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ANTHROPOGENIC PRESSURE ON THE WESTERN HIMALAYAN MOIST TEMPERATE FORESTS OF BAGH, AZAD JAMMU & KASHMIR

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Abstract

The rural population of Himalayas is strongly dependent on the forest wood and pastures to fulfill their fuel, shelter and livestock fodder demands. Due to absence of any effective conservation management policy for forests, the over exploitation of forest ecosystem is threatening its existence. Upper and lower elevation villages of District Bagh were surveyed to investigate the average wood consumption, preferred fuelwood trees and average land holding per family. Wood consumption in the higher and lower altitude villages was found to be 3.76 and 2.19 kg/capita/day respectively with an average of 2.97kg/capita/day. The present consumption level of the resources far exceeds the carrying capacity and natural regeneration rates of the local forest resources. Comprehensive conservation policy with practical implementations is utmost essential in order to conserve the rapidly depleting forest resources of the area.

Introduction

Over the past few decades, the Himalayan forests have experienced unprecedented land-use changes driven by rapid human population growth and intensifying anthropogenic activities, such as agriculture and expanding human settlements (Nayar & Sastry, 1990; Tikader 1983). Traditionally, people of the Himalayan region have been fulfilling their energy needs almost entirely from forests (Bhatt *et al*., 1994). Fuel wood has been identified as one of the most significant causes of forest decline in many developing countries. According to one estimate, firewood accounts for over 54% of all global harvests per annum, suggesting a significant forest loss (Osei, 1993, Wahab *et al*., 2008). About 49925 (93.7%) out of 53275 housing units in Bagh are using wood to fulfill their cooking and heating demands (Anon., 1998).

The uncultivated lands around Kashmir villages present a pathetic scene as the outcome of intensive grazing. Especially in summer, livestock migration from the villages to the temperate forests and the alpine meadows contributes to eliminate rich flora. Local herdsmen need wood for fuel, thus they seriously damage shrubs and trees of the alpine forest zone (Polunin & Stainton, 1984).

In many rural regions fuelwood is the most important energy source (Broadhead *et al.*, 2001) and many people rely on fuelwood extraction from natural forests for cooking and heating (Anon., 2002). The amount of wood harvested for fuelwood is much more than harvested volumes for industrial and other purposes. In contrast to logging for timber, fuelwood harvesting usually occurs continually in the same place and does not rely on heavy machinery for transportation. The impacts of timber harvesting on forest biodiversity and wildlife have been subject to extensive research (Fimbel *et al.*, 2001; Putz *et al.*, 2001; Zarin *et al.*, 2004; Meijard *et al.*, 2005; Asner *et al.*, 2006).

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Deforestation is mainly caused by heavy uncontrolled grazing, commercial logging and local use of trees for firewood, clearance for cultivation, pastures and defective road construction. Logging is one of the most severe silvicultural intervention (Putz *et al.*, 2001). The over exploitation of land resources has resulted in partial or complete removal of forest cover. Expansion of agricultural activities contributes more than 96% in deforestation. The greatest of all reasons is pasture creation for cattle ranching because it is an excellent form of income (Geist & Lambin, 2002).

Himalayan forests are very much de-graded due to nomadic activities, sedentary livestock overgrazing, legal as well as illegal tree cutting (Ahmed *et al.*, 1990, 1991, 2006). Perennial and palatable grass species become less dominant due to extensive grazing giving place to annual, less nutritious and less palatable species (Gupta, 1978) majority of which possess invasive potential.

Materials and methods

District Bagh lies in the western Himalayas, having sub tropical to moist temperate vegetation with 54.58% area under forest cover (Anon., 2007). The district Bagh lies between 73° - 75° East longitudes and 33° - 36° North latitudes. Total area of district is 1368Sq.Km, which is about 10% of total land area of AJK (Anon., 1998). Population of Bagh is about 0.434 million, with an annual growth rate of 2% and comprises 12.96% of total AJK population (Anon., 2007). The average household size is 7.4 per family. Some 94% of population lives in rural areas (Anon., 2008). The general elevation is between 1000 and 2500 meters above sea level. Average annual temperature is 21°C (ranging from 2°C in January to 40°C in July). The annual precipitation is about 1500 millimeters (Anon., 2005).

The study was carried out during June 2008 to March 2009 starting with a preliminary survey in the villages of different communities to count the number of families and members in each household. Bagh district has nine natural watersheds. The area was divided into two agro climatic zones based on its altitude. A total of 18 villages, 9 of them in the upper elevation zone (1700-2200 m.a.s.l.) and the other 9 in the lower elevation range (1000-1500 m.a.s.l.) were selected. The altitude, latitude and longitude (coordinates) of all the study sites were recorded by using Garmin corp-2002 Global Positioning System.

