ETHNOMEDICINAL KNOWLEDGE OF TAMANG COMMUNITIES IN RASUWA DISTRICT, NEPAL

A Dissertation Submitted

For the Partial Fulfillment of the Requirements for the

Master of Science in Botany

Submitted By

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CERTIFICATE

This is to certify that the dissertation work entitled **"ASSESSMENT OF THREATENED MEDICINAL PLANTS IN LANGTANG NATIONAL PARK, CENTRAL NEPAL"** submitted by **Mr. Nawal Shrestha** has been carried out under my supervision. The entire work is based on the results of his research work and has not been submitted for any other degrees to the best of my knowledge. I recommend this dissertation work to be accepted for partial fulfillments of Master of Science in Botany, Tribhuvan University, Kirtipur, Kathmandu.

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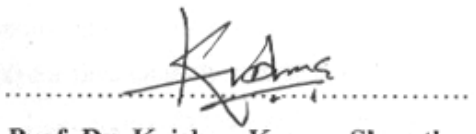
LETTER OF APPROVAL

The dissertation work submitted by **Mr. Nawal Shrestha** entitled **"ASSESSMENT OF THREATENED MEDICINAL PLANTS IN LANGTANG NATIONAL PARK, CENTRAL NEPAL"** has been accepted as a partial fulfillment of Master of Science in Botany.

Expert Committee



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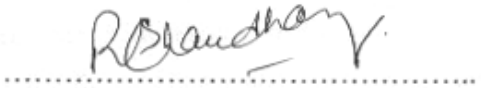

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July 27, 2007 **Deepshikha Prasai**

List of acronyms

CAMP	Conservation Assessment and Management Planning
CBS	Central Bureau of Statistics
CITES	Convention on International Trade in Endangered Species of wild flora and fauna
DDC	District Development Committee
DFO	District Forest Office
DNPWC	Department of National Parks and Wildlife Conservation
DPR	Department of Plant Resources
ESON	Ethnobotanical Society of Nepal
HNCC	Herbs and NTFP Co-ordination Committee
IUCN	The World Conservation Union
KATH	National Herbarium and Plant Laboratories, Godavari
LNP	Langtang National Park
MAP	Medicinal and Aromatic Plants
TRPAP	Tourism for Rural Poverty Alleviation Program
TU	Tribhuvan University
TUCH	Tribhuvan University Central Herbarium
VDC	Village Development Committee
WWF	World Wide Fund for nature

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ABSTRACT

Langtang National Park (LNP) is the second nearest park from Kathmandu situated directly to the north of it and lying in the central Himalayan region. LNP encompasses three districts: Rasuwa, Nuwakot and Sindhupalchowk in Central Nepal. Rasuwa covers almost 56 % of the total area of the park. The park offers a rich cultural diversity. The main ethnic group in the LNP is Tamangs. They are thought to have originated from Tibet and they occupy the entire portion of Rasuwa district. Tamangs constitute about 65 percent of the total population of Rasuwa. Flora of LNP represents many species, which are highly valuable to local people for medicine, food, fodder, timber, fuel, condiment, dye, etc. The present study was undertaken in three VDCs of Rasuwa district within LNP to document ethno-botanical information of ethnic Tamang communities. The study was accompanied by three field visits which were made between Jun 2005 and Sep 2006. Semi-structured questionnaires were used to collect traditional ethnomedicinal information. Preference analysis was carried out to assess the most preferred species of medicinal plants in the area.

Rich traditional knowledge of the Tamang community on utilization of plant resources has unraveled medicinal value of many useful plants. The present study has documented 46 species of highly utilized medicinal plants from the area that are used for the treatment of 24 different ailments. The most commonly used part is the root. Root of about 47 % of the plants is used in local therapeutics. Similarly, leaves and stem constitute about 13 % of the total utilized plants, followed by fruit and bark (8 %), whole plant (6 %), flower (3 %) and seed (2 %).

Cultivation of medicinal plants is in preliminary phase and is limited to few households and few medicinal herbs only. Out of 120 households in Thulo syaphru village, only 6 households have cultivated medicinal herbs in their farm lands. The species that are in cultivation includes *Swertia chirayita*, *Rheum australe*, *Paris polyphylla* and *Valeriana jatamansii*. About 10 % of the people in Thulo Syabru village depend upon cultivated products and the remaining 90 % utilizes forest resources. Higher dependency of the local community on wild resources and less availability of these resources in nature has put them under high threat risk. Promotion of cultivation practices and sustainable utilization of the resources seems to be the most viable option for their effective management.

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1. INTRODUCTION

1.1 Background

Nepal is an excellent repository of cultural heritage for diverse ethnic groups and it has a rich tradition of folk practices for utilization of wild plants (Manandhar, 1993a). There exists more then 102 caste groups, and more than 92 different languages are spoken within the country (CBS, 2005). Rural people have used plants, particularly wild species for fulfilling their subsistence needs (Bhattarai, 1992a) and treating disease since time immemorial. The country consists of a wide range of traditional medicinal knowledge due to its cultural and ethnic diversity. About 70-80% rural population depends on traditional medicine for health care (Manandhar, 1980a).

More than 60 ethnic groups residing in different geographical belts depend on agriculture, but annual product is not enough to meet the requirements (Manandhar, 1998). To make up the deficit these populations use wild plants. In addition, approximately two thirds of the population of the country lives below subsistence level, their purchasing capacity being very low. These people depend on local plant-based therapy for health care, which is cheap and easily available.

Medicinal and aromatic plants have been in use, perhaps since the beginning of civilization. In Nepal, there is a very strong tradition in the use of medicinal and aromatic plants, both as part of the Ayurvedic system and the widespread home remedies (Bashyal *et al.*, 1994). More than 80 percent of the total population of the country are said to practice the traditional herbal medicinal for the primary healthcare (Rajbhandari and Bajracharya, 1994), which is not only a case of preference but also of situation of having no access to modern medicine. A large number of species have medicinal value and are used under different traditional systems including Ayurvedic, Homeopathic and Tibetan (Shrestha *et al.*, 2000). Besides, a large number of species are in use in remote areas as folklore medicines.

Estimates for the number of medicinal plant species in Nepal, range from 593 to 1,792 species. The greatest number of species is found in central Nepal and, in particular, in the sub-tropical zone. There are diminishing numbers towards the east and west. Over 1,624 species of medicinal and aromatic plants (MAPs) including 1,515 species of angiosperm, 18 species of gymnosperms, 58 species of pteridophytes, 6 species of bryophytes, 18 species of lichens and 9 species of fungi has been compiled (Shrestha *et al.*, 2000). A recent figure of 1,792 species of medicinal plants is provided by Baral and Kurmi (2006). These facts justify the biological and cultural diversity of the country.

Medicinal plants are of great importance in the Himalaya, supporting people's healthcare, income and cultures. Majority of the herbal medicines used in Ayurvedic system come from the Himalayan region. The great majority of people in the Himalaya rely primarily on herbal medicine as compared with western medicine (Ghimire *et al.*, 2005) and they depend on the harvesting of wild medicinal plants for an income. There is generally very little cultivation. An estimated 323,000-470,000 households (2.6 million people) are engaged in the collection of wild medicinal plants for sale in Nepal (Larsen *et al.*, 2000). High collection pressure on these wild resources, without any substantial measures to regenerate them, has imposed serious threat to the medicinal plants. Fifty one medicinal plants have already entered into different threat categories such as rare, endangered, vulnerable and commercially threatened (Bhattarai *et al.*, 2002). Many others are under threat, especially through habitat loss (including deforestation) and commercial over-harvesting. Over-harvesting of resources in many cases has made them rare in the wild, in some cases threatening or even endangering their status.

Langtang National park (LNP) is the nearest park from Kathmandu situated directly to the north of it and lying in the central Himalaya region. It was established in 1976 to conserve the unique flora and fauna of the region. Flora of LNP represents many species, which are highly valuable to local people for medicine, food, fodder, timber, fuel, condiment, dye, etc. Traditionally, people of the park have considered forest as a source of life and a symbol of creation. The major portion of the park lies in Rasuwa district covering almost 56 % of the park. Tamangs are the dominant ethnic group in LNP as well as Rasuwa. They have rich traditional knowledge on local utilization of plant resources for food supplement, fodder, fuel, timber and medicines. The present study was undertaken in few VDCs of Rasuwa district within Langtang National Park to document ethno-botanical information of ethnic Tamang communities. The purpose of the study was to document indigenous knowledge of the people of Langtang National park, particularly Tamangs, about the uses of plants for folk medicine.

1.2 Justification of the study

The resource base of LNP is very rich in terms of biodiversity. The area harbors a number of high valued medicinal plants that are widely utilized by the local communities. There have been various records of medicinal plants from the area. The most significant were those of Manandhar (1980b), Joshi and Edington (1990), Yonzon (1993), Shrestha

and Shrestha (2000), Dangol (2002) and Shrestha *et al.* (2002). The works were basically focused on documenting ethnbotanical information particularly medicinal plants that are widely used in local therapeutics in the area. However, no works have been done targeting ethnic group of the area. Tamangs are the dominant ethnic group inhabiting the area. They occupy almost 65% of the total population of the park. The ethnobotanical knowledge possessed by Tamang community can add a lot to medicinal plant resources of the country. New information on utilization of plant resources may open up new vistas in traditional healthcare systems. The present study, as such, attempts to document indigenous knowledge of Tamang community of LNP on utilization of wild medicinal plant resources. Emphasis has been given to document information on ethnomedicinal practices of Tamang communities in the area, particularly Rasuwa district.

1.3 Objectives

The present study was conducted to fulfill the following objectives through scientific documentation of the indigenous knowledge of Tamang community in Langtang National Park.

- To explore and enumerate wild plant resources used by indigenous Tamang people for folk medicine.
- To assess the dependency of local community upon wild medicinal resources and their cultivation practices.
- To identify the most preferred species of medicinal plants in Tamang's livelihood and assess their status and distribution in the area.

1.4 Limitations of the study

The study intends to explore ethnomedicinal knowledge possessed by the ethnic Tamang community in Langtang National Park, Rasuwa district. However due to time constraints, entire area of the park could not be surveyed. The study has been limited to few major places of Tamang settlements within the park. Due to adverse weather condition, intensive field survey could not be made. As such, specimens of most of the species could not be collected. The information was documented based entirely on local people's knowledge. The study was made during two seasons of the year (Jun 2006 and Sep 2006) and in a very short field visits (3 visits of 15 days each). Hence, the study cannot claim to have presented a complete documentation of ethnomedicinal knowledge of the people of LNP. Furthermore, as the study was limited to few places within the park, the study cannot be generalized for the entire area of the park.

2. LITERATURE REVIEW

2.1 Status of ethnobotany in Nepal

Human beings are known to use plants in different ways since the dawn of human civilization. In the early days, most of the ethnobotanical work was inventorying indigenous knowledge of plant used in the traditional societies and consisted mainly of the compilation of list. (Alcorn, 1995; Martin, 1995; Aumeeruddy, 1998).

This has broadened the scope of ethnobotany from traditional qualitative focus of compilation to a more quantitative approach, which has higher recognition with biological science. Ethnobotanical studies which started in the mid-1950s, but only from the last few decades its importance has been recognized in Nepal.

It is nearly a two-century old history since the recorded botanical exploration and the study started by foreign scientists in Nepal. It was also the start of the ethnobotanical exploration in Nepal. It was Francis Buchanan, a Scotish medical man, who first collected plant specimens in Nepal in 1802-03, and that was followed by Nathanial Wallich in 1820-21, who collected plant samples in and around Kathmandu valley (Rajbhandari, 1976). Their collections of plants with ethnobotanical notes are recorded by Don (1825) and Wallich (1824-1826). The study of the ethnobotany was also accompanied by Banerjee's publication on medicinal and food plants of east Nepal (Banerjee, 1955). Since then, many Nepalese as well as foreign researchers contributed to the field of ethnobotany in Nepal concentrating on medicinal plants used by different ethnic groups. The herbal encyclopaedia "Bir Nighantu" compiled by Pandit Ghana Nath Devkota is considered as an earliest and excellent icon of Nepalese Medicinal plants as well as reference book of Ayurvedic science. Similarly the work of Pandey (1964), Devkota (1968), Malla and Shakya (1968), Singh (1968) are some of the earlier works on ethnobotany of Nepal. Thereafter, from the year 1975, numerous works were conducted in ethnobotany focusing basically on medicinal plants (Anonymous, 1971; Regmi, 1972; Debellmar *et al.*, 1973; Rajbhandari, 1974; Toba, 1975; Dobremez, 1976; Bajracharya, 1979; Singh *et al.*, 1979; Sharma, 1979; Lecup, 1980; Manandhar, 1980b).

2.2 Medicinal and aromatic plants of Nepal

Medicinal and aromatic plants have been in use, perhaps since the beginning of civilization. In Nepal, there is very strong tradition in the use of medicinal and aromatic

plants, both as part of the Ayurvedic system and the wide spread home remedies. Various works has been carried out in Nepal which have documented a large number of plants having medicinal properties. The earliest publication was that of Banerjee (1955) who studied edible and medicinal plants from East Nepal. There are several pre-historical manuscripts on utilization of plant resources available from seventh century, that are published in different scripts. A hand written herbal encyclopaedia "Chandra Nighantu" was published in 8 volumes at the end of 19th century (Kanai, 1971). The book contains 750 coloured plates of plants and their medicinal uses.

The book "Medicinal Plants of Nepal" was published by the Department of Medicinal Plants, in 1970 which provides comprehensive information on 393 species of medicinal plants, their therapeutic uses, distribution, etc. (HMG Nepal, 1970). It was supplemented by another volume in 1984 with additional 178 species of plants (HMG Nepal, 1984).

