



Plant resource utilization by local inhabitants around Machiara National Park, Azad Kashmir, Pakistan

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Abstract

In mountain forests of Azad Jammu and Kashmir (AJK), Pakistan, rural communities much depend on the plant resources from nearby natural forests. This study was carried out to determine the different types of plant resources which are utilized by local inhabitants in Machiara National Park in AJK. The national park is located in one of the global biodiversity hotspots of the world. A total of 210 household members from three villages were selected and interviewed using a standard questionnaire, in addition, group discussions and field observations were conducted to add information on resource use patterns and the impact of resource exploitation by local communities. The study revealed that 57 species were of medicinal value, 53 were used as fodder plants, 12 as torchwood, 27 as fuelwood, 10 species as timber for construction, 37 species served as food as vegetables, and 18 species provided a source of wild fruits. Cooperation between public institutions and local resource users was weak and legal rules and regulations were inadequately defined; this ultimately entailed an unsustainable use of forest vegetation resources.

Key words: Plant resource use, ethnobotany, indigenous knowledge, species inventory, protected area, people-park relations, Machiara National Park, Azad Kashmir.

Introduction

Mountain forests provide many important ecosystem services such as watershed protection, local climate regulation, natural hazards mitigation, as well as recreational and cultural services. By storing and sequestering a lot of carbon in their biomass, forests also contribute towards mitigating global warming. Furthermore, forests are an important habitat for wildlife and an asset for biodiversity conservation¹. However, unsustainable resource extraction often affects these functions, especially in poor regions, where local villagers depend on a wide range of products such as timber, fuelwood, medicinal plants, and wild food.

In remote rural areas of Pakistan local people rely heavily on forests for their livelihoods. According to Termizi and Rafiq² almost half of the rural population (48.5%) in Pakistan is dependent on forest resources for various uses. Such utilization is not the sole factor responsible for the loss of forests and forest biodiversity. In the self-governing State of Azad Jammu and Kashmir (AJK) the state itself gains large profits since 50% of the total revenues come from forests, 94% of which is generated from the sale of timber through the Azad Jammu and Kashmir Logging and Sawmills Corporation (AKLASC), while 6% are contributed by other non-timber forest products (NTFPs)³. Uncontrolled exploitation has therefore led to the reduction of forest cover from 42% in 1948 to 11% in 2006³.

Pro-environmentalist NGOs and some government agencies are increasingly pushing for the protection of forests in order to preserve wildlife areas and alleviate regional impacts of climate change and biodiversity loss, and the increasing threats of natural

hazards⁴. Different interests and diverging perceptions are thereby often a cause of tensions between the local people and such agencies⁶. In order to integrate local communities' demands in a socially acceptable way into any environmental management plans the importance of the forests to the local people needs to be recognized and properly assessed⁷.

As yet very few studies exist on the issue of the local villagers' utilization of plant resources from natural forest vegetation at Machiara National Park (MNP)⁸⁻¹⁵, especially if compared to the number of studies on wildlife¹⁶⁻¹⁸. This study concerned with how communities living near MNP are utilizing available plant resources found in or near MNP. The study aimed to provide an updated documentation of plant resources in the study area utilized by local inhabitants.

Study Area

The Machiara National Park (MNP) is located in the Himalayan area of Pakistan within Muzaffarabad District in the self-governing State of Azad Jammu and Kashmir (AJK) (Fig. 1; coordinates 73° 37' East, 34° 31' North). MNP covers an area of 13,532 ha and lies at an elevation of 2000-4700 m above mean sea level¹⁹.

MNP was notified as a national park on 14 March 1996. MNP represents temperate Himalayan forests and alpine scrub rangeland ecosystems rich in plant biodiversity (a part of the Western Himalayan biodiversity "hotspot"), wildlife and bird life²⁰⁻²². On its periphery MNP includes 28 villages with an estimated population of 35,497 persons (as by the end of 2004)¹⁹. The objective of MNP is to introduce sustainable management and

resource utilization models thereby warranting effective conservation of forest use areas, grazing grounds, and wildlife. With participation of local communities activities are aimed at social mobilization, environmental awareness raising, and capacity building of local stakeholders and village conservation committees. The MNP management aims to allocate ownership and define a legal framework for resource uses within the park area. MNP is the first national park in Azad Jammu and Kashmir State¹⁹ and one of three globally significant national parks selected for World Bank funding²³.

The climate of the MNP area varies with the altitude but generally its forest areas fall in the moist temperate zone. Winters can be very cold with heavy snowfalls where its high peaks remain ice clad until June or even longer giving a splendid background to the lush green forest vegetation of Machiara and the surrounding villages. Summers are cool and pleasant.

The nearest meteorological station to MNP is in Muzaffarabad which has an elevation of 650 m above mean sea level and is situated 35 km away from MNP. At that (lower) location the mean daily minimum temperatures range from 3.2°C in January to 22.8°C in July while the mean daily maximum temperatures range from 15.9°C in January to 37.6°C in June¹¹. The mean annual rainfall is 1526.7 mm with 84.5 rainy days. July is the wettest month (average rainfall of 327.6 mm) and the driest month is November (only 35.4 mm)¹¹.

Despite being relatively close to the capital city, the literacy rate in the MNP area is very low at 17.5%, with approximately 25% and 10% for the male and female populations, respectively. This compares with an average literacy rate of 60% in AJK²². Local people practice subsistence agriculture (often on rather infertile steep slopes), growing mainly single crops of maize and some vegetables. Nonetheless, due to generally small landholdings, crude agricultural practices, and an unfavorable climate, production is very low to sustain a large and growing human population. This is a main reason for a significant out-migration of villagers to join the skilled and unskilled labor force in Muzaffarabad and other larger towns of Pakistan.

Materials and Methods

The study employed a quantitative research design that requires interviews by questionnaire and related techniques. As study sites three villages, i.e. Bheri, Machiara and Jheeng, were selected from three union councils (Fig. 1). A total of 210 respondents were sampled from the villages and interviewed (Table 1). The uneven number of male (160) and female (50) participants in the study reflects local customs that limit the participation of women in such activities.

Before commencing the interview, respondents were informed on the purpose of the research to give them the opportunity to retract or continue their participation in the research study.

