of rural domestic energy (such as crop residues, animal dung, wood from trees on the farm, biogas, kerosene, sun and wind power) do not cause forest degradation (Heltberg et al., 2000).

2. Materials and Methods

2.1 Study area description

The study was conducted in Southern Shan State (Taungyi District). The State extends from approximately 20 15' to 20˚45'N Latitude and 96 49' to 96˚ 48' E Longitude. Basic rocks of the Shan plateau are Lime stone. Granite and Shale can be found in some areas. Soil found in the Taungyi District is mountainous brown and yellow brown, classified as Cambisol and Ferrasols as per FAO classification. Climate is a broad summation of temperature, humidity, rain fall and wind velocity. The ambient temperature and rain fall are main factors which influence the environment. The minimum temperature occurs in December around 13˚ to 24 C while maximum temperature occurs during April within a range of 21˚-32 C. The area experiences severe cold nights during the Cold Season. The humidity ranges from less than 40% in March to 90% in August. In summer the prevailing winds are south-westerly warm tropical winds, originating from the Bay of Bengal. In the Cold Season (December to February) the winds are north-easterly cold winds, originating from Central Asia. The Rainy Season occurs during the period from April to November, with maximum rainfall occurring from August to September.

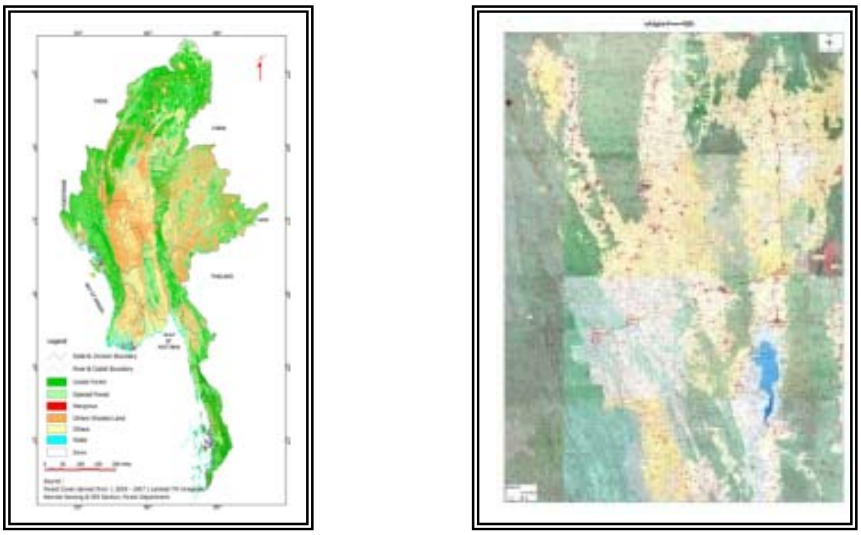

Figure (1) Taungyi District

2.2 Data collection and analysis

The study was conducted from 15 November to 5th January of 2013 within the Maing lee Quarter, Khaung Taing and Kan Taung villages from Nyaung Shwe Township, No. (7) Quarter, Myin ka village and Kyauk talone village from Kalaw Township and Ywar Ma Quarter, Peinnekon and Yechanpyin villages from Ywar Ngan Township. Qualitative and quantitative data was gathered to gain a better understanding of fuelwood consumption within area. Rapid Rural Appraisal (RRA) was applied to assess the use of wood-fuel and other energy sources (based on the prepared questions). Semi Structure interview was conducted for each household and cottage industries with sampling intensity of 10%. Focus group discussion was also carried out with different -aged of people to focus dependency of fuel wood on forest and the practical way to substitute wood-fuel utilization.

2.3 Interview

Before the interviews were administered, pre-test interviews were conducted to ensure that the questions were comprehensible and appropriate. Interviews were conducted based on the living standards (poor, medium and rich) and number of household members (large, medium and less) to cover all the strata of households.

Interviews took place face to face with the head of the household. Information gathered on demographics, gathering and collection of fuelwood, home and domestic attributes, charcoal use, and social factors were recorded. The data was analysed by suing Spearman Correlation and Microsoft Excel.

