

Full Length Research Paper

Forest resource utilization assessment for economic development of rural community in northern parts of Pakistan

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A study on the ethnobotanical investigation of some multipurpose fruit plants was conducted in three important sites of District Swat of Pakistan during summer, 2008. The aim of the study was to identify the multipurpose fruit plants growing in the area and to collect information on their uses by the local people. Ethnobotanical information was collected through the show-and-tell/semi-structured method and personal interviews during field trips. The methodology is largely based on the 'sustainable livelihood framework', which is based on the premise that livelihood is not about resource productivity, but about people and their lives. A total of 30 fruit tree plants were identified belonging to eleven angiosperm families and has multiple use value in the area. These species were widely used by the indigenous community in traditional system of medicine for the treatment of different human ailments. Similarly, these fruit plants were also used as fuel wood (21 spp.), fodder (16 spp.), agricultural tools making (12 spp), furniture making (6 spp.), timber (7 spp.), thatching (8 spp.), condiments and spices (3 spp.), shade (6 spp.), fencing and poles (7 spp.), tannins and dyes (2 spp), ornamental purpose (2 spp.) and soil stabilization (8 spp.). These plants are of great importance in supporting people's healthcare, income and culture. In spite of the scarcity of natural forests in the study area, the local populations continue to depend on indigenous and exotic trees in their surroundings for their survival. There is, therefore, need for cultivation, protection and sustainable management of these valuable resources for rural livelihoods.

Key words: Ethno botany, local uses, fruit plants, economic development, livelihood.

INTRODUCTION

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 (Focho et al., 2009). The importance of timber and other tree products from outside forests is attracting increasing attention, to help meet growing demands and reduce pressure on natural forests and plantations. Trees growing in open areas seem to have potentials in providing options for rural livelihoods and biodiversity conservation. These trees can contribute to poverty mitigation serving as subsistent "safety nets" or

low income "gap fillers". In addition to environmental stabilization, trees are useful for industrial, cultural, pharmaceutical and socio-economic purposes to man, contributing billions of dollars yearly to the world's economy. Estimates have shown that about 90 percent of cooking and heating energy comes from trees. Traditional societies in Africa and elsewhere have always used plants to promote healing and traditional medicine and it is still the predominant means of health care in developing countries.

District Swat is situated in the extreme north of Pakistan.

- 35° No
- 72° East Longitudes (Map).

The region is mountainous and sprawls over 10,360 square kilometers at an average elevation that varies

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from 600 - 6069 m. The highest peak "Falakser", towering more than 6096 m, occupies the floristically rich southern extinction of Hindu raj of Hindu Kush series. The average maximum temperature in July is 38°C and the minimum (during January) is 1°C. The normal temperature is at a maximum of 21°C and a minimum of 7°C. Main sources of livelihood of the people are agriculture, tourism and government, as well as private jobs. The valleys in upper Swat comprise forests and pastures and these pastures are occupied by hundreds of households of nomadic herdsmen who come to these valleys in May and June each year. They use the pastures for grazing their livestock during summer and migrate to the down districts in October and November. Humid summer and chilly winters are the two plus points that help in the development of deciduous fruits husbandry in the area (Figure 1).

In the mountainous areas of Pakistan in general and district Swat in particular, large number of valuable multipurpose fruit tree plants (MPFTP) naturally grow mostly in fragile ecosystems that are predominantly inhabited by poor rural and indigenous communities. The sustainable management of these traditionally used MPFTP not only help conserve nationally and globally important biodiversity, but also provide critical resources to sustain livelihoods. Himalayan mountain region, for example, has in abundance, a diverse range of these species that have significant medicinal value and other importance whose local uses are known to indigenous community for centuries, but are currently threatened due to lack of concerted conservation efforts.

In all parts of the study area, MPFTP play a significant role in the subsistence economy of the people, especially those living in the rugged and impoverished hills, mountains and rural interiors. The collection, simple processing and trading of MPFTP contribute significantly to the cash income of the poor and women in the study area. Therefore, by sustainably using and growing economically remunerative MPFTP, there is an ample scope to maintain both the rural livelihoods and environmental sustainability. MPFTP -based local micro-enterprises can also bridge the gap between rural poor and relatively well-off urban rich and promote social harmonization and sound environment conservation. Therefore, conceptually, and indeed practically, the agriculture system of multipurpose fruit tree plants (MPFTP) has a close relationship with social forestry. Pasaribu (2007) and Imang et al. (2008), for instance, define social forestry as any condition and effort which intimately involve local people in forestry activities to ensure economic, ecological and social benefits and simultaneously sustain the resources.

In the wake of current awful environmental degradation, it has been appreciated that state resources alone, through centralized approaches of resource conservation, cannot arrest erosion of resources, unless private sector and local communities are effectively involved. This is so, since social forestry of MPFTP is an indigenous practice

and has the potential to sustain it. In the past, these species were neglected and limited information is available about its importance in social forestry. However, neglected and underutilized species play significant roles in uplifting the socio economic status of rural populations. In spite of their great potential, little attention has been given to these species. This increases the possibility of genetic erosion which would further restrict the survival strategies of people living in mountainous areas. MPFTP are the plant species that has edible fruits and a number of other useful applications that include the use of leaves as fodder, branches for fencing, wood as fuel, timber and furniture making and also used for the treatment of different human and livestock ailments in traditional system of medicine.

Moreover, most of the MPFTP are adapted to dry and arid climates which make it suitable for cultivation in an environment characterized by increasing degradation of land and water resources. Secondly, MPFTP are one of the essential items of food both for the rich and poor. Their role in human diet need no emphasis as they are the rich and cheap source of vitamins and minerals and are regarded as protecting food in order to combat malnutrition.