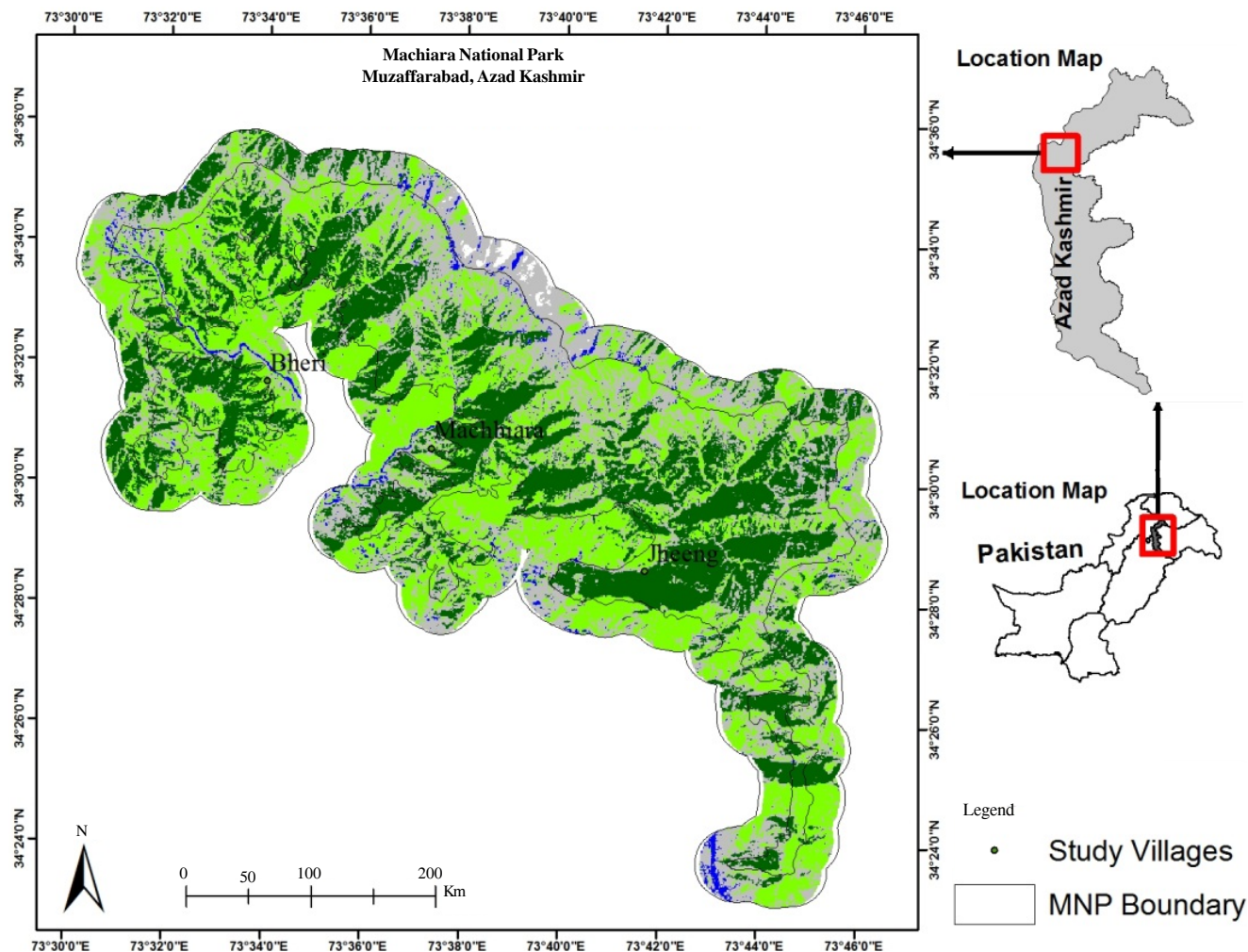


Figure 1. Map of Machiara National Park situated in Azad Jammu and Kashmir, Pakistan.

Table 1. No of participants interviewed in each village.

| Village | Sex | | Total |
|----------|--------|------|-------|
| | Female | Male | |
| Bheri | 21 | 63 | 84 |
| Machiara | 17 | 43 | 60 |
| Jheeng | 12 | 54 | 66 |
| Total | 50 | 160 | 210 |

Moreover, a clear statement in the local language (Urdu) was read to the respondents about the purpose of the study. This included a consent clause stating that the data obtained will be used strictly for research purposes and the identity of respondents would not be revealed anywhere else except in the results which were to be made available to the respondents.

Standard questionnaire data were gathered on plant species used for various purposes, i.e. medicine (M), fuelwood (Fw), torchwood (Tw), fodder (Fd), vegetables (V), fruits (F), and timber (T). In addition, data were also gathered on several socio-economic indicators. For documentation purposes, plant species collected by local inhabitants and informants were recorded with the vernacular names of the species and the corresponding uses, and their scientific names were determined and recorded in accordance with the Flora of Pakistan and other related reference materials^{8,9,25,26}. In order to more clearly identify plant species utilized in the area along with their names group discussions were also conducted in each village with at least 20 participants per group.

Results

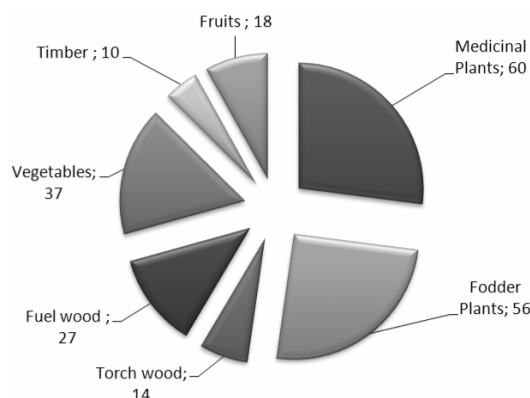
Demographical data, household characteristics and labour:

Prior to asking the main questions during the interview, data on age, gender and occupation of the respondents were gathered. The mean age of the respondents was 42 years (with a range of 19-85 years), whereby respondents belonging to the age cohort 31-40 years comprised the highest number (31%). The composition of the household population was estimated at 4.2 males against 3.2 for females. Data on land ownership showed that 81% of the respondents owned their agricultural land (cultivated lands and pastures), but most of the forest areas were under government control (79%). Apart from agriculture major sources of livelihood income included government services followed by labour work and local business. In most families (54%) at least one person worked outside the village, contributing to the total household income.

Resource uses: Plant species and their uses were listed by the respondents. Fig. 2 shows the total number of species counted in each resource category. The highest number of plant species was used for medicinal purposes (i.e. 57), whereas only 10 species were used for timber.

Pinus wallichiana (Himalayan white pine), *Juglans regia* (walnut), *Zea mays* (corn), *Punica granatum* (pomegranate), *Skimmia laureola*, *Mentha arvensis* (wild mint), *Geranium wallichianum*, *Amaranthus viridis*, *Rheum australe*, *Atropa acuminata*, *Berberis lycium*, *Berberis vulgaris* (barberry), *Datura stramonium*, *Mentha longifolia*, *Viburnum grandiflorum*, *Thymus linearis*, *Ajuga bracteosa* and *Cuminum cyminum* (cumin) were the most widely used species reported as medicinally important by more than 100 out of the 210 respondents (Table 2).

Several trees such as *Pinus wallichiana*, *Pinus roxburghii* (chir pine), *Cedrus deodara* (Himalayan cedar), *Juglans regia* (walnut),

**Figure 2.** Plant resource utilization chart.

Picea smithiana (West Himalayan spruce) and *Abies pindrow* (West Himalayan fir) were important species used for timberwood.

Fodder species included trees, grasses and herbs; the most important species were *Zea mays*, *Aesculus indica* (Himalayan horse chestnut), *Acacia* sp., *Brachiaria ramosa*, *Brachiaria eruciformis*, *Bothriochloa pertusa*, *Chrysopogon aucheri*, *Themeda anathera*, *Amaranthus viridis*, *Avena fatua* (common wild oat), *Digitaria pennata*, *Capsella bursa-pastoris* and *Echinochloa crus-galli* (barnyard grass) (Table 2).