Malla and Shakya (1984) have listed 630 species of plants from Nepal that have potential medicinal uses.

A medicinal plant database, MAPDON was prepared by Ethnobotanical society of Nepal (ESON) in 2000. The database has listed 1,624 medicinal and aromatic plants of Nepal, which are commonly available in crude drug market, under cultivation and in wild from (Shrestha *et al.*, 2000).

Further works have documented many other new species of medicinal plants from the country. A recent figure of 1,792 species of medicinal plants has been provided by Baral and Kurmi (2006) in their "A Compendium of Medicinal Plants in Nepal".

2.3 Ethno-medicinal knowledge of ethnic groups in Nepal

After 1980, extensive ethnobotanical work was conducted in different parts of the country focusing mainly on specific ethnic groups, such as Chepang, Danuwar, Gurung, Hayu, Limbu, Mooshar, Raute, Sherpa, Tamang, etc (Toba, 1975; Sacherer, 1979; Coburn, 1984; Manandhar, 1985, 1986b, 1989a, 1989b; Shrestha 1988a, 1988b; Chhetry, 1996; Siwakoti *et al.*, 1997; Tamang, 1998; Nepal, 1999; Upadhaya, 1999; Dangol and Gurung, 1999; Poudel, 2000; Dangol, 2002; Ghimire *et al.*, 1999a, 1999b, 2000).

The major contribution was that by N.P. Manandhar. His contribution covers different ethnic groups of the country such as Chepang, Danuwar, Mooshar, Raute, Tharu

etc. His studies were carried out in Nepalgunj, Rasuwa, Nuwakot, Dang–Deokhuri, Jumla, Dhanusha, Manang, Lamjung, Gorkha, Makwanpur, Chitwan, Sindhuli, Kabhrepalanchowk, Dhading, Surkhet, Baglung, Kaski, Jajarkot, Myagdi, Dadeldhura, etc. Manandhar (1974, 1980b, 1982, 1985, 1986a, 1986b, 1987a, 1987b, 1989a, 1989b, 1989c, 1990, 1991, 1992, 1993a, 1993b, 1994, 1995a, 1995b, 1998). These works have identified several species of medicinal plants used by local communities for their primary healthcare including their dose and modes of preparation.

2.4 Studies in Rasuwa and adjoining areas

Ethnobotanical exploration has been conducted in Nuwakot district by Manandhar (1982). He identified total eighty five species of wild plants for their different local uses.

Manandhar (1989c) studied the folklore medicine of Chitwan district. Altogether 74 different plants used for the treatment of 24 aliments were reported in this paper.

Medicinal plants lore of Tamang tribe of Kabhrepalanchowk district was studied by Manandhar (1991). As many as 95 plant species, both wild and cultivated have been found to be of common use for the treatment of various ailments.

Manandhar (1992) studied the folklore medicine of Dhading district. He reported 139 species of plants with their medicinal value that are used in local therapeutics in the area.

Ethnobotanical notes on folklore remedies of Baglung district has been studied by Manandhar (1993b). The study revealed 107 species of plants that are used to cure 27 types of disease with their medicinal uses, parts used and doses.

From the ethnobotanical survey of herbal drugs of Kaski district, Manandhar (1994) documented 80 species of herbal drugs of ethnomedicinal uses.

Bhattarai (1988) studied the home herbal remedies of the urban population of Kathmandu valley. Sixty plant species utilized for the treatment of common ailments have been reported.

Shrestha (1988a and 1988b) documented ethnobotanical information on 100 wild plants used by Tamangs of Kathmandu valley for various purposes such as medicine, food, fodder, firewood, timber, fibre and miscellaneous uses.

Bhattarai (1989c) studied the traditional physiotherapy among the Sherpas of Helambu, 67 widely accepted prescriptions involving 49 plant species were presented along with details on uses.

Joshi and Edington (1990) studied the use of medicinal plants by two village communities in the central development region of Nepal. Information on medicinal plant collected from Chaubas in the Shivapuri Watershed and Wildlife reserve area and Syabru in the LNP is recapitulated in this paper. A total of 66 species is enlisted along with details on its utilization.

Amatya (1996) studied the ethnomedicinal use of plants of Bara district. It deals with important medicinal plants which are abundantly available and used by local people.

Joshi and Joshi (2000) studied the indigenous knowledge and uses of medicinal plants by local communities of Kali Gandaki watershed area and documented 48 species of medicinal plants.

Shrestha and Shrestha (2000) reported 82 species of ethno-medicinal plants of Langtang National Park, which have been used to cure 32 types of diseases.

Shrestha *et al.* (2002) documented and mapped medicinal plants of Langtang National Park. They found some 95 species of medicinal plants belonging to 52 families in the region which were widely used by the local Tamang communities for treating up to 40 different types of diseases.

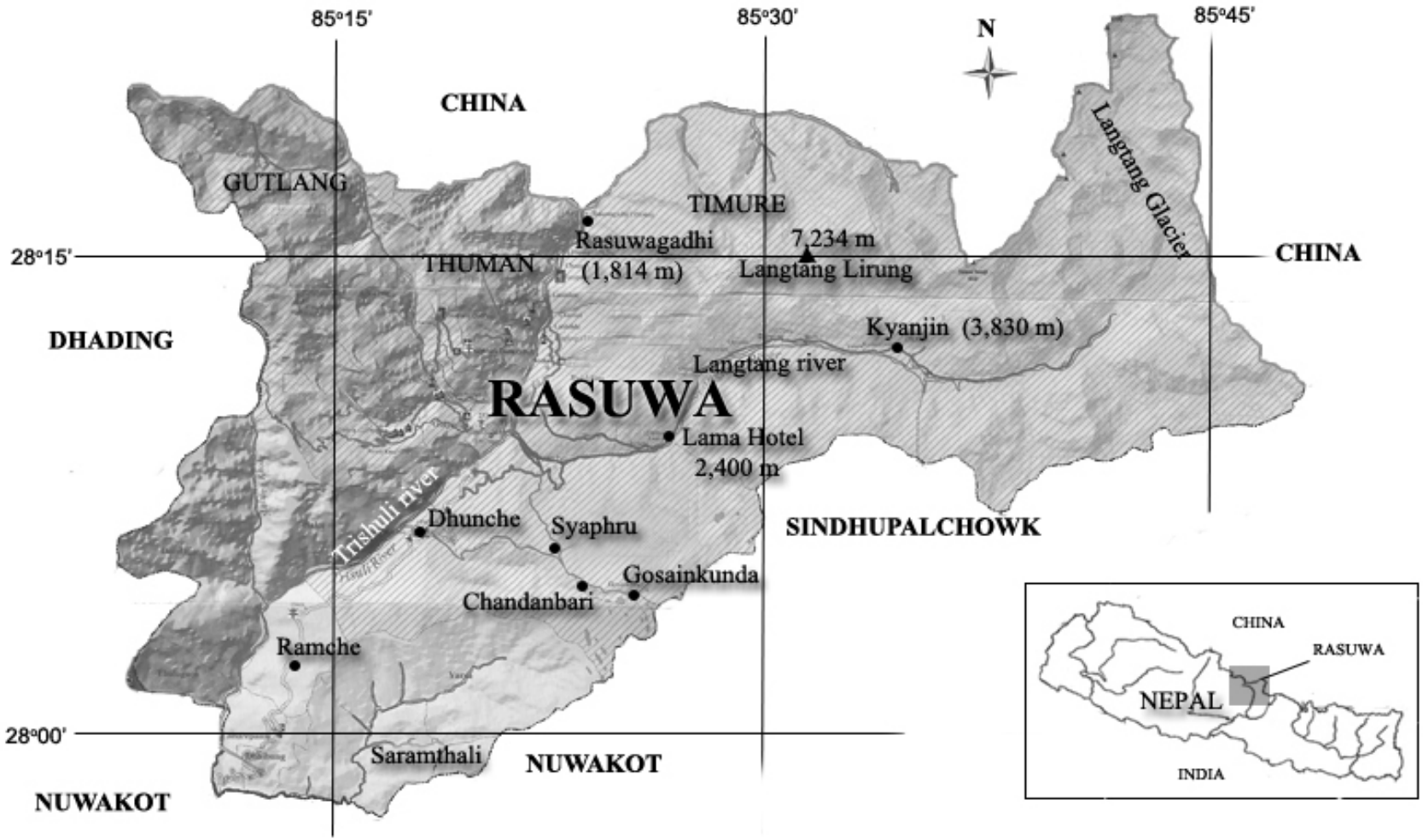
Dangol (2002) assessed the forest community diversity and associated medicinal plants in Langtang National Park and reported a total of 85 species of medicinal plants in the 8 vegetation communities.

3. STUDY AREA

Langtang National Park was established in 1976 to conserve the unique flora and fauna of the region. It has an area of 1710 sq. km. and extends over parts of Nuwakot, Rasuwa and Sindhupalchowk district in the southern mountainous terrain of Nepal-China (Tibet) border. In 1998, an area of 420 sq. km in and around the park was declared buffer zone. The Langtang National Park is the second nearest park from Kathmandu situated directly to the north of Kathmandu in the central Himalayan region. The park represents a meeting point between Indo-Himalayan and Palearctic realms and holds a rich biodiversity. The elevation ranges from 792 m on the Bhote Koshi to the peak of Langtang Lirung at 7,245 m (Chaudhary, 1998; Shrestha *et al.,* 2002). The present study was undertaken in 3 major VDCs of Rasuwa district: Dhunche, Syaphru and Langtang VDCs. The areas surveyed under Syaphru VDC were Thulo Syaphru, Singompa, Cholangpati, Laurivinayak and Gosainkunda. Similarly, under Langtang VDC, Lamahotel, Ghodatabela, Langtang village and Kyanjin were surveyed (Map 1).

3.1 Vegetation

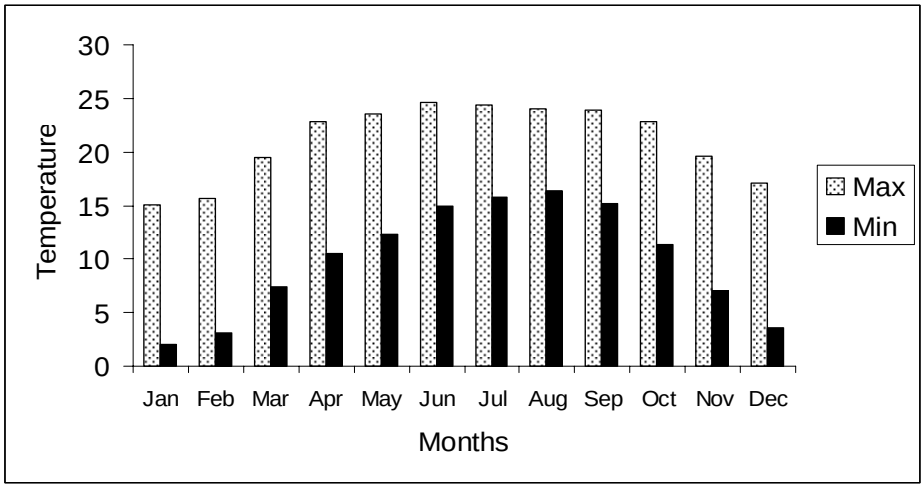
LNP represents some of the best examples of graded climatic conditions in the Central Himalaya. Elevational gradients (ranging from mid-hills to alpine) coupled with complex topography and geology have produced a rich biodiversity unique patchwork of vegetation. Montane tropical forest (below 1,000 m) characterized by Sal (*Shorea robusta*) in the southern section of the park is gradually taken over by *Schima wallichii* and *Castanopsis indica* forest in the subtropical zone (1,000-2,000 m). Hill forest (2,000-2,600 m) consists of Himalayan Blue Pine (*Pinus wallichiana*), *Rhododendron arboreum* and Nepalese Alder (*Alnus nepalensis*). The temperate zone (2,600-3,000 m) is covered mainly by Oak (*Quercus semicarpifolia*) forest fading to old forest of Silver fir (*Abies spectabilis*), Hemlock (*Tsuga dumosa*) and Larch (*Larix himalaica*) in the lower sub-alpine zone (3,000-3,600 m). The upper sub-alpine zone (3,600-4,000 m) is characterized by Birch (*Betula utilis*) forest associated with species of Rhododendron such as *R. arboreum*, *R. barbatum*, *R. campanulatum* and *R. lepidotum.* Tree species such as *Betula utilis, Abies spectabilis*, *Sorbus macrophylla* are found near the tree line. Juniper (*Juniperus indica*) and Rhododendron shrubs (*R. anthopogon*) slowly dissolve into the expansive alpine grassland meadows at 4,000 m. The upper alpine zone between 4,500-5,500 m consists of diverse species composition like *Androsace tapete, Gentiana depressa, Pedicularis longiflora* and *Anemone demissa*. (Chaudhary, 1998).



