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RESEARCH ARTICLE

SOCIO ECONOMIC IMPORTANCE OF CHILGOZA PINE FOREST OF AFGHANISTAN: A SURVEY BASED ASSESSMENT

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ABSTRACT

In Afghanistan, chilgoza pine is distributed in eastern and southeastern provinces. Chilgoza pine is the only edible pine species of the country. Pine nuts are an important non-timber forest product (NTFP). Chilgoza pine forests play significant role in the livelihood of communities. Local villagers harvest and roast the nuts for their own use or sell them to local markets. Chilgoza pine nuts are traded worldwide and used raw, roasted or mixed with other ingredients. This study was intended to investigate the importance of chilgoza pine forests for local communities living across the species range. The study results revealed that compared to other non-timber forests products, pine nuts is the most important NTFP in eastern and southeastern provinces of the country. In Afghanistan most of the chilgoza forests are owned and managed by village or tribal shura (community council), while a small percentage of chilgoza forests are owned by individual families. After collection large portion of pine nuts are sold to local traders. The average price of chilgoza per kilogram sold by villagers in 2015-2016 was about 582 AFN (\$8.5). The early income from chilgoza pine nuts is varied from year to year. On average, families receive 85500 AFN (\$1251) per year from sale of pine nuts

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INTRODUCTION

Chilgoza pine is an important forest tree species distributed in eastern and southeastern forests of Afghanistan. Besides various environmental services, this species plays an important role in the livelihood of communities living close to the forest (Mail, 2012). Pine nuts harvested from this tree are one of the major NTFP of Afghanistan and are traded internationally. Unshelled pine nuts are highly valued in international markets; however local villagers receive less than \$10 per kilogram (Kuhn *et al.*, 2006). Chilgoza pine plays an important role in socio-economic development of rural communities living nearby chilgoza pine forests (Mail, 2012). In the genus *Pinus* L., 18 species of pine nuts are edible (Harrison, 1951). Among them, *P. gerardiana* (chilgoza pine), *P. koraiensis* (Korean pine) and *P. pinea* (pinyon pine) are important pine nuts produced and traded in large quantities (Kuhn *et al.*, 2006). Chilgoza pine is the only edible pine species in Afghanistan, India, and Pakistan (Gupta, 1945; Kumar and Hamal, 2009). Chilgoza pine nuts are an important NTFP of Afghanistan's forests. Local villagers harvest and roast the nuts for their own use or sell them to local markets (Alam, 2011). Nuts are usually harvested and processed (dried and extracted) by local people (CAB International, 2002).

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Chilgoza pine nuts are traded worldwide and used raw, roasted or mixed with other ingredients (Sharma *et al.*, 2013). The nuts of chilgoza pine are a good source of unsaturated fatty acids with zero cholesterol (Distailats *et al.*, 2010; Thakur *et al.*, 2009; Venkatachalam and Sathe, 2006). Chilgoza pine nuts are rich in carbohydrates, proteins and minerals as well (Malik *et al.*, 2012; Troup, 1921). Each 100 grams of pine nuts contain 31 grams of protein (Kuhn *et al.*, 2006). Also, fresh seeds contain 4.1% sugar, 52.1% oils and 24.4% moisture (Malik *et al.*, 2009). The tree bark, wood, leaves and cones are resinous and produce oleoresins (Malik *et al.*, 2013; MAIL, 2012; WCS, 2008). Oleoresins can be obtained by tapping tree bark, however it is not produced in large quantities (WCS, 2008). These chemicals contain turpene oil and other substrates that are used for different purposes such as; cosmetics, waxes, traditional medicine, cooking oil, varnishes and pitch (MAIL, 2012; WCS, 2008). The wood of chilgoza pine is very resinous, sturdy, soft, even-textured and easy to saw (Anonymous). The sapwood is white to yellowish white, heartwood is reddish brown to dark brown, and the average wood density is 580 kg/m³ (Anonymous). The wood is of low timber importance and is not used widely (CAB International, 2002; Khan and Khan, 1992; MAIL, 2012). It is used for planking, house construction, doors and windows, rafters, ceiling and other joinery work (Anonymous). Wood of chilgoza pine is used as fuel wood by local people (CAB International, 2002; MAIL, 2012). Chilgoza pine plays an

