



Assessment of the Potential of Non-timber Forest Products in Livelihoods' Sustenance of the Flood Proximate Communities of the Indus Basin, Pakistan

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Flood-proximate communities are the most affected from the destructions caused by floods occurring almost every year in Pakistan. The people in these areas, due to frequent natural calamities, usually have poor economic conditions. These communities mainly rely on conventional income-generating strategies i.e. agriculture, fishing, daily wages etc. But due to natural disasters, these methods end up yielding the least profit, thus different means of income-inducing strategies are needed to explore for the community's sustainable growth. The current study focuses on the potential of Non-Timber Forest Products (NTFPs) in the region of D I Khan in supporting the livelihoods of the inhabitants. The research utilized a mixed method approach (blend of quantitative and qualitative) through a semi-structured questionnaire aiming to assess the livelihood sustenance of flood proximate communities through NTFPs. A total of 150 respondents were randomly selected from 05 administration units, tehsils. The results revealed that communities in non-flooded areas (NF) used collecting NTFPs mostly for construction material whereas those in flooded areas (F) used it for construction as well as utensil making (F:41 %; NF: 39%; $P < 0.05$; χ^2 : 0.812). Both groups were involved in harvesting and using shrubs such as *S. munja*, *T. latifolia*, *N. ritchiana*, *S. sesban* and *T. dioica* and trees such as *E. camadulensis*, *V. nilotica*, and *D. sissoo* for firewood and cottage industry. Both groups were significantly different in meeting their livelihood needs such as their income source and meeting household expenses efficiently (F: 48%; NF: 100 %; $P < 0.01$; χ^2 : 12.03). The present study concludes that the NTFPs sector in flood-proximate areas has been neglected as a profitable income strategy for sustainable livelihood of the poor in this region.

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1. INTRODUCTION

The term Non-Timber Forest Products as defined by various authors emphasized it as any tangible product extracted from forest such as fruits, seeds, leaves, resins, essential oils, honey, spices except timber for human use [1,2,3]. NTFPs all over the world especially in economically challenged areas play a pivotal role in providing sustainable livelihoods in terms of daily wages jobs, daily subsistence thus enhancing their household economy [4]. These products obtained from the forests are not only less destructive than logging but enhance the value of standing forest crop thereby providing sustainable incentives [5]. In recent years NTFPs have gained sufficient economic significance in the world [6]. Currently it is estimated that, some of the NTFPs obtained worldwide annually gain worth of US \$90 billion and without entering the market economy about one third of the same value is consumed by forest proximate communities [7].

NTFPS are usually classified based on end use and plant part used. Typically, NTFPs are also classified using phylogenetic groupings e.g. palm, rattan, bamboos, Typha, or other functional categories such as wood carving, medicinal and aromatic plants. While to organize ecological understanding, this may be significant but to understand development or even conservation implications it often considered to be inappropriate [1]. The collection of NTFPs is considered to be a source of cash income as they get their commercial significance increasing day by day [8,9] Globally 1.2 billion people living below the poverty line which depend upon the collection of NTFPs. People who do not have financial capital and lack of their own agricultural lands mostly involved in these activities of NTFPs collection [10]. Another kind of people involved in this activity were those who had their own agriculture lands but in off seasons. In many regions NTFPs is considered the only economical source of the households. To enter NTFPs business there are not much pre requirements and provide fast cash, thus the people are easily adjusted in this activity [11]. NTFPs utilized in the form of fuel wood, construction material, wooden tools, household utensils, considered to be the most important set of assets in the livelihood strategies of poor people [12]. Most of the poor people get their

food, building and medicinal needs from these NTFPs as well [13]. By building up the marketing opportunities and getting expected output, livelihood based on NTFPs could be improved. Most of the development and conservation organization are taking interest in NTFPs as they understand the significance of these resources. The smallholder families in different parts of the world make 10% to 25% of their household income by exploiting NTFPs. Furthermore, in the part of Southeast Asia tropical forests provide more than 50\$ per month per hectare to the people by utilizing NTFPs [14]. With the same situation in Bangladesh, nearly 300,000 poorest rural population received major employment opportunities that contribute 1.3 billion of the country's annual economy [14]