Figure (2) Semi-structure interview in the Kan Taung Village

Figure (3) Focus Group Discussion in Peinnekon Village

3. Results and Discussion

3.1 Fuelwood and charcoal consumed by households in the study area

According to the results of the questionnaires, it was observed that almost all of the households in the rural (villages) were used the fuelwood for cooking. In Nywe Shwe township, fuelwood consumption of Khaung Taing and Kan Taung Villages were (12) tons and (2.11) tons per year per household respectively. In Myin Ka and Kyauk Talone Villages in Kaw Township, fuelwood consumption were (2.55) tons and (2.15) tons per year per households. In Ywar Ngan Township, the estimated fuelwood consumption of two villages; Peinnekon and Yechanpyin were (2.5) tons and (3.53) tons per year per households as shown in table (1) and figure (2). One significant was found in Khaung Taing Village where all households were doing small cottage industries and the fuelwood consumption was higher than other villages. Utilization of agricultural residues (maize – pits) was also observed in Khaung Taing and Kyauk Taw Villages. It was observed that the consumption of wood waste for tomatoes boxes were increased day by day, it was one of the benefit from waste in Nyaung Shwe Township. In Kyauk Talone Village, the consumption of fuelwood was decreased one third lesser than in the previous time during two years due to the utilization of improved cooking stoves. Moreover, the forest condition was better due to the replacement of home gardens instead of shifting cultivation in the study area. The self owned forests heritage from relatives was also observed in the Ywar Ngan Township; they could easily collect fuelwood from those forest and as a result less dependence of natural forest was occurred in these areas. On the other side, almost all of the households in the urban (quarters) were used charcoal and electricity for cooking and they also use electricity for lighting. The higher consumption of charcoal was occurred in the Maing Lee Quarter due to the favour of charcoal for cooking. The following table (1) shows the consumption of fuelwood, charcoal, agricultural residues and electricity in the study areas.

Table (1) Consumption of fuelwood and charcoal per household in the study areas

No	Township	Quarter/ Village	No of house hold	Fuelwood (tons)/yr	Charcoal/ (tons)/yr	Agricultural Residues (cartloads)/yr	Electricity (unit)/month
1	Nyaung Shwe	Maing lee quar.	38		3		387
2		Khaung Taing vil.	21	12		43	162
3		Kan Taung vil.	25	2.11		28	125
4	Kalaw	No(7) quar	28		0.57		209
5		Myin Ka vil.	17	2.55			62
6		Kyauk Talon evil.	12	2.15			
7	Ywar Ngan	Ywar Ma quar.	33		0.45		202
8		Peinne Kon vil.	22	2.5			
9		Yechanpyin vil.	16	3.53			

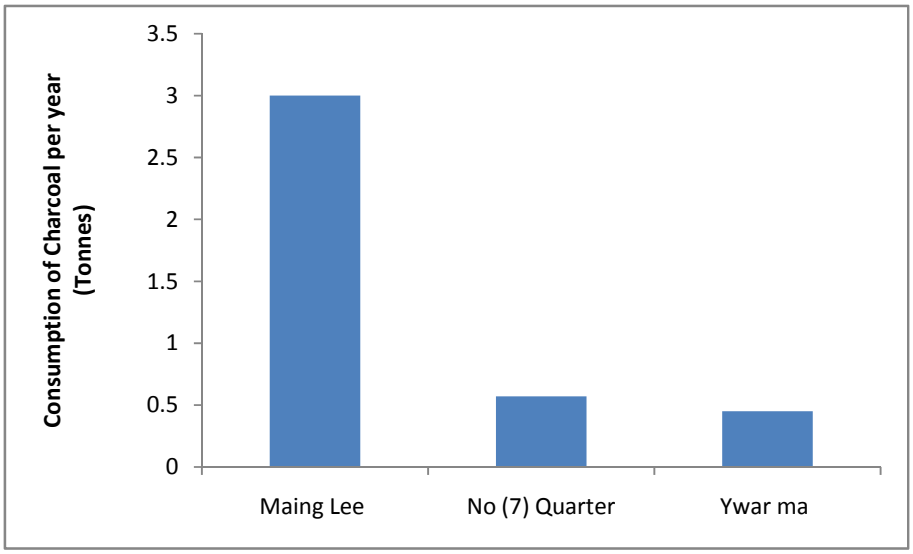

Figure (4) Consumption of charcoal in the study areas.