In District Swat, consumption of fruits is still less due to low production resulting in high costs. Per capita consumption is still 80 gm compared to per capita consumption of 310 gm in the developed world (Annon, 2006). Therefore, keeping the acute poverty and awful environmental degradation in view, the present study was conducted with the aim to explore ways and means to expand livelihood opportunities for the inhabitants of the area through documentation and research on MPFTP. Lack of research on MPFTP hinders its successful improvement and promotion. Therefore, studies are needed for full exploitation of these species. This paper aims at summarizing information on different aspects of MPFTP to stimulate interest in these crops as a social forestry component. Secondly, it aims to document the uses of indigenous and cultivated species of fruit trees growing in both plain and hilly areas of the study.

MATERIALS AND METHODS

A combination of quantitative and qualitative research methods was undertaken in various parts of the study. Qualitative data were particularly useful in understanding people's perspectives, meanings, attitudes, beliefs, goals and processes for interpreting quantitative data. The concepts of validity and reliability were applied for the integration of qualitative and quantitative techniques. The fieldwork was conducted during summer 2008 for a period of seven months and was completed in the following two stages.

Prior to the research sites' visit, questionnaire was designed and pre-tested to find out if it actually worked. The questionnaire was tried out on a small group of 5 people in a randomly selected village outside the sampling frame of both research sites. In the following week of the pre-testing, an amendment was incorporated in the questionnaire. Participatory techniques were used to collect information and the main techniques and tools used for data collections were household surveys, key informant interviews, focus



Figure 1. Study area.

Table 1. Distribution of sampled households into wealth quartiles by villages.

Village name	Wealth quartiles								Total No. of respondents
	Lowest 25%		25-50%		50-75%		Top 25 %		
	No. of HH	Land size (Ha.)	No. of HH	Land size (Ha.)	No. of HH	Land size (Ha.)	No. of HH	Land size (Ha.)	
Khwazakhela	13	< 0.86	13	0.86-1.72	11	1.72-2.72	12	> 2.72	49
Matta	12	< 1.00	15	1.00-2.00	11	2.00-3.00	5	> 3.00	43
Mingora	16	< 0.50	21	0.50-1.00	9	1.00-2.00	13	> 2.00	59
Total	41		49		31		30		151

group discussions (FGDs) and specialized surveys. The study followed the Denzin and Lincoln's (1988), cited in Sher et al. (2005), recommendation of multiple method selection (triangulation) in an attempt to secure in-depth and reliable information. Moreover, during the field research, other tools were also used to supplement the main instruments used to collect data. Questionnaire was administered to solicit information on socio-economic conditions and fruit trees utilization with respect to their conservation and development aspects. A total of 153 households were interviewed during the household survey. FGDs were conducted on specific issues with elderly knowledgeable people to understand the mechanism of natural resource distribution and benefit sharing with minority groups and also with the schools teachers, who represented the young generation of the village, to know about their aspirations.

Data analysis

The data were coded and analyzed by using SPSS, that is, statistical program for social sciences. The coding involved structuring the responses from the questionnaire and assigning them nominal values for analytical purposes. Considering the nature of the study, mainly descriptive statistics were used.

Creating wealth quartiles

The respondents in each village were grouped into wealth quartiles (Table 1) based on the cultivated land holding size. Wealth quartiles are created separately for each village due to variation in cultivated land across the villages.

RESULT

The present study was conducted during summer 2008 in several villages of District Swat. The study reported 30 important and common MPFTP occurring in the investigated area (Table 2).

These species were found to be used for different purposes by local people, that is, wild fruits (30 species), fuel wood (21 species), fodder (16 species), agricultural tools (12 species), medicinal purposes (15 species), timber (7 species), furniture making (6 species), shade (6 species), thatching (8 species), condiments and spices (3 species), fencing or poles (7 species) and ornamental purposes (2 species).

Species description

- 1) Botanical name: *Berberis lycium* L; Family: Berberidaceae; Common name: Berberis; Local name: Kwaray; Parts used: Roots bark, fruits and wood; Medicinal value: used for treatment of hepatitis. The roots are boiled and the solution is then used for stomachache and as a cooling agent. The dried and crushed roots are mixed with flour and fried in cow's ghee, while the mixture is then used for treatment of fractured bones and wound healing. The bark is also used for wound healing.
- 2) Botanical name: *Citrus aurantium* L.; Family: Rutaceae; Common name: Sour orange; Local name: Naranj; Parts used: Fruits and wood; Medicinal value: Carminative
- 3) Botanical name: *Cydonia oblonga* Mill; Family: Rosaceae; Common name: Quince; Local name: Batang; Parts used: Fruits, seeds and wood; Medicinal value: Seeds are boiled and ingested. Also, they are thought to combat pneumonia.
- 4) Botanical name: *Diospyros lotus* L; Family: Ebenaceae; Common name: Black persimmon or Date plum; Local name: Tor Amlook; Parts used: Wood, leaves and fruits; Medicinal value: Fruits are laxative and purgative. It is sedative and febrifuge
- 5) Botanical name: *Ficus carica* Forsk; Family: Moraceae; Common name: Fig; Local name: Inzar; Parts used: Fruit, stem, leaf, latex and wood; Medicinal value: Fruits are laxative, demulcent and are used in constipation, piles and urinary bladder problems. The latex is locally used in skin diseases and to remove spines and thorns which have wounded the body.
- 6) Botanical name: *Ficus palmata* Forsk; Family: Moraceae; Common name: Wild fig; Local name: Inzar; Parts used: Fruit and stem; Medicinal value: Fruits are demulcent and laxatives. They are used in constipation, lung and bladder diseases.
- 7) Botanical name: *Juglans regia* L; Family: Juglandaceae; Common name: Walnut; Local name: Ghwaz; Parts used: Leaves, wood, bark and wood; Medicinal value: Leaves are astringent, tonic and anthelmintic. They are useful in herpes, eczema, scrofula and syphilis and intestinal worms. The ripened fruits are used as brain tonic. Dried fruits mixed with

Table 2. MPFTP and their major uses.