The quantity of fuelwood consumption was measured over a period of 24 hrs using a weight survey method (Mitchell, 1979; Bhatt *et al*., 1994). Each sampled household was visited randomly round the year to record the firewood consumption. Initially, a wood lot was weighted and left in the kitchen and the household was requested to burn wood only from this bundle. After 24 h, the actual fuelwood consumption was measured. From this value, fuelwood consumption in kilogram/capita/day was calculated for each studied site.

The data about land holding, cattle rearing, crop production, grazing area/grazing unit was obtained through field survey questionnaire method. A total of 180 questionnaires (10 /site) were administrated in study area (Ogunkunle & Oladele, 2004).

Results

District Bagh has a total area of 328,677 acre of which 179, 405 (54.58%) is declared as demarcated forest (Table 1). There are 53275 housing units in the area with an average land holding of 2.415 acres/ family. More than 94% of the population lives

in the villages in the traditional mountainous life style. In the present study, we revealed that the majority of the rural population depends on forestry, livestock and agriculture to eke-out its subsistence and demands. The fuelwood consumption level in the high altitude villages (1700-2200m.a.s.l) was found to be 3.76kg/capita/day. In the lower altitude villages (1000-1500m.a.s.l) it decreased to 2.19kg/capita/day (Table 5). This result confirms the direct proportionality of wood consumption level and elevation of the area. Average wood consumption of the whole district was estimated to be 2.97kg/capita/day. Average annual consumption of the fuelwood /house hold in Bagh was found to be 10.197 metric tons (Table 5). During the present study we estimated that approximately 509086 metric tons fuelwood is consumed annually in Bagh. Most of this fuelwood demand is fulfilled from the nearby forests on which the locals also claim rights. 90% of the wood extraction is carried out illegally by the locals.

The upper Bagh villages are located just adjacent to the demarcated forest areas. The average fuelwood consumption in upper Bagh villages (13.714 metric tons) was double than that of lower Bagh villages i.e.6.68 metric tons. (Tables 3,4). The wood consumption level also increased with the increase in the family size. Firewood consumption was influenced by climate and season of the year. On average, the fuelwood consumption was 2.0 –3.0-fold higher in winter than summer (considering 210 days as winter and 155 days as summer). This winter rise in consumption was very much marked in the upper Bagh villages due to the harsh climatic conditions, freezing temperatures and lack of alternative fuel.

Average land holding in the area was estimated to be 2.145 acres per family. The herd size in study area was found to be 3.31, which was fair enough (Table 5). Our findings showed that very little land was available for the live stock grazing i.e. 0.41acres/grazing unit (Table 5). The preferred fuel wood species of the area i.e., *Quercus incana, Q. dilatata, Pinus wallichiana* and *Abies pindrow,* exhibit a low regeneration rate.

Discussion

Dependency on forest for fuelwood is causing severe deforestation in the Himalayas (Ahmed *et al.,* 1990, 1991, 2006). The present study revealed that fuelwood consumption among the village locals ranged from 2.19 to 3.76 kg/capita/day with an average of 2.97kg/capita/day, which seems considerably higher than the value reported for the rural and tribal communities of the western Himalayas (1.49 kg/capita/day) by Bhatt *et al*., (1994); for Southern India (1.9–2.2 kg/capita/day) by Hedge (1984); for South and South-East Asian countries (1.7–2.5 kg/capita/day) by Donovan (1981) and for Himalayan range of Nepal (1.23 kg/capita/day)by Mahat *et al*., (1987). It has also been observed that the firewood consumption also differs according to family size and large families have more firewood consumption than those of medium and small families (Bhatt & Sachan, 2004).

Substantial increase in human and livestock population, lack of land ownership rights, post earth quake reconstruction timber demand causing increased extraction, over grazing, forest fires and clearance of forest for pastures and urban development has caused severe deforestation besides firewood extraction.

One of the very severe impacts of repeated fuelwood harvesting on the structure of the forest is the ruthless decline of large old trees resulting in their complete disappearance. Once these trees are lost, the size of gaps created either by natural tree falls or logging also increases (Ruger *et al.*, 2007), resulting in forest fragmentation

and susceptibility to invasion by ephemerals, that inhibit the regeneration of seedlings of tree species.

The ecological impact of the harvesting scenarios on the forest increased linearly with increasing levels of wood extraction. Hence, every additional amount of harvested wood causes a proportional change of forest size structure and plant functional type composition. There seem to be no critical thresholds of harvesting intensity where the state of the ecosystem would dramatically change. Of course, this argument only holds true if no other factors become important in disturbed forests which were not included in our study, for example, invasion of alien species and their allelopathic effect on tree seedlings and increased fire susceptibility of logged forests (Cochrane, 2003). Harvesting scenarios with high levels of wood extraction markedly alter the size structure and plant functional type composition of the forest (Ruger *et al.*, 2007).