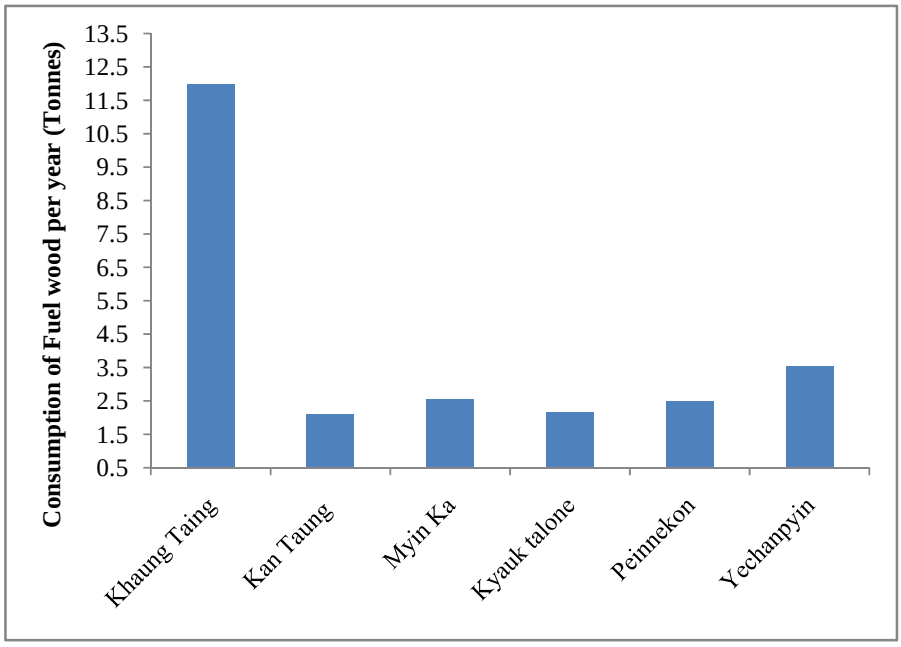

Figure (5) Consumption of fuelwood in the study area

Table (2) Spearman correlations for consumption of fuelwood /charcoal and socio-economic characteristic of households in the study area.

1 = Age of households

2 = No of household members

3 = Total land areas(acres)

4 =No of income earnings household members

5 = Income per month

6 = Distance for fuelwood collection

7 = Education (years of study)

8 = Use of electricity (unit)

* P < 0.05, n= number of sample households in the village

(A) Khaung Taing Village

No.	n	Mean	SD	r
1	21	51.333	7.351	-0.61*
2	21	4.857	1.424	-0.58*
3	21	3.810	1.030	-0.39
4	21	1.905	0.944	-0.35
5	21	109545.5	28531.90	-0.96*
6	21	9.905	1.411	-0.35
7	21	7.762	3.520	-0.60*
8	21	162.857	54.14	-0.45*

(B) KanTaungVillage

No.	N	Mean	SD	r
1	25	49.8	6.58	0.02
2	25	4.3	0.85	-0.29
3	25	2.8	0.65	-0.14
4	25	1.6	0.51	-0.18
5	25	111000.0	32627.95	-0.17*
6	25	4.8	0.75	-0.10
7	25	6.5	2.76	0.17
8	25	125.2	52.21	-0.33

(C) Myin Ka Village

No.	n	Mean	SD	r
1	17	48.7	7.09	-0.27
2	17	4.3	0.99	-0.07
3	17	2.9	0.83	-0.28*
4	17	1.6	0.49	0.12
5	17	106666.7	25075.64	0.33
6	17	3.6	0.55	-0.18
7	17	8.5	3.32	0.04
8	17	62.4	21.07	-0.32

(D) Kyauk Talone Village

No.	N	Mean	SD	r
1	12	48.9	10.69	0.12
2	12	4.1	1.08	0.33
3	12	2.7	0.89	0.23
4	12	1.4	0.51	0.14
5	12	77666.67	33518.88	0.23
6	12	3.9	0.65	-0.04*
7	12	6.3	3.25	-0.18