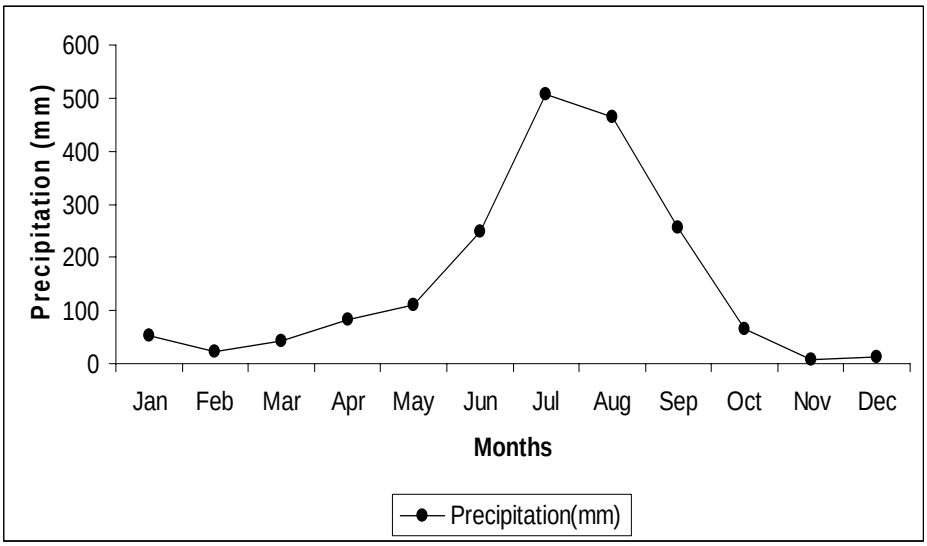
Map 1: Location map of study area

3.2 Climate

Climate varies from place to place depending upon the land structure and altitude of the area. Most of the upper part of park is covered with snow from September through May. The weather is dry except in January and February. The place receives heavy monsoon rain from June to August that is carried by the wind blowing from the south west. In winter, the area receives mild showers. Records of Department of Hydrology and Meteorology for the last 5 years (2001-2005) shows an average minimum temperature of 2.07°C in January and an average maximum temperature of 24.6°C in June (Fig. 1a). The maximum precipitation recorded during the five year period was 635 mm in July 2003 (Fig. 1b). The average total precipitation of the five years was 894 mm per annum.



a) Mean monthly maximum and minimum temperature



b) Mean monthly precipitation

Fig. 1: Climatic data of Rasuwa (2001-2005). Station: Dhunche, Rasuwa

Source: Department of Hydrology and Meteorology, Kathmandu (2007)

3.3 Fauna

Langtang's expansive high meadows provide summer habitat for numerous ungulate species, such as Musk Deer (*Moschus chrysogaster*), Wild Boar (*Sus scrofa*) and Himalayan Thar (*Hemitragus jemlahicus*). The park is also well known for population of Red Panda (*Ailurus fulgens*), Himalayan Black Bear (*Selenarctos thibetanus*), Snow Leopard (*Panthera uncia*), Wild dog (*Cuon alpinus*), Ghoral (*Naemorhedus goral*) and Serow (*Capricornis sumatrensis*). Small animals include Royle's Pika (*Ochotona roylei*), orange-bellied Himalayan squirrel (*Dremomys lokriah*) and Indian porcupine (*Hystrix indica*). The park is rich in avifauna. More than 250 species of birds are found inside the park (DNPWC). Some of them are Dark-rumped Rosefinch (*Carpodacus edwardsii*), Satyr Tragopan (*Tragopan satyra*), Ibisbill (*Ibidorhyncha struthersii*), Bay woodpecker (*Blythipicus pyrrhotis*), Crimson-browed finch (*Propyrrhula subhimachala*) and Spot-winged grosbeak (*Mycerobas melanozanthos*) (Chaudhary, 1998).

3.4 People and culture

The park also offers a rich cultural diversity. The main ethnic group in the Langtang National Park is Tamangs. They are thought to have originated from Tibet. They occupy the entire portion of Rasuwa district. Tamangs constitute about 65 percent of the total population of the district (Fig. 2). The Tamangs are traditional farmers and cattle herders of the region. Their farm lands and villages stretch south and west of the Bhote Koshi and Trishuli. The people of the Langtang village are Bhotias with recent Tibetan origin; many have intermingled with local Tamangs. Generally, they inhabit the higher elevational range. The Yolmo people of the Helambu region are often referred to as "Sherpa". They are rather more akin to Langtang Bhotias and may also have migrated from the Kyirung area of Tibet. Their religion and monasteries are rich in Buddhist culture. In addition to Brahmins, Tamangs, Newar and Gurung inhabit the lower elevational range along the edges of the park, in the buffer zone.

Of the 18 VDCs of Rasuwa district, 7 VDCs (Ramche, Yarsa, Dhunche, Syaphru, Bridim, Timure and Langtang) are within the park area. The major settlements of Tamang are in Bhorle, Saramthali and Haku VDC outside the park. Similarly, inside the park, the major settlements are in Yarsa, Syaphru, Dhunche and Langtang VDC.

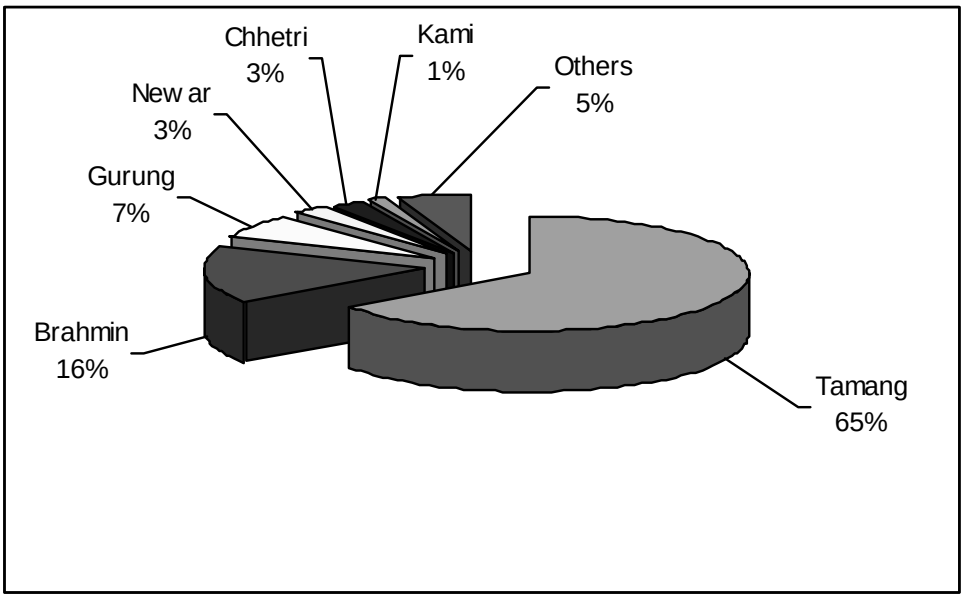


Fig. 2: Caste groups of Rasuwa *(Source: DDC, Rasuwa, 2006)*

3.5 Occupations

Agriculture is the major occupation of the people of Rasuwa. About 84 percent of the people are engaged in agriculture. The other sector includes hotels, restaurants, transportation, communication, etc. which has provided employment to about 11 percent of the people. Likewise, about 5 percent of the people of Rasuwa are engaged in occupations related to mining, production industries, electricity, and water and gas production (Fig. 3).

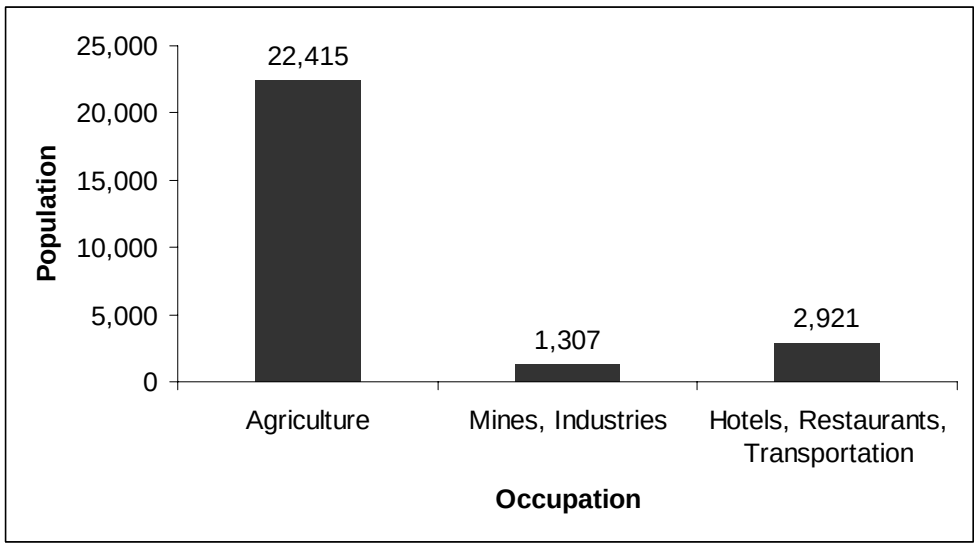


Fig. 3: Major occupations of the people of Rasuwa (*Source: DDC, Rasuwa, 2006*)

3.6 Languages

Different communities exist in Rasuwa district. Tamangs are one of the largest ethnic groups in the area and a large portion of the district is occupied by Tamang community. About 63 % of the population speaks Tamang as their first language. The people of Thulo Syabru, Singompa, Cholangpati, Laurivinayak, Gosainkunda, Ghodatabela, Langtang village and Kyanjin are mostly Tamangs and they communicate in their native language (Tamang). Other castes like Brahmin and Chhetri that reside in the lower elevation, speak Nepali language and this constitute about 32 % of the total population. Other languages like Newar, Tibetan and Gurung are spoken by a very small number of populations (Fig. 4).

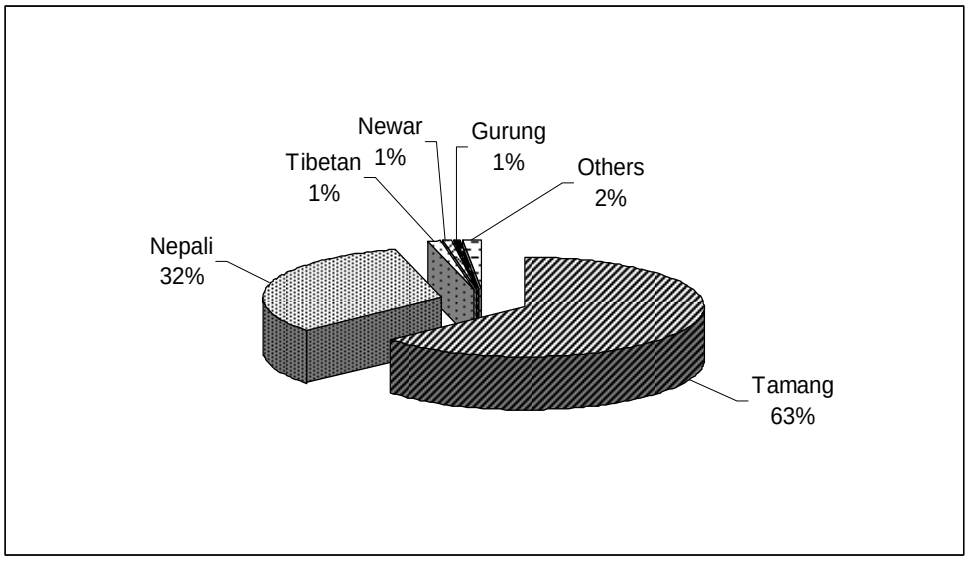


Fig. 4: Percentage of languages spoken in Rasuwa *(Source: DDC, Rasuwa, 2006)*

3.7 Literacy status

The literacy status of Rasuwa is very low. Only 40 % of the population is literate and the remaining 60 % are illiterate (Fig. 5). Of the illiterate population, 45 % are males and 55 % are females. About 34 % of the population (male: 66 % and female: 34 %) is literate and they are able to read and write. Similarly, the percentage of population that can read only is 5 %. The status of about 1 % population is unknown (Fig. 5).

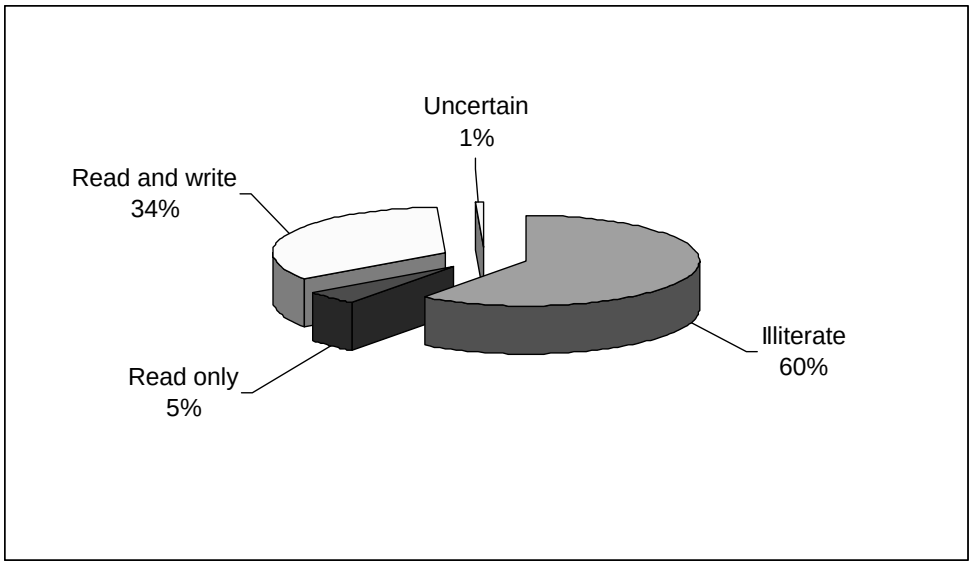


Fig. 5: Literacy status of the people of Rasuwa *(Source: DDC, Rasuwa, 2006)*

3.8 Land holdings

According to the agriculture census 2048, out of the total 6448 households in Rasuwa district, only 16 households are landless (DDC, Rasuwa). On an average, 0.91 hectares of land is owned by each household. About 42 % of the household possess land between 0.1 to 0.5 hectares (Fig. 6). Similarly, about 51 % of the household possess land between 0.5-2.0 hectares, 6 % of the household between 2-5 hectares, and 0.4 % of the household between 5-10 hectares and about 0.6 % of the household possess land above 10 hectares (Fig. 6).