Pakistan is one of the most densely populated country in the world. It consists of about 191 million people, 23% of whom live below the poverty line. Natural disaster as one of the major factors in Indus Basin areas of Pakistan that affect human society by damaging forest and agricultural resource by reducing livelihood options. Floods of 2010 and 2022 affected the country badly inflicting suffering from poor economic, social and political infrastructure which create mismanagement in the country. In such situations, when there arises an agricultural shortfall or any kind of emergency NTFPs are the safety net to fill all the gaps [15,16,17]. Most of the country's poor population depend on natural resources which result in overexploitation and depletion of these resources e.g forest and other natural resources. That is, when crops fail due to flood, disaster or when shocks hit the household causing death, diseases, or unemployment, NTFPs are available as the good option for the people by direct consumption or sale. In Pakistan some of the important NTFPs are produced such as honey, mazri palm, *Saccharum munja*, spices, fruits, condiments, and many others [18]. *Mazri and Munja* are the two important plants that mostly used nearly in most of the Indus basin areas. They are used for various purposes such as making ropes, mats, baskets, bread bins, hand fans, handbags, brooms, trays, different commodities of mosques and other decoration materials etc in Dera Ismail Khan, Swat, Kohat, Banu in KPK, Gujrat, Kot addu in Punjab and in some areas of Baluchistan.

Keeping in view importance of NTFPs as the potential means to conserve biodiversity and

enhancing rural livelihoods in many regions of the world [19,20,21] besides, considered as the important source of cash income especially for marginalized people and communities living around problem areas paved the way for present study to focus on determining the livelihood strategies of the local communities using NTFPs in flood proximate communities of the Indus basin around Dera Ismail Khan, KPK, Pakistan. The Indus basin is often covered with diverse vegetation which the local and poor communities used for their daily household use but also sell them to sustain their livelihood.

1.1 Objectives

In context of the above, this research was formulated to (1) To understand the status of NTFPs in the study area and (2) To understand the role of NTFPs in livelihood sustenance and market system and potential of the selected NTFPs in flood proximate communities of the Indus Basin.

2. METHODOLOGY

2.1 Study Area

The purpose of this study was to understand the role of NTFPs in the livelihood of people that are living in the flood proximity areas where people make their earnings through collection, processing and selling of NTFPs. For this purpose, the area selected for this research was Dera Ismail Khan (DIKhan) an oldest city in Khyber Pakhtunkhwa province (KPK). DIKhan lies on west bank of river Indus, one of the most important rivers in Pakistan. Generally, the city has hot desert climatic conditions. The weather of this city is extremely hot in summers while the winters are mild. Precipitation usually occurs from February to April, during late winter and early springs and during June July which is regarded as the monsoon season. Due to the geographical features, a vast majority of area is prone to flooding due to which agriculture land has been damaged many times, especially the floods during 2010 washed away a vast land area including agriculture fields. So besides cattle rearing, NTFPs are prominent source of people, which make this area suitable for our study.

2.2 Respondents' Selection Procedure

The study was conducted in five sites along the bank of river Indus. Out of five three of them

receive floods almost every year whereas two of them are non-flooded sites namely *Ghafray wali*, *Thoya fazal* and *Barseeno wali basti* and *Basti chanchlaba* and *Muryali* respectively. Systematic random sampling methodology was used for the selection of different sites. In the stage 05 villages were randomly selected out of total 20 in the vicinity of the river. In the 2nd stage 150 respondents were selected 30 from each site especially those who are directly or indirectly involved in NTFPs collection, marketing, and value addition.

2.3 Research Design and Data Collection Procedure

Present study was conducted following survey strategy of research. A mixed method (quantitative and qualitative) approach was adopted in which face to face interviews were conducted using questionnaire consists of structured and semi-structured questions. The questionnaire was prepared in such terms that it could generate information from the people about the importance of NTFPs in their life. The materials and instruments used in the survey were questionnaire, pencil, paper bags and audio recorder. While visiting study sites, respondents While visiting the selected areas, we shared our questionnaire, aim of conducting the study and discussed the proper method and time to approach NTFPs harvesters. The guides were very helpful as they assisted us to understand the local dialect. remain unexplored due to some socioeconomic and cultural issues.