(E) Peinne Kon Village

No.	n	Mean	SD	r
1	22	51.18	8.24	0.29
2	22	4.41	0.85	0.26
3	22	2.59	0.80	0.32
4	22	1.27	0.46	0.50*
5	22	94318.18	33284.33	-0.22
6	22	2.59	0.43	-0.48*
7	22	6.00	2.12	0.24

(F) Yechan Pyin Village

No.	N	Mean	SD	r
1	16	48.63	8.39	-0.15
2	16	3.81	1.17	0.01
3	16	2.19	0.66	-0.25
4	16	1.50	0.63	-0.24
5	16	83250.00	32868.42	-0.42*
6	16	3.18	0.25	0.22

7	16			0.13
		5.75	2.02	

1 = Age of households
2 = No. of household members
3 = Total land areas(acres)
4 =No of income earnings household members
5 = Income per month
6 = Education (years of study)
7 = Use of ,electricity (unit)
*P<0.05.,

(G) Maing Lee Quarter

n= Number of sample households in the quarter

No.	n	Mean	SD	r
1	38	47.2	6.89	-0.22
2	38	4.2	0.96	-0.26*
3	38	0.6	0.76	0.07
4	38	2.1	0.73	-0.15
5	38	184473.7	53710.81	0.06
6	38	10.8	2.74	0.05
7	38	387.4	440.75	0.06

(H) No (7) Quarter

No.	N	Mean	SD	r
1	28	49.5	10.02	-0.18
2	28	4.2	1.10	-0.19
3	28	0.8	0.75	0.08
4	28	1.6	0.57	-0.22
5	28	148214.3	50921.40	-0.20
6	28	9.9	2.65	-0.22*
7	28	209.6	45.26	-0.16

(I) Ywar Ma Quarter

No.	n	Mean	SD	r
1	38	54.2	8.60	-0.01
2	38	4.4	0.93	-0.16
3	38	0.8	0.76	-0.07
4	38	1.5	0.51	-0.23
5	38	169697.0	62524.24	0.20
6	38	10.9	0.42	-0.32*
7	38	202.4	2.28	-0.15

In Khaung Taing Village, all socio-economic characteristic are negatively correlated with the consumption of fuelwood by households. A significant difference was noticed about the consumption of fuelwood for households in Khaung Taing village contributing towards age of households, total land areas, income per month, education (years of study) and use of electricity. . A significant difference was observed about the consumption of fuelwood by households contributing towards income per month in Khaung Taing village.

Except age of household and education, all socioeconomic characteristics are negatively correlated with the consumption of fuelwood by households in Kan Taung Village.

A significant difference was occurred about the consumption of fuelwood by households contributing towards total lands area and most of the socioeconomic characteristics are negatively correlated with the consumption of fuelwood by households in Myin Ka Village.

In Kyauk Talone village, a significant difference was occurred about the consumption of fuelwood by households contributing towards the distance for fuelwood collections and others are positively correlated with the consumption of fuelwood by households, except use of electricity.

Significant differences were occurred about the consumption of fuelwood by households contributing towards the number of income earnings and education in Peinne Kon Village. Only significance was observed about the consumption of fuelwood by households contributing towards income per months in Yechan Pyin Village.

In Nyaung Shwe Township, Maing lee quarter, four socioeconomic characteristics; total land area, income per month, education (years of study) and use of electricity, were positively correlated and the rests are negatively correlated with the consumption of charcoal by households. A significant difference was noticed about the consumption of charcoal contributing towards number of household members.

A significant difference was noticed about the consumption of charcoal for households in No (7) quarter in Kalaw Township, contributing towards education (years of study). It was observed that all other socioeconomic characteristics are negatively correlated with the consumption of charcoal by households except total land area whereas in Ywar Ma quarter of Ywar Ngan Township, all are negatively correlated except one characteristic, income per month. Significance was occurred that the consumption of charcoal for households contributing towards education (years of study) in Ywar Ngan Quarter.

