Human Pressure and Forest Resource Depletion in and Around Dachigam National Park, Kashmir

Naziya Khurshid[1*], G. Mustafa Shah[1], Ulfat Jan[1], Muniza Manzoor[1] and Kulsum Ahmad Bhat[1]

[1]Department of Zoology, University of Kashmir, Srinagar-190006, J & K, India
***Corresponding author: naziya.scholar@kashmiruniversity.net**

Abstract
The human pressure and forest resource depletion was assessed in and around Dachigam National Park (DNP) for a period of 2 years. Semi-structured interviews with locals, villagers, head of Villages, gujjars and bakarwals residing in and around the buffer zone of the National Park were conducted. In addition to this, the Minor Forest Produce (MFP) extracted from the forest was assessed by using semi-structured Questionnaire. It was observed that people rely on DNP largely for fire wood, grazing their livestock etc. Fire wood has been identified as one of the most significant causes of forest decline directly affecting the living of birds and animals there. Human pressure is found mainly to affect *Parrotiopsis jacquemontiana*, *Prunus*, *Rubus*, *Lonicera*, *Cotoneaster* and *Koeleria cristata*. Given the magnitude of damage caused by unabated anthropogenic pressures, it might be too late to protect the threatened taxa on the verge of extinction.
Keywords: Dachigam National Park, anthropogenic, extinction.

Introduction

Biodiversity lifts ecosystem throughput where each species, no matter how small, all have an important role to play. A vigorous biodiversity provides a number of natural amenities for everyone. India has one of the highest levels of biological diversity in the world, ranging from landscapes, ecosystems, species and genes that should all be considered in a state of biodiversity assessment. Unfortunately, we have very little knowledge of our amazing vast biodiversity and the ecological implications of this for sustaining our natural systems and heritage. The halting current rates of biodiversity loss will be defining challenge of the 21st century. For the purpose of containing threats to natural habitat areas, some environmental policy instruments, such as environmental certification and licensing, payment for ecosystem services (Angelsen *et al.*, 2009), fiscal and commercial policies (UNEP, 2004), and especially, the establishment of protected areas (Naughton-Treves *et al.*, 2005; Chape *et al.*, 2008; Schmitt *et al.*, 2009), have been employed for biodiversity conservation.

Most commonly, the purpose of these protected areas are to protect ecosystems and all their constituent species, protect ecosystem services, protect populations of specific threatened species, and even protect traditional cultures (Beltran and Phillips, 2000; Nagendra, 2008; Angelsen *et al.*, 2009). Although protected areas constitute a cornerstone of local and international conservation approaches (Jenkins and Joppa, 2009), they continue to experience anthropogenic pressure (Nagendra, 2008; Vicente *et al.*, 2013).

Dachigam landscape is of significance because of its propinquity to populated tracts, wonderful continuity, and endemic fauna and flora. The natural resources in this region are in a process of severe degradation due to increased anthropogenic activities. To enable applicable conservation action, it is perilous to map and monitor changes in the type and magnitude of land cover/use and habitat classes, which can be correlated to human pressures over time. Effective conservation of biodiversity requires the development and implementation of a portfolio of responses that address the issues in strategic, cost effective and proactive ways across a range of scales. The conceptual frame work for present study was to assess the effects of human pressure and forest product depletion in Dachigam landscape.

Study Area

Dachigam National Park is present in Srinagar city of Jammu and Kashmir. It is approximately 22.5 km long and 8 km wide located (34°05′ to 34°32′N; 74°50′ to 75°16′E) in the Zanskar mountain range of the Western Himalayas covers a total area of 141 km^2 with high mountains ranging from 1700 to 4250 m in elevation (Rodgers and Panwar, 1988; Rodgers *et al.*, 2000 and Ahmad *et al.*, 2016).