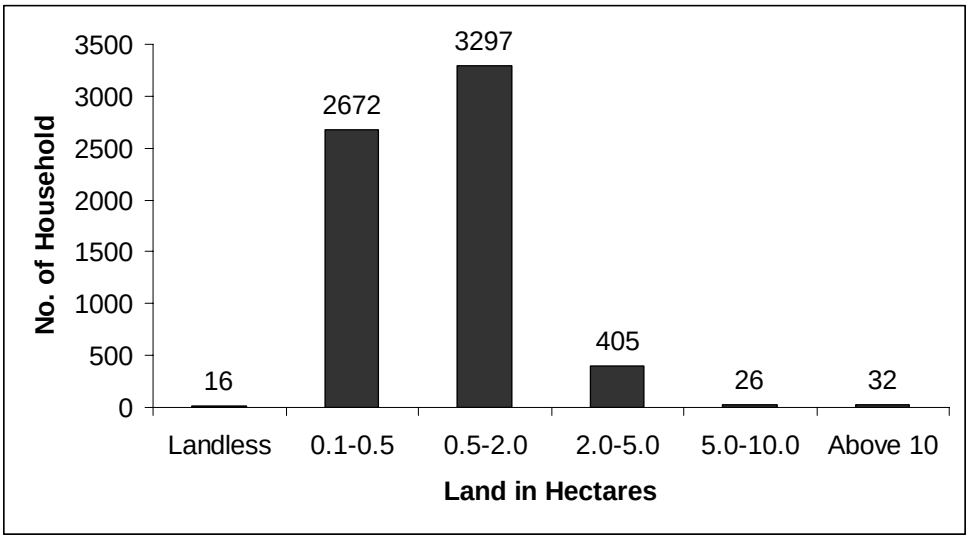


Fig. 6: Land holdings of the people of Rasuwa *(Source: DDC, Rasuwa, 2006)*

4. MATERIALS AND METHODS

4.1 Field visits

Different parts of Langtang district were surveyed three times during 2005-2006. The first field visit was made in Jun 2005 to explore the area and estimate the feasibility of study. The second visit was made in Jun 2006 and final visit in Sep 2006. The study was focused on ethnic Tamang community, the dominant inhabitants of the area. An effort was made to collect all the required ethno-botanical information.

4.2 Interviews and questionnaire

The survey technique includes focus group discussions among the key informants, including local faith healers (Dhami/Jhankri) etc, the community members and elderly people of the focused ethnic groups. For the interviews, a standard questionnaire was developed and used, having question on parts used, purpose, mode of preparation and people's perception. Altogether 42 informants were interviewed of the age group 30-60 from Tamang community of Dhunche, Thulo Syabru, Singompa, Laurivinayak, Lamahotel, Langtang village and Kyanjin, out of which 80 % were males and the remaining 20 % were females. The obtained information was recorded on the questionnaire sheet as preliminary work. Cross check interviews were also performed for the reliability and validity of the information.

4.3 Specimens collection and plant identification

Plant specimens were collected from different sites of study area. Their local names were known by interviewing the local people. The specimens were identified using standard botanical literatures (Hooker, 1872-1897; Hara *et al.,* 1978, 1982; Hara and Williams, 1979; Polunin and Stainton, 1987; Stainton, 1988; Grierson and Long (1983-2001). The rare and threatened species were stored with their stunning pictures. Each specimen were dried and mounted with standard herbarium technique. The collected plant specimens were deposited at Tribhuvan University Central Herbarium (TUCH).

4.4 Categorization of plant specimen

The primary information regarding the use and values of medicinal plants were collected during empirical fieldworks in the study area. The medicinal plants include those

plants, which are used to treat different diseases. They were given along with the different tamang terms for various ailments.

4.5 Documentation of plant species

After identification and confirmation of the voucher specimens, a detailed study was carried out based on the information gathered from the primary interviews and personal observation as well as from the secondary data available from different published sources. All the recorded plant resources are presented here according to alphabetical order of their scientific names. Nomenclature follows Press *et al.* (2000) and so as the national and international distribution. Description of the plants is based on Stainton (1998), Hooker (1872-1897) as well as personal observation. While describing the results, a systematic order is maintained for each plant. The order for each is started from its scientific name in alphabetical order followed by family, local names, description, habitat, distribution, part(s) used and local uses.

4.6 Preference analysis

Preference ranking is used to assess the most preferred species in the community for food, fodder, medicine and other purposes. Firstly, a complete set of native categories is obtained by framing the right question to the informants. When people are asked to recall things, they tend to list the most significant ones. In addition, prominent categories are cited by almost everybody, thus giving some idea of the things that are culturally more important. This information helps us to come up with a ranking index.

In this method, the key group of informants is asked to arrange the items in order of preference. Each person arranges the items according to personal preference, perceived importance in the community, or any other criterion. Each rank is given an integer value (1, 2, 3 and so on) with the most important or preferred item assigned the highest number. The most preferred species is assigned an integer value 1 and subsequently other values (2, 3,…..) are assigned for species with decreasing preference. These numbers are summed up for all respondents, giving an overall ranking for the item as indicated by the sample group of respondents. During the household survey, people were asked for their preference of various plants for firewood, timber and medicines. The preference level was recorded and preference index was calculated using the method described by Amatya *et al.* (1996).

$$\text{Preference Index} = \frac{\sum \text{Preference level x Number of respondents}}{\text{Total number of respondents}}$$

4.7 Secondary data

The secondary data were obtained from different books, research reports, journals, documents, and articles available in central library of Tribhuvan University, library of IUCN, WWF, DNPWC, and ESON etc. The social data of the district was obtained from District Development Committee, Rasuwa.

5. RESULTS

5.1 Traditional ethnobotanical knowledge

The people of Rasuwa have rich ethnobotanical knowledge on utilization of plant resources for their daily needs. The place is one of the remote areas in central Nepal and has no access to modern facilities. However, the people have developed their own ways of living with the environment. Day to day life in these mountain villages is crucially dependent on plant resources. The area is rich in many important floras. The people have retained their traditional knowledge and practices to fulfill their daily needs. A large number of plants are utilized for food supplement, medicinal purposes, fuel wood, fodder, timber, etc. Forest products especially medicinal and aromatic plants play an important role in local health care. People have no access to modern medicines and hence, they have to depend largely, on forest resources. The knowledge is housed by few elderly people and some "Lamas" and "Jhakris". These people have wide knowledge on utilization of plant resources. The knowledge has been acquired from their preceding generations and some "Lamas" have undergone trainings to gain this knowledge. Most of the elderly people have rich knowledge on utilization of plants for treating basic illness like cough, cold, fever, cuts and wounds, burns, diarrhoea, etc. Only in some specific cases, the help of a trained practitioner is sought.

5.2 Medicinal and aromatic plants

A large number of plants are utilized by the local communities for various disorders. The present study has documented the most preferred species of medicinal plants used in therapeutics in the area. Altogether, 46 species of plants were found to be of high utilization (Table 1). These species are used for the treatment of 24 different medicinal ailments. Of the 46 species of medicinal plants, 38 species were found to be used to treat one ailment, 7 species for two ailments and only 2 species (*Bergenia ciliata* and *Rheum australe*) for the treatment of three ailments.

Thirteen species of medicinal plants were found to have other uses in the area (Table 2). Theses species were mostly used as vegetables, pickles and some of them were used for religious purposes. Similarly 16 other species were found in the area whose medicinal properties were not reported in the present study. However, the species were reported to be of medicinal value by other researchers (Table 3).

Table 1: List of medicinal plants used locally for the treatment of different ailments

Ailments	Species	Local names (Tamang)	Parts used
Fever	*Aconitum spicatum*	Bikh	Tuber *(Rin)*
(Chhawa Khapa)	*Asparagus racemosus*	Satawari	Root *(Rin)*
	Lonicera myrtillus	Taktak	Root *(Rin)*
	Neopicrorhiza scrophulariiflora	Kutki	Root *(Rin)*
	Saussurea gossypiphora	Bhutkesh	Root *(Rin)*
	Swertia chirayita	Timda	Whole plant *(Dhongpo)*
	-	Yakim	Root *(Rin)*
	-	Mahaguru	Root *(Rin)*
	Swertia angustifolia	Timda	Whole plant *(Dhongpo)*
Cough /Cold	*Acorus calamus*	Bojho	Rhizome *(Rin)*
(Le Tongbala)	*Astilbe rivularis*	Thulo ausadhi	Root *(Rin)* Leaf *(Lapti)*
Backpain/Jointache	*Bergenia ciliata*	Bramendo	Stem *(Thongbo)*
(Thuchi)	*Betula alnoides*	Takpa	Bark *(Pako)*
Scabies / Skin diseases	*Artemisia vulgaris*	Chhuwenti	Leaf *(Lapti)*
(Por)	*Eupatorium adenophorum*	Banmara	Leaf *(Lapti)*
	Rubia manjith	Tiru	Root *(Rin)*
Cuts (Thahapa) **and wounds**	*Boschniakia himalaica*	Kangdol	Root *(Rin)*
(Por)	*Dactylorhiza hatagirea*	Ompolakpa	Tuber *(Rin)*
	Paris polyphylla	Satuwa	Root *(Rin)*
Burns *(Krova)*	*Swertia multicaulis*	Sharmaguru	Root *(Rin)*
Gastritis / Stomach disorder	-	Aunghar	Root *(Rin)*
(Phoso Hawa)	*Fritillaria cirrhosa*	Kaakoli	Whole plant
	Lonicera myrtillus	Taktak	Root *(Rin)*
	Rheum australe	Chhurcha	Stem *(Thongbo)*
	Thallictrum foliolosum	Bathuri	Root *(Rin)*
	Zanthoxylum armatum	Timur	Fruit *(Polang)*
	Zanthoxylum nepalense	Timur	Fruit *(Polang)*
Menstrual disorder/Post pregnancy *(Te Tabala)*	*Astilbe rivularis*	Thulo ausadhi	Root *(Rin)* Leaf *(Lapti)*
	Bergenia ciliata	Bramendo	Stem *(Thongbo)*
	Betula alnoides	Takpa	Bark *(Pako)*
	Fragaria nubicola	Palpapolang	Fruit *(Polang)*
	Potentilla peduncularis	Pangthar	Root *(Rin)*
Antidote *(Hartal)*	*Delphinium himalayai*	Bhongmar	Root *(Rin)*
Diarrhoea	*Hippophae salicifolia*	Govo, Taru	Fruit *(Polang)*
(Kam Som)	*Hippophae tibetana*	Taru	Fruit *(Polang)*
	Jurinea dolomiaea	Dhupjadi	Root *(Rin)*
	Rheum australe	Chhurcha	Root *(Rin)*
	Rheum moorcroftianum	Yayuchawa	Root *(Rin)*

Fracture	*Rheum australe*	Chhurcha	Root *(Rin)*
(Bhale Thuchi)	*Rumex nepalensis*	Alpibi	Root *(Rin)*
Anthelminthic *(Phoi Kwaite)*	*Pieris formosa*	Pra pra	Leafy shoot *(Thongbo)*
Headache	*Myrica esculenta*	Namin	Bark, root *(Rin)*
(Kranava)	*Potentilla peduncularis*	Pangthar	Root *(Rin)*
Pharynxitis,	*Bergenia ciliata*	Bramendo	Stem *(Thongbo)*
(Milang swahaj)	*Juniperus recurva*	Sukpa	Fruit *(Polang)*
Tonic *(Top)*	*Asparagus racemosus*	Sunga	Root *(Rin)* Stem *(Thongbo)*
	Cordyceps sinensis	Yarsha gomba	Whole plant *(Dhongpo)*
	Rhododendron arboreum	Paramendo	Flower*(Mendo)*
Respiratory tract infection	*Taxus wallichiana*	Silding	Leaf *(Lapti)* Stem *(Thongbo)*
Heart disease *(Tinksho Khawala)*	*Myrica esculenta*	Namin	Bark *(Pako)* Root *(RIn)*
Eye inflammation *(Me Tangba)*	*Mahonia napaulensis*	Kyarpa	Bark *(Pako)*
Blood pressure	*Valeriana jatamansii*	Pe	Leaf *(Lapti)*
Blood purifier *(Pho Syalba)*	*Berberis asiatica*	Pichyar	Root *(Rin)*
	Berberis aristata	Pichyar	Root *(Rin)*
Boils and pimples *(Chi Por)*	*Lyonia ovalifolia*	Tomasing	Leaf *(Lapti)*
Stimulant *(Thang Sweba)*	*Rhododendron anthopogon*	Sunpati	Flower *(Mendo)*
	Taxus wallichiana	Silding	Leaf (*Lapti)*
Epilepsy *(Shah)*	*Nardostachys grandiflora*	Jatamansi	Rhizome *(Rin)*
Asthma *(Upsa)*	*Ephedra gerardiana*	Somlata	Stem *(Thongbo)*

Table 2: Species of medicinal plants that have other uses

S.N.	Species / Family	Local names (Tamang)	Local uses
1.	*Asparagus racemosus* (Liliaceae)	Sunga	Tender shoots are used as vegetable
2.	*Berberis asiatica* (Berberidaceae)	Pichyar	Fruits are eaten
3.	*Dactylorhiza hatagirea* (Orchidaceae)	Ompolakpa	Root is used as incense
4.	*Fragaria nubicola* (Rosaceae)	Palpa polang	Fruits are eaten
5.	*Hippophae salicifolia* (Elaeagnaceae)	Govo, Taru	Fruit juice is taken as tonic
6.	*Hippophae tibetana* (Elaeagnaceae)	Taru	Fruit juice is taken as tonic
7.	*Rheum australe* (Polygonaceae)	Chhurcha	Leaves and shoot used as pickle
8.	*Rheum moorcroftianum* (Polygonaceae)	Yayuchawa	Leaves and shoot used as pickle
9.	*Rhododendron anthopogon* (Ericaceae)	Sunpati	Flowers are used in the preparation of tea
10.	*Rubia manjith* (Rubiaceae)	Tiru	Roots are used in the preparation of dye
11.	*Swertia multicaulis* (Gentianaceae)	Sharmaguru	Roots are used as a "*Buti*" to wand evil spirits
12.	*Valeriana jatamansii* (Valerianaceae)	Pe	Root is used as incense
13.	*Zanthoxylum armatum* (Rutaceae)	Timur	Fruits are used as pickle