The pressure is developing on the most favorite and preferred fuel wood tree species which include *Quercus incana, Quercus dilatata, Abies pindrow, Pinus wallichiana and Pinus roxburghii.* Although *A. pindrow, P. wallichiana* and *P. roxburghii* are most significant timber wood species, but due to ignorance and acute shortage of alternate fuel sources, these species are preferred for fuel. On one hand due to fuel wood and timber demands, very extensive and heavy extraction is going on in the local forest reserves while on the other hand due to limited grazing area available for the livestock, over and illegal grazing of demarcated forest areas is threatening the growing seedlings of these tree species. Loss of these species will have disastrous impacts on industries involving domestic carpentry, furniture and pulp mills. Once densely-forested, the mountain slopes in Kashmir have become largely naked through too heavy tapping and cutting of the trees; with concomitant landslides, frequent floods and loss of fertile topsoil. People living on the land of Kashmir have to protect these vital species (Oza, 1980, 2003). Locals have to build their houses, shelter for their livestock as well as to cultivate their crops in the limited available area. Nearly everyone in the area is involved in agricultural practices with in the same land holding. Due to the limited land holding/family in the area, there is an increasing trend of encroaching forest lands for building houses. This phenomenon is especially marked in the upper Bagh villages most of which are remote and surrounded by forests without any effective monitoring by the forest department. There is no clear demarcation of private and government forest lands. Usually the forest areas and villages are intermingled. Such a pattern allows greater interference and exploitation of the forest lands by locals and their live stock.

If the rich flora of the moist temperate forests of the Kashmir Valley can be conserved, there can still be hope that Kashmir's natural beauty environment, waters heads, resources, biodiversity and heritage might revive to its past glory (Oza, 1985).

Table 1. Housing and physical indicators in District Bagh, AJ & K.

Housing indicators	Total	Rural	Urban
Housing units	53275	50243	3032
Percentage	100	94	6
Availability of fuelwood%	93.71	95.30	66.72

(Source: Earthquake rehabilitation and reconstruction authority, 2008.)

Table 2. Division of forest area of District Bagh, AJ & K (Acres).

Forest division	Divisional land area (Acres)	Commercial forest (Acres)	Potential commercial forest (Acres)	Un commercial forest (Acres)	Total forest area (Acres)	% Of divisional land area
BAGH	328,677	29,124	104,763	45,518	179,405	54.58%

(Source: AJK at a glance, 2007)

Table 3. Village wise fuelwood consumption, land holding, herd size and grazing area of upper Bagh.

S. No.	Village name	Elevation m.a.s.l.	Av. No. of individuals/ family	Fuelwood consumption/ year (metric tons)	Fuelwood consumption Kg/capita/day	Land holding/ family (Acres)	No of cattle/ family	Av. grazing area/ unit (Acres)
1.	Jhundi	1870 ± 7	9 ± 2	10.7 ± 1.5	3.2 ± 0.9	1.7 ± 0.3	4 ± 2	0.2
2.	Thollini	1890 ± 5	10 ± 3	13.5 ± 2.0	3.9 ± 0.3	0.23 ± 0.1	3 ± 1	0.00
3.	Khamkot	2060 ± 8	12 ± 1	8.98 ± 1.0	2.1 ± 0.5	1.42 ± 0.4	4 ± 1	0.14
4.	Besooti	2140 ± 13	13 ± 4	16.2 ± 0.8	3.42 ± 0.9	2.77 ± 0.6	6 ± 2	0.36
5.	Noorgala	1950 ± 7	7 ± 2	14.98 ± 2.4	5.85 ± 1.3	2.03 ± 1.0	5 ± 2	0.26
6.	Sudhangalli	2225 ± 11	9 ± 2	20.2 ± 3.2	6.4 ± 2.2	1.04 ± 0.5	3 ± 1	0.12
7.	Thob	1800 ± 9	10 ± 3	16.6 ± 2.0	4.61 ± 0.8	1.5 ± 0.7	4 ± 1	0.16
8.	Chitra	1995 ± 11	9 ± 4	13.8 ± 3.6	4.02 ± 1	2.72 ± 0.9	3 ± 2	0.62
9.	Nakkar	1700 ± 12	11 ± 2	8.8 ± 2.0	2.13 ± 0.5	2.36 ± 1.0	2 ± 1	0.51
10.	MEAN	1950	10	13.8	3.8	1.8	4	0.27

Table 4. Village wise fuelwood consumption, land holding, herd size and grazing area of lower Bagh.