Family	Botanical name	Local name	Habitat	Uses
Rosaceae	<i>Cydonia oblonga</i>	Batang	Hillside area	FW; Fod; Fr
	<i>Malus baccata</i>	Beeha	Hillside area	FW; Fod; Fr
	<i>Malus pumila</i>	Manra	Margins of fields	FW; AT; Fod; Fr
	<i>Prunus amygdalus</i>	Badaam	Margins of fields	Fr
	<i>Prunus armeniaca</i>	Khubanai	Hillside area	FW; Fr
	<i>Prunus avium</i>	Cherra	Hillside area	FW; Fr;TR
	<i>Prunus cerasifera</i>	Alubukhara	Hillside area	FW; Fod; Fr
	<i>Prunus corneta</i>	Mamosai	Hillside area	FW; Fod; Fr
	<i>Prunus domestica</i>	Aalucha	Hillside area	FW; Fod; Fr
	<i>Prunus persica</i>	Shaftalu	Hillside area	FW; Fr;AT
	<i>Pyrus Paschia</i>	Tangai	Hillside area	Fenc; AT; Fr
Rutaceae	<i>Citrus aurantium</i>	Naranj	Official places	FW; AT; SC; O
	<i>Zanthoxylum armatum</i>	Dambara	Hillside area	Fenc; WS; SC
Anacardiaceae	<i>Pistacia chinensis</i>	Shnai	Hillside area	TW; Fur; AT; Fr
Berberidaceae	<i>Berberis lyceum</i>	Kwaray	Hillside area	FW;TD; Fenc; Fr
Ebenaceae	<i>Diospyros lotus</i>	Tor amlook	Hilly area and on margins of fields	FW; Fod; Fur; Fr
Juglandaceae	<i>Juglans regia</i>	Ghwaz	Hillside area	TW; Fur; ST; TD; SS; Oi; Ti; Fr
Moraceae	<i>Ficus carica</i>	Inzar	Margins of field and courtyard	FW; SS; Fr
	<i>Ficus palmata</i>	Inzar	Margins of fields	FW; SS, Fr
	<i>Morus alba</i>	Speen toot	Margins of fields and Hillside area	TW; Bask; AT; Fur; ST; SS; Fod; TR; Fr
	<i>Morus nigra</i>	Tor toot	Margins of fields	TW; Bask; AT; Fur; ST; SS; Fod; TR; Fr
	<i>Morus laevigata</i>	Shahtoot	Margins of fields	TW; Bask; AT; Fur; ST; SS; Fod; TR; Fr
Oleaceae	<i>Olea ferruginea</i>	Khona	Graves and shrines	TW; ST; FW; SS; AT; Oi; Fr
	<i>Olea europaea</i>	Khona	Graves and shrines	TW; ST; FW; SS; AT; Oi; Fr
Punicaceae	<i>Punica granatum</i>	Zangali anaar	Hillside area	FW; O; TR; SC; Fr
Rhamnaceae	<i>Zizyphus mauritiana</i>	Baira	Margins of fields and Hillside area	FW; Fenc; Fr
	<i>Zizyphus nummularia</i>	Karkanda	Margins of fields and Hillside area	FW; Fenc; Fod;Fr
	<i>Zizyphus sativa</i>	Makhranrai	Margins of fields and Hillside area	FW; Fenc; Fod;Fr
	<i>Zizyphus oxyphila</i>	Badrai	Margins of fields and Hillside area	FW; Fenc; Fr
Vitaceae	<i>Vitis Jacquemontii</i>	Geedar kwar	Hillside area	Fod; FW; Fr

Fr; fruit, Fur; furniture, O; ornamental, Fod: Fodder, Fenc; fencing, SS; soil stabilization, ST; shade tree, TC; timber, TR; thatching roofs, Oi; oil, TD; tannins and dyes, SC; spices and condiments, Ti; textile industry, FW; fuel wood, AT; agricultural tools, TW; timber wood.

coconut and honey is used as general body tonic and in relief of heart problems.

8) Botanical name: *Malus baccata* (L). Borkh; Family: Rosaceae; Common name: Siberian crab; Local name: Beeha; Parts used: Fruits and branches; Medicinal value:

Anodyne and paste is used for forehead to relieve headache.

9) Botanical name: *Malus pumila* L; Family: Rosaceae; Common name: Apple; Local name: Manra; Parts used: Fruits, leaves and wood; Medicinal value: Apple may

reduce the risk of colon and lung cancer. They may also help in heart disease, weight loss and controlling cholesterol. Fruits are purgative and expectorant.

10) Botanical name: *Morus alba* L; Family: Moraceae; Common name: White mulberry; Local name: Speen/ baidana toot; Parts used: Leaves, wood, branches and fruits; Medicinal value: Leaves are emollient, used for cleaning throat, cooling agent, anthelmenthic and astringent. They are also laxative and purgative.

11) Botanical name: *Morus laevigata* Wall. ex Brandis; Family: Moraceae; Common name: Mulberry; Local name: Shahtoot; Parts used: Fruits, stem, branches and wood; Medicinal value: Fruits are laxative and purgative. Leaves are used as cooling agents

12) Botanical name: *Morus nigra* L; Family: Moraceae; Common name: Black mulberry; Local name: Tor Toot; Parts used: Fruits, leaves, wood and branches; Medicinal value: laxative and purgative. Leaves are emollient and astringent. Fruits are used as general body tonic. It is also used as a remedy for cough and cold.