Methodology

Study range, was divided into ten transects in order to get a fair understanding of anthropogenic pressures**.** Almost alike, exhaustive efforts were applied across all transects, to get the proper account of anthropogenic activities. Each transect were visited along fixed trails with a uniform stride, and area of all sides of transect were first scanned visually, then followed by semi-structured interviews and group conversation with locals, head of the village and also with the officials of the national park. The field survey was carried regularly from for 2 years from September 2014 to September 2016, covering each transect to assess the anthropogenic pressures on the study range. Transects were selected based on altitude, location (core/edge/adjoining) and floristic composition **(Table 1).** Each transect were surveyed on a rotational basis 4 times a month in different time periods – (winter/autumn) and (spring/summer) – regularly for the two years of the study.

Table 1. Transects surveyed in Dachigam landscape

Transect	Transect site	Altitude	Location	Coordinates
Transect I	Mahadev	1769 m to 1910 m	Core	34°09.104' 74°55.336' 34°09.231' 74°55.650'
Transect II	Shah Mohalla Harwan	1690 m	Adjoining	34°09.466' 74°54.188'
Transect III	Darah/Darwani	1648 m	Adjoining	34°11.104' 74°55.801'
Transect IV	Aastan Mohalla Brein	1970 m	Peripheral	34°05.633' 74°54.538'
Transect V	Sangri Khonmoh	2005 m	Adjoining	34°05.309' 74°69.192'
Transect VI	Narastan	1662 m	Peripheral	33.93° 75.10°
Transect VII	Zuastan	1582 m	Peripheral	33.25° 74.10°
Transect VIII	Surfraw Kangan	1810 m	Peripheral	34.16° 74.55°
Transect IX	Buzliwas to Dagwan	2730 m	Core	34°09.104' 74°55.336
Transect X	Main Gate to Draphama	1697 m to 1814 m	Peripheral	34°08.915' 74°55.201' 34°09.013' 74°55.178'

Socio-economic structure

To evaluate the socio-economic structure of local inhabitants in Dachigam landscape, a detailed questionnaire survey was conducted. Data on various parameters including: demography, land-use pattern, occupation, and major economic activities were generated. Data was collected from 137 different informants (including 57 males and 80 females). The informants were classified into eight age groups, i.e.: 21-30, 31-40, 41-50, 51-60, 61-70 and above 70 years of age **(Tables 2 & 3).**

Seventy one percent of the informants were illiterate due to the lack of education facilities, while the remaining thirty percent were educated (mostly secondary school level or below). The inhabitants of the Dachigam landscape hold small portion of the land **(Table 4).** The economy of people is poor and is mostly reliant on agricultural crop land, livestock grazing, and collection of other forest products; however, people have already started growing orchards in place of traditional crop to boost their economy (Naqash and Sharma, 2011-2016).

Table 2. Characteristics of the study participants

Categories	Number	Percentage
Gender		
Male	57	41.60
Female	80	58.39
Age group		
Below 50 years	25	18.24
Above 50 years	112	81.75
ducation level		
Illiterate	98	71.53
Primary	5	3.64
Middle	2	1.45
High School	20	14.59
Graduates	3	2.18
Masters	9	6.56
Socioeconomics		
Farmers	41	29.92
Shepherds	16	11.67
Woodcutters	4	2.91
Teachers	8	5.83
Housewives	68	49.63

Table 3. Total number and percentage of interviewees per age group

21-30	12	4	8	8.75
31-40	32	20	12	23.3
41-50	24	8	16	17.5
51-60	34	16	18	24.81
61-70	13	4	9	9.48
Above 70	22	5	17	16.05

Table 4. Land-use pattern in Dachigam Landscape (Naqash and Sharma, 2011-2016)

Category	Area (ha)
Built-up land	3804.13
Forest Area	24556.72
Cultivated	15004.22
Plantation/Orchard	3679.71
Marshy Area	745.22
Barren/Grassland	22993.92
Query site	207.41
Water body	1926.72
Snow covered	18149.76
Total	91067.84

Collection of minor forest produces and fuel wood

Information on collection of minor forest produce (MFP) by local people from various parts of national park was gathered using semi-structured questionnaire. Moreover, the extraction of medicinal plants was also recorded. Interviews and ranking exercises were the main methods employed to collect the ethno-medicinal data. The main method employed to collect the data was fidelity labelled door to door information collection.