Table 3: Plants found in the area that are not used in folk medicine but their medicinal uses have been reported by others

S.N.	Species	Tamang names	Local uses	Medicinal uses reported by others
1.	*Abies spectabilis*	Gobre salla	Used as timber and firewood	Decoction of leaves is used for cough and bronchitis (Bhattarai, 1989; Joshi and Edington, 1990; Pohle, 1990).
2.	*Allium wallichii*	Dundudhap	Whole plant is edible, used as vegetable	Decoction of leaves has carminative property; cut bulb is used to treat headache (Bhattarai, 1992a; Coburn, 1984; Joshi and Edington, 1990).
3.	*Alnus nepalensis*	Utis	Used in construction and also as firewood	Powdered bark is used to treat cuts and burns (Joshi and Edington, 1990; Toba, 1975).
4.	*Berberis aristata*	Sidhangshi	Fruits are edible	Decoction of stem-bark is used in eye infection. Decoction of root-bark is used for malarial fever at Dang (Acharya, 1996; Bhattarai, 1992a; Coburn, 1994; Manandhar, 1991).
5.	*Carum carvi*	Kongril	Whole plant is used as spices	Fruit oil is strong carminative, stimulant and aromatic. Plant is used as poultice in the swelling of breast and testicle (Bhattacharjee, 2001).
6.	*Cotoneaster microphyllus*	Prema	Firewood	Root paste is applied to treat headache, and the juice is given during indigestion (Manandhar, 2002).
7.	*Gaultheria fragrantissima*	Chenjawa	Fruits are edible	Fruits are eaten to cure stomachache. Oil from leaves is used for rheumatic pains (Bhattarai, 1991a; Joshi and Edington, 1990; Bhattarai, 1980b).
8.	*Girardiana diversifolia*	Polo	Leaves used as vegetable; also a fibre plant	Warm root juice is given to drunkard for cooling effect in Dang district (Acharya, 1996).
9.	*Juglans regia*	Tangsarkado	Used in construction, firewood; fruit edible	Decoction of stem bark is drunk warm for its anthelmintic property at Karnali zone. Stem bark is used in toothache at Makwanpur district (Bhattarai, 1991, 1992c; Pohle, 1990).

10.	*Juniperus recurva*	Sukpa	Leaves are used as incense, fruits are used as ornament by *Lama*	Smoke from green wood is a powerful emetic that produces long and continued vomiting (Kirtikar and Basu, 1980).
11.	*Myricaria rosea*	Yumbu	Used in funeral, pyre	Plant paste is taken to treat cold and is applied to relieve headache in Manang. Decoction of stems is used to treat tuberculosis (Manandhar, 1987a; Pohle, 1990).
12.	*Pinus roxburghii*	Khote salla	Used as timber and firewood	Resin with common salt is boiled in water and drunk warm to get relief from cough at Karnali. Resin is used for skin infections. Resin is applied to hasten in healing of the wounds (Bhattarai, 1992a; Coburn, 1984; Joshi and Edington, 1990; Manandhar, 1987a).
13.	*Pinus wallichiana*	Rani salla	Used as timber and firewood	Resin is used as a plaster for bone fractures at Karnali zone. Resin is applied as a balm to get relief from labour pain (Bhattarai, 1992a; Pohle, 1990).
14.	*Polygonatum cirrhifolium*	Ramserkia	Whole plant is used as vegetable	Tender parts are eaten as a vital tonic. Root paste is given to dogs as a health tonic in weakness (Bhattarai, 1992a; Manandhar, 1986b; Pohle, 1990).
15.	*Ranunculus sceleratus*	Saapramu	Leaves and shoot used as vegetable	A piece of cloth soaked in plant juice is spread over stomach by the Tharus of Dang district to subdue gastric inflammation (Manandhar, 1985).
16.	*Salix daltoniana*	Longmar	Inflorescence is used as incense	Bark and leaves are tonic, astringent; used in fever. Bark anthelmintic (Kirtikar and Basu, 1980)

5.2.1 Mode of use of medicinal plants

Different parts of plants are utilized for the treatment of various ailments. The most commonly used part is the root. Root of about 47 % of the plants is used in local therapeutics (Fig. 8). Similarly, leaves and stem constitute about 13 % of the total utilized plants, followed by fruit and bark (8 %), whole plant (6 %), flower (3 %) and seed (2 %). The mode of use varies from direct intake in raw form to consumption of decoction, extract, etc. and sometimes application on the affected parts, in case of any injuries, cuts and wounds. Plant parts are thoroughly washed and a fine paste is prepared by crushing it. The paste is diluted with water and is consumed. This is the most common method of intake of most medicinal herbs (*Fritillaria cirrhosa*, *Rheum australe*, *Bergenia ciliata*, *Jurinea dolomiaea*, etc).

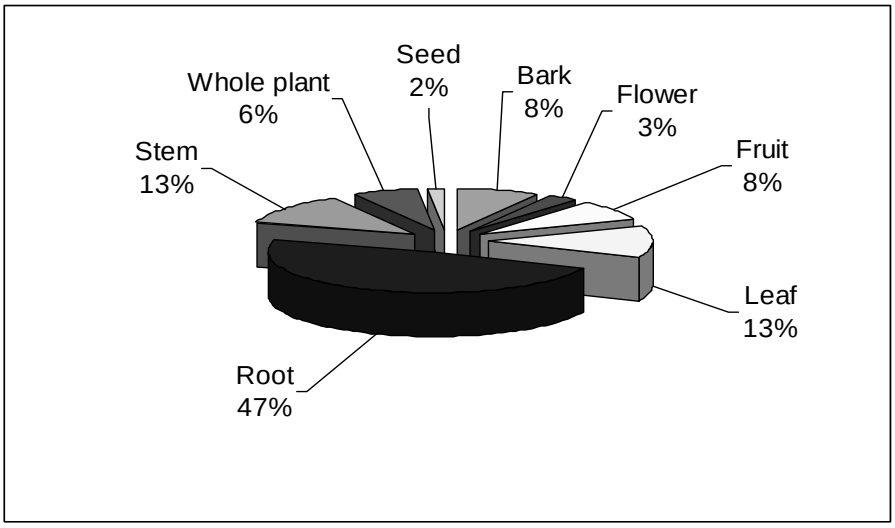


Fig. 7: Utilized parts of medicinal plants

5.2.2 Dependency of the people on medicinal plants

People have no access to modern facilities and hence, they rely largely on wild resources for local healthcare. Almost all of the interviewed people used local medicines for their primary healthcare. However, in cases of severity, modern medicines are preferred. The use is self administered and only in some severe cases, the help of a trained practitioner is sought. They usually get these resources from the wild. Some medicinal herbs are also grown in farm lands. However, the cultivation is limited to few species only and people have to depend upon forest for a number of other useful herbs. About 10 % of the people in the Thulo Syabru village depend upon cultivated products and the remaining

90 % utilizes forest resources (Fig. 9). They collect medicinal herbs during flowering seasons (Aug-Sep) and the species are stored for future uses. The mostly collected herbs are *Neopicrorhiza scrophulariiflora, Swertia chirayita, Rheum australe, Valeriana jatamansii*, etc. Besides the use of medicinal herbs for local health care, some of the species that are of high commercial value are in trade in the area. Medicinal herbs, thus, have also contributed a lot to the economy of the local people.

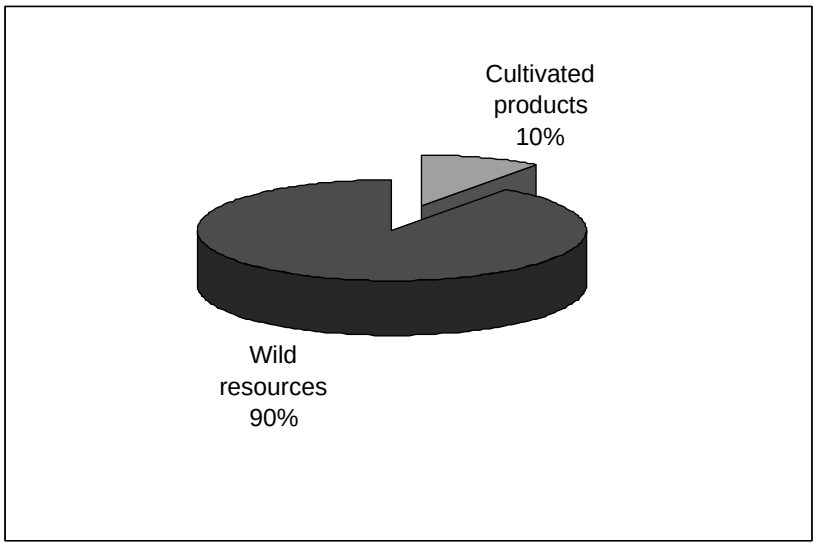


Fig. 8: Dependency of people on wild and cultivated resources

5.2.3 Cultivation practices

Few species of medicinal herbs are cultivated within the park in Dhunche and Syaphru VDCs. The cultivation is in preliminary phase and very less number of households has adopted medicinal herbs farming. People of Thulo syaphru and Brabal areas have cultivated species like *Swertia chirayita*, *Rheum australe*, *Paris polyphylla* and *Valeriana jatamansii*. Out of 120 households in Thulo syaphru village, only 6 households have cultivated medicinal herbs in their farm lands. About 18 ropanis of land is occupied by medicinal plant farms in Thulo syaphru village. The cultivated products are either channeled to Kathmandu by the growers or sometimes it is also sold to primary traders. The growers have to face lots of challenges in marketing their products. Herbal companies seek medicinal herbs in bulk, which farmers are incapable of producing and hence they have to sell their products at a cheaper rate to primary traders. Primary traders, on the other hand, collect these herbs from a large number of farmers and then sell them to secondary traders or herbal companies with a handsome margin.

5.3 Preference analysis

Free list of medicinal plants was prepared based on the information provided by local communities and the people were asked to arrange the items in order of their preferences. Based on their information, the most preferred species used by local communities for their primary health care was evaluated. The species of medicinal plants that are highly preferred by the local community were *Neopicrorhiza scrophulariiflora, Dactylorhiza hatagirea, Swertia chirayita, Nardostachys grandiflora, Valeriana jatamansii, Rheum australe, Bergenia ciliata, Rhododendron anthopogon, Aconitum spicatum* and *Paris polyphylla*. *Neopicrorhiza scrophulariiflora* was the most preferred species of all. Of the 42 respondents, 25 respondents placed it in first preference level. Only 10 respondents placed the species in second preference level, 5 respondents in third level and 1 respondent in fourth and sixth preference level each. The preference index was 1.67 (Table 4). The next preferred species was *Dactylorhiza hatagirea* with preference index value of 2.50, followed by *Swertia chirayita*, *Nardostachys grandiflora* and *Valeriana jatamansii* with preference index value of 2.50, 3.36, 4.40 and 5.36 respectively (Table 4). The preference index value for *Paris polyphylla* was 9.10 and was the least preferred species of all. The preference indices value and their corresponding ranks are given in the table 4.

Table 4: Preference indices of highly preferred medicinal plants

S.N.	Species	No. of respondents per preference level										PI*	Ranking
		1	2	3	4	5	6	7	8	9	10		
1.	*Neopicrorhiza scrophulariiflora*	25	10	5	1	0	1	0	0	0	0	1.67	I
2.	*Dactylorhiza hatagirea*	7	17	10	6	2	0	0	0	0	0	2.50	II
3.	*Swertia chirayita*	5	4	15	10	5	3	0	0	0	0	3.36	III
4.	*Nardostachys grandiflora*	2	3	8	13	3	5	8	0	0	0	4.40	IV
5.	*Valeriana jatamansii*	1	2	2	3	16	8	6	4	0	0	5.36	V
6.	*Rheum australe*	1	3	2	3	6	15	7	5	0	0	5.57	VI
7.	*Bergenia ciliata*	1	3	0	2	5	9	14	1	7	0	6.26	VII
8.	*Rhododendron anthopogon*	0	0	0	2	3	1	5	17	5	9	7.98	VIII
9.	*Aconitum spicatum*	0	0	0	2	2	0	2	2	18	16	8.81	IX
10.	*Paris polyphylla*	0	0	0	0	0	0	0	13	12	17	9.10	X

*PI= Preference Index = $\frac{\sum \text{Preference level x Number of respondents}}{\text{Total number of respondents}}$

5.4 Status of highly preferred species

Altogether, ten species of medicinal plants of high preference were assessed from the study. They include *Neopicrorhiza scrophulariiflora, Dactylorhiza hatagirea, Swertia chirayita, Nardostachys grandiflora, Valeriana jatamansii, Rheum australe, Bergenia ciliata, Rhododendron anthopogon, Aconitum spicatum* and *Paris polyphylla*. These species were found to occur between 2000-4400 m in forests, shrubberies, and alpine pastures. Besides *Neopicrorhiza scrophulariiflora* and *Rhododendron anthopogon*, all other species were poorly distributed in the area. *Neopicrorhiza scrophulariiflora* was found abundantly in Gosaikunda region towards the south of the lake at an altitude of 4400m. The species is utilized not only for local use but also a large quantity of the herb is traded from the area. *Rhododendron anthopogon*, one of the highly utilized plants in Cholangpati and Laurivinayak area, occurs in fairly large quantity in sub-alpine slopes. The flower of the plant is collected and is used for making tea. *Dactylorhiza hatagirea*, one of the highly threatened species, is found only in Laurivinayak. The species is highly threatened in the area due to its less availability and high demand. The local distribution of other preferred species in the area are given in table below (Table 5).