13) Botanical name: *Olea europaea* L; Family: Oleaceae; Common name: European Olive; Local name: Khona; Parts used: Fruits and wood; Medicinal value: Fruits are anti-diabetic, while miswaks are made from thin branches which are good in toothache. Leaves are astringent, antiseptic, diuretic, antiperiodic and are used in sore throat, toothache and other gum diseases. Oil obtained from seeds is used for massages.

14) Botanical name: *Olea ferruginea* Royle; Family: Oleaceae; Common name: Indian olive; Local name: Khona; Parts used: Fruits, leaves, branches and wood; Medicinal value: Fruits are antidiabetic. Branches are used in toothache. Leaves are astringent, antiseptic, diuretic, antiperiodic and used in sore throat, toothache and other gum diseases. Oil is obtained from seeds which are used for massages

15) Botanical name: *Pistacia chinensis integerrima* (J.L. Srewart) Rech .f; Family: Anacardiaceae; Common name: Pistachio; Local name: Shnai; Parts used: Woods, leaves and fruits; Medicinal value: the leaves and galls are used for treating jaundice.

16) Botanical name: *Prunus amygdalus* L; Family: Rosaceae; Common name: Wild Almond; Local name: Baadam; Parts used: Nuts, kernel oil and wood; Medicinal value: Almond nuts possess demulcent and nutritive properties. Nuts are considered as brain nourishing. Oil is obtained from kernel which is tasteless and has medicinal value.

17) Botanical name: *Prunus armeniaca* L; Family: Rosaceae; Common name: Apricot; Local name: Khubanai; Parts used: Fruits, wood and leaves; Medicinal value: Fruits are antidiarrhoeal, antipyretic, emetic, allaying thirst and not good for old people. Fruits are also laxatives and purgatives and are refrigerant in fever. The seeds are tonic and anthelmenthic and are used in liver troubles, piles, earache and deafness.

18) Botanical name: *Prunus avium* L; Family: Rosaceae;

Common name: Wild cherry/ sweet cherry; Local name: Cherry; Parts used: Fruits, leaves and stem; Medicinal value: Astringent.

19) Botanical name: *Prunus cerasifera* Ehrh; Family: Rosaceae; Common name: Plum; Local name: Alu bukhara; Parts used: Fruits and stem; Medicinal value: Fruits are laxatives.

20) Botanical name: *Prunus cornuta* (Wall. ex Royle.) Steud; Family: Rosaceae; Common name: Himalayan bird cherry; Local name: Mamosai; Parts used: Fruits and stem; Medicinal value: Fruit are astringent.

21) Botanical name: *Prunus domestica* L; Family: Rosaceae; Common name: Plum; Local name: Aloochoa; Parts used: Fruits leaves and wood; Medicinal value: Fruits are laxatives.

22) Botanical name: *Prunus persica* (L) Batsch; Family: Rosaceae; Common name: Peach; Local name: Shaftaloo; Parts used: Leaves, wood and fruits; Medicinal value: Leaves are demulcent, sedative, diuretic and expectorant.

23) Botanical name: *Punica granatum* L; Family: Punicaceae; Common name: Wild pomegranate; Local name: Ananghore/ zangali anaar; Parts used: Fruits, barks, leaves, wood and seeds; Medicinal value: Leaves are used in skin diseases and dysentery. Fruits are astringent, cooling agents and blood purifier. Fruit bark is used in whooping cough and is laxative. Also, it is good for diarrhea, dysentery and stomachache. Bark of the roots and stem is anthelmenthic, mouth washer, anti-pyretic and expectorant. Ripe fruits are used as tonic and are useful in sore throat, sore eyes, brain diseases and chest trouble.

24) Botanical name: *Pyrus paschia* Butch Ham ex D. Don; Family: Rosaceae; Common name: Wild pear; Local name: Tangai; Parts used: Fruits, stems and leaves; Medicinal value: Fruits are astringent.

25) Botanical name: *Vitis jaequemontii* Parker; Family: Vitaceae; Common name: Grape; Local name: Geedar kwar; Parts used: Fruits, leaves and stem; Medicinal value: Laxative and purgative.

26) Botanical name: *Zanthoxylum armatum* DC; Family: Rutaceae; Local name: Dambara; Parts used: Bark, fruits, stem and seeds; Medicinal value: Carminative and stimulant. Fruits are useful in both stomach and toothache. Young shoots are useful in gum diseases and as a result, it induces the flow of saliva and produces a sense of warmth in the stomach, thus enhancing the production of intestinal juices. It is diuretic and its bark is used as stimulant and tonic.

27) Botanical name: *Zizyphus mauritiana* Lam; Family: Rhamnaceae; Common name: Jujube; Local name: Baira; Parts used: Leaves, fruits, stem and wood; Medicinal value: Fruits are emollient and expectorant. They are used as cooling agents and tonic. It is good in nausea and vomiting. They are applied externally in poultice and to wounds (Anon 1976). Leaves are laxatives and are prescribed in poultice and throat troubles. Root bark

macerated in milk is given along with honey in diarrhea and dysentery. It is also recommended in stomach problems and whooping coughs.

28) Botanical name: *Zizyphus nummularia* (Burm. f) W and A; Family: Rhamnaceae; Common name: English Jujube; Local name: Karkanda; Parts used: Roots, fruits, branches and leaves; Medicinal value: Fruits are laxatives and astringent, while leaves are used in scabies and boils.

29) Botanical name: *Zizyphus sativa* Gareth; Family: Rhamnaceae; Common name: Chinese Jujube; Local name: Makharnarai; Parts used: Fruits, branches and leaves; Medicinal value: Fruits are astringent and laxative. They are used as cooling agent and tonic.

30) Botanical name: *Zizyphus oxyphyla* Edgew; Family: Rhamnaceae; Local name: Badre; Parts used: Wood and fruits; Medicinal value: Astringent and laxative.