S. No.	Village name	Elevation m.a.s.l.	Av. No. of individuals/ family	Fuelwood consumption/ year (metric tons)	Fuelwood consumption Kg/capita/day	Land holding/ family (Acres)	No of cattle/ family	Av. grazing area/ unit (Acres)
1.	Kafalgarh	1510 ± 6	10 ± 3	8.4 ± 1.5	2.25 ± 0.9	6 ± 2.0	4 ± 2	0.88
2.	Channala	1395 ± 9	8 ± 2	7.8 ± 1.0	2.6 ± 0.9	1.8 ± 0.5	3 ± 1	0.26
3.	Kaila kathi	1450 ± 11	10 ± 4	6.22 ± 0.8	1.63 ± 0.4	2.2 ± 0.3	3 ± 2	0.34
4.	Gahlan	1345 ± 4	8 ± 3	6.6 ± 1.2	2.15 ± 0.9	1.2 ± 0.5	4 ± 2	0.12
5.	Bhagloor	1180 ± 5	8 ± 2	7.16 ± 0.9	2.5 ± 0.6	3.9 ± 0.9	3 ± 1	0.84
6.	Sahlian	1175 ± 7	7 ± 1	6.7 ± 0.7	2.8 ± 0.9	2.05 ± 0.3	2 ± 1	0.54
7.	Nindhrai	1205 ± 9	8 ± 1	2.2 ± 0.3	0.7 ± 0.05	1.23 ± 0.4	1	0.58
8.	Nomanpura	1020 ± 11	7 ± 3	8.03 ± 2.3	3.3 ± 0.6	2.4 ± 1.0	2 ± 1	0.52
9.	Patrata	1100 ± 10	9 ± 2	6.8 ± 1.8	2.02 ± 0.2	2.2 ± 0.7	1	0.8
10.	MEAN	1270	8	6.7	2.2	2.6	3	0.55

Table 5. Comparative wood consumption and land use pattern in upper and lower Bagh villages.

Zone	Av. elevation m.a.s.l.	Av. no of individuals/ family	Fuelwood consumption/ year (metric tons)	Fuelwood consumption kg/capita/day	Av. land holding/ family (Acres)	Av. no of cattle/family	Av. grazing area/ unit (Acres)
Upper Bagh	1950	10	13.8	3.76	1.75	4	0.27
Lower Bagh	1270	8	6.68	2.2	2.54	3	0.55
Mean	1610	9	10.2	3	2.2	3	0.41

Table 6. Preferred fuelwood tree species of lower Bagh zone.

S. No.	Tree species	Local name	Elevation range (meters)	Status
1.	*Pinus roxburghii*	Chir	700-1500	Fair
2.	*Olea cuspidata*	Kahu	Below 1100	Under pressure
3.	*Robinia pseudoaccacia*	Kikar	Below 1500	Fair
4.	*Melia azaderach*	Draik	Below 1400	Fair
5.	*Ailanthus altissima*	Drewea	Below 1400	Fair
6.	*Punica granatum*	Darru	Below 1000	Under pressure
7.	*Berberis lyceum*	Sumblu	900-1700	Fair
8.	*Dodonia viscose*	Sanyatha	Below 1000	Fair

Table 7. Preferred fuelwood tree species of upper Bagh zone.

S. No.	Tree species	Local name	Elevation range (meters)	Status
1.	*Abies pindrow*	Tung	1900-2500	Under pressure
2.	*Picea smithiana*	Thunni	1900-2500	Under pressure
3.	*Pinus wallichiana*	Byar, Rair	1500-2100	Under pressure
4.	*Quercus incana*	Reen	1400-1900	Under pressure
5.	*Quercus dilatata*	Reen	1400-1900	Under pressure
6.	*Machillus odoratissima*	Chaan	1600-2000	Fair
7.	*Prunus armeniaca*	Harri	1200-1800	Fair
8.	*Pinus roxburghii*	Chir	700-1600	Fair

Conclusion

Our core findings on fuelwood consumption patterns revealed serious considerations about the problem of deforestation in the area. Higher fuel wood consumption is mainly due to lack of unconventional energy sources. Extensive farming for firewood could be the only alternative to bridge the gap between the demand and supply. Hence, a comprehensive forest policy is required in the region so that there would be net addition to a perpetuating stock even after meeting the essential food, fodder and timber requirements of the people, as well as, the growing requirement of commercial exploitation. To achieve this, greater coordination between the Govt. machineries, people and NGOs is needed under protective care and supervision. Technologies regarding the use of smokeless and efficient cooking stoves should be encouraged, which can reduce pressure on forests. To meet out the growing demand of firewood, efforts are needed for mass afforestation through suitable firewood tree species. The loss of large old trees can be mitigated by explicit retention of some trees that are allowed to grow large and die naturally. This way the structural complexity of used forests could be increased and plant and animal species associated with large trees, senescent trees, or dead woody debris could be conserved.

The information obtained from the present study on fuel wood consumption pattern at different altitude could form the basis for designing appropriate technologies and management policies for energy plantations in the region.

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