important role in socio-economic development of rural communities living nearby chilgoza forests (Malik *et al.*, 2013; Kumar *et al.*, 2013; WWF-P, 2014). In India, it is valued as an important tree species due to its significant contribution to the economy of local people (Thakur *et al.*, 2014). Chilgoza pine forests not only provide pine nuts as an economic commodity, but also provide fuel wood, medicinal plants, pasture and shelter for livestock as well as wildlife habitat and other environmental services. Nuts of chilgoza pine are highly prized, collected and sold by local villagers (Eckenwalder, 2009). Empty cones are used as fuel wood (Anonymous). Also wood is used as fuel wood in areas where no other tree species are found near villages (Anonymous). Sometimes its wood is used in construction at the domestic level as well (WCS, 2008). Chilgoza pine forests of Afghanistan have not been studied and there is very little information on socio economic importance of this species. This paper is part of a complementary survey designed to study various aspects of chilgoza pine forests of Afghanistan. The aim of this study was to investigate the socio-economic importance of chilgoza pine forests for local communities across Eastern Forest Complex (EFC).

METHODS

This study was based on interviews and questionnaires. A questionnaire was prepared for local villagers and community members living across the chilgoza range. Target population was individuals living in the EFC close to chilgoza pine forest stands. Totally, 56 subjects were surveyed in Kapisa, Laghman, Kunar, Nuristan, Nangarhar, Paktia, Khost, and Paktika provinces. Number of interviewed per province was distributed based on the area of chilgoza forest and security conditions. A preliminary goal was set to interview at least one subject in each district of these provinces. The number of subjects varied from 1 subject/province to 23 subjects/province. The survey was performed in 29 districts of the above 8 provinces. Since many of the subjects were illiterate and were not familiar with reading and writing, the majority of questionnaires were completed via in-person meeting or phone calls. Major questions asked from local villagers were; value of NTFP, yearly income from pine nuts, ownership, conflicts between communities, markets, and per unit value of unshelled pine nuts across the range of the species.

RESULTS AND DISCUSSION

Importance of Chilgoza Pine to Local Communities

Chilgoza pine forests are very important to communities living in the EFC of Afghanistan. Among the NTFPs such as oak leaves, spices, walnut, medicinal plants and acorns, pine nut is the most important and valuable NTFP listed by the participants of the surveys (Figure 1). The livelihood of these communities is somewhat connected to chilgoza pine forests. As members of a community or village, they receive direct or indirect benefit from chilgoza forests. Based on this survey, not all villagers are involved in all processes such as cone collection, processing, nut extraction, marketing etc. Most of the villagers are farmers or work other jobs while a smaller number of people are busy with pine nut collection, extraction and trade. However, at the time of harvesting a certain number

of community members take part in activities and all of the community members (all families) receive revenue from the sale of pine nuts.

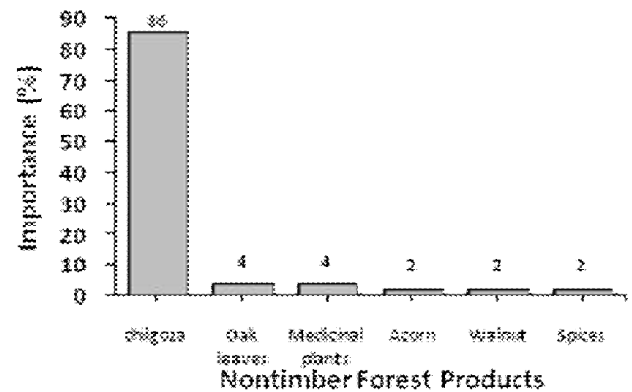
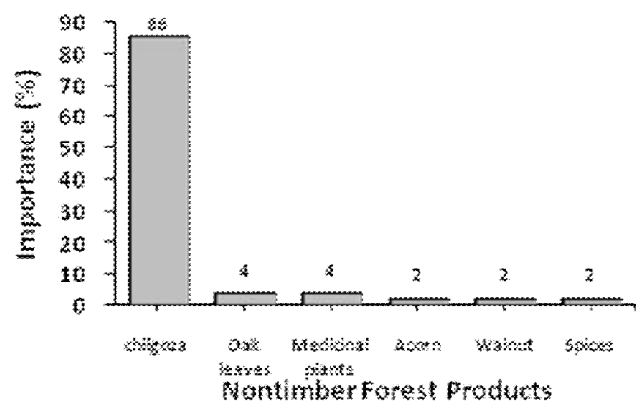


Figure 1. Importance of pine nuts compared to other non-timber forest products

Distribution and Use of Chilgoza Forests by Communities

Based on Afghanistan's Forest Law, natural forests are government property and communities are allowed to sustainably manage and use this resource under a community based natural resource management approach (MAIL 2012). However, we found that local villagers believe natural forests as their property and have divided forests among tribes, communities or villages. According to the surveys conducted, most chilgoza forests are owned and managed by village or tribal shuras (community council) while a small percentage of chilgoza forests are owned by individual families (Figure 2).