2.4 Statistical Analysis

All the data from the questionnaire was summarized and analyzed using software IBM SPSS 21. comparisons were drawn and statistical differences were tabulated using chi square statistic.

3. RESULTS AND DISCUSSION

3.1 Status and Utilization of NTFPs

3.1.1 Status

The knowledge regarding the status of NTFP's is presented in Table 1. Knowledge was evaluated by observing different terms in which NTFP's used such as construction, utensils or both. It was predicted from the results that NTFP's mostly used in terms of both construction and

utensils purpose with total percentage of 36% (F:41%;Non-NF:28%;P<0.658; χ^2 : 0.65). According to the respondents, wan/thatching material, mats, roofs, curtains include in the category of construction. While NTFP's used for the purpose of utensils contain baskets, decoration material, teeth cleaning twig, hand fans, brooms, hand bags, munja stools, hubble bubble bread bins and grain bins. So with respect to both terms usage, it was predicted from the table that people used NTFP's for construction purpose more (33%) rather than only using utensils (31%). Resembling to the studies [22] indicated that NTFPs can be integral in subsistence livelihoods.

When interviewers asked about the preferred species used for NTFPs, most people were of the view that they preferred *Saccharum munja* and *Tamarix dioica* (20%). The reason behind that both species are easily available in wide

range in the KPK district DIKhan. Some people answered that they used *Nannorphos ritichiana* along *Tamarix dioica* with total percentage of 18% as these species were rare in flooded areas.

Similarly, there were many other species such as *Typha latifolia*, *Dalbergia sissoo* etc also used in flooded and non-flooded areas but relatively in less preference. The preference of species was different among respondents. Such as some of the respondents thought that they could easily work with *Saccharum munja*. Likewise some species i.e *Typha latifolia* and *Nannorphos ritichiana* are easily available at the spot and most of the products formed by using these species. It was evaluated that respondents preferred these species widely due to the reason of easily accessible (49%) with respect to flooded and non-flooded areas (F:52%; NF:39%; χ^2 : 3.2, P<0.000).

Table 1. Status of NTFPs in the study area

Sr #	Statement	Categories	F (%)	NF (%)	Total (%)	Significance
1	NTFPs used	Construction	30	39	33	$(\chi^2: 0.812)$ (P<0.658)
		Utensils	30	33	31	
		Both Construction & utensils	41	28	36	
10	Preferred species	SM	22	0	13	$(\chi^2: 10.5)$ (P<0.000**)
		TL	15	0	9	
		Both SM, TD	22	17	20	
		SM, TD, TL	26	0	15	
		SM, TL	0	39	16	
		TD, NR	0	44	18	
		SM, TL, DS	15	0	9	
11	Reason of preference	Easy to access	52	39	47	$(\chi^2: 13.2)$ (P<0.000**)
		Easy to work	19	0	11	
		Most products formed	15	0	9	
		Both 1&2	0	61	24	
		Both1&3	15	0	9	
12	Change in NTFPs availability	Increased	25	61	40	$(\chi^2: 14.8)$ (P<0.000**)
		Decreased	0	39	17	
		Remained same	75	0	43	
13	Reason of decreasing NTFPs	Don't know	79	17	52	$(\chi^2: 10.9)$ (P<0.000**)
		Insufficient facilities	0	44	19	
		Any accident (flood)	21	0	12	
		Migration	0	39	17	
14	Increased resources by	Increasing market demand	25	56	38	$(\chi^2: 3.9)$ (NS)
		Providing facilities	75	44	62	

* and** denotes significance at 5% and 1% of probability whereas NS shown non-significant results using chi square statistics. "F" denotes flooded whereas "NF" shows Non-Flooded areas

Note: TL: *Typha latifolia*, SM: *Saccharum munja*, NR: *Nannorphos ritichiana*, TD: *Tamarix dioica*, DS: *Delbargia sissoo*