Economic utilization

Multipurpose trees are defined as all woody perennial that are purposefully grown to provide more than one significant contribution to the production and or service functions of a land use system (Chang et al., 2000). Hence, when a food component is added to these, they become MPFTP, which beside other functions serve as an important source of diet fulfilling the needs of proteins, carbohydrates, vitamins, minerals, etc. required by human body.

In the view of importance of MPFTP, FAO (1995) recognized the role of such trees and reported three major links between forestry and food security such as Environment, production and socio-economic linkages which are interrelated. Although the production and sustainability of food is the job of an agriculturist, yet, forest or farm tree do provide a critical support to agricultural production.

Therefore, all the natural resource managers, such as botanist and forester, can play an important role in raising the living standard of rural people, just as forest (one element) can within the complete fabric of rural life. In spite of the importance of MPFTP as outlined below (Table 3), none of the agencies have paid the due importance to MPFTP. This study was therefore, conducted with the aim to suggest ways and means to conserve and manage the source of important food species in the area.

Economic utilization of MPFTP in the study area other than food

Timber

The present study showed (Table 3) that 7 species of MPFTP are used for timber purpose in construction such as *Juglans regia*, *Morus alba*, *Morus laevigata*, *Morus nigra*, *Olea europaea*, *Olea ferruginea* and *Pistacia chinensis*, out of which *Morus* species and *Juglans regia*

are used at larger scale as timber wood.

Fuel wood

The result of the study showed (Table 3) that 21 out of 30 MPFTP are utilized by the local people as fuel wood such as *Berberis lycium*, *Citrus aurantium*, *Cydonia oblonga*, *Diospyros lotus*, *Ficus carica*, *Ficus palmata*, *Malus baccata*, *Malus pumila*, *Prunus amygdalus*, *Prunus armeniaca*, *Prunus avium*, *Prunus cerasifera*, *Prunus cornuta*, *Prunus domestica*, *Prunus persica*, *Punica granatum*, *Pyrus paschia*, *Vitis jaequemontii* and *Zizyphus* species, out of which the members of Rosaceae are used very frequently. Winter season is long and severe in the study area. Due to long and severe winters and unavailability of resources, the consumption of wood as fuel is very high in the study area.

Fodder

The result of the study showed that the local people utilize 16 species of MPFTP for fodder purposes such as *Diospyros lotus*, *Malus baccata*, *Malus pumila*, *Morus alba*, *Morus laevigata*, *Morus nigra*, *Prunus amygdalus*, *Prunus armeniaca*, *Prunus avium*, *Prunus cerasifera*, *Prunus cornuta*, *Prunus domestica*, *Prunus persica*, *Vitis jaequemontii*, *Zizyphus nummularia* and *Zizyphus sativa*.

Furniture making

In the study area, the inhabitants utilize 6 species of MPFTP, that is, *Diospyros lotus*, *Juglans regia*, *Morus alba*, *Morus nigra*, *Morus laevigata* and *Pistacia chinensis*, to fulfill this vital need. *Juglans regia* is widely used in making beds, chairs and tables, followed by *Morus* species which are used in making chairs, tables and charpais. Other species used for this purpose are *Pistacia chinensis* and *Diospyros lotus* at some places (Table 3).

Agricultural tools making

Inhabitants of the study area were found to use indigenous methods and tools for farming. They also utilized 12 species of MPFTP, that is, *Citrus aurantium*, *Malus pumila*, *Morus alba*, *Morus nigra*, *Morus laevigata*, *Olea europaea*, *Olea ferruginea*, *Prunus armeniaca*, *Prunus avium*, *Prunus persica*, *Pyrus paschia* and *Pistacia chinensis*, for making handles and other parts of sickles, harrows, hoes, axes, etc.

Shade

Local people were found to utilize a total of 6 species of

Table 3. Major uses of MPFTP.