Vegetable species were classified based on whether they were collected from the wild or grown locally. The most important vegetable species were *Brassica rapa* subsp. *campestris* (turnip mustard), *Lycopersicon esculentum* (tomato), *Cucurbita maxima* (hubbard squash), *Solanum tuberosum* (potato), *Brassica rapa* subsp. *rapa* (turnip), *Allium sativum* (garlic), *Allium cepa* (onion), *Cucumis sativus* (cucumber), *Luffa cylindrica*, *Morchella esculenta* (morel mushroom) and *Taraxacum officinale* (dandelion).

Fruit tree species reported as most widely used were *Juglans regia* (walnut), *Solanum nigrum* (black nightshade), *Prunus domestica* (plum tree), *Ficus palmata*, *Prunus bokhariensis*, *Prunus persica* (peach), *Diospyros lotus* (date-plum), *Vitis vinifera* (common grape vine), *Viburnum grandiflorum*, *Berberis lycium*, *Prunus padus* (bird cherry) and *Morus alba* (white mulberry) (Table 2).

In the village Bheri only few villagers provided detailed information on plant resource use as most of the people were working outside of the village. The plant species reported by more than 40 respondents from Bheri as medicinal were *Zea mays*, *Punica granatum*, *Pinus wallichiana*, *Juglans regia*, *Skimmia laureola*, *Rumex nepalensis*, *Rheum australe*, *Sonchus asper*, *Mentha arvensis*, *Rosa chinensis*, *Mentha longifolia*, *Geranium wallichianum*, *Viburnum grandiflorum* and *Amaranthus viridis*, while the highest number of fuelwood species reported were *Abies pindrow*, *Pinus wallichiana*, *Pinus roxburghii*, *Cedrus deodara* and *Juglans regia*. The fodder species most available in this village were *Aesculus indica*, *Acacia* sp., *Brachiaria ramosa*, *Chrysopogon aucheri* and *Digitaria pennata*, and the most frequently reported fruit and vegetable species were *Allium cepa*, *Allium sativum*, *Brassica* sp., *Solanum tuberosum*, *Mentha spicata*, *Ficus palmata*, *Luffa cylindrica*, *Prunus bokhariensis* and *Prunus* sp. (Table 2).

Many inhabitants of Machiara were dependent on products extracted from the forest lands in or near MNP. Important medicinal

Table 2. Plant resource use in three villages (Bheri, Machiara, and Jheeng) in Machiara National Park. The ‘use’ denotes plants used for medicinal (M), fuelwood (Fw), torchwood (Tw), fodder (Fd), vegetable (V), fruit (F), and timber (T) uses; cultivated plants are indicated by a star*. The plant growth forms or types (‘Gr Form’; all seed plants except F and M) are indicated as herbs (H), grasses (G), ferns (F), mushrooms (M), shrubs and vines (S), and trees (T); alien introduced species are indicated by a star*.

| Botanical name | Plant family | Local name | Use | Gr. Form | Village | | | MNP |
|---|------------------|-----------------|-----|----------|---------|-------|-------|------|
| | | | | | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Achillea millefolium</i> L. | Asteraceae | Chiti booti | M | H | 16.7 | 30 | 16.7 | 20.5 |
| <i>Aconitum chasmanthum</i> Stapf ex Holmes. | Ranunculaceae | Mohri | M | H | 22.6 | 88.3 | 21.2 | 41 |
| <i>Aconitum heterophyllum</i> Wall ex Royle | Ranunculaceae | Patris | M | H | 21.4 | 81.7 | 22.7 | 39 |
| <i>Aconogonon alpinum</i> (All.) Schur. | Polygonaceae | Chakroon | M | H | 26.2 | 80 | 40.9 | 46.2 |
| <i>Adiantum capillus-veneris</i> L. | Pt: Pteridaceae | Kakwai | M | F | 2.4 | 15 | 4.5 | 6.7 |
| <i>Adiantum incisum</i> Forssk. | Pt: Pteridaceae | Kakawa | M | F | 1.2 | 6.7 | 3 | 3.3 |
| <i>Aesculus indica</i> (Wall. ex Camb.) Hook.f. | Hippocastanaceae | Ban khor | M | T | 7.1 | 40 | 31.8 | 24.3 |
| <i>Ajuga bracteosa</i> Wall. ex Benth. | Labiatae | Thandi jari | M | H | 39.3 | 63.3 | 51.5 | 50 |
| <i>Amaranthus viridis</i> L. | Amaranthaceae | Ganyar | M | H | 45.2 | 75 | 90.9 | 68.1 |
| <i>Angelica glauca</i> Edgew. | Umbelliferae | Chora | M | H | 16.7 | 60 | 53 | 40.5 |
| <i>Artemisia scoparia</i> Waldst. & Kit. | Asteraceae | Lussjaree | M | H | 14.3 | 58.3 | 36.4 | 33.8 |
| <i>Atropa acuminata</i> Royle ex Miers | Solanaceae | Challah lubbur | M | H | 42.9 | 86.7 | 69.7 | 63.8 |
| <i>Azadirachta indica</i> A.Dr. Juss. | Meliaceae | Dreak | M | T | 29.8 | 63.3 | 45.5 | 44.3 |
| <i>Berberis lycium</i> Royle. | Berberidaceae | Sumbal | M | S | 36.9 | 96.7 | 65.2 | 62.9 |
| <i>Berberis vulgaris</i> L. | Berberidaceae | Kala sumbal | M | S | 25 | 98.3 | 63.6 | 58.1 |
| <i>Bistorta affinis</i> (D. Don) Green. | Polygonaceae | Masloon | M | H | 21.4 | 70 | 47 | 43.3 |
| <i>Chenopodium album</i> L. | Chenopodiaceae | Bathwa | M | H | 22.6 | 71.7 | 18.2 | 35.2 |
| <i>Chenopodium ambrosioides</i> L. | Chenopodiaceae | Drubra | M* | H* | 21.4 | 41.7 | 33.3 | 31 |
| <i>Coriandrum sativum</i> L. | Umbelliferae | Dhaniya | M* | H | 25 | 23.3 | 28.8 | 25.7 |
| <i>Cuminum cyminum</i> L. | Umbelliferae | Kalizeeri | M* | H | 36.9 | 70 | 48.5 | 50 |
| <i>Datura stramonium</i> L. | Solanaceae | Datoora | M | H | 41.7 | 95 | 45.5 | 58.1 |
| <i>Diospyros lotus</i> L. | Ebenaceae | Amllook | M | T | 14.3 | 23.3 | 6.1 | 15.2 |
| <i>Equisetum arvense</i> L. | Pt: Equisetaceae | Ban kaiya | M | F | 8.3 | 8.3 | 4.5 | 7.1 |
| <i>Eriobotrya japonica</i> (Thunb.) Lindl. | Rosaceae | Lokat | M* | T* | 21.4 | 45 | 6.1 | 23.3 |
| <i>Ficus palmata</i> Forssk. | Moraceae | Phagwara | M | T | 31 | 46.7 | 31.8 | 37.6 |
| <i>Foeniculum vulgare</i> Mill. | Umbelliferae | Sounf | M* | H | 14.3 | 90 | 62.1 | 51 |
| <i>Gentianodes kurroo</i> (Royle) Omer | Gentianaceae | Neeli jaree | M | H | 21.4 | 63.3 | 39.4 | 39 |
| <i>Geranium wallichianum</i> D. Don ex Sweet | Geraniaceae | Ratan jog | M | H | 50 | 96.7 | 71.2 | 70 |
| <i>Hyoscyamus niger</i> L. | Solanaceae | Ajwain | M | H | 16.7 | 81.7 | 30.3 | 39.5 |
| <i>Inula racemosa</i> J.D. Hook. | Asteraceae | Poshkara | M | H | 21.4 | 45 | 13.6 | 25.7 |
| <i>Jasminum humile</i> L. | Oleaceae | Jangli chumbali | M | H | 16.7 | 30 | 15.2 | 20 |
| <i>Juglans regia</i> L. | Juglandaceae | Akhrote | M | T | 77.4 | 96.7 | 90.9 | 87.1 |
| <i>Lavatera cachemiriana</i> Camb. | Malvaceae | Dug sonchal | M | H | 15.5 | 63.3 | 33.3 | 34.3 |
| <i>Medicago sativa</i> L. | Papilionaceae | Sinjee | M* | H | 31 | 108.3 | 21.2 | 50 |
| <i>Mentha arvensis</i> L. | Labiatae | Podina | M | H | 53.6 | 135 | 40.9 | 72.9 |
| <i>Mentha longifolia</i> (L.) L. | Labiatae | Jungli podina | M | H | 52.4 | 96.7 | 30.3 | 58.1 |
| <i>Oxalis corniculata</i> L. | Oxalidaceae | Khatli booti | M | H | 19 | 31.7 | 12.1 | 20.5 |
| <i>Pinus wallichiana</i> A.B. Jackson. | Pinaceae | Kail | M | T | 81 | 90 | 98.5 | 89 |
| <i>Plantago major</i> L. | Plantaginaceae | Chamchi patar | M | H | 25 | 90 | 24.2 | 43.3 |
| <i>Podophyllum emodi</i> Wall. ex Royle | Podophyllaceae | Bandakree | M | H | 22.6 | 98.3 | 36.4 | 48.6 |
| <i>Prunus cerasus</i> L. | Rosaceae | Gilas | M* | T* | 19 | 73.3 | 40.9 | 41.4 |