Furthermore, when questions were asked about the change in the availability of NTFPs, may it be increased, decreased, or remained the same since long. Majority answered as category of “remained same” (43%). The respondents living around flooded site that they did not found any change in the availability of NTFPs and their usage etc as their ancestors do (F:75%;NF:0%; χ^2 : 14.8;P<0.000**). But the people living in non-flooded site replied with no answers as they had no idea about the changes related to NTFPs. Most of respondents answered with the increase of NTFP’s availability (40%). While least number of respondents (17%) tell that they found NTFP’s to be decreased as compared to their previous knowledge. Same studies described by [23-27] that different perceptions obtained from different households residing in the same area. People thought that there was alarmingly decrease in the NTFP’s while few said that NTFPs increased manifold. When interviewers asked about the reason behind the decrease in NTFP’s, majority of them reported that they don’t know the reason (52%). In the similar way, some of them indicate that NTFP’s decreased due to insufficient facilities (19%) and 17% of the respondents said that when they were forced to migrate as NTFPs found to be decreased and very few of them (12%) pointed out the floods or due to any other accidental situation caused decrease in NTFPs availability. Moreover, in order to sought out the problem of decreasing value of NTFPs findings revealed that by increasing market demand (38%) and providing sufficient facilities (62%) to the people engaged in NTFPs activity, the resources would be increased. But this variable of increasing resources show non-significant data, which means most of the people were not agreed with the answer. This was also formulated that NTFP’ could be increased by adopting controlled harvesting techniques.

According to [28,29] most of the resources were ruined due to overharvesting.

3.1.2 Utilization

The details about the utilization of NTFP’s presented in Table 2 which further revealed the names of species mostly used in the surveyed area. During field household surveys, various types of NTFPs found to be used but in this study. Out of many, 08 species were recorded as abundant which are mostly used for subsistence and income generation purpose by the respondents. According to the studies of [30,31,32]. The study area villagers depend on plant species particularly, typha, munja, tamarix, palm, eucalyptus, vachellia, dalbergia, sasbania spp used for making variety of products. It was observed from the findings that most of the NTFPs e.g *Typha latifolia* which respondents are called “kundra” collected for construction purpose such as in thatching, in making mats, sheets. Similarly, *Nannorphos ritichiana* locally called palm found near the living place of all respondents utilize in utensils or cottage products (bird cages, hand fans, hand bags, bread bins). *Saccharum munja* which is widely visible plant in the study area used for cottage products like decoration, curtains, bubble (hukahpipe), brooms and grain bins. Some of the baskets and brooms also prepared form the *Tamarix dioca* which is locally known as “Lai”.

All these NTFPs collected to meet the household subsistence and cash sale. On the other hand, *Eucalyptu camaldulensis*, *Dalbergia sissoo*, *Vachellia nilotica*, *Sasbania sesban* are mainly collected only for their household needs i.e firewood/fuelwood and teeth cleaning twig. With similar studies [33,34,35] reported that more than 70% of the country’s households directly rely on firewood as their main sources of energy.

Table 2. Utilization of NTFPs

Sr#	Species used	Local name	Utilization
1	<i>Typha latifolia</i>	Kundra	Thatching material, mats/sheets, (construction)
2	<i>Nannorphos ritichiana</i>	Palm	Bird cages, Hand fans, Hand bags, Bread bins, Mats/sheets, (cottage & construction)
3	<i>Saccharum munja</i>	Munja	Decoration, curtains, munja stools, hubble bubble (Hookah pipe), brooms, grain bins, (cottage)
4	<i>Tamarix dioca</i>	Lai (Kamba)	Baskets, brooms, (cottage)
5	<i>Eucalyptus</i>	Sufeda	Firewood, (cottage)
6	<i>Vachellia nilotica</i>	Kiker	Teeth twig, (cottage)
7	<i>Dalbergia sissoo</i>	Sheesham	Firewood, teeth twig
8	<i>Sesbania sesban</i>	Jantar	Firewood