Major uses	Suitable MPFTP
Timber (7 spp.)	<i>Juglans regia</i> , <i>Morus alba</i> , <i>Morus nigra</i> , <i>Morus laevigata</i> , <i>Olea europaea</i> , <i>Olea ferruginea</i> and <i>Pistacia chinensis</i> .
Fuel wood (21 spp.)	<i>Berberis lycium</i> , <i>Citrus aurantium</i> , <i>Cydonia oblonga</i> , <i>Diospyros lotus</i> , <i>Ficus carica</i> , <i>Ficus palmata</i> , <i>Malus pumila</i> , <i>Malus baccata</i> , <i>Prunus amygdalus</i> , <i>Prunus avium</i> , <i>Prunus armeniaca</i> , <i>Prunus cerasifera</i> , <i>Prunus cornuta</i> , <i>Prunus domestica</i> , <i>Prunus persica</i> , <i>Punica granatum</i> , <i>Pyrus paschia</i> , <i>Vitis jaequemontii</i> , <i>Zizyphus Mauritiana</i> , <i>Zizyphus nummularia</i> and <i>Zizyphus sativa</i> .
Fodder (16 spp.)	<i>Diospyros lotus</i> , <i>Malus pumila</i> , <i>Malus baccata</i> , <i>Morus alba</i> , <i>Morus laevigata</i> , <i>Morus nigra</i> , <i>Prunus amygdalus</i> , <i>Prunus avium</i> , <i>Prunus armeniaca</i> , <i>Prunus cerasifera</i> , <i>Prunus cornuta</i> , <i>Prunus domestica</i> , <i>Prunus persica</i> , <i>Vitis jaequemontii</i> . <i>Zizyphus nummularia</i> and <i>Zizyphus sativa</i> .
Furniture (6 spp.)	<i>Diospyros lotus</i> , <i>Juglans regia</i> , <i>Morus alba</i> , <i>Morus nigra</i> , <i>Morus laevigata</i> and <i>Pistacia chinensis</i> ,
Agricultural tools making (12 spp.)	<i>Citrus aurantium</i> , <i>Malus pumila</i> , <i>Morus alba</i> , <i>Morus nigra</i> , <i>Morus laevigata</i> , <i>Olea europaea</i> . <i>Olea ferruginea</i> , <i>Prunus armeniaca</i> <i>Prunus avium</i> , <i>Prunus persica</i> , <i>Pyrus paschia</i> and <i>Pistacia chinensis</i> .
Shade (6 spp.)	<i>Juglans regia</i> , <i>Morus alba</i> , <i>Morus laevigata</i> , <i>Morus nigra</i> , <i>Olea europaea</i> and <i>Olea ferruginea</i> ,
Tannis/Dyes (2 spp.)	<i>Berberis lyceum</i> and <i>Juglans regia</i> .
Fences / poles (5 spp.)	<i>Berberis lyceum</i> , <i>Pyrus paschia</i> , <i>Zanthoxylum armatum</i> , <i>Zizyphus sativa</i> , <i>Zizyphus mauritiana</i> , <i>Zizyphus nummulria</i> and <i>Zizyphus oxyphila</i> .
Native medicines (15 spp.)	<i>Berberis lycium</i> , <i>Diospyros lotus</i> , <i>Ficus carica</i> , <i>Ficus palmata</i> , <i>Juglans regia</i> , <i>Morus alba</i> , <i>Morus laevigata</i> , <i>Morus nigra</i> , <i>Olea europaea</i> , <i>Olea ferruginea</i> , <i>Prunus amygdalus</i> , <i>Zanthoxylum armatum</i> , <i>Zizyphus mauritiana</i> , <i>Zizyphus nummularia</i> and <i>Zizyphus sativa</i> .
Ornamental (2 spp.)	<i>Citrus aurantium</i> and <i>Punica granatum</i> .
Soil stabilization (8 spp.)	<i>Ficus carica</i> , <i>Ficus palmate</i> , <i>Juglans regia</i> , <i>Morus alba</i> , <i>Morus laevigata</i> , <i>Morus nigra</i> , <i>Olea europaea</i> and <i>Olea ferruginea</i> .
Thatching (8 spp.)	<i>Morus alba</i> , <i>Morus laevigata</i> , <i>Morus nigra</i> , <i>Prunus amygdalus</i> , <i>Prunus armeniaca</i> , <i>Prunus cerasifera</i> , <i>Prunus domestica</i> and <i>punica granatum</i> .
Condiments (3 spp.)	<i>Citrus aurantium</i> , <i>Punica granatum</i> and <i>Zanthoxylum armatum</i> .
Minor uses (7 spp.)	Baskets: <i>Morus</i> species Wood pots: <i>Morus</i> species Textile industry: <i>Juglans regia</i> wood is used in making some woody parts of power looms. Some parts are also made from <i>Diospyros</i> species. Walking sticks: <i>Zanthoxylum</i> wood and other straight branched species. Oils: from some oils are obtained which are used for various purposes like oil of <i>Olea europaea</i> and <i>Juglans regia</i> . Sports goods: species of <i>Morus</i> are used on small scale for making various sports goods like Cricket bats and hockey sticks.

MPFTP, such as *Juglans regia*, *Morus alba*, *Morus laevigata*, *Morus nigra*, *Olea europaea* and *Olea ferruginea*, for shade purposes during the months of summer. Inhabitants were found to sit, in afternoon time, in the cool shade of trees. Species of *Morus*, *Olea* and *Juglans regia* are used frequently for shade purposes.

Field fencing

The result of the present study showed (Table 3) that the local people use a total of 7 MPFTP for fencing and poles purposes, that is, *Berberis lycium*, *Pyrus paschia*, *Zizyphus sativa*, *Zizyphus mauritiana*, *Zizyphus nummularia*, *Zizyphus oxyphila* and *Zanthoxylum armatum*, out of which *Berberis* species are used commonly, followed by species of *Zizyphus* and *Zanthoxylum*.

Native medicines

Results of the present study showed (Table 3) that a total of 15 species are utilized as medicines for curing many ailments. These are *Berberis lycium*, *Diospyros lotus*, *Ficus carica*, *Ficus palmate*, *Juglans regia*, *Morus alba*, *Morus laevigata*, *Morus nigra*, *Olea europaea*, *Olea ferruginea*, *Prunus amygdalus*, *Zanthoxylum armatum*, *Zizyphus mauritiana*, *Zizyphus nummularia* and *Zizyphus sativa*. Among these, *Berberis* and *Punica granatum* are used frequently for curing many diseases.

Tannins and dyes

The present study showed that 2 species are used for tanning purposes, that is, *Berberis lyceum* and *Juglans regia*.

Condiments and spices

Result of the present study showed (Table 3) that a total of 3 species are used as spices and condiments for flavoring food. These include *Zanthoxylum*, which is used in many local remedies as flavoring agent, followed by *Punica grantum* "anaar dana" and *Citrus aurantium*.

Ornamental

Species like *Punica grantum* and *Citrus aurantium* are used by the inhabitants for ornamental purposes because of their flowery beauty and structure. These species are found in homes, schools, colleges, hospitals and other government and private institutions (Table 3).

Soil stabilization

Results of the present study showed that a total of 8

species, that is, *Ficus carica*, *Ficus palmate*, *Juglans regia*, *Morus alba*, *Morus laevigata*, *Morus nigra*, *Olea europaea* and *Olea ferruginea*, are used for soil stabilization purposes (Table 3).