Results and Discussion

Humans consistently modify their environments—both directly and indirectly. Humans transform the environment in both intended and unintended ways, as documented from at least as early as the first use of tools. Thus, although anthropogenic landscapes were established early in human history, the scale of anthropogenic transformation of landscapes increased in conjunction with growth in size, population density, and longevity of full-time settlement. Humans have already modified a major portion of the planet (Ellis and Ramankutty, 2008; Ellis, 2011), resulting in unprecedented rates of species extinction (Säterberg *et al.,* 2013). Habitat loss is a major human driver triggering species loss. Today a large part of biodiversity is located in human-altered landscapes, with 70 percent of forests worldwide located within 1 km or less from anthropogenic edge (Haddad *et al.,* 2015).

Human activities not only decrease forest cover but also lead to concomitant biosphere changes (Ellis *et al.,* 2013; Ellis and Ramankutty, 2008). The Himalayan forests have shown a great degree of variation over the last few centuries and currently form a highly impacted natural mountainous landscape. However, the changes in the recent years have been extremely drastic leading to severe ecological deterioration (Nandy *et al.,* 2011) which mostly includes trans-humane grazing, conversion of forests to cultivated and urban areas, and anthropocentric activities in the name of development. Along with impacts on forests, human activities are likely to significantly affect the people dependent on forests and forest-based resources (Briner *et al.,* 2013). Adverse effects are likely to happen in the Himalayan region, where many communities have subsistence living and are mostly dependent on forests and agricultural production for their livelihoods (Banerji and Basu, 2010).

Anthropogenic alteration of natural habitats is the greatest menace to biodiversity and one of the primary reasons for forming protected areas. Among these protected areas, Dachigam is one of the important national parks famous for harbouring diverse fauna and flora, including a large number of rare and threatened plants, animals and birds.

In the backdrop of limited knowledge about human impacts on Dachigam landscape the present study has been undertaken to document the human pressure and forest product extraction in Dachigam landscape.

Inhabitants in Dachigam landscape

A large proportion of the resident population in Dachigam landscape is very poor and dependent upon agriculture, livestock rearing, and the production of fuel wood, thatched goods (baskets and grass holders), as well as other forest resources.

A total of 2,417 families and govt. staff are present in Dachigam landscape with an overall average of 9 members per family/staff **(Table 5).** Adjoining areas (6, 306) have high populace in agreement with the expectancy followed by peripheral areas (4, 288) and core areas (521) **(Figure 1).** The high population of peripheral areas of Dachigam National Park is mostly contributed by CRPF personnel and other staff. Core areas of Dachigam National Park are chiefly inhabited by migrant grazers and other staff. The number of daily domestic and foreign visitors coming to

Dachigam landscape in tourism season is almost 500 annually in the core areas**.** An intense influx of visitors is experienced in the landscape through the arrival of excursion buses from various schools, colleges and other academic institutions, however, entry to core areas is restricted to educational and research purposes only.

Table 5. Number of inhabitants in Dachigam Landscape

Transect	No. of Families or staff present	Average No. of Family/Staff members	Average No. of tourists	Total population	Percentage population
Transect I	66	6	100	496	3.92
Transect II	100	6	1000	1600	12.65
Transect III	1365	4	0	5460	43.17
Transect IV	72	5	20	380	3.00
Transect V	41	6	0	246	1.94
Transect VI	52	4	0	208	1.64
Transect VII	48	5	0	240	1.89
Transect VIII	642	5	0	3210	25.38
Transect IX	25	5	10	135	1.06
Transect X	6	45	400	670	5.29
Total	2,417				