Continue of Table 2.

| Botanical name | Plant family | Local name | Use | Gr. Form | Village | | | MNP |
|--|------------------|------------|-----|----------|---------|-------|-------|------|
| | | | | | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Prunus domestica</i> L. | Rosaceae | aloocha | M* | T* | 28.6 | 70 | 56.1 | 49 |
| <i>Punica granatum</i> L. | Punicaceae | Daroon | M | T | 82.1 | 93.3 | 60.6 | 78.6 |
| <i>Rheum australe</i> D. Don. | Polygonaceae | Chityal | M | H | 60.7 | 86.7 | 51.5 | 65.2 |
| <i>Rosa chinensis</i> Jacq. | Rosaceae | Ghulab | M | S | 52.4 | 81.7 | 43.9 | 58.1 |
| <i>Rumex nepalensis</i> Spreng. | Polygonaceae | Hola | M | H | 63.1 | 65 | 22.7 | 51 |
| <i>Skimmia laureola</i> (DC.) Sieb. & Zucc. ex Walp. | Rutaceae | Neira | M | S | 72.6 | 88.3 | 66.7 | 75.2 |
| <i>Sonchus asper</i> (L.) Hill. | Asteraceae | Gazban | M | H | 54.8 | 73.3 | 48.5 | 58.1 |
| <i>Taraxacum officinale</i> F.H. Wigg. | Asteraceae | Hund | M | H | 36.9 | 51.7 | 37.9 | 41.4 |
| <i>Thymus linearis</i> Benth. | Labiatae | Cheekan | M | H | 40.5 | 78.3 | 47 | 53.3 |
| <i>Urtica dioica</i> L. | Urticaceae | Kayaree | M | H | 32.1 | 60 | 33.3 | 40.5 |
| <i>Verbascum thapsus</i> L. | Scrophulariaceae | Gadhi kan | M | H | 21.4 | 51.7 | 39.4 | 35.7 |
| <i>Viburnum cotinifolium</i> D. Don. | Caprifoliaceae | Guchh | M | S | 20.2 | 20 | 9.1 | 16.7 |
| <i>Viburnum grandiflorum</i> Wall. ex DC. | Caprifoliaceae | Guchh. | M | S | 50 | 85 | 18.2 | 51 |
| <i>Viola biflora</i> L. | Violaceae | Banafsha | M | H | 25 | 70 | 13.6 | 34.3 |
| <i>Zanthoxylum armatum</i> DC. | Rutaceae | Timber | M | S/T | 41.7 | 23.3 | 28.8 | 32.4 |
| <i>Zea mays</i> L. | Poaceae | Mak | M* | G* | 85.7 | 90 | 81.8 | 85.7 |

Plants used for fuelwood

| Botanical name | Plant family | Local name | Use | Gr. Form | Village | | | MNP |
|--|------------------|------------|-----|----------|---------|-------|-------|------|
| | | | | | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Abies pindrow</i> Royle. | Pinaceae | Rewar/fir | Fw | T | 85.7 | 81.7 | 72.7 | 80.5 |
| <i>Acacia</i> sp. | Mimosaceae | Kikar | Fw | T | 21.4 | 26.7 | 43.9 | 30 |
| <i>Aesculus indica</i> (Wall.ex Camb.) Hook.f. | Hippocastanaceae | Ban khor | Fw | T | 10.7 | 45 | 18.2 | 22.9 |
| <i>Ailanthus altissima</i> (Mill.) Swingle. | Simaroubaceae | Darawa | Fw* | T* | 10.7 | 23.3 | 22.7 | 18.1 |
| <i>Berberis lycium</i> Royle | Berberidaceae | Sumbal | Fw | S | 4.8 | 1.7 | 4.5 | 3.8 |
| <i>Cedrus deodara</i> (Roxb. ex D. Don) G. Don. | Pinaceae | Deodar | Fw | T | 77.4 | 85 | 86.4 | 82.4 |
| <i>Diospyros lotus</i> L. | Ebenaceae | Amlok | Fw | T | 6 | 3.3 | 9.1 | 6.2 |
| <i>Ficus palmata</i> Forssk. | Moraceae | Pugwara | Fw | S/T | 10.7 | 11.7 | 7.6 | 10 |
| <i>Indigofera heterantha</i> Wall. ex Brandis | Papilionaceae | Kainthi | Fw | S | 33.3 | 60 | 28.8 | 39.5 |
| <i>Juglans regia</i> L. | Juglandaceae | Akhrot | Fw | T | 39.3 | 31.7 | 45.5 | 39 |
| <i>Malus domestica</i> Borkh. | Rosaceae | Saib | Fw* | T | 8.3 | 15 | 9.1 | 10.5 |
| <i>Melia azedarach</i> L. | Meliaceae | Daraik | Fw | T | 15.5 | 30 | 12.1 | 18.6 |
| <i>Morus alba</i> L. | Moraceae | Shahtoot | Fw* | T* | 9.5 | 8.3 | 13.6 | 10.5 |
| <i>Parrotiopsis jacquemontiana</i> (Dcne.) Rehder. | Hamamelidaceae | Peshor | Fw | S | 14.3 | 13.3 | 12.1 | 13.3 |
| <i>Picea smithiana</i> (Wall.) Boiss. | Pinaceae | Kachhal | Fw | T | 84.5 | 90 | 72.7 | 82.4 |
| <i>Pinus roxburghii</i> Sargent. | Pinaceae | Chir | Fw | T | 85.7 | 51.7 | 90.9 | 77.6 |
| <i>Pinus wallichiana</i> A. B. Jackson. | Pinaceae | Kail/biar | Fw | T | 85.7 | 81.7 | 65.2 | 78.1 |
| <i>Prunus bokhariensis</i> Royle ex C.K. Schneid. | Rosaceae | Alubukhara | Fw* | T | 6 | 15 | 3 | 7.6 |
| <i>Prunus domestica</i> L. | Rosaceae | Alucha | Fw* | T* | 9.5 | 11.7 | 0 | 7.1 |
| <i>Prunus padus</i> L. | Rosaceae | Perth | Fw | T | 6 | 20 | 3 | 9 |
| <i>Prunus persica</i> (L.) Batsch. | Rosaceae | Khubani | Fw* | T* | 22.6 | 13.3 | 10.6 | 16.2 |
| <i>Prunus</i> sp. A | Rosaceae | Aru | Fw | T | 27.4 | 20 | 10.6 | 20 |
| <i>Prunus</i> sp. B | Rosaceae | Hari | Fw | T | 16.7 | 16.7 | 6.1 | 13.3 |
| <i>Pyrus pashia</i> Buchanan-Hamilton ex D.Don. | Rosaceae | Batangi | Fw | T | 13.1 | 20 | 9.1 | 13.8 |
| <i>Quercus incana</i> Roxb. | Fagaceae | Chhur | Fw | T | 9.5 | 75 | 4.5 | 26.7 |
| <i>Salix denticulata</i> Andersson. | Salicaceae | Bheens | Fw | T | 20.2 | 8.3 | 25.8 | 18.6 |
| <i>Taxus wallichiana</i> Zucc. | Taxaceae | Bermi | Fw | T | 15.5 | 20 | 31.8 | 21.9 |

