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HARVESTING AND CONSUMPTION OF FUEL AND TIMBER WOOD IN RURAL AREA OF DISTRICT TANK, PAKISTAN

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Abstract

The study revealed that 90% of the rural people with different age group of District Tank, Pakistan depended upon firewood for catering. The total annual wood consumption for fueling by brick brewers, food sellers and domestic utilization was 18371 metric tons in this remote region. The saw machines also convert 13650 metric tons of timber wood yearly into logs and boards of various grades. The total wood consumption exceeds the quantity of wood harvested by tree fellers, farmers and wood sellers. Therefore the balance of over 13000 metric tons is sourced from neighboring forest of Tehsil Kulachi and Dera Ismail Khan. The quantity of wood removed and consumed for various purposes did not show a significant difference at α (0.05) among the six locations. However student t-test showed significant difference existed in the mean annual removal and consumption of wood in the area. The study also enumerated *Acacia nilotica*, *Tamarix aphylla*, and *Sueda fruticosa* as the best and preferred fuel species. While *Acacia nilotica*, *Prosopis farcta* and *Dalbergia sisso* as the frequently used timber species in the region. The criterion of firewood and lumber consumption was very conventional like durability in blaze and opposed to termite. Consequently, it is recommended scientific vegetation conservation strategies meant at improved burning of fuel wood and maximized used of timber products as a complimentary efforts to enforced tree planting for conservation of plant resources..

Key word: Conservation, Fuel wood, Timber wood, Ethnobotany, Pakistan.

Introduction

District Tank lies from 31° 15' to 30° 31' N latitudes and 70° 22' E longitudes. It has an area of 1679 km^2. The altitude varies from 260 to 300 meters over the sea height. The climate is semiarid. The winter is cold and stimulating. The total area of forests in Pakistan is 4.2 million ha which is 5 % of the total land area. However, it may be mentioned here that the farmland trees and linear planting along roadsides, canal sides and railway sides covering an estimated area of 466,000 ha and 16,000 ha respectively do not constitute forests within the context of legal, ecological or silvicultural/management definition of forests. The situation is also similar, but to a lesser extent, in the case of miscellaneous plantations over an area of 155,000 ha. If the area of these three categories of plantations is excluded from total forest area of 4.2 million ha, then the latter is reduced to 3.6 million ha which is approximately 4.1% of the total area (Ahmad, 2007). Ethnobotany, an area of human ecology, defines the interface between people and their forests, and offers clues needed for rural development based on sustainable yields of forest products. The importance of timber and other fuel tree products from outside forests is attracting increasing attention to help meet growing demands and reduce pressure on natural forests and plantations (Focho *et al.,* 2009).Trees growing in open areas seem to have potentials to provide options for rural livelihoods and biodiversity conservation (Pasiecznik *et al*., 2006). Estimates have shown that about 90 percent of cooking and heating energy comes from trees (Kirubi *et al*., 2001).

Plants with fuel and timber and other uses were observed by Kappelle *et al*., (2000); Gutkowski, *et al*., (2002); Olsen & Larsen (2003); Ahmad (2004); Kala, (2005); Alm (2006); Okello & Segawa (2007). No such reference is however, traceable on the plants from District Tank. Mizaraitė *et al.,* (2007) mentioned that firewood production for home consumption is one of the most important forest owners' objectives. Similarly Kairiukstis & Jaskelevicius (2003) worked on the Forest energy resources and their utilization in Lithuania. Wood fuel use in the traditional cooking stoves in the rural floodplain areas of Bangladesh is also of great concern (Miah *et al*., (2009). Farlane (2009) evaluated that urban trees and wood waste offer a modest amount of biomass that could contribute significantly more to regional and national bio-economies than it does at present. Gilani *et al*., (2003); Hussain & Jan (2005); Hussain *et al*., (2006); Wazir *et al*., (2007); Khan & Khatoon (2008) reported data regarding fuel and timber wood from various parts of Pakistan.