Sale of Pine Nuts and Revenue Distribution

Figure 2. Ownership of chilgoza pine forests of Afghanistan

After the extraction, pine nuts are sold to local traders or contractors. Most of the villagers and pine nut harvesters sell their pine nuts to local traders and only a small percentage sell their commodity to contractors (Figure 3a). Due to lack of local markets and the long distances to major markets, villagers sell pine nuts to local traders. Pine nuts are generally sold to different buyers every year. The revenue generated from pine nuts is distributed among village or community members. Most of the communities or villages divide the revenue equally between all villagers, however in some communities the money earned from pine nuts is distributed based on the amount of work done (Figure 3b).

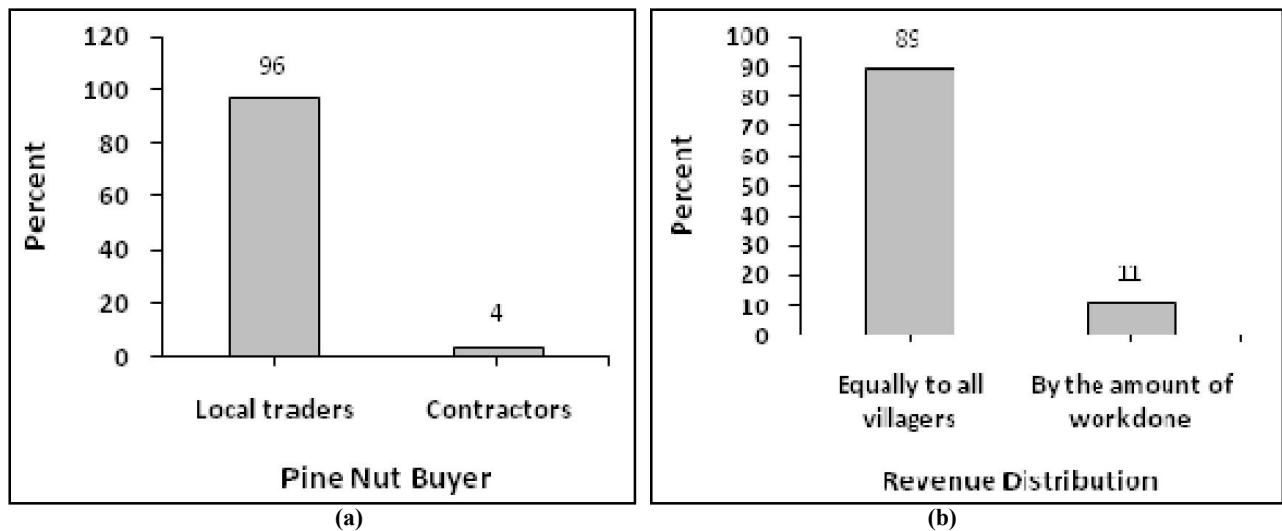


Figure 3. a) Percentage of pine nut buyers in local villages; and, b) distribution of revenue generated from chilgoza pine nuts among community members