Continue of Table 2.

| Plants used for animal fodder | | | | | Village | | | MNP |
|--|------------------|---------------|-----|----------|---------|-------|-------|------|
| Botanical name | Plant family | Local name | Use | Gr. Form | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Acacia</i> sp. | Mimosaceae | Kikar | Fd | T | 63.1 | 68.3 | 42.4 | 58.1 |
| <i>Aesculus indica</i> (Wall. ex Camb.) Hook.f. | Hippocastanaceae | Bankhor | Fd | T | 76.2 | 65 | 36.4 | 60.5 |
| <i>Agrostis munroana</i> Aitch. & Hemsel. | Poaceae | Brackla ghass | Fd | G | 13.1 | 13.3 | 3 | 10 |
| <i>Agrostis vinealis</i> Schreb. | Poaceae | Beero ghass | Fd | G | 25 | 30 | 6.1 | 20.5 |
| <i>Ailanthus altissima</i> (Mill.) Swingle. | Simaroubaceae | Daraiwa | Fd* | T* | 26.2 | 68.3 | 0 | 30 |
| <i>Amaranthus spinosus</i> L. | Amaranthaceae | Gunhar | Fd | H* | 21.4 | 26.7 | 7.6 | 18.6 |
| <i>Amaranthus viridis</i> L. | Amaranthaceae | Gunhar | Fd | H | 28.6 | 46.7 | 47 | 39.5 |
| <i>Apluda mutica</i> L. | Poaceae | Chit ghass | Fd | G | 14.3 | 0 | 13.6 | 10 |
| <i>Aristida adscensionis</i> L. | Poaceae | Chant | Fd | G | 25 | 40 | 34.8 | 32.4 |
| <i>Aristida funiculata</i> Trin. & Rupr. | Poaceae | Chhanj | Fd | G | 21.4 | 40 | 1.5 | 20.5 |
| <i>Aristida</i> sp. | Poaceae | - | Fd | G | 27.4 | 31.7 | 45.5 | 34.3 |
| <i>Avena fatua</i> L. | Poaceae | Chawal | Fd* | G* | 31 | 40 | 50 | 39.5 |
| <i>Bothriochloa pertusa</i> (L.) A. Camus. | Poaceae | Peelwa | Fd | G | 26.2 | 63.3 | 69.7 | 50.5 |
| <i>Brachiaria eruciformis</i> (J.E. Smith) Griseb. | Poaceae | Bubbar ghass | Fd | G | 22.6 | 51.7 | 86.4 | 51 |
| <i>Brachiaria ramosa</i> (L.) Stapf. | Poaceae | Bagnoo ghass | Fd | G | 52.4 | 31.7 | 83.3 | 56.2 |
| <i>Brassica rapa</i> subsp. <i>campestris</i> (L.) Clapham. | Brassicaceae | Peeli saryan | Fd | H | 32.1 | 51.7 | 24.2 | 35.2 |
| <i>Capsella bursa-pastoris</i> (L.) Medik. | Brassicaceae | - | Fd | H | 34.5 | 60 | 21.2 | 37.6 |
| <i>Cenchrus biflorus</i> L. | Poaceae | Damero ghass | Fd | G | 15.5 | 48.3 | 21.2 | 26.7 |
| <i>Chenopodium album</i> L. | Chenopodiaceae | Bathwa | Fd | H | 10.7 | 26.7 | 10.6 | 15.2 |
| <i>Chrysopogon gryllus</i> subsp. <i>echinulatus</i> (Nees) T. | Poaceae | Beeran | Fd | G | 50 | 60 | 45.5 | 51.4 |
| <i>Chrysopogon aucheri</i> (Boiss.) Stapf. | Poaceae | Chitkanda | Fd | G | 39.3 | 30 | 54.5 | 41.4 |
| <i>Cynodon dactylon</i> (L.) Pers. | Poaceae | Khabal | Fd | G | 14.3 | 38.3 | 28.8 | 25.7 |
| <i>Cyperus rotundus</i> L. | Cyperaceae | Muther | Fd | C | 7.1 | 15 | 30.3 | 16.7 |
| <i>Dichanthium annulatum</i> (Forssk.) Stapf. | Poaceae | Trakana ghass | Fd | G | 21.4 | 8.3 | 59.1 | 29.5 |
| <i>Digitaria pennata</i> Hochst. | Poaceae | Choteli ghass | Fd | G | 42.9 | 11.7 | 57.6 | 38.6 |
| <i>Echinochloa crus-galli</i> (L.) P. Beauv. | Poaceae | Chiroo ghass | Fd | G | 17.9 | 51.7 | 48.5 | 37.1 |
| <i>Eragrostis minor</i> Host. | Poaceae | Charita ghass | Fd | G | 14.3 | 15 | 33.3 | 20.5 |
| <i>Ficus palmata</i> Forssk. | Moraceae | Pugwar | Fd | T | 21.4 | 36.7 | 47 | 33.8 |
| <i>Heteropogon contortus</i> (L.) P. Beauv. ex Roem. & Schult. | Poaceae | Suriala | Fd | G | 10.7 | 63.3 | 24.2 | 30 |
| <i>Indigofera heterantha</i> Wall. ex Brandis. | Papilionaceae | Khainthi | Fd | S | 28.6 | 31.7 | 34.8 | 31.9 |
| <i>Juglans regia</i> L. | Juglandaceae | Akroth | Fd | T | 38.1 | 40 | 42.4 | 44.8 |
| <i>Malus domestica</i> Borkh. | Rosaceae | Saib | Fd* | T | 6 | 26.7 | 25.8 | 18.1 |
| <i>Medicago sativa</i> L. | Papilionaceae | Sinji | Fd* | H | 14.3 | 15 | 12.1 | 13.8 |
| <i>Ochthochloa compressa</i> (Forssk.) Hilu. | Poaceae | Drub ghass | Fd | G | 32.1 | 31.7 | 19.7 | 28.1 |
| <i>Oxalis corniculata</i> L. | Oxalidaceae | Khatra | Fd | H | 0 | 8.3 | 10.6 | 5.7 |
| <i>Persicaria nepalensis</i> (Meisn) H. | Polygonaceae | Masloon | Fd | H | 9.5 | 30 | 12.1 | 16.2 |
| <i>Plantago lanceolata</i> L. | Plantaginaceae | Dand jaree | Fd | H | 0 | 0 | 7.6 | 2.4 |
| <i>Poa alpina</i> L. | Poaceae | Malli ghass | Fd | G | 6 | 61.7 | 39.4 | 32.4 |
| <i>Poa annua</i> L. | Poaceae | Booji ghass | Fd | G | 27.4 | 21.7 | 27.3 | 25.7 |
| <i>Poa pratensis</i> L. | Poaceae | Dagri | Fd | G | 10.7 | 6.7 | 15.2 | 11 |
| <i>Portulaca oleracea</i> L. | Aizoaceae | Kulfa | Fd | H* | 9.5 | 0 | 1.5 | 4.3 |
| <i>Prunus persica</i> (L.) Batsch. | Rosaceae | Alucha | Fd* | T* | 31 | 30 | 27.3 | 29.5 |
| <i>Prunus</i> sp. A | Rosaceae | Alu bukhara | Fd | T | 10.7 | 8.3 | 12.1 | 10.5 |
| <i>Prunus</i> sp. B | Rosaceae | Hari | Fd | T | 6 | 6.7 | 7.6 | 6.7 |
| <i>Salix denticulata</i> Andersson. | Salicaceae | Bheens | Fd | T | 16.7 | 31.7 | 42.4 | 29 |
| <i>Sorghum halepense</i> (L.) Perss. | Poaceae | - | Fd | G | 17.9 | 18.3 | 22.7 | 19.5 |
| <i>Themeda anathera</i> (Nees ex Steud.) Hack. | Poaceae | Baroo ghass | Fd | G | 16.7 | 46.7 | 68.2 | 41.4 |