Table 5: Local distribution of highly preferred medicinal plants in Rasuwa

S.N.	Species	Local distribution	Altitude (m)
1)	*Aconitum spicatum*	Laurivinayak	3800
2)	*Bergenia ciliata*	Brabal, Thulo syaphru	2200
3)	*Dactylorhiza hatagirea*	Laurivinayak	3800
4)	*Nardostachys grandiflora*	Laurivinayak	3900
5)	*Neopicrorhiza scrophulariiflora*	Laurivinayak, Gosainkunda	3800-4400
6)	*Paris polyphylla*	Thulo syaphru	2200
7)	*Rheum australe*	Cholangpati, Laurivinayak, Gosainkunda, Langtang	3600-4400
8)	*Rhododendron anthopogon*	Laurivinayak, Gosainkunda	3700-4400
9)	*Swertia chirayita*	Thulo syaphru	2200
10)	*Valeriana jatamansii*	Thulo syaphru, Langtang	2200-3300

5.5 Profile of highly preferred species of medicinal plants

1) Aconitum spicatum (Bruhl) Stapf

Synonym: *Aconitum ferox* var. *spicata* Bruhl

Family: Ranunculaceae

Local name: Bikh (Nep)

Short description: Perennial erect herbs, 1-2 m, with large, tuberous roots. Leaves often softly hairy, deeply cut into ovate lobes; lobes further cut into toothed acute segments mostly more than 3 mm wide. Flowers purple to greenish white, 2-2.5 cm, in dense terminal spike, sometimes with lateral branches. Hood of flower about as long as broad.

Habitat: Sub-alpine scrubland.

Locality of occurrence: Laurivinayak (3800 m)

Ethnomedicinal uses: Tuber of the plant acts as an antipyretic and used in fever. The plant is highly poisonous so it is detoxified using milk or cow urine before use.

Previous reports: Root paste is used as an arrow poison in Jumla district (Manandhar, 1986; Rajbhandari, 2001). Tincture of the drug from *Aconitum* is used as a heart and nervine sedative (Edwards, 1996). Root juice is used in cuts and wounds, cough and cold and liver problems in Dolpa (Kunwar and Adhikari, 2005).

Parts used: Tuber

Flowering: Aug-Sep

Harvesting: Sep-Oct

Trade value: The root of the plant is traded with the name "*Bish Jara*". In the fiscal year 2062/63, about 200 kg of "*Bish jara*" was traded from Rasuwa. The current market value of the species is NRs 190 per kg.

Conservation status: Prioritized for agro-technology by DPR; prioritized for research and management by HNCC.

Threat category: Vulnerable (CAMP), Threatened (IUCN).

Cultivation/Domestication practices: None

Distribution: a) Nepal: WCE. Alt: 1800-4200 m

b) Global: Himalaya (Nepal to Bhutan), China (Xizang).

Voucher specimen: Laurivinayak, 3900m, 1st Sep 2006, *N. Shrestha, D. Prasai, B. Karki & K. Homagain* 247 (TUCH).

2) Bergenia ciliata (Haw.) Sternb.

Family: Saxifragaceae

Local name: Pakhanved (Nep)

Short description: Perennial rhizomatous herb, 10-30 cm high, occurring in subtropical and temperate zones, with suborbicular or broadly obovate leaves, and flowers white tinged with pink, paniculate, branches cymose.

Locality of occurrence: Thulo Syaphru (2200m), Brabal (2200 m)

Ethnomedicinal uses: Stem paste is used for back pain, jointache, menstrual disorder, and pharynxitis in Rasuwa. Rhizome is crushed and mixed with water which is used in fever and diarrhoea. It is also used to get rid of roundworm.

Previous reports: Juice from the rhizome is taken to get relief from fever at Karnali zone (Bhattarai, 1992a). Seeds are used for diarrhoea at Manang (Manandhar, 1987a). Rhizome paste is taken to get relief from roundworm at Nuwakot (Manandhar, 1982).

Parts used: Stem, rhizome

Flowering: May-Jun

Harvesting: Aug-Sep

Trade value: The stem and rhizome of the plant is traded under the name "*Pakhanved*". About 4,700 kg of "*Pakhanved*" was traded from Rasuwa in the fiscal year 2062/63. The price per kg of the species is NRs 16.

Conservation status: Prioritized by HNCC for research and management.

Threat category: Threatened (IUCN).

Cultivation/Domestication practices: None

Distribution: a) Nepal: WC. Alt: 1600-3200 m

b) Global: Afghanistan, Himalaya (Kashmir to Bhutan), China (Xizang), NE India.

Voucher specimen: Not collected.

3) Dactylorhiza hatagirea (D. Don) Soo

Synonym: *Orchis hatagirea* D. Don

Family: Orchidaceae

Local name: Paanchaunle (Nep), Ompolakpa (Tamang)

Short description: Stem robust, leafy, 30-90 cm, bearing terminal spikes of many flowers; leaves many, oblong lanceolate. Flowers rosy purple, spotted, c. 1.8 cm long, upper sepals and petals forming a hood, lateral sepals spreading, lips shallowly 3-lobed, spotted, dark purple, spur stout, curved.

Habitat: Exposed damp slopy area.

Locality of occurrence: Laurivinayak (3800 m).

Ethnomedicinal uses: A fine paste of tuber is prepared and is spread on wounds to control bleeding.

Previous reports: Tuberous root of *Dactylorhiza* yield salep. Salep is a washed, scaled and dried tuber of the plant with ovate or digitate form, often yellow in color. It is used as farinaceous food, nervine tonic and aphrodisiac. Tubers yield a lot of mucilage with water and form a jelly, supposed to be nutritious and used in diarrhea, dysentery and chronic fever. Salep is also used as sizing material in silk industry (Edwards, 1996). Decoction of root is utilized in treating stomach troubles at Jumla district (Manandhar, 1986b).

Remarks: Tuber contains a bitter principle and volatile oil. An infusion of the tuber is used to relieve hoarseness (Edwards, 1996).

Parts used: Tuber

Flowering: Jun-Jul

Harvesting: Sep

Trade value: None

Conservation status: Banned for collection, transportation and trade; prioritized for agro-technology by DPR; prioritized for research and management by HNCC.

Threat category: Endangered (CAMP).

Cultivation/Domestication practices: None

Distribution: a) Nepal: WCE. Alt: 2800-3960 m.

b) Global: Pakistan, Himalaya (Kashmir to Bhutan), China (Xizang).

Voucher specimen: Laurivinayak, 3900m, 1st Sep 2006, *N. Shrestha, D. Prasai, B. Karki & K. Homagain* 244 (TUCH).

4) Nardostachys grandiflora DC.

Synonyms: *Nardostachys gracilis* Kitam, *Nardostachys jatamansi* DC.

Family: Valerianaceae

Local name: Jatamansi (Nepali)

Short description: An erect perennial herb, 10-60 cm high, with long stout, woody rhizome, found in alpine Himalayas, radical leaves elongate, spathulate, cauline leaves sessile, few, oblong or sub-ovate, flower rosy, pale pink or blue in dense cymes.

Habitat: Open slopy area

Locality of occurrence: Laurivinayak (3800 m)

Ethno-medicinal uses: Plant is used for making incense. Rhizome paste is used in epilepsy.

Previous reports: Oil of rhizome is used for rheumatism and dislocation of joints at Chaubas and Syabru villages. Plant paste applied on boils at Lamjung district. Plant paste is applied to treat gout. The rhizome is used as an aromatic adjunct in the preparation of medicinal oils, it is reported to promote the growth of hair and also impart the blackness (Bhattarai, 1991; Joshi and Edington, 1990; Pohle, 1990).

Parts used: Rhizome

Flowering: Jun-Aug

Fruiting: Aug-Sep

Harvesting: Sep-Oct

Trade value: The root of the plant is traded with the name "*Jatamansi*". The amount of *Jatamansi* traded from Rasuwa in the fiscal year 2062/63 was 825 kg.

Conservation status: Banned for export outside the country without processing; prioritized by DPR for agro-technology; prioritized by HNCC for research and management.

Threat category: Appendix II (CITES), Vulnerable (IUCN), Vulnerable (CAMP)

Cultivation/Domestication practices: None

Distribution: a) Nepal: WCE, Alt: 3200-5000m,

b) Global: Himalaya (Uttar Pradesh to Bhutan), W China

Voucher specimen: Not collected

5) Neopicrorhiza scrophulariiflora (Pennell) Hong

Synonym: *Picrorhiza scrophulariiflora* Pennell

Family: Scrophulariaceae

Local name: Kutki

Short description: An erect herb, up to about 1 m tall; leaves opposite, petiole ovate, cordate or elliptic, acute, tooth glabrous or pubescent; flowers greenish in long axillary, terminal, panicled cyme

Habitat: Open grassland

Localities of occurrence: Gosainkunda (4400m), Kyanjin (3800 m)

Ethnomedicinal uses: Root of the plant is used in fever. About 2-3 inches of a root is taken and soaked in a glass of water for 3-4 hours and the liquid is consumed.

Previous reports: Considered a valuable bitter tonic, anti-periodic, cholagogue, stomachic, laxative in small doses and cathartic in large doses. It is reputed to have beneficial action in dropsy (Edwards, 1996).

Remarks: The roots of the plants were earlier reported to contain a large proportion of bitter principles mainly a glucoside named "Picrorhizin" (Edwards, 1996).

Parts used: Root

Flowering: Jul-Aug

Harvesting season: Sep

Trade value: The species is banned for collection, transportation and trade. However, a fairly large quantity of the plant is collected and exported illegally from the district.

Conservation status: Banned for collection, transportation and trade by the Government of Nepal; prioritized by HNCC for agro-technology development.

Threat category: Vulnerable (IUCN), Vulnerable (CAMP).

Cultivation/Domestication practices: None

Distribution: a) Nepal: WCE. Alt: 3500-4800 m

b) Global: Himalaya, Uttar Pradesh to Bhutan, and Myanmar, China (Sichman, Xizang, Yannan).

Voucher specimen: Gosainkunda, 4400m, 31st Aug 2006, *N. Shrestha, K. Homagain & B. Karki* 224 (TUCH).

6) Paris polyphylla Sm**.**

Family: Liliaceae

Local name: Satuwa (Nepali)

Short description: Creeping rhizomatous forest plant, with erect stem to 40 cm. Leaves 4-9 in a whorl, elliptic, short stalked. Flowers solitary, terminal, with 4-6 green lanceolate long stalk, leaf-like perianth segment, 5-10 cm, and an inner whorl of thread-like purple or yellow perianth segment. Stamens 10, short. Fruit globular. Seed scarlet.

Habitat: Open dry land

Locality of occurrence: Thulo Syabru (2200m), Brabal (2200m)

Ethno-medicinal uses: Decoction of root is taken in fever. It is also used as an anthelmintic.

Previous reports: Rhizomes possess anthelmintic property; its powder taken with hot water is used as tonic. Root paste is applied to wounds for rapid healing. Root is dried, ground and mixed with a little water and is applied to open wounds. Powder of root is used in diarrhoea in Manang. Root paste is applied as an antidote to the bite of poisonous insects and snakes. It is also used as incense, in-perfumery and as an insect repellant (Bhattarai, 1991, 1992c; Manandhar, 1986b; Pohle, 1990).

Remarks: Rhizomes of the plant contains sugar (7.9 %) and 2-glucosides viz: alpha-paradin and alpha-paristyphnin (Edwards, 1996).

Parts used: Rhizome

Flowering: Apr-May

Fruiting: Jun-Jul

Harvesting: Aug-Sep

Trade value: None

Conservation status: None

Threat category: Vulnerable (IUCN), Vulnerable (CAMP)

Cultivation/Domestication practices: Small scale cultivation in Thulo syabru and Brabal VDC.

Distribution: a) Nepal: CE. Alt: 1800-3300m

b) Global: Himalaya (Uttar Pradesh to Bhutan), NE India, China

Voucher specimen: Not collected.

7) Rheum australe D.Don

Synonym: *Rheum emodi* Wall. ex Meisn.

Family: Polygonaceae

English name: Rubarb

Local name: Padamchal (Nepali), Chhurcha (Tamang)

Short Description: Stem stout, streaked green and brown, 1.5-2mm. Leaves with rounded to broadly ovate blade with heart shaped base, basal leaves up to 60 cm across, leaf stalk very stout to 45 cm. Flowers dark reddish purple, in dense branched clusters, in a long inflorescence to 30 cm. Corolla c. 3mm across with 6 segments. Stamens 9.

Habitat: Open moist land

Locality of occurrence: Cholangpati (3600m), Laurivinayak (3800m), Langtang village (3600m)

Ethnomedicinal uses: Root paste is used in diarrhoea. Leaves and stems are extensively used for pickles in Rasuwa.

Previous reports: Powdered roots are used for cleaning teeth. They are also sprinkled over ulcer for quick healing (Edwards, 1996). Petioles are eaten with common salt as an appetizer. Root and stem are made into a salve and applied to the area around the fracture at Manang. Powder of rhizome is used to treat diarrhoea at Syabru village (Bhattarai, 1989, 1992c; Coburn, 1984; Joshi and Edington, 1990; Pohle, 1990).

Remarks: Total oxalic acid content of the leaves and stem are reported to be 0.65 and 0.81 percent respectively. "Rutin" is present in leaves and flowers. The characteristic odour of the essential oil is due to the presence of "Eugenol" (Edwards, 1996).

Parts used: Woody rhizomes, petioles, leaves and roots.