Minor uses

Some of the MPFTP (Table 3) have minor uses including:

1. **Basketry:** Baskets are used for many purposes like sampling of fruits in the market and storing many other things at homes. Baskets are made from thin branches of *Morus* species.
2. **Textile industry:** *Juglans regia* wood is used in making some woody parts of power looms. Some of the parts are also made from *Diospyros* species.
3. **Walking sticks:** *Zanthoxylum* wood and some other straight branched species are used for making walking sticks.
4. **Sports goods:** Sports goods like cricket bats, hockey sticks, etc. are made from *Morus* species.
5. **Oils:** Oils are obtained from species of olive, almond and walnut, which are used for various purposes.

COMMERCIAL POTENTIAL OF FRUITS

There is a large horticultural export market and Pakistan, although being an agricultural country, is marginally present in this market. Various fruits have different market value. However, the rate at the local market of Swat (Tables 4 and 5) is significantly less than the outside market that prevails at the major cities of Pakistan. Commercial potential of some fruits is discussed below:

Malus pumila

The fruit has great commercial potential because of its high demand in the market. The fruit also has potential to be stored for long times, thus enhancing its potential manifold.

The table given below shows the area under cultivation, in which the production of apple is more than any other fruit grown in Swat. Quality of some varieties is good enough to support foreign export.

Prunus persica

This fruit also has great commercial potential. The storage period of this fruit is not more than a week and thus affects its market value, but on the other hand, large number of varieties having different ripening periods overcomes its storage deficiency, thereby, making it a valuable fruit. It is second to apple, in area under cultivation and production, in the study area.

Table 4. Major fruits of district swat and their production.

	Species	Area (ha.)	Annual production (tons)	Annual production (tons/ha)
1	Apple	4060	48445	11.9
2	Peach	3610	37560	10.4
3	Persimmon	1970	19700	10.0
4	Citrus fruits	608	4713	7.7
5	Apricot	584	6136	10.5
6	Plum	567	5670	10.3
7	Walnut	433	4461	10.3
8	Pear	412	7334	17.8
9	Almond	70	196	2.8
10	Grapes	60	300	5.0

Source: Agricultural statistic government of Pakistan.

Table 5. Production of MPTFS per year and Income per year.

	Name of species	Annual production (Kg)	Rate per Kg (PK Rs)	Annual income (PK Rs)	Category
1	<i>Diospyros lotus</i>	100-120	20	2000	B
2	<i>Ficus carica</i>	20-25	20	400	C
3	<i>Juglans regia</i>	80-100	40	3600	A
4	<i>Prunus amygdalus</i>	25-35	50	1500	B
5	<i>Prunus armeniaca</i>	60-80	30	1800	B
6	<i>Prunus domestica</i>	50-70	30	1600	B
7	<i>Prunus avium</i>	20-30	40	1200	B
8	<i>Prunus persica</i>	50-60	20	1000	B
9	<i>Pyrus malus</i>	80-100	30	2700	A
10	<i>Pyrus paschia</i>	40-50	15	600	C
11	<i>Punica granatum</i>	10-20	130	1300	B
12	<i>Vitis jaequemontii</i>	30-40	20	600	C
13	<i>Zizyphus mauritiana</i>	30-40	20	700	C
14	<i>Zizyphus sativa</i>	20-30	15	400	C
15	<i>Berberis lyceum</i>	5-6	25	150	C

Source: Personal communication- based on the market survey and interviews with growers and sellers. Category A: Rs 2000 or above; Category B: Rs 1000-2000; Category C: Rs200- 100.

Pyrus species

Pears family fruit are one of the most frequently occurring fruits in the study area. Their production per hectare is more than any fruit growing in the study area. Though, these fruits still have good market value, but much could be done by introducing improved varieties.

Citrus fruits

Citrus fruits have high market demand and its supply always remained less than its demand. Therefore, the price per fruit often jumps up to 5 – 8 rupees. The area under cultivation is the fourth most abundant. Most of the area, in the study area, is suitable for frequent cultivation

of this fruit. The storage potential is not so good, but still, it is transported to various parts of the country. These fruits are also used in jams and marmalade. This species has great commercial potential.

Prunus armeniaca

Apricot is a sweet and delicious fruit of District Swat. It is the fifth most abundant fruit of the study area, having high market value and commercial potential. The storage capability of the fruit is not so good, so, its harvesting is done in a somewhat unripened condition and transported to various parts of the country. The fruit, which has good market value, can also be dried and thus enhancing the potential of this fruit.

Prunus domestica

Plum is another valuable fruit having good commercial potential. The fruit cannot be stored for so long, but still has some storage capability, which gives it a moderate market value. It is the sixth most abundant fruit of the study area. This fruit is exported to various parts of the country and is liked by people.

Vitis species

The agro-climatic conditions of Swat are favorable for the growth of grapes and its demand in the market is good. In order to fully exploit this species, improved varieties must be introduced. This fruit is not grown so much on the commercial scale, thus a lot of work is needed to uplift the cultivation of this high valued fruit.

Prunus avium

Cherry is one of the high priced fruit of the country. The price of cherries often jumps up to Rs 150 per Kg. This high price highlights the demand of this fruit in the market. The agro-climatic conditions of Swat are highly favorable for the cultivation and growth of this fruit. This fruit has great commercial potential but has not yet been fully exploited.

Prunus amygdalus

Almond is a high valued dry fruit. This fruit has multiple uses, that is, used as dry fruit, used widely in cooking, used in baking and also used in many local remedies. For as long as the fruit can be stored for many years, the market value is improved. This fruit has high export potential.

Juglans regia

Walnut is a high valued dry fruit. It, like almond, has great economic value and demand due to its multiple uses. The fruit can be stored for years, thus, it is transported to almost all parts of the country and its wood furniture is famous throughout the country because of its black shining colour.