Continue of Table 2.

| Plants used for animal fodder | | | | | | | | |
|---|--------------------|-------------|-----|----------|---------|-------|-------|------|
| Botanical name | Plant family | Local name | Use | Gr. Form | Village | | | MNP |
| | | | | | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Trifolium alexandrianum</i> L. | Papilionaceae | Shatal | Fd | H | 21.4 | 40 | 34.8 | 31 |
| <i>Trifolium repens</i> L. | Papilionaceae | Shatal | Fd | H | 10.7 | 60 | 10.6 | 24.8 |
| <i>Triticum aestivum</i> L. | Poaceae | Kanak | Fd* | G* | 6 | 48.3 | 12.1 | 20 |
| <i>Zea mays</i> L. | Poaceae | Mak | Fd* | G* | 72.6 | 81.7 | 87.9 | 80 |
| <i>Zizyphus nummularia</i> (Burm.f.) Wight & Arn. | Rhamnaceae | Bair | Fd | S | 16.7 | 15 | 22.7 | 18.1 |
| Plants used as torchwood | | | | | | | | |
| Botanical name | Plant family | Local name | Use | Gr. Form | Village | | | MNP |
| | | | | | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Abies pindrow</i> Royle. | Pinaceae | Rewar/fir | Tw | T | 4.8 | 30 | 4.5 | 11.9 |
| <i>Acacia</i> sp. | Mimosaceae | Kikar | Tw | T | 6 | 6.7 | 10.6 | 7.6 |
| <i>Aesculus indica</i> (Wall. ex Camb.) Hook.f. | Hippocastanaceae | Bankhor | Tw | T | 16.7 | 31.7 | 15.2 | 20.5 |
| <i>Cedrus deodara</i> (Roxb. ex D. Don) G. Don | Pinaceae | Deodar | Tw | T | 16.7 | 71.7 | 22.7 | 34.3 |
| <i>Eucalyptus globulus</i> Labill. | Myrtaceae | Safaيدا | Tw* | T* | 6 | 13.3 | 7.6 | 8.6 |
| <i>Juglans regia</i> L. | Juglandaceae | Akhrot | Tw | T | 2.4 | 10 | 6.1 | 5.7 |
| <i>Picea smithiana</i> (Wall.) Boiss. | Pinaceae | Kachhal | Tw | T | 6 | 65 | 13.6 | 25.2 |
| <i>Pinus roxburghii</i> Sargent. | Pinaceae | Chir | Tw | T | 54.8 | 30 | 34.8 | 41.4 |
| <i>Pinus wallichiana</i> A.B. Jackson. | Pinaceae | Kail/biar | Tw | T | 8.3 | 60 | 31.8 | 30.5 |
| <i>Quercus incana</i> Roxb. | Fagaceae | Reen | Tw | T | 9.5 | 20 | 3 | 10.5 |
| <i>Taxus wallichiana</i> Zucc. | Taxaceae | Barmi | Tw | T | 1.2 | 8.3 | 3 | 3.8 |
| Plants used as vegetables | | | | | | | | |
| Botanical name | Plant family | Local name | Use | Gr. Form | Village | | | MNP |
| | | | | | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Abelmoschus esculentus</i> (L.) Moench. | Malvaceae | Bindi | V* | H | 53.6 | 48.3 | 25.8 | 43.3 |
| <i>Allium cepa</i> L. | Alliaceae | Piaz | V* | H | 73.8 | 26.7 | 22.7 | 44.3 |
| <i>Allium sativum</i> L. | Alliaceae | Thum | V* | H | 69 | 40 | 31.8 | 49 |
| <i>Allium victorialis</i> L. | Alliaceae | Jangli piaz | V | H | 20.2 | 60 | 21.2 | 31.9 |
| <i>Amaranthus viridis</i> L. | Amaranthaceae | Ganyar | V | H | 25 | 70 | 50 | 45.7 |
| <i>Brassica oleracea</i> L. | Brassicaceae | Bund gobi | V* | H* | 60.7 | 30 | 21.2 | 39.5 |
| <i>Brassica rapa</i> subsp. <i>campestris</i> (L.) Clapham. | Brassicaceae | Sarso | V | H | 25 | 43.3 | 42.4 | 35.7 |
| <i>Brassica rapa</i> subsp. <i>rapa</i> L. | Brassicaceae | Shaljam | V* | H | 33.3 | 56.7 | 48.5 | 44.8 |
| <i>Brassica</i> sp. | Brassicaceae | Karam | V* | H | 61.9 | 71.7 | 43.9 | 59 |
| <i>Capsicum annuum</i> L. | Solanaceae | Hari mirch | V* | H* | 26.2 | 48.3 | 54.5 | 41.4 |
| <i>Coriandrum sativum</i> L. | Umbelliferae | Dhania | V* | H | 27.4 | 48.3 | 37.9 | 36.7 |
| <i>Cucumis sativus</i> L. | Cucurbitaceae | Kheera | V* | H | 28.6 | 60 | 74.2 | 51.9 |
| <i>Cucurbita maxima</i> Duch. ex Lam. | Cucurbitaceae | Kadu | V* | H* | 34.5 | 30 | 13.6 | 26.7 |
| <i>Cucurbita</i> sp. | Cucurbitaceae | Tinda | V* | H | 14.3 | 15 | 16.7 | 15.2 |
| <i>Daucus carota</i> L. | Umbelliferae | Gajar | V* | H | 34.5 | 35 | 25.8 | 31.9 |
| <i>Dipsacus inermis</i> Wall. | Dipsacaceae | Pulha | V | H | 4.8 | 78.3 | 16.7 | 29.5 |
| <i>Dryopteris stewartii</i> Fraser-Jenk. | Pt:Dryopteridaceae | Kungi | V | F | 31 | 58.3 | 56.1 | 46.7 |
| <i>Geranium wallichianum</i> D. Don ex Sweet. | Geraniaceae | Ratanjog | V | H | 14.3 | 63.3 | 39.4 | 36.2 |
| <i>Luffa cylindrica</i> (L.) Roem. | Cucurbitaceae | Tori | V* | H | 48.8 | 35 | 43.9 | 43.3 |
| <i>Lycopersicon esculentum</i> Miller. | Solanaceae | Tamatar | V* | H* | 31 | 56.7 | 68.2 | 50 |
| <i>Malva neglecta</i> Wallr. | Malvaceae | Sonchal | V | H | 31 | 31.7 | 12.1 | 25.2 |
| <i>Medicago sativa</i> L. | Papilionaceae | Singi | V* | H | 32.1 | 23.3 | 33.3 | 30 |
| <i>Mentha spicata</i> L. | Labiatae | Podina | V | H | 50 | 40 | 54.5 | 48.6 |
| <i>Morchella esculenata</i> Fr. | F:Morchellaceae | Guchii | V | M | 33.3 | 85 | 39.4 | 50 |
| <i>Phytolacca latbenia</i> (Moq.) Walter. | Phytolaccaceae | Lubar | V | H | 6 | 40 | 7.6 | 16.2 |