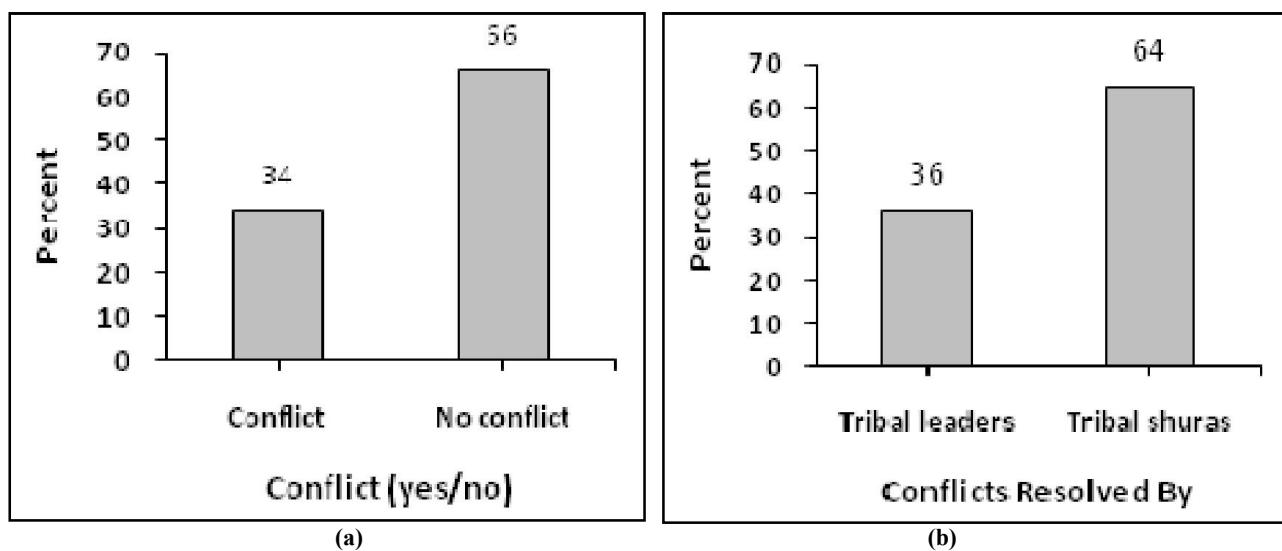


Figure 4. a) Conflict level; and, b) conflict resolution during chilgoza pine forest distribution among local communities

Table 2. Mean, standard error (S.E.), minimum and maximum price (AFN) of one kilogram unshelled pine nuts sold by local villagers to local traders

Province	Mean (AFN)	S.E.	Min	Max	N
Kapisa	595	12	583	606	2
Khost	575	41	490	686	5
Kunar	536	0	536	536	1
Laghman	513	13	490	536	3
Nangarhar	636	26	560	746	8
Nursitan	571	30	541	630	3
Paktia	530	17	441	816	22
Paktika	702	31	555	816	8
Total	582	14	441	816	52

Table 3. Mean, standard error (S.E), minimum and maximum income (AFN) gained per family from selling chilgoza pine nuts per year

Province	Mean (AFN)	S.E.	Min	Max	N
Kapisa	24651	5061	19590	29712	2
Khost	70198	5715	32650	117540	4
Kunar	124070	0	124070	124070	1
Laghman	82713	8707	65300	91420	3
Nangarhar	90196	4777	75095	111010	8
Nursitan	95773	20678	75095	137130	3
Paktia	91114	6498	50608	143660	16
Paktika	72157	9298	48975	104480	5
Total	85500	4383	19590	143660	42

Most of the villagers surveyed reported that their access to chilgoza forests and the pine nut revenue distribution ends without any conflict. However, sometimes there are conflicts among community members on pine nut revenue distribution (Figure 4a). In the case of conflict, tribal shuras or tribal leaders are responsible to resolve the conflict. In most of the chilgoza pine region, conflicts are resolved by tribal shuras and to a lesser degree tribal leaders resolve the issues (Figure 4b). Pine nuts are usually sold to local traders.

Price per kilogram of unshelled pine nuts varies among provinces ranging from a low of 513 AFN reported in Laghman to a high of 702 AFN in Paktika Provinces (Table 1). Total mean price paid per kilogram of unshelled pine nuts across the region was 582 AFN in 2015 – 2016 (Table 1). The quality (size, taste, level of damage incurred during processing) of pine nuts differs among provinces and high quality pine nuts are sold for better prices than low quality

ones. The average price per kilogram of pine nuts in 2006 was reported as \$2.87 USD by Kuhn et al. (2006) compared with the higher average price in 2015 – 2016 (\$8.51 USD) revealed by this study. This should not be construed as evidence of trending since price per kilogram of unshelled pine nuts is known to vary from year to year and is also dependent on supply and demand factors that are affected by yearly production levels and by time of year of sale. On average, families receive 85500 AFN (\$1251) per year from sale of pine nuts (Table 2). The yearly income from chilgoza pine nuts varies between provinces and from year to year. Lowest per family income was reported in Kapisa Province, while the highest was reported in Nuristan Province (Table 2). This data was not analyzed in relation to the total weight or number of pine nuts sold; as such, the reported differences in annual income generation per family are at least partially related to the size of the community's forest (number of pine trees) as well as nut quality. For instance, Kapisachilgoza forests are at the western most edge of the EFC. Here the size of the forests is relatively small and the quality of pine nuts is lower than in other provinces.

Conclusions

Chilgoza pine is an important forest species of Afghanistan which play significant role in the socio-economic development of adjacent communities. Pine nuts is a high value NTFP on the country which is traded internationally. Local communities harvest pine nuts and sale in local markets. Based on Afghanistan forest law, natural forests are governmental property, while local people are allowed to sustainably use and manage these resources considering community based management approach. Across EFC forested areas are divided between villages / tribes and a very small portion is managed by individual families. Compared to chilgoza pine nuts prices on local and international markets villagers'/community members receives very low income. As well as, the yearly income received from pine nuts is inconsistent. There are no standardized methods and equipment to be used during cone collection, nut extraction, processing and storage. Likewise, local and provincial markets are unorganized and lack storage facilities.

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