DISCUSSION

The present study showed that the people of the study area use MPFTP for various purposes in one way or the other in the lives of the rural community. These species serve more than one function, for example, in addition to

the main function as fruit plant, *Juglans regia* is widely used by the people in the manufacturing of furniture, medicine and tool handles (hoes, spears, axes, cutlasses and knives). Hussain (1995) also reported that most of the plants were found to be used for multi purposes such as medicinal, timber wood, leaves as fodder, fruits and seeds are edible, provide dry fruits, used in spices and agro-forestry is based on them. This finding also agree to Mcdicken and Mehl (1990) and Sher (2002) who highlighted the importance of multipurpose plants and also touched fruit and fodder aspects of these species. The present investigation also revealed that MPFTP can play a vital role in boosting of local community, but these trees have never been fully exploited to their potential. This statement is parallel with that of Latif and Shinwari (2003). According to them, forest resources, especially non-timber forest produces, are the only source of income and food for the people of Chitral and Kalash valleys. The principle temperate fruits are almond, apples, pears, peaches, plums, cherries and grapes. The fruits suited to warm the temperate zone are sweet cherries, Japanese plum, quince, apricot, peach and walnut. The result of the present study also showed that main fruits of the area are apples, peaches, plums, apricot, walnuts, pear grapes and mulberries. Most of the MPFTP can serve as genetic source base and can be converted into improved varieties. Khan (1994) also provided similar information, which he reported for citrus, fig, pomegranate, persimmon, loquat, apple, quince, sweet cherry, apricot, peach, walnut and almond. Pistachio nuts support the improvement of fruits genetic resources, conservation and utilization. According to Morico (1998), horticultural crops comprising fruits are the only part of genetic diversity.

The present study showed that some of the fruit trees are used for soil stabilization purpose. They play a vital role in controlling soil erosion. Sher et al. (2004a) support this view. According to Morico, the downfall of agriculture is its reliance upon repeated thinning of the soil to grow annual crops, resulting in massive amount of soil erosion and destruction. He also presented his solution, which is to develop an agriculture based on trees rather than annual crops and give examples of forest agriculture from around the world. Some of the species like *Punica granatum*, *Ficus carica*, *Juglans regia*, *Diospyros lotus*, *Berberis lycium*, *Zanthoxylum* species, *Zizyphus* species, etc. are used for medicinal purposes locally. Sher and Hussain (2003) also reported that these species are used for medicinal purposes in Udigram village of district Swat. MPFTP serve as food and could be used to ensure food security along with other food crops. This view is supported by Morico (1998). According to him, fruits, nuts, legumes, roots and tubers, vegetables, medicinal, aromatic and ornamental plants contribute greatly both to satisfying food and to integrate and diversify dietary needs of mankind. In fact, in some regions of the world, horticultural crops are important staple. The present study

showed that the research and technology have not worked on utilization and full exploitation of MPFTP resources up to its potential. Morico's (1998) work is in favor of this statement. They reported that research and technology have neglected minor and under utilized horticultural species of particular importance for subsistence farming system in developing countries and for preserving environmental and socio-economic fabric in marginal areas of developed countries.

Result of the present study showed that *Juglans regia*, *Prunus armeniaca*, *Prunus domestica* and *Pyrus malus* are economically more important. *Juglans regia*, *Morus* species and *Pistacia chinensis* are reported as important species because of their use as timber wood and in furniture industry. Latif and Shinwari (2003) support this view. They reported *Juglans* and *Morus* species as important, from timber and furniture making point of view, for Chitral and Kalash valleys. Hussain et al. (2004) also support these observations and pointed out that these species are used for timber and furniture purposes. There is a need for reform of forest policy in the country to focus on community management of revenues earned from possession of local forest resources which encourage a quantum shift in social and economic relations under community forest governance. The creation and expansion of markets, for fair-trade timber and premiums, for sustainably produced forest products under community forestry programs would significantly improve returns for local communities and greatly contribute to local livelihoods and poverty reduction among the rural poor (De Zoyza and Inoue, 2008). Forest certification and third party wood chain monitoring are valuable tools for promoting forest governance and improving corporate social responsibility in multi-stakeholder arrangements for forest management.

The present study also showed that the renewable resources are not scientifically managed and therefore, forests including MPFTP are disappearing in many parts of the investigated area. The finding of Sher et al. (2004b) and (2005) also supported the study's result as they reported that due to increase in human and livestock population, the human and grazing pressure have also increased tremendously on the forest products. As a result, the indigenous plants species are becoming rare and sparse in many parts of Pakistan. Secondly, the number endangered species is increasing day by day due to environmental degradation and indiscriminate uses of forest resources. The study generally observed that most of the MPFTP are the important sources of nutrition and income generation for the inhabitants of the study area. In addition, some of these species have other important uses such as fodder, fuel, timber wood, medicine, etc. McDicken and Mehl (1990) and Sher et al. (2005) also highlight the fruit, fodder and medicinal aspects of MPTFS. Gunasena (1994) reported that in Sri Lanka, fruit trees were supplementing the staple rice diet by using jak bread fruit (*Atrocarpus utilis*). The result of the present study revealed that enough space exists for the

establishment of clonal seed orchards in the area. This will bring genetically, important, as well as economically and ecologically, valuable MPFTP under social forestry system in the area.

Conclusion

Many people in the study area still depend on plants growing around them for most of their needs. The study concluded that the younger generations in this region are more interested in western lifestyles, but some indigenous knowledge of plants still remains. The documented 30 species of fruit plants identified in the study area were used for the treatment of common human ailments. All of the species are utilized for multiple purposes by the local people to improve their livelihoods. The population has to be educated on propagation and conservation of the plants, especially those used to treat the most common ailments, and also have significant contribution to the livelihood of the local masses.

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