Continue of Table 2.

| Plants used as vegetables | | | | | Village | | | MNP |
|-------------------------------------|----------------|---------------|-----|----------|---------|-------|-------|------|
| Botanical name | Plant family | Local name | Use | Gr. Form | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Pisum sativum</i> L. | Papilionaceae | Matar | V* | H* | 10.7 | 20 | 12.1 | 13.8 |
| <i>Plantago major</i> L. | Plantaginaceae | Chamchi patar | V | H | 14.3 | 45 | 45.5 | 32.9 |
| <i>Portulaca oleracea</i> L. | Aizoaceae | Loonsaluni | V | H | 32.1 | 58.3 | 43.9 | 43.3 |
| <i>Raphanus sativus</i> L. | Brassicaceae | Muli | V* | H* | 21.4 | 56.7 | 36.4 | 36.2 |
| <i>Rumex nepalensis</i> Spreng. | Polygonaceae | Hola | V | H | 9.5 | 41.7 | 15.2 | 20.5 |
| <i>Solanum melongena</i> L. | Solanaceae | Baingan | V* | H | 39.3 | 40 | 39.4 | 39.5 |
| <i>Solanum tuberosum</i> L. | Solanaceae | Alu | V* | H* | 58.3 | 46.7 | 69.7 | 58.6 |
| <i>Spinacea oleracea</i> L. | Chenopodiaceae | Palak | V* | H | 28.6 | 30 | 28.8 | 29 |
| <i>Taraxacum officinale</i> Wigg. | Asteraceae | Hund | V | H | 19 | 85 | 21.2 | 38.6 |
| <i>Trifolium repens</i> L. | Papilionaceae | Shatal | V | H | 19 | 71.7 | 43.9 | 41.9 |
| <i>Trigonella foenum-graecum</i> L. | Papilionaceae | Maithi | V* | H | 9.5 | 35 | 24.2 | 21.4 |
| <i>Vigna vexillata</i> (L.)A.Rich. | Papilionaceae | Phalia | V | H | 13.1 | 15 | 18.2 | 15.2 |

| Plants from which fruits are collected | | | | | Village | | | MNP |
|---|----------------|------------|-----|----------|---------|-------|-------|------|
| Botanical name | Plant family | Local name | Use | Gr. Form | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Berberis lycium</i> Royle. | Berberidaceae | Sumbal | F | S | 19 | 70 | 45.5 | 41.9 |
| <i>Diospyros lotus</i> L. | Ebenaceae | Amlok | F* | T* | 16.7 | 63.3 | 63.6 | 44.8 |
| <i>Ficus palmata</i> Forssk. | Moraceae | Pugwara | F | T | 48.8 | 55 | 47 | 50 |
| <i>Fragaria nubicola</i> (Hook.f.) Lindl. ex Lacaita. | Rosaceae | Budi mewa | F | H | 21.4 | 36.7 | 4.5 | 20.5 |
| <i>Juglans regia</i> L. | Juglandaceae | Akhrot | F | T | 72.6 | 65 | 87.9 | 75.2 |
| <i>Malus domestica</i> Borkh. | Rosaceae | Saib | F* | T | 46.4 | 41.7 | 66.7 | 51.4 |
| <i>Morus alba</i> L. | Moraceae | Toot | F* | T* | 31 | 36.7 | 31.8 | 32.9 |
| <i>Prunus bokhariensis</i> Royle ex C.K.Schneid. | Rosaceae | Alubukhara | F* | T | 39.3 | 63.3 | 47 | 48.6 |
| <i>Prunus domestica</i> L. | Rosaceae | Alucha | F | T | 19 | 23.3 | 27.3 | 22.9 |
| <i>Prunus dulcis</i> (Mill.) D.A. Webb . | Rosaceae | Hari | F* | T | 44 | 36.7 | 36.4 | 39.5 |
| <i>Prunus padus</i> L. | Rosaceae | Perth | F | T | 19 | 73.3 | 16.7 | 33.8 |
| <i>Prunus persica</i> (L.) Batsch. | Rosaceae | Aru | F* | T* | 14.3 | 73.3 | 62.1 | 46.2 |
| <i>Prunus</i> sp. A | Rosaceae | Naspati | F* | T | 45.2 | 31.7 | 54.5 | 44.3 |
| <i>Prunus</i> sp. B | Rosaceae | Khubani | F* | T | 64.3 | 53.3 | 18.2 | 46.7 |
| <i>Pyrus pashia</i> Buchanan-Hamilton ex D. Don. | Rosaceae | Batangi | F | T | 32.1 | 25 | 30.3 | 29.5 |
| <i>Solanum nigrum</i> L. | Solanaceae | Kachhmach | F | H | 39.3 | 68.3 | 66.7 | 56.2 |
| <i>Viburnum grandiflorum</i> Wall. ex DC. | Caprifoliaceae | Guch | F | S | 28.6 | 60 | 48.5 | 43.8 |
| <i>Vitis vinifera</i> L. | Vitaceae | Angoor | F* | S | 36.9 | 26.7 | 71.2 | 44.8 |