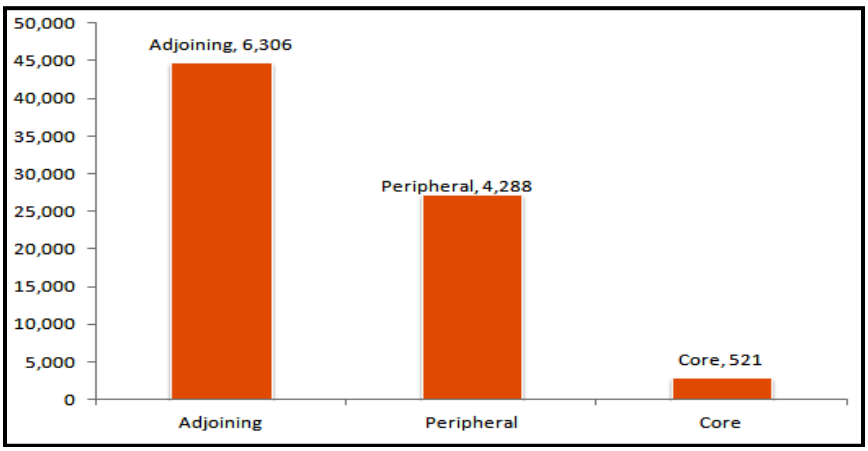

Figure 1. Inhabitants in Dachigam landscape

Natural resources and concomitant biological variety provide the basis of living for human populations. Local communities have high reliance on plant resources for their survival requirements. Consequently, humans have a great influence on local undergrowth and vice versa. For local communities reliant on forest resources, participatory approach should be investigated in deciding future livelihood possibilities, along with conservation of endangered flora and fauna. In order to make them socially resilient, forest management practices for communities should be updated, and awareness and education programmes within the communities dependent on forests and forest-based resources should be implemented. The local communities enter the park through different tress passes and extract

fuel wood, grass and timber. Inhabitants of Dachigam landscape also engage in charcoal making during autumn months, the activity which may lead to forest fires in the park.

Forest products harvested in Dachigam landscape

A forest ecosystem provides a wide range of goods and services to human society and plays a vital role in sustaining livelihood of the local community. Local communities of Dachigam landscape are mainly reliant on forest products for their survival. Main reliance is for the use of firewood, fodder collection, grazing and tree-felling for commercial purposes, as well as non-timber forest products (NTFP) such as fruits, foliage, bark and roots which serve, among other, as medicine, food and source of income for local. Approximately, 75,000 kg of forest products are harvested annually from Dachigam landscape **(Table 6).** Of these, the major harvested product is firewood 30,966 kg (41%) followed by grass 22,193 kg (30%) and medicinal plants 8,154 (11%) while, mushroom and morel contribute (6,781 kg) and (6,746 kg) 9% each respectively. Adjoining areas contribute most of the total harvested produce 44,796 kg (60%) followed by peripheral areas 27,169 kg (36%) and core areas 2,875 kg (4%) **(Figure 2).**

Table 6. Forest products harvested per year in Dachigam Landscape

Transect	Natural resources harvested per year (kg)					Total
	Firewood	Grass	Medicinal plants	Mushroom	Morel	
Transect I	700	385	145	405	310	1945
Transect II	2000	3200	500	300	250	6250
Transect III	16380	10920	2730	2730	4095	36855
Transect IV	648	864	216	280	150	2158
Transect V	615	648	205	123	100	1691
Transect VI	780	728	104	156	90	1858
Transect VII	480	624	240	144	100	1588
Transect VIII	8988	4494	3852	2500	1560	21394
Transect IX	275	300	150	125	80	930
Transect X	100	30	12	18	11	171
Total	30,966	22,193	8,154	6,781	6,746	74,840