3.2 Livelihood Potential of NTFP's

3.2.1 Livelihood impacts

Outcomes of first variable in Table 3 (i.e. income obtained from cottage products yearly) showed that majority of respondents (44%) earned Rs 25,000-45,000 (152-274 USD) in a year through NTFPs sector [F:44%; NF:44%]. While people who generate Rs 45,000-65,000 (274-396USD) annually income from NTFPs were at the bottom comprising (31%) from flooded and non-flooded site (41%;17%). Likewise, respondents who said that they get less than 25,000 (152 USD) annually were just at beneath with (25%). [14] witnessed in the results that people engaged in NTFP's activity usually earned 5000-15000 (less than 25,000) in Bangladesh while some using it for their own purposes. It was formulated from the findings that NTFP's meet the expenses of their households (69%) [F:48%; NF:100%] whereas (22%) respondents said that not fully but somehow, they furnished their expenses

through NTFPs [F:37%; P<0.001]. Few of them (9%) replied with the option "no" which means they were not satisfied with NTFP's. When it was asked by the respondents about selling mode of NTFPs, (58%) of them said that they sell their assets in auction [F:56%; NF:61%]. Whereas (13%) [F:22%] told that they sold NTFP's directly into the markets. Differences amongst selling mode of NTFPs were found statistically non-significant. It was proved in the research of [16] that people usually sell their products directly to the markets. As they thought it gave them a lot of money rather than any other source. Findings related to awareness of NTFP's prices evaluate that respondent from both flooded (70%) and non-flooded (61%) who said that they knew about the prices of NTFP's were at highest rate (67%). But (30%) respondents from flooded and (39%) from non-flooded areas said that they didn't know about the market prices regarding NTFP's remained lowest (33%). Similar outcomes obtained during the research of [36] in West Bengal.

Table 3. Livelihood impacts of NTFP's

Sr#	Variables	Categories	F (%)	NF (%)	Total (%)	Significance
1	Income obtained from cottage products (yearly)	Less than 25,000 (152.601 USD)	15	39	25	$(\chi^2: 4.4)$ (NS)
		25,000-45,000 (152.601-274.682 USD)	44	44	44	
		45,000-65000 (274.682-396.742 USD)	41	17	31	
2	NTFPs meet the expenses of your household	Yes	48	100	69	$(\chi^2: 12.03)$ (P<0.001*)
		No	15	0	9	
		Somehow	37	0	22	
3	Selling mode of NTFPs	Auction	56	61	58	$(\chi^2: 0.4)$ (NS)
		Direct sell	22	0	13	
		Others	22	39	29	
4	Market information on NTFPs pricing	Yes	70	61	67	$(\chi^2: 0.4)$ (NS)
		No	30	39	33	
5	Agreement from any instituton for NTFp	No	100	100	100	P<0.a
6	Alternate source of income in case of risk	Labor	44	56	49	$(\chi^2: 7.6)$ (P<0.000**)
		Hemstitching	0	44	18	
		Begging	18	0	11	
		No	37	0	22	
7	NTFPs give more profit	Cottage products	37	44	40	$(\chi^2: 0.2)$ (NS)
		Construction	63	56	60	

* and** denotes significance at 5% and 1% of probability whereas NS shown non-significant results using chi square statistics. "F" denotes flooded whereas "NF" shows Non-Flooded areas

Results regarding the variable agreement of selling NTFPs showed that almost all (100%) of the respondents said that they didn't bound with any agreement from any kind of institution related to NTFPs. In accordance with [37] respondents were free from any kind of agreement of collection. So they extracted as much as they need and then sold NTFPs to the markets. It was asked by the respondents about alternate source of income in case of risk, (49%) [F:44%; NF:56%] answered that in case of risk they found some daily wages labor. While (18%) [NF:44%] said that their females do hemstitching or some embroidery work at homes to run their needs. Likewise, when they had to face any kind of risk, most of them (11%) forced to do begging to feed their children [F:18%; P<0.000]. Results of the last variable showed that (60%) of the people get profit by using NTFP's in construction purpose [F:63%; NF:56%]. Whereas (40%) get more profit through selling of cottage products [F:37%;NF:44%]. Similar findings obtained by the research of Mamo et al., [22], that (21%) of forest income obtained by construction material for houses, furniture etc.

3.2.2 NTFP's net income

Net income obtained by selling NTFPs displayed in Table 4. The information gathered in this table showed the total income obtained from different types of products like mats, brooms, baskets etc. Results about first variable mats showed that (70%) [F:95%; NF:27%] of interviewees obtained Rs 501-1000 (3-6 USD) net income by selling of single mat. Whereas (30%) get Rs 200-500 (1.22-3.05 USD) of the money from this category [F:5%; NF:73%; P<0.000]. As preparing of mats was depended upon sizes, larger mats require large income and smaller needs some amount.