Materials and Method

Data collection: Data regarding fuel and timber wood species was gathered through a semi structured open questionnaire by interviewing 375 respondents in different areas, which directly or indirectly involved in utilization of plants. These were the brick baking (Kilns Owner), food seller (hotels / Tandor), tree fellers (tree cutter), farmers and fuel wood dealers (Ogunkunle & Oladele, 2004) and (Badshah *et al*., (2006). These categories of people were selected because of more knowledgably than others by virtue of their trades and utilizations. The study was conducted during 2011–20013. The information was also gathered on sex, age and education back ground. The questionnaire sought the name of the plant preferred and quantity utilized. They were also asked to give the criteria why particular plant was best for fuel and timber wood. Fuel wood sellers were asked to quantify their weekly sales with reference of number of mounds. The tree fellers were made to

quantify their weekly cutting and removal on the number of average standard logs. The food seller and domestic cooking were made to give information on the average number of donkey carts load of wood utilized in a week. While the farmer supplied the number of average sized tree removed during farming season. Plants were collected and identification was confirmed in National Herbarium of NARC Islamabad, QAU Islamabad and PUP Department of Botany University of Peshawar. Identification was carried out with the help of (Nasir & Ali, 1970-1989, Ali & Qaiser, 1993-2012) and (Hussain & Badshah, 2006).

Derivation of wood utilization in six different areas of district Tank: The average amount of wood consumed for various purposes in a year and the quantity of wood removed from the forest / farms in the study area were first estimated in local units and then converted to metric tons in the following way.

A. The average consumption of brick backing kilns is 3000 mounds per round and numbers of rounds per year are 4. The numbers of mounds are therefore 12000 per kilns. From the numbers of mounds in a year, the estimated quantity of wood in metric ton yr $^{-1}$ was obtained by multiplying the appropriate factor (No of Kilns × 3000 × 4)

B. The average carrying capacity of a tractor Trali is about 15 logs, each log weighs 5 mounds (0.25 metric tons). From the numbers of logs converted into various timber purposes in the machine saw and logs removed from the forest by tree feller in a week of wood in metric tons yr -1 was obtained by multiplying with the appropriate factor (No of logs per week × 52).

C. The quantity of wood used by food sellers / hotels and domestic uses were estimated from the numbers of full load of donkey cart used in a week. Donkey cart carry an average weight of 5 mounds. This was then multiplied by appropriate factor to get estimation for whole year (standard cart weight × 52)

D. One average size tree felled by farmers during farming season was observed to be 2 donkey carts. Each with 5 mounds (0.25 metric tons). Only one farming season was seen in the area. The estimated annual wood removed by this way was then obtained by using factor (2 × 0.25 × 1) to get actual numbers of trees felled in metric tons yr $^{-1}$

E. Fuel wood seller used to sale an average 20 mounds per week therefore multiplying appropriate factor (20 × 52) obtained total sale in metric tons yr $^{-1}$.

Derivation of plants frequency: The frequency of timber wood species was calculated as a percentage of numbers of interviewee (35 Saw machine) converting a specific plant into various timber purposes. Likewise, the frequency of fuel wood species was obtained as a percentage of the user using a particular plant for fuel against the total respondents (115).

Statistical analyses: Data collected were subjected to statistical analysis using the SPSS computerized program. Three different test were conducted viz. ANOVA for the wood removal in different areas; ANOVA for wood consumption in six different area and t-test for the mean total removal and using up.

Results and Discussion

Information about the respondents: Of the respondents, 360 were male making up about 96% and 15 were female (4%). Most of them were in the age of 41- 61, illiterate and had just primary education (Table 1).

About 100% of the respondent told that no Bain or any law exists against deforestation. Due to lack of education, poverty and no alternative to fueling, vegetation removal were common in the study area. The loss from deforestation by this way took the form of soil erosion and destruction of local flora and fauna. (Nagothu *et al.,* 2001) in Rajistan India, (Danesh *et al.*, 2009) in Bangladesh and (Alam & Starr, 2009) in Sudan presented similar threats to forests due to lacking of facilities like gas and electric city to the community.