Flowering: Jun-Jul

Fruiting: Aug

Harvesting: Sep

Trade value: The species is traded with the name "*Padamchal*". In the fiscal year 2062/63, about 660 kg of *Padamchal* was traded from Rasuwa district. The current market price of *Padamchal* is NRs 45 per kg.

Conservation status: Prioritized for research and management by HNCC.

Threat category: Vulnerable (CAMP)

Cultivation/Domestication practices: In Thulo Syabru VDC, the plant is cultivated for domestic use.

Distribution: a) Nepal: CE. Alt: 3200-4200 m

b) Global: Pakistan, Himalaya (Himachal Pradesh to Nepal, Bhutan), China

Voucher specimen: Cholangpati, 3600m, 7th Jun 2005, *N. Shrestha & D. Prasai* 115 (TUCH).

8) Rhododendron anthopogon D.Don

Family: Ericaceae

Local name: Sunpati (Nepali)

Short description: Small aromatic shrublet to 60 cm, often gregarious on alpine slopes and shrubberies. Leaves oval to obovate, to 4 cm, gently scaly beneath. Flower white or yellow tinged pink in cluster of 4-6. Corolla 2 cm across, with narrow tube and 5-rounded spreading lobes. Stamens 5-8.

Habitat: Open slopy area

Locality of occurrence: Laurivinayak (3800m), Gosainkunda (4400m)

Ethnomedicinal uses: Tea made from flower is taken to cure gastritis. Flowers are collected and air dried. Dried flowers are boiled in water and tea prepared which is taken as tonic as well as stomach disorder.

Previous reports: Decoction of leaf is used in cold, cough and chronic bronchitis. Fragrant dried and powdered flowers mixed with bland oil are used for massage over the entire body in post-delivery complications like fevers, cough and cold. (Bhattacharjee, 2001).

Other uses: Plant is used as incense.

Parts used: Flower

Flowering: Jun-Jul

Fruiting: Jul-Aug

Harvesting: May-Aug

Trade value: None

Conservation status: None

Threat category: None

Cultivation/Domestication practices: None

Distribution: a) Nepal: WCE alt -3300m-5100m

b) Global: Himalaya (Punjab to Bhutan), China (Xizang).

Voucher specimen: Laurivinayak, 3350m, 12th Jun 2006, *D. Prasai & S. Yadav* 210 (TUCH).

9) Swertia chirayita (Roxb. ex Fleming) Karsten

Family: Gentianaceae

Local name: Chirayito (Nepali), Timda (Tamang)

Short description: Annual or biennial herb, up to 90cm high, occurring in temperate zone, with ovate or elliptic leaves, and greenish-yellow flowers in small clusters on branches of panicles.

Habitat: Open moist land

Locality of occurrence: Thulo Syabru (2200 m)

Ethnomedicinal uses: Whole plant is used in fever. It is also used as an appetizer.

Previous reports: It possesses the property of bitter tonic. Chirayita is prescribed in variety of forms and combination in chronic fever and anemia. It is used as a remedy for bronchial asthma and liver disorder. If taken with sandal wood paste it is said to stop internal haemorrhage of the stomach. It is said to be used for dyeing cotton clothes yellow. It is also used in liquor industry as bitter ingredients. It is usually administered as concentrated infusion or as a tincture (Edwards, 1996; Bhattarai, 1989; Joshi and Edington, 1990; Manandhar, 1986b).

Parts used: Whole plant.

Flowering: Apr-May

Fruiting: Jun-Jul

Harvesting: Aug

Trade value: *Swertia chirayita* is the most traded species from Rasuwa. Whole plant is traded with the name "*Chirayito*". In the fiscal year 2062/63, about 515 kg of *Chirayito* was traded from Rasuwa. The current market price of *Chirayito* is NRs. 250 per kg.

Conservation status: Prioritized for agro-technology by DPR; prioritized for research and management by HNCC.

Threat category: Vulnerable (IUCN), Vulnerable (CAMP)

Cultivation/Domestication practices: *Swertia chirayita* is the most preferred species for cultivation in the area. It is cultivated in Syabru and Brabal VDC for commercial purpose as well as for local use.

Distribution: a) Nepal: CE. Alt: 1500-2500 m

b) Global: Pakistan, Himalaya (Kashmir to Bhutan), North East India

Voucher specimen: Not collected

10) Valeriana jatamansii Jones

Synonym: *Valeriana wallichii* DC.

Family: Valerianaceae

Local name: Sugandhwal (Nep), Pe (Tamang)

Short description: A pubescent herb, leaves, radical long-petioled, ovate, deeply cordate, acute or short acuminate, crenate, cauline. Flower white or pink, small in terminal corymbs. Corolla funnel shaped with 5 blunt spreading lobes.

Habitat: Open dry land

Locality of occurrence: Thulosyabru (2200m), Brabal (2200m)

Ethnomedicinal use: Root is used in headache, eye pain. Root paste is prepared and mixed with water and consumed to get relief from headache.

Previous reports: It is prescribed as a remedy for hysteria, hypochondriasis, nervous unrest and emotional troubles. Powder drug mixed with sugar is used in urinary troubles. A decoction of the drug is reported to be given to the mothers after parturition probably as a sedative. Plant paste is applied to treat gout. Root is used as incense at Manang. It is also used as incense, in perfumery and as an insect repellant (Bhattarai, 1991, 1992c; Joshi and Edington, 1990; Manandhar, 1982; Pohle, 1990).

Parts used: Root

Flowering: Apr-Jun

Fruiting: Aug-Sep

Harvesting: Oct-Nov

Trade value: The plant is traded with the name "*Sugandhawal*". In the fiscal year 2062/63, about 115 kg of *Sugandhawal* was traded from Rasuwa. The current market price of *Sugandhawal* is NRs. 110 per kg.

Conservation status: Prioritized for agro-technology by DPR; prioritized for research and management by HNCC.

Threat category: Vulnerable (CAMP)

Cultivation/Domestication practices: Small scale cultivation of *Valeriana jatamansii* occurs at Thulo Syabru and Brabal VDC.

Distribution: a) Nepal: WCE. Alt: 1500-3300 m

b) Global: Afghanistan, Himalaya (Kashmir to Bhutan), NE India, Myanmar, WC China

Voucher specimen: Not collected

5.6 Profile of other species of medicinal plants

1. Acorus calamus L.

Family: Araceae

Local name: Bojho (Nepali)

Description: Perennial, semiaquatic, erect, aromatic, herb; rootstock thick, creeping, 5-5.4 x 0.36-2cm wide. Leaves distichous; nerves parallel, spathe leaf-like; spadix 4-8 cm; tapering, covered with small, yellow-green, and 2 sexual flowers.

Distribution: WCE (1700-2300 m); Temperate N. Hemisphere.

Habitat: Moist area

Part used: Rhizome

Ethnomedicinal uses: Rhizome of the plant is dried and used in small doses during cough and cold. It is also used in fever in Dhunche and Thulo Syabru.

Voucher specimen: Dhunche, 2000m, 28th Aug 2006, *D. Prasai* and *N. Shrestha* 221 (TUCH)

2. Artemisia indica Willd.

Synonym: *Artemisia grata* Wall.

Family: Compositae

Local name: Chhuwenti (Tamang)

Description: An erect, aromatic undershrub, abundant on open fields. Branchlets grey-pubescent. Leaves laciniate, 1-2-pinnatipartite, green on both surfaces, ultimate segments lanceolate, acute or acuminate. Heads small, reddish, numerous, in axillary and terminal racemes.

Distribution: CE (300-2400m); Himalaya, India, Myanmar, Thailand, S China, Japan.

Habitat: Open slope, forest floor.

Part used: Leaves

Ethnomedicinal uses: Leaves of the plant are crushed and decoction is applied in the affected part of the skin during skin infection (scabies, ring worm).

Voucher specimen: Singmopa, 3600m, 12th Jun 2006, *D. Prasai and N. Shrestha* 212 (TUCH).

3. Asparagus racemosus Willd.

Synonym: *Asparagus volubilis* Buch.-Ham.

Family: Liliaceae

Local name: Satawari (Nepali)

Description: Tall, woody, climbing, excessively branched, undershrub; root 5-13 cm long, 5-8 mm wide, pointed at both ends, longitudinally striated. Leaves flattened branchlets (cladodes) 12-25 mm long, spreading. Flowers 2-sexual, racemes very slender, 4 mm, long and perianth petaloid.

Distribution: CE (600-2100m); Himalaya, India, Malaysia, Australia, Africa.

Habitat: Forest floor.

Part used: Root

Ethnomedicinal uses: A fine paste of the root of the plant is prepared and mixed with water. About 5-10 ml of the extract is taken during fever.

Voucher specimen: Not collected

4. Astilbe rivularis Buch.-Ham. ex D.Don

Family: Saxifragaceae

Local name: Thulo ausadhi (Nepali)

Description: A big, hairy herb, upto 1 m high, on open and moist slope near streams. Leaves 2-pinnate; leaflets usually 5 pinnules, ovate, slightly cordate, doubly serrate, acuminate, hairy with brown, rough hairs. Flowers yellowish, in axillary and terminal panicles.

Distribution: WCE (2000-3600m); Himalaya (Kashmir to Bhutan), NE India, Thailand, N. Indochina, W. China.

Habitat: Open fields.

Part used: Root

Ethnomedicinal uses: Root of the plant is dried and powdered. A teaspoonful of powder is mixed with a cup of milk and administered during post pregnancy and menstrual disorders. It is also useful in the treatment of cough.

Voucher specimen: Not collected

5. Berberis aristata DC.

Synonym: *Berberis ceratophylla* G. Don

Family: Berberidaceae

Local name: Pichyar (Tamang)

Description: Shrub; bark 2 mm thick, external surface longitudinally as well as transversely striated, yellowish grey, wood yellow. Leaves simple, spiny-toothed, sessile, broadly lanceolate. Flowers in corymbs or racemes, yellow.

Distribution: WC (1800-3000m); India, Himalaya (Nepal).

Habitat: Temperate exposed slopes.

Part used: Root

Ethnomedicinal uses: Decoction of root bark is used during diarrhoea and jaundice. It is also used as a blood purifier.

Voucher specimen: Not collected

6. Berberis asiatica Roxb. ex DC.

Family: Berberidaceae

Local name: Pichyar (Tamang)

Description: Branched shrub to 3 m tall with yellow-wood; stem with spines of 1-1.5 cm long. Leaves thick, rigid, evergreen with 2-5 spiny teeth, shining dark green above and grayish beneath, obovate to elliptic to 7.5 cm long. Inflorescence corymbose raceme to 3 cm long. Flowers small, yellow. Fruit a berry, black or reddish deep purple.

Distribution: WCE (1200-2500m); Himalaya (Uttar Pradesh to Bhutan), NE India, China (Yunnan).

Habitat: Schima-Castanopsis forest.

Part used: Root

Ethnomedicinal uses: Decoction of root bark is used during diarrhoea and jaundice. It is also used as a blood purifier.

Voucher specimen: Thulo Syabru, 2200m, 14th Jun 2006, *D. Prasai and S. Yadav* 218 (TUCH).

7. Betula alnoides Buch.-Ham. ex D. Don

Synonym: *Betula cylindrostachya* Lindl.

Family: Betulaceae

Local name: Takpa (Tamang)

Description: Tree, 15-18 m high. Leaves 7.6-15.2 cm long, petioled. Male and female spikes 7.6-12.7 cm long, slender; female cones usually in clusters.

Distribution: WCE (1200-2600m); Himalaya (Uttar Pradesh to Bhutan), NE India, W. and C. China.

Habitat: Forest

Part used: Bark

Ethnomedicinal uses: Stem bark is taken orally to treat excessive menstruation.

Voucher specimen: Not collected

8. Boshniakia himalaica Hook. & Thoms. ex Hook.f.

Synonym: *Xylanche himalaica* (Hook. & Thoms.) G. Beck

Family: Orobanchaceae

Local name: Kangdol (Tamang)

Description: Parasitic herb up to 50 cm high, stem stout, erect covered with overlapping scale leaves. Flowers in a dense, stout spike, yellowish-brown. Fruit a capsule, ovoid, to 2 cm, 4-valved.

Distribution: CE (2900-4300m); Himalaya (Uttar Pradesh to Arunachal Pradesh), China, Taiwan.

Habitat: Sub-alpine moist scrubland.

Part used: Root

Ethnomedicinal uses: Root of the plant is crushed and a paste is prepared. The paste is applied in cuts and wounds for healing.

Voucher specimen: Kyanjin, 3800m, 13th Jun 2006, *D. Prasai and N. Shrestha* 215 (TUCH).

9. Cordyceps sinensis (Berk.) Sacc.

Synonym: *Sphaeria sinensis* Berk.

Family: Clavicipitaceae

Local name: Yarshagomba (Nepali)

Description: Fungus which comes out of the anterior end of a worm (caterpillar) during the monsoon period. The worm is seen living if the plant is collected in early monsoon. The plant looks like a small spike of *Ophioglossum* with dark brown frutification and yellowish white stalk 5-8 cm long.

Distribution: Himalaya

Habitat: Alpine pastures

Part used: Whole plant

Ethnomedicinal uses: Whole plant is taken with a glass of milk as a tonic during illness. It is believed to provide energy to the body.

Voucher specimen: Not collected

10. Delphinium himalayai Munz

Synonym: *Delphinium himalayense* Chowdhury ex Mukerjee

Family: Ranunculaceae

Local name: Bhongmar (Tamang)

Description: Herb, 40-60 cm tall. Leaf-blades to 10 cm wide, 5-lobed nearly to base, the lobes broad and further lobed and toothed. Flowers purplish-blue 2-2.5 cm including spur to 15 mm in a long one-sided spike 10-15 cm; outer petals bristly-hairy outside, hairless inside; inner petals blackish; spur ascending; flower-stalks erect; follicles densely hairy.