| Plants used for timberwood | | | | | Village | | | MNP |
|---|------------------|------------|-----|----------|---------|-------|-------|------|
| Botanical name | Plant family | Local name | Use | Gr. Form | Bheri | Mach. | Jhee. | Mean |
| | | | | | % | | | % |
| <i>Abies pindrow</i> Royle. | Pinaceae | Fir | T | T | 75 | 86.7 | 66.7 | 75.7 |
| <i>Acacia</i> sp. | Mimosaceae | Kikar | T | T | 50 | 38.3 | 57.6 | 49 |
| <i>Aesculus indica</i> (Wall. ex Camb.) Hook.f. | Hippocastanaceae | Ban khor | T | T | 81 | 80 | 77.3 | 79.5 |
| <i>Cedrus deodara</i> (Roxb. ex D. Don) G. Don. | Pinaceae | Deodar | T | T | 84.5 | 88.3 | 87.9 | 86.7 |
| <i>Eucalyptus globulus</i> Labill. | Myrtaceae | Safaida | T* | T* | 70.2 | 46.7 | 66.7 | 62.4 |
| <i>Juglans regia</i> L. | Juglandaceae | Akhrot | T | T | 72.6 | 81.7 | 63.6 | 72.4 |
| <i>Picea smithiana</i> (Wall.) Boiss. | Pinaceae | Kachal | T | T | 69 | 85 | 72.7 | 74.8 |
| <i>Pinus roxburghii</i> Sargent. | Pinaceae | Cheer | T | T | 84.5 | 70 | 92.4 | 82.9 |
| <i>Pinus wallichiana</i> A.B. Jackson. | Pinaceae | Kail | T | T | 76.2 | 78.3 | 87.9 | 80.5 |
| <i>Quercus incana</i> Roxb. | Fagaceae | Choor | T | T | 45.2 | 70 | 80.3 | 63.3 |

species at Machiara were *Medicago sativa*, *Berberis vulgaris*, *Podophyllum emodi*, *Juglans regia*, *Mentha longifolia*, *Geranium wallichianum*, *Berberis lycium*, *Datura stramonium*, *Punica granatum*, *Zea mays*, *Pinus wallichiana*, *Plantago major*, *Foeniculum vulgare*, *Skimmia laureola*, *Aconitum chasmanthum*, *Rheum australe*, *Atropa acuminata*, *Viburnum grandiflorum* and *Rosa chinensis*. Fuelwood species reported by more than 40 respondents included *Cedrus deodara*, *Abies pindrow*, *Pinus wallichiana*, *Quercus incana*, *Indigofera heterantha*, *Pinus roxburghii*, *Aesculus indica* and *Juglans regia*. Frequently reported fodder species were *Acacia* sp., *Ailanthus altissima*, *Aesculus indica*, *Bothriochloa pertusa* and *Heteropogon contortus*, while common fruit and vegetable species were *Morchella esculenata* (mushroom), *Taraxacum officinale*, *Dipsacus inermis*, *Prunus padus*, *Prunus persica*, *Brassica* sp., *Trifolium repense*, *Amaranthus viridis*, *Berberis lycium*, *Solanum nigrum*, *Prunus bokhariensis*, *Diospyros lotus*, *Geranium wallichianum*, *Viburnum grandiflorum*, *Cucumis sativus*, *Allium victorialis*, *Portulaca oleracea* and *Dryopteris stewartii*.

Important medicinal plant species recorded for the village Jheeng included *Pinus wallichiana*, *Juglans regia*, *Amaranthus viridis*, *Zea mays*, *Geranium wallichianum*, *Atropa acuminata*, *Skimmia laureola*, *Berberis lycium*, *Berberis vulgaris*, *Foeniculum vulgare* and *Punica granatum*, while frequently reported fuel wood species were *Pinus roxburghii*, *Cedrus deodara*, *Abies pindrow*, *Pinus wallichiana*, *Juglans regia*, *Acacia* sp. and *Taxus wallichiana*. Important fodder species were *Brachiaria eruciformis*, *Brachiaria ramosa*, *Bothriochloa pertusa*, *Themeda anathera*, *Dichanthium annulatum*, *Digitaria pinnata* and *Chrysopogon aucheri*, and commonly used fruit and vegetable species included *Cucumis sativus*, *Vitis vinifera*, *Solanum tuberosum*, *Solanum melongena*, *Solanum nigrum*, *Prunus domestica*, *Diospyros lotus*, *Prunus persica*, *Dryopteris stewartii* and *Capsicum annum*.

Discussion

Seven types of available resources in MNP were identified according to their uses. Several of these resources, i.e. timber, fuelwood and medicinal plants, were apparently characterized by a declining status; this was evident from the information given by the respondents, where 193 perceived a worsening condition of the forest as opposed to only 17 who indicated an improving condition. Resources collected such as fuelwood, medicinal plants, leaf litter, timber, and fodder did not differ substantially between the three villages of Bheri, Machiara and Jheeng²⁷.

About 50% of the local inhabitants raised various livestock for subsistence and a substantial part of the fodder requirements was extracted from the MNP area. During summer, livestock were often kept inside the park while fodder grasses were cut to be stored for winter to feed the livestock¹¹. Problems of overgrazing have been noted in some parts of MNP. This may be partly aggravated by additional grazing herds of nomads from other parts of Azad Kashmir. The people in and around MNP use fuelwood extracted from the area for cooking and heating purposes during winter. Since alternative resources are largely unavailable the inhabitants continue to be dependent on forest fuelwood, timber, and medicinal plants. They often have no other options than pursue practices which may be partly illegal within MNP. Such problems and constraints have also been observed by Shova

and Hubacek²⁸ in Bardia National Park of Nepal.

The local people's perceptions about MNP are multifaceted and often somewhat contradictory. When the respondents were interviewed in the presence of the MNP Management Authority, they were mostly affirmative in regards to official MNP activities but when asked the same questions in the absence of the management staff, the answers were often different and partly opposing to MNP initiatives. Such patterns of behavior were also observed in Bardia National Park by Allendorf *et al.*²⁹. Villagers in principle seem to appreciate the MNP management for protecting the natural resources of the area for future generations; in practice, however, they often disapprove of any new rules and regulations, and react with resentment when being caught illegally extracting resources. Furthermore, corruption within the MNP Management and the Forest Department creates anger and frustration among many members of the local communities.

Conclusions

This study showed that communities in and around MNP considerably depend for their livelihoods on various types of plant resources extracted from the MNP area. Fuelwood, timber and medicinal plant species are the main forest resources exploited along with fruits, vegetables, torchwood and fodder (including leaf litter). A number of community projects are ongoing in and around MNP with the assistance of NGOs but the direct benefits to poor people are as yet limited. In the absence of any alternatives in terms of job opportunities and resources local inhabitants will continue to rely on the currently available plant resources, and these uses may partly be in conflict with legal restrictions imposed by the MNP authorities. In several ways political influence and corruption are equally responsible for a considerable level of resource degradation. Unless such concerns are properly addressed and alternatives are made available, it would be difficult to achieve the goals set by the establishment of the new national park.

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