Table 1. Knowledge by age and education.

Age group	Up to 2	3- 4	+ 5	Total
Up to 20	3	-	-	3
21 – 40	10	7		17
41 – 60	5	5	40	50
61 – 80	-	2	28	30
81+	-	0	0	0
Total	18	14	68	100
Education Illiterate	2	10	23	35
Primary	3	6	18	27
Middle	5	5	13	23
Matric	5	-	-	5
FA/ F.Sc	4	-	3	7
BA /B.Sc	-	2	-	2
MA/M.Sc	1	-	-	1
Total	**20**	**23**	**57**	**100**

Table 2. Plants harvested in forest for firewood and timber purposes in metric ton yr $^{-1}$

S. No.	Areas	Town city	Warana	Gul Imam	Ranwal	Dabara / Gomal	Umar Ada	Total
1.	Tree feller	-	3900 (10)	2770 (7)	3120 (8)	1950 (5)	1170 (3)	12870 (33)
2.	Farmers	-	5.5 (11)	10 (20)	12.5 (25)	15 (30)	17.5 (35)	60.5 (121)
3.	Fuel wood seller	156 (3)	260 (5)	780 (15)	676 (13)	1092 (21)	728 (14)	3692 (71)
Total		**156 (3)**	**4165.5 (26)**	**3520 (42)**	**3808.5 (46)**	**3057 (56)**	**1926 (52)**	**16622.5 (225)**

(Number of respondents is shown in parenthesis)

Table 3. Utilization of fuel and timber wood in metric ton yr $^{-1}$.

S. No.	Areas	Town city	Warana	Gul Imam	Ranwal	Dabara / Gomal	Umar Ada	Total
1.	Brick backing	6000 (10)	4800 (8)	2400 (4)	1800 (3)	1200 (2)	600 (1)	16800 (28)
2.	Machine saw	5850 (15)	1950 (5)	1560 (4)	780 (2)	2340 (6)	1170 (3)	13650 (35)
3. a.	Cooking Food seller	520 (20)	-	52 (2)	-	182 (7)	130 (5)	882 (34)
b.	Domestic cooking	130 (10)	117 (9)	91 (7)	104 (8)	130 (10)	117 (9)	689 (53)
Total		**12500 (55)**	**6867 (22)**	**4103 (17)**	**2684 (13)**	**3852 (25)**	**2017 (18)**	**32021 (150)**

(Number of respondents is shown in parenthesis)

Table 4. Mean of the wood harvested and consumed in metric tons yr $^{-1}$

S. No	Areas	Town city	Warana	Gul Imam	Ranwal	Dabara / Gomal	Umar Ada	Total
1.	Wood removed	52	160	84	83	55	37	471*
2.	Wood consumed	227	312	241	206	154	112	1252 **

Level of wood consumption: It has been estimated that a total of 16622.5 metric tons of wood was removed per year (Table 2). This also showed that the quantity of wood harvested in six different locations was different; however the statistics did not show a significance difference among the quantity of wood removed in different areas at α (0.05).

This was calculated by the relative number of respondent involved in wood harvesting to the total amount of wood harvested/removed which were more or less equal except that of town where the removal was negligible as land and forest were converted into buildings**.** Table 3 showed that the total amount of wood consumed in different location was 32021 metric tons per year. The analysis of variance (ANOVA) also did not show any marked difference in amount of wood consumed in the areas at α (0.05). However significant difference at α (0.05) existed in the mean annual removal and consumption of wood in the area (Table 4).

The mean annual removal and consumption of wood in Warana station was highest to the rest of the five stations due to abundance brick brewers and presence of many saw machine Inn. The amount of wood consumed outstrips the amount harvested in the investigated area (Table 4). The balance of 15398.5 metric tons per year was rushed from the neighboring forest of Tehsil Kulachi and Dera Ismail Khan. Our finding agree to (Ogunkunle & Oladele, 2004 and Bensel, 2008), who reported similar results from Nigeria Philippines respectively. Rawat *et al*., (2009) stated that Fuel wood consumption among the tribal communities in cold desert of the Lahaul valley India was extremely high and the people has to rely on local flora for their fuel energy.