Respondents who said that they generate less than Rs 200 (1.22 USD) price by selling a single broom were at highest rate (77%) [F:67%; NF:81%], who said that they achieve Rs 501-1000 (3.05-6.10 USD) were at bottom (19%) [F:28%; NF:12%]. They usually sold bulk of brooms at once so these people are very few. While some of the respondents told that they get Rs 200-500 (1.22-3.05 USD) net income by selling of brooms were at lowest rate (4%) [F:5%;NF:7%]. Likewise, (62%) people generate Rs 200-500 (1.22-3.05 USD) income and (38%) get Rs 501-1000 (3.05-6.10 USD) from baskets [F:92%;NF:18%;P<0.000]. As products larger in size generate more income as compared to smaller one. As described by [38] that baskets made from *T. dioca* and an average household annually makes 2000 baskets. These baskets transported to the nearby town to sold them at an average price of Rs. 500 (3.05 USD). Respondents (100%) who work for making hand fans get the net income of actually Rs 501-1000 (3.05-6.10 USD) comprising (71%) from flooded and (8%) from non-flooded areas (p<0.000). As these fans were prepared by extracting Mazri (dwarf palm). [18] concluded from the results that in 2000-01 Mazri production increased to (95%) as compared to 1999-00 i.e.394,559. Results evaluated that people who involved in the construction of single roof usually generate net income between Rs 200-500 (1.22-3.05 USD) followed by (F:29%;NF:92%;P<0.000). The last one variable of Table 4. 7 indicates that majority of the respondents (73%) [F:32%;NF:88%] get 501-1000 income from selling of thatch material whereas (27%) get Rs 200-500 (1.22-3.05 USD) of the money [F:68%;NF:12%;P<0.001]. All these results conclude that usually respondents from studied area generate their livelihood potential by selling of these NTFP's [39].

Table 4. NTFP's net income

Sr#	Variables	Categories	F (%)	NF (%)	Total (%)	Significance
1	Mats	Rs 200-500 (1.22-3.05 USD)	5	73	30	$(\chi^2: 14.5)$ (P<0.000**)
		Rs 501-1000 (3.05-6.10 USD)	95	27	70	
2	Brooms	Less than Rs 200 (1.22 USD)	67	81	77	$(\chi^2: 3.9)$ (NS)
		RS 200-500 (1.22-3.05 USD)	5	7	4	
		Rs 501-1000 (3.05-6.10 USD)	28	12	19	
3	Basket	Rs 200-500 (1.22-3.05 USD)	8	82	62	$(\chi^2: 12)$ (P<0.000**)
		Rs 501-1000 (3.05-	92	18	38	

Sr#	Variables	Categories	F (%)	NF (%)	Total (%)	Significance
		6.10 USD)				
4	Hand fans	Rs 501-1000 (3.05-6.10 USD)	71	8	100	(χ^2 : 8.6) (P<0.000**)
5	Roof/construction	Rs 200-500 (1.22-3.05 USD)	29	92	100	(χ^2 : 13.8) (P<0.000**)
6	Thatching material	Rs 200-500 (1.22-3.05 USD)	68	12	27	(χ^2 : 10) (P<0.001*)
		Rs 501-1000 (3.05-6.10 USD)	32	88	73	

* and** denotes significance at 5% and 1% of probability whereas NS shown non-significant results using chi square statistics. "F" denotes flooded whereas "NF" shows Non-Flooded areas

4. CONCLUSIONS

Floods have devastated impacts on local inhabitants living around the Indus Basin. The catastrophe damages precious resources of the communities yet provided them important NTFPs generating them with income and domestic use products to support them in post flood rehabilitation. Since, use of NTFPs have played a positive impact in raising the economic conditions of this poverty stricken and disaster-prone region, there is an urgent need for public-private partnership in provisioning of updated and sustainable harvesting, processing and marketing of NTFPs along with provision of market information to collectors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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