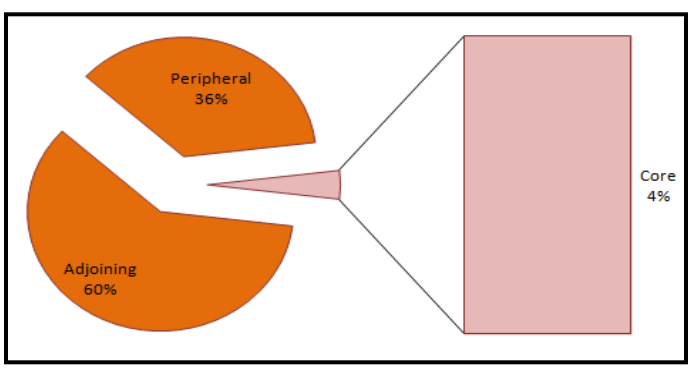

Figure 2. Forest products harvested per year in Dachigam Landscape

We reported 16 plant species mainly used as a source of income by the local people of Dachigam landscape **(Table 7).** Three species *Parrotiopsis, Morus* and *Aesculus* are marketed as firewood with an average price of 2,167/quintal.

Nine species of herbaceous and medicinal plants are marketed at decent rates with *Aconitum heterophyllum* and *Macrotonia benthamii* sold at average rates of 3500/kg. Morels and mushroom have very high market value with *Morchella esculenta* and *Morchella elata* selling at the rates of 20,000/kg and 5,000/kg respectively.

Table 7. Market price of forest products harvested per year in Dachigam landscape

Name of the species	Local name	Price
Trees and Shrubs		
Parrotiopsis spp.	Firewood/Hatab	2000/quintal
Morus spp.	Mulberry/Shahatoot	1500/quintal
Aesculus spp.	Horse chestnut/Haanthdoon	3000/quintal
Herbaceous and Medicinal Plants		
Aconitum heterophyllum	Atees	4000/kg
Arnebia benthamii	Arneb	3000/kg
Dioscorea deltoidea	Yam	60/kg
Mentha lonifolia	Mint	600/kg
Saussurealappa	Kuth	350/kg
Artemisia absinthium	Tethwan	720/kg
Rheum webbianum	Pumbchalan	600/kg
Berberis lyceum	Barberry/Kaawdash	250/kg
Themedaanathera	Wal-Gascii	200/kg
Morels and Mushroom		
Morchella esculenta	Guchhi	20,000/kg
Morchella elata	Guchhi	5,000/kg
Verpa spp.	Morel	600/kg
Agaricus campestris	Mushroom	700/kg

References

Ahmad, K., Qureshi, Q., Agoramoorthy, G. and Nigam, P. 2016. Habitat use patterns and food habits of the Kashmir red deer or Hangul (*Cervus elaphus hanglu*) in Dachigam National Park, Kashmir, India. ***Ethology Ecology and Evolution*, 28**(1): 85-101.

Angelsen, A., Brockhaus, M., Kanninen, M., Sills, E., Sunderlin, W. D. and Wertz-Kanounnikoff, S. editors 2009. *Realising REDD+* ***National strategy and policy options. Bogor, Indonesia: CIFOR,*** 1-9, pp.

Banerji, G. and Basu, S. 2010. Adapting to climate change in Himalayan cold deserts. ***International Journal of Climate Change Strategies and Management,* 2:** 426-448.

Beltran, J. and Phillips, A. editors 2000. Indigenous and Traditional Peoples and Protected Areas: principles, guidelines and Case Studies. IUCN-WCPA-WWF: Gland, Switzerland and Cambridge, UK.

Briner, S., Elkin, C. and Huber, R. 2013. Evaluating the relative impact of climate and economic changes on forest and agricultural ecosystem services in mountain regions. ***Journal of Env. Management,* 129**: 414-422.

Chape, S., Spalding, M. and Jenkins, M. editors 2008. *The World's Protected Areas: status, values and prospects in the 21st century*. UNEP World Conservation Monitoring Centre, University of California Press: Berkeley, USA.