Twenty five species were commonly used as fuel wood (Table 5). The total annual consumption being 18373 metric tons. Almost 100% of the house hold used fuel wood for cooking and they had nothing as an alternative to fuel. Similarly (Hulscher & Patrick, 2000) concluded that the demand for fuel wood can only be supplied by overexploiting forests, and that numerous developing countries are already doing just that. Amongst the countries mentioned are Bangladesh, China, India, Pakistan, and Thailand. Likewise 13650 metric tons of timber wood was utilized from ten species in the region, which showed that people in the area even in this modern age rely on forest for most of their timber purposes. Same result was obtained by (Saqib *et al.*, 2002 and Badshah *et al.*, 2013) in other parts of Pakistan.

Table 5. Frequency of the flora harvested for fire and timber.

S. No.	Scientific name	Local name	Family	% Age frequency	
				Fuel wood	Timber wood
1.	*Acacia modesta*	Palosa	Papalionaceae	0.8	2.8
2.	*Acacia nilotica*	Kikar	Mimosaceae	86.9	88.5
3.	*Aerva tomentosa*	Sperai	Amaranthaceae	3.4	-
4.	*Brassica campestris*	Usoon	Brassicaceae	0.8	-
5.	*Calotropis procera*	Spulmaka	Aesclapidaceae	1.7	-
6.	*Capparis decidua*	Kira	Capparidaceae	6.1	2.8
7.	*Celtis eriocarpa*	Therawan	Ulmaceae	0.8	-
8.	*Cymbopogan jwarancusa*	Sargaray	Poaceae	0.8	-
9.	*Dalbergia sisso*	Sava	Pailionaceae	4.3	28.5
10.	*Dodonea viscosa*	Zerawany	Sapindaceae	0.8	-
11.	*Eucalyptus globulus*	Sufaida	Myrtaceae	30.4	17.4
12.	*Ficus carica*	Anger	Moraceae	0.8	-
13.	*Melia azedarach*	Dahark	Meliaceae	1.7	-
14.	*Morus alba*	Toor toot	Moraceae	6.1	5.7
15.	*Morus nigra*	Spin toot	Moracea	-	5.7
16.	*Phoenix dactylifera*	Kajoor	Palmaea	13.9	8.5
17.	*Prosopis cineraria*	Kikray	Mimosaceae	44.3	-
18.	*Prosopis farcta*	Niskora	Mimosaceae	42.6	17.4
19.	*Salvadora oleoides*	Pleman	Salvadoraceae	4.3	-
20.	*Sasola imbricata*	Lanrhay	Chenopodiaceae	9.5	-
21.	*Sueda fructicosa*	Zamay	Chnopodiaceae	61.7	-
22.	*Tamarix aphylla*	Ghaz	Tamaricaceae	89.5	14.2
23.	*Tamarix dioca*	Sarghaz	Tamaricaceae	35.6	-
24.	*Typha latifolia*	Lokha	Typhaceae	8.6	-
25.	*Zizyphus mauritiana*	Bera	Rhmnaceae	52.1	20.0
26.	*Zizyphus nummularia*	Karkan bera	Rhmnaceae	2.6	-