Figure (6) Collection of agricultural residues in Khaung Taing Village for Cooking

3.2 Consumption of fuelwood and charcoal by cottage industries in the study area

It was observed that the consumption of wood waste for tomatoes boxes were increased day by day that, it was one of the benefit from waste in Nyaung Shwe Township. The annual use of wood waste for the tomato boxes was (150) tones per cottage industry, annual consumption of fuel wood for Blacksmith was (36.36) tones and per restaurant consumption of saw dusts and rice husk was (350) cartloads and (480) cartloads respectively. One significant in Nyaung Shwe township was that consumption of rice husk and saw dust was (4000) cartloads per year by Hupin Sugar Industry.

The following table shows the consumption of fuelwood and charcoal by cottage industries in the study area.

Figure (8) Utilization of wood wastes for tomatoe boxes in Nyaung Shwe Township

Figure (9) Collection of Fuelwood

Table (2) Consumption of fuelwood, charcoal and other sources by cottage industries in the study area

No	Township	Quarter	Kind of cottage industry			Fuelwood (tons)/yr	Charcoal (tons)/yr	Agricultural residues (card loads)/yr		Electricity (unit)/month	Natural gas (viss)/ month
			Small	Medium	Large			Rice husk	Saw dust		
1	Nyaung Shwe	Maing lee	-	-	Bakery	142.65	-	-	-	-	-
	-	-	-	-	Hupin Restaurant	106.92	25.45	480	80	22850	48
	-	-	-	-	Blacksmith	36.36	-	-	-	-	-
	-	-	-	-	Sugar Industry	-	-	4000	4000	-	-
	-	-	-	-	Tomatoes boxes	150	-	-	-	-	-
2.	Kalaw	No.(7)	-	-	Hotel	11.09	17.62	-	-	43016	174
3	Ywar Ngan	Ywar Ma	Coffee Industry	-	-	2.38	-	-	-	-	-
		-	-	-	Soe Winn Coffee	59.4	-	-	-	-	-
		-	-	-	Restaurant	-	-	350	480	12000	-

3.3 Sources of fuelwood

The following descriptive analysis is based on unadjusted data. It was observed that home garden (36%) was the main source of fuelwood, followed by self owned forest (30%), natural forest (20%), community forest (10%) and agricultural residues (4%) in the study area. The following table shows the main sources of fuelwood in the study areas.

Table (3) Quarters/ Villages and different sources of fuelwood (descriptive characteristics)

Quarters/Villages	No of households	Community forest(%)	Home Garden(%)	Agricultural residues(%)	Natural Forest(%)	Self-owned Forest(%)
Maing lee quar.	38				16	
Khaung Taing vil.	21	9	22	14	13	42
Kyauk taw vil.	25	9	30	1	18	42
No.(7) quar.	28		70	8	19	
Myin ka vil.	17	32	24	4	16	46
Kyauk talone vil.	12	14	37	2	14	43
Ywar ma quar.	33		60		31	
Peinne kon vil.	22	10	41	5	23	46
Yechan pyin vil.	16	16	38	2	29	48

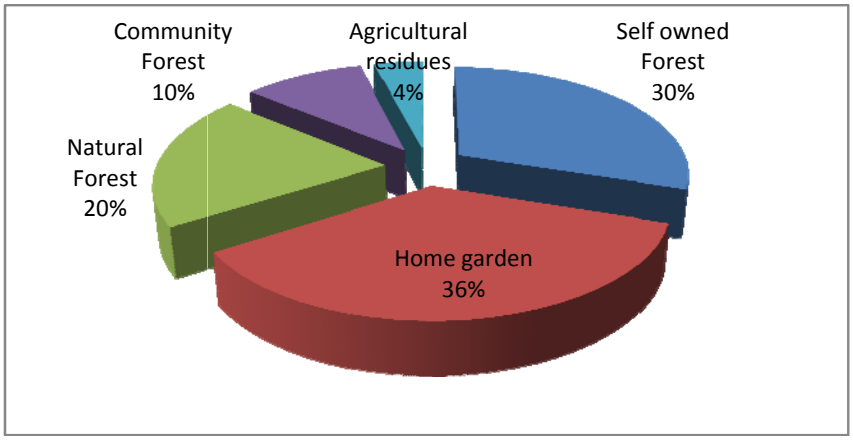

Figure (3) Sources of fuelwood in the study area

3.4 Main causes of forest degradation and deforestation in the study area

The forest is the main sources of the fuelwood in the Taungyi District. The use of fuel wood is the only form of energy for cooking. Men, women and children from nearby forested areas collect firewood. At higher elevations people collected firewood during winter months only and store it in heaps for the whole year, whereas, at lower elevations collection is made