Ellis, E. C. 2011. Anthropogenic transformation of the terrestrial biosphere. ***Philosophical Transactions of the Royal Society A***, **369**: 1010-1035.

Ellis, E. C. and Ramankutty, N. 2008. Putting people in the map: anthropogenic biomes of the world. ***Frontiers in Ecology and the Environment*, 6**(8): 439-447.

Ellis, E. C., Kaplan, J. O., Fuller, D. Q., Vavrus, S., Goldewijk, K. K. and Verburg, P. H. (2013). Used planet: a global history. ***Proceedings of the National Academy of Sciences USA*, 110**(20): 7978-7985.

Haddad, M., Lars, A. B., Clobert, J., Davies, K. F., Gonzalez, A., Holt, R. D., Lovejoy, T. E., Sexton, J. O., Austin, M. P., Collins, C. D., Cook, W. M., Damschen, E. I., Ewers, R. M., Foster, B. L., Jenkins, C. N., King, A. J., Laurance, W. F., Levey, D. J., Margules, C. R., Melbourne, B. A., Nicholls, A. O., Orrock, J. L., Song, D. and Townshend, J. R. 2015. Habitat fragmentation and its lasting impact on Earth's ecosystems. ***Science Advances*, 1**: e1500052.

Jenkins, C. N. and Joppa, L. 2009. Expansion of the global terrestrial protected area system. ***Biological Conservation*,142**: 2166-2174.

Nagendra, H. 2008. Do parks work? Impact of protected areas on land cover clearing. ***Ambio***, **37**: 330-337.

Nandy, S., Kushwaha, S. P. S. and Dadhwal, V. K. 2011. Forest degradation assessment in the upper catchment of the river Tons using remote sensing and GIS. ***Ecological Indicators*,11**: 509-513.

Naqash, R. Y. and Sharma, L. K. 2011-2016. ***Dachigam National Park, Management plan,*** Srinagar India, 141 pp.

Naughton-Treves, L., Holland, M. B. and Brandon, K. 2005. The Role of Protected Areas in Conserving Biodiversity and Sustaining Local Livelihoods. ***Annual Review of Env. and Resources,* 30**: 219-252.

Rodger, W. A. and Panwar, H. S. 1988. Planning a wildlife protected area network in India. Wildlife Institute of India Press: Dehradun, India.

Rodgers, W. A., Panwar, H. S. and Mathur, V. B. 2000. Wildlife Protected Area Network in India: A Review. Wildlife Institute of India Press: Dehradun, India.

Säterberg, T., Stefan, S. and Ebenman, B. (2013). High frequency of functional extinctions in ecological networks. ***Nature,* 499**: 468-470.

Schmitt, C. B., Burgess, N. D., Coad, L., Belokurov, A., Besançon, C., Boisrobert, L., Campbell, A., Fish, L., Gliddon, D. Humphries, K., Kapos, V., Loucks, C., Lysenko, I., Miles, L., Mills, C., Minnemeyer, S. Pistorius, T., Ravilious, C., Steininger, M. and Winkel, G. 2009. Global analysis of the protection status of the world's forests. ***Biological Conservation,* 142:** 2122-2130.

UNEP 2004. *The Use of Economic Instruments in Environmental Policy: Opportunities and Challenges. UNEP/ETB.* Available: http://www.unep.ch/etb/publications/EconInst/econInstruOppChnaFin.pdf. (15. 05. 2015)

Vicente, J. R., Fernandes, R. F., Randin, C. F., Broennimann, O., Goncalves, J., Marcos, B., Pôcas, I., Alves, P., Guisan, A. and Honrado, J. P. 2013. Will climate change drive alien invasive plants into areas of high conservation value? An improved model based regional assessment to prioritize the management of invasions. ***Journal of Environmental Management,* 131:** 185-195.