The respondents also prioritized the best timber and fuel wood species in the area. Among them, *Acacia nilotica* was frequently used both for timber and a lot for fuel wood. This is due to its durability (43%) as timber and high heat value (50%) as fuel, made it the best species in all feature (Table 6). Waziristan (Badshah *et al*., 2006), Batkhela (Barkatullah *et al*., 2009) and Uganda (Hartter & Boston, 2008) stated that most of the species were preferred for fuel wood and were under heavy stress consistent to our finding. *Prosopis farcta* was also extremely used for timber and seldom as firewood. The criteria used for its best consideration as a timber wood was its straight nature (39%) and easy planking (21%). The local also have realized their smoky fire and less availability in the area. *Tamarix aphylla* and *Suaeda fruticosa* respectively have negligibly used as timber wood but extensively as fuel wood because of abundantly growth (24%), easy collection and light in transportation as a head load. *Dalbergia sisso* was the only timber wood especially for its utility in furniture (31%) and beautiful wood (41%). Pasiecznik *et al*., (2006) stated that different trees are converted into various timber purposes in UK, which is in line with our findings.

The other rarely converted timber species in the area were *Tamarix aphylla*, *Eucalyptus globulus, Phoenix dactylifera, Morus alba* and *Zizyphus mauritiana*. Virtually any woody species was used for fueling in the study area. Potential wood fuel supply and consumption were investigated using a literature review and analysis of statistical data (Mizaraitė *et al.,* 2007). *Prosopis cinenaria, Eucalyptus globulus, Salsola imbricata, Tamarix dioca* and *Zizyphus nummularia* were also popular fuel wood species in the area. Ali & Benjaminsen (2004) in Siran valley Pakistan, observed that increased human population has resulted in increased demands for natural resources, leading to severe resource depletion, especially deforestation for fuel and timber. The stumpy proportion of forested land and long-lasting degradation of existing forest cover are serious threats to the sustainability of forestry in Pakistan (Zubair & Chris, 2006).

On the whole, an estimated 32021 metric tons of wood was used annually for both fueling and timber in the rural area of the district Tank. The only alternate observed was dung cakes utilization which shows the lack of provision of modern facilities of fuel. Within the scope of this study our findings are consistent with those of (Ogunkunle & Oladele, (2004) that the rural area of Obomosa, Nigeria utilized and consumed about 85873 metric tons of fuel and timber wood every year. The rapidly decreasing forest due to timber, fuel and over grazing, the land is becoming barn and less productive resulting into habitat loss. This badly affecting farm productivity and hence the local and national economy. Miah *et al*., (2009) in Bangladesh showed that family size, income, amount cooked and burning hours significantly affected the amount of wood fuel used per family per year. Taking into account different family sizes, the study observed that 4.24 tons of fuel wood was consumed per family per year which satisfied our findings.

Table 6. Criteria for fuel and timber wood as the best.

S.No.	Criteria	Fuel wood species		
		Acacia nilotica	*Tamarix aphylla*	*Suaeda fruticosa*
1.	High heat worth	50	15	-
2.	Free of charge availability	20	8	-
3.	Fewer smoke	10	-	-
4.	Long and constant fire	8	-	-
5.	Fast increase	12	15	-
6.	Get dry soon	-	-	10
7.	Snatch fire soon	-	-	15
8.	Easy collection	-	30	25
9.	Light in transportation	-	-	30
10.	Abundantly	-	24	-
11.	No spines	-	8	-
12.	Self renewal	-	-	20
S.No.	**Criteria**	**Timber wood species**		
		Acacia nilotica	*Prosopis farcta*	*Dalbergia sisso*
1.	Toughness of wood	43	21	20
2.	Quick growth	13	-	-
3.	Self regeneration	10	-	-
4.	Resistant to termite attack	15	10	8
5.	Utility as furniture	-	-	31
6.	Gorgeous wood	-	14	41
7.	Stoutness	19	-	-
8.	Not twisting	-	39	-
9.	Wood planking easy	-	16	-

Conclusion

Through this investigation ethnobotanical data have proved to be informative in identifying the best timber and fuel wood species. No conservation strategy was pragmatic in the area therefore the Government should take initiative for tree conservation, especially identified with rapid loss. It is necessary for the Government to intensify efforts towards encouraging and if possible enforcing tree planting which is of special concern. It is also recommended to seek for scientific vegetation conservation strategies with an attempt to improve burning of fuel wood and frequent use of timber products.

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