throughout the year. Due to collection of huge amount of fuelwood, forests near to the villages are subjected to rapid degradation and over exploitation. A very small fraction of fuelewood comes from the agriculture residues. According to the focus group discussion, it was observed that the main causes of forest degradation and deforestation is fuel wood collection (60%) and others including agricultural expansion, wild fire, mining, increased population, illegal logging, shifting cultivation and fuelwood collection was (40%) as shown in figure (4).

Table (4) Quarters/ Villages and different causes of forest degradation and deforestation in the study area(descriptive characteristics)

Quarter/Village	Agricultural Expansion (%)	Wild Fire (%)	Mining (%)	Increased Population (%)	Illegal logging (%)	Shifting Cultivation (%)	Fuelwood Collection (%)
Maing Lee	10	3	6	9	8	4	60
Khaung Taing	8	4	4	10	6	6	62
Kyauk Taw	9	6	4	14	7	5	55
No.(7)	6	2	7	13	9	7	56
Myin Ka	8	5	3	8	10	8	58
Kyauk Talone	2	7	5	6	12	9	59
Ywar ma	3	5	4	7	7	9	65
Peinne kon	5	2	6	8	9	6	64
Yechan pyin	7	4	2	12	3	10	62

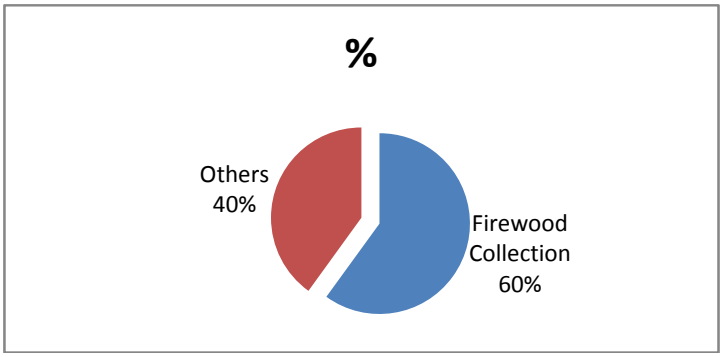

Figure (4) Main causes of forest degradation and deforestation in the study area

4. Conclusions

In addition, the dependency on forests for fuel-wood is 60% and consumption of agricultural waste is 4%. The urban household consumption of charcoal is (1.3) tons in the Taungyi District and average rural household consumption of fuel-wood are (2.67) tons per year. Due to increased population growth and development of the living standard of urban and rural people, the fuel-wood consumption is decreased. Systematic Utilization of fuel-wood should be

applied and also alternative utilization of agricultural wastes such as rice husks, coconut husks, waste of corns and other agricultural residues for cooking should be planned and implemented. Awareness should be raised to utilize the improved cooking stoves. Fuel-wood demand will be in some extent in future. At least, before the widely use of electricity and bio-gases instead of fuel-wood, we need to analysis the ways to protect natural forests. It is necessary to conduct research to fulfill 60 % of fuel-wood demand and to give awareness for the utilization of fuel wood substitutes e.g agricultural crops, natural gases and bio-gasification.

5. Recommendations

(a) Village-owned fuel-wood plantations and community forest plantation should be established.
(b) Natural forests should be conserved to meet forest policy target.
(c) Distribution of improving cooking stoves should be promoted.
(d) Multipurpose use of tree plantation should be established around the farm lands.
(e) The inherited land should be legally transferred to future generations (Appropriate land use policy for inherited land).
(f) Opportunity for Electricity should be assessed.
(g) Alternative ways to reduce environmental impacts should be approached.
(h) Urgent need for government to provide cheap, reliable and affordable sources of energy like kerosene, electricity, solar energy and cooking gas at affordable prices so as to avert the reliance on fuelwood with its related negative effects on the environment. Provision of modern fuel efficient stoves will encourage people to shift to the modern energy and reduce the excessive usage of wood. Cultivation of fast growing tree species needed to accelerate the regeneration of forests.

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