Distribution: WC (3000-4500m); Nepal.

Habitat: Dry rocky slopes

Part used: Root

Ethnomedicinal uses: Roots are used to cure cough, diarrhoea and ailments related to blood. Also used in liver trouble. Slightly poisonous.

Voucher specimen: Singmopa, 3600m, 30th Aug 2006, *N. Shrestha and D. Prasai* 224 (TUCH).

11. Ephedra gerardiana Wall. ex Stapf

Family: Ephedraceae

Local name: Somlata

Description: Shrub; branches short, slender. Leaves reduced to opposite, membranous scales. Flowers minute, 1-sexual, cone-like spikes, male and female spikes on separate plants; male spikes solitary or few, crowded, female cones 1-2-fid and solitary.

Distribution: W (3700-5200m); Afganistan, Karakoram, Himalaya (Kashmir to Nepal).

Habitat: Sub-alpine dry and exposed slope.

Part used: Stem

Ethnomedicinal uses: About 5-10ml of extract from the stem is used during asthma. Plant juice is used as cardiac stimulant and also used in respiratory diseases.

Voucher specimen: Kyanjin, 3800m, 13th Jun 2006, *D. Prasai and N. Shrestha* 216 (TUCH).

12. Eupatorium wallichii DC.

Synonym: *Eupatorium chinense* L.

Family: Compositae

Local name: Banmara (Nepali)

Description: A tall herb, locally abundant along track. Leaves simple or trisect, short petioled, elliptic-lanceolate, acuminate, coarsely serrate, pubescent on both surfaces. Heads whitish, numerous, in terminal corymbs.

Distribution: WC (2100m); India to Japan.

Habitat: Forest floor

Part used: Leaves

Ethnomedicinal uses: Leaf paste is prepared with little water and is applied on the effected parts of the skin during skin infection.

Voucher specimen: Not collected

13. Fragaria nubicola Lindl. ex Lacaita

Synonym: *Fragraria vesca* L. var. *nubicola* Hook.f.

Family: Rosaceae

Local name: Palpa polang (Tamang)

Description: Small, softly silky-haired perennial herb with long runners which root at the nodes. Leaves trifoliate, long-stalked, arising from the rootstock; leaflets ovate 2.5-4 cm, deeply and coarsely toothed. Flowers few, white, 1.5-2.5 cm across; petals 5, broadly obovate; calyx with 5 epicalyx lobes alternating with 5 calyx-lobes which are spreading in fruit; flowering stems 5-10 cm. Fruit c. 1 cm, red, insipid.

Distribution: WCE (1600-4000m); Himalaya (Kashmir to Bhutan), N. Myanmar, W. China.

Habitat: Moist forest floor.

Part used: Fruit

Ethnomedicinal uses: A teaspoonful of fruit juice is taken to get relief from profuse menstruation.

Voucher specimen: Thulo Syabru, 2200m, 12th Jun 2006, *D. Prasai and N. Shrestha* 213 (TUCH).

14. Fritillaria cirrhosa D.Don

Family: Liliaceae

Local name: Kaakoli (Nepali)

Description: Perennial herbs, occurring in alpine zone, with subglobose bulb, whitish fleshy scales, covered with whitish, papery tunic. Leaves linear-lanceolate, opposite or in whorls of 3, apex filiform or cirrhose. Flowers single, usually drooping, subtended by a whorl of usually 3 leaf-like bracts, outside flushed tawny or olive-brown, inside yellowish-green.

Distribution: WCE (3000-4600m); Himalaya (Nepal to Bhutan), China (Xizang), N. Myanmar.

Habitat: Open rocky slopes.

Part used: Whole plant

Ethnomedicinal uses: The plant is boiled and a cup of its juice is taken to reduce stomach pain. It is also used for the treatment of gastritis.

Voucher specimen: Gosainkunda, 4400m, 31st Aug 2006, *N. Shrestha, D. Prasai & B. Karki* 225 (TUCH).

15. Hippophae salicifolia D.Don

Synonym: *Hippophae rhamnoides* L. subsp. *salicifolia* (D.Don) Servett.

Family: Elaegnaceae

Local name: Govo, Taru (Tamang)

Description: Deciduous thorny willow-like shrub or small tree to c. 5m, with rusty scaly shoots, and oblong-lanceolate leaves. Leaves 3-7 cm long and 6-8 mm broad, with star-shaped hairs beneath, and above when young, and with a scaly midrib, very short-stalked. Female flowers solitary appearing on leafless stems. Male flowers c. 3 mm, with 2 scaly lobes, stamens usually 4; female flowers short-stalked, 2-lobed, stigma exserted. Fruit c. 7 mm globular, orange or red, succulent, ranged along the stems.

Distribution: WC (2200-3500m); Himalaya (Punjab to Bhutan), China (Xizang).

Habitat: Dry and exposed areas.

Part used: Fruit

Ethnomedicinal uses: Fruits are crushed and mixed with water. The juice is used as tonic as well as administered to the person suffering from diarrhoea.

Voucher specimen: Not collected

16. Hippophae tibetana Schlecht.

Synonym: *Hippophae rhamnoides* L. subsp. *tibetana* (Schlecht.) Servett.

Family: Elaegnaceae

Local name: Govo, Taru (Tamang)

Description: Densely branched shrub with long stout terminal spines formed from the tips of old branches. Leaves small narrow-elliptic, 1.5-2 cm long and 2-4 mm broad, numerous, covered with rust coloured scales. Flowers stalkless, yellowish, about 4 mm across, in clusters appearing on leafless stems. Fruit orange-red when ripe.

Distribution: CE (3800-4500m); Himalaya (Punjab to Bhutan), N. and W. China.

Habitat: Dry and exposed areas.

Part used: Fruit

Ethnomedicinal uses: Fruits are crushed and mixed with water. The juice is used as tonic as well as administered to the person suffering from diarrhoea.

Voucher specimen: Not collected

17. Juniperus recurva Buch.-Ham. ex D.Don

Family: Cupressaceae

Local name: Sukpa (Tamang)

Description: Low spreading shrub, or a tree to 10 m tall or occasionally taller with rather lax growth; stems often brown, with ultimate branches tail-like and curving separately in various directions. Leaves awl-shaped, 6-8 mm long, in whorls of three, more or less adpressed to the branchlets and loosely overlapping. Fruit purplish-brown to black, shining when ripe, ovoid, 8-13 mm long, 1-seeded.

Distribution: CE (3300-4600m); Pakistan (Chitral), Himalaya (Kashmir to Bhutan), NE India, Myanmar, W. China.

Habitat: Sub-alpine slopes

Part used: Fruit

Ethnomedicinal uses: Fruit of *Juniperus recurva* is consumed directly with water during throat infection.

Voucher specimen: Cholangpati, 3600m, 31st Aug 2006, *N. Shrestha, D. Prasai & B. Karki* 227 (TUCH).

18. Jurinea dolomiaea Boiss.

Synonyms: *Carduus macrocephalus* Wall., *Dolomiaea macrocephala* Royle, *Jurinea macrocephala* (Royle) C.B. Clarke

Family: Compositae

Local name: Dhupjadi (Nepali)

Description: Stemless perennial herbs with rosette of prostrate leaves radiating to 30cm from stout taproot. Leaves oblong blunt, pinnate-lobed, with lobes toothed or shallowly lobed, often with purple mid-vein, woolly beneath, stalked. Flower-heads pinkish, very short-stalked, in dense domed central cluster to 10 cm across. Outer involucral bracts lanceolate, hairy; inner narrower, long pointed, dark red, papery.

Distribution: WCE (3200-4300m); Himalaya (Kashmir to Nepal), W. Asia (Turkey and Iran).

Habitat: Dry and exposed sub-alpine slopes.

Part used: Root

Ethnomedicinal uses: Root of the plant is crushed and paste is prepared. The paste is mixed with water and filtered. It is consumed during diarrhoea.

Voucher specimen: Not collected

19. Lonicera myrtillus Hook.f. et Thoms.

Synonym: *Lonicera parviflora* Edgew.

Family: Caprifoliaceae

Local name: Taktak (Tamang)

Description: A bushy shrub on exposed bouldered slopes. Leaves small, short-petioled or sessile, oblong or obovate, obtuse, margin entire, recurved, glabrous. Flowers paired, white; calyx teeth minute, triangular, glabrous.

Distribution: WCE (2200-4200m); Himalaya (Kashmir to Bhutan), Myanmar, W. China.

Habitat: Dry and exposed area.

Part used: Root

Ethnomedicinal uses: Extract of root is used for the treatment of stomach disorder.

Voucher specimen: Gosainkunda, 4400m, 30th Aug 2006, *D. Prasai and N. Shrestha* 223 (TUCH).

20. Lyonia ovalifolia (Wall.) Drude

Synonym: *Andromeda ovalifolia* Wall.

Family: Ericaceae

Local name: Tomashing (Tamang)

Description: Shrub to small tree 6-12 m high. Leaves rounded at the base, glabrous or pilose beneath. Flower pedicellate, white, on simple raceme. Capsule, glabrous. Seeds small, linear-oblong.

Distribution: WCE (1300-3300m); Himalaya (Punjab to Bhutan), NE India, Myanmar, China, Malay Peninsula.

Habitat: Forest floor.

Part used: Leaves

Ethnomedicinal uses: Leaf paste of the plant is applied in pimples and other skin diseases. The effected part is thoroughly washed with water before its application.

Voucher specimen: Not collected

21. Mahonia napaulensis DC.

Synonym: *Berberis nepalensis* (DC.) Spreng.

Family: Berberidaceae

Local name: Kyarpa (Tamang)

Description: Erect evergreen shrub to 3 m, with stout little-branched stems and large pinnate leaves borne at the ends of the stem. Leaves oblong-lanceolate, to 40 cm, with 4-5 pairs of stiff, slightly overlapping ovate leaflets spiny marginal teeth and conical apices; leaflets largest in the middle of the leaves, 6-9 cm long. Flowers yellow, in terminal clusters of several or many, dense; many flowered spikes, 10-25 cm long; petals c. 6 mm, notched. Fruits in dense cylindrical clusters, berries blue, strongly bloomed, 9 mm long.

Distribution: WCE (1000-2900m); Himalaya (Nepal to Bhutan), NE India.

Habitat: Dry and exposed forest area.

Part used: Bark

Ethnomedicinal uses: Bark is crushed and a juice is prepared. A drop of bark juice is applied during the irritation of the eyes.

Voucher specimen: Not collected

22. Myrica esculenta Buch.-Ham. ex D. Don

Synonym: *Myrica integrifolia* Roxb.

Family: Myricaceae

Local name: Namin (Tamang)

Description: Evergreen, dioecious tree; bark 1.5 cm thick, outer surface rough, brown, inner surface smooth. Leaves crowded towards the end of the branches, lanceolate, 7-13 cm long, acute or obtuse, entire. Flowers minute, unisexual, male flowers in catkins and female flowers axillary.

Distribution: WCE (1200-2300m); Himalaya (Kashmir to Bhutan), India, Myanmar, W. and S. China and South to Malaysia.

Habitat: Forest area

Part used: Bark, root

Ethnomedicinal uses: The extract is prepared from the bark and consumed for the treatment of heart disease.

Voucher specimen: Thulo Syabru, 2200m, 11th Jun 2006, *D. Prasai and N. Shrestha* 210 (TUCH).

23. Pieris formosa (Wall.) D.Don

Synonym: *Andromeda formosa* Wall.

Family: Ericaceae

Local name: Prapra (Tamang)

Description: Shrub or small evergreen tree to 3 m high. Leaves dark green, leathery, lanceolate, brilliant red when young in spring, mature leaves 6-15 cm long, stalk finely toothed. Flowers small, white, globular, pendant; corolla 5-8 mm, constricted at the mouth and shallowly lobed; calyx-lobes triangular, glandular-hairy, capsule globular, 5-valved.

Distribution: CE (2000-3300m); Himalaya (Nepal to Bhutan), NE India, Myanmar.

Habitat: Mixed forest.

Part used: Leafy shoot

Ethnomedicinal uses: Leaf and stem of the plant is believed to possess anthelmintic property. Leaf extract is prepared and consumed to get rid of intestinal worms.

Voucher specimen: Brabal, 2200m, 10th Jun 2006, *D. Prasai and N. Shrestha* 208 (TUCH).

24. Potentilla peduncularis D. Don

Synonym: *Potentilla velutina* Wall.

Family: Rosaceae

Local name: Pangthar (Tamang)

Perennial herb; rootstock stout, covered with old leaf bases. Leaves to 20 cm, mostly basal, silvery haired when young, with many overlapping oblong and deeply toothed leaflets mostly 1.3 to 2.5 cm long with long soft silvery hair beneath, and silky hairs or hairless above. Flowers yellow, 1.3-2.5 cm across, few, usually on stems as long as or longer than the leaves; calyx silky-haired.

Distribution: WCE (3000-4700m), Himalaya, China.

Habitat: Alpine dry slopes

Part used: Root

Ethnomedicinal uses: Root paste is prepared and mixed with water. The juice is taken to get relief from headache.

Voucher specimen: Gosaikunda, 4400m, 31th Aug 2006, *D. Prasai and N. Shrestha* 228 (TUCH).

25. Rheum moorcroftianum Royle

Family: Polygonaceae

Local name: Yayuchawa (Tamang)

Description: Robust herb. Leaves stalked, large, orbiculate, leathery, glabrous above, stellately pubescent beneath. Flowers magenta, in racemes arising from the rootstock.

Distribution: WC (3600-4400m); Himalaya (Uttar Pradesh, Nepal).

Habitat: Sub-alpine dry slopes

Part used: Root

Ethnomedicinal uses: Root paste is prepared by finely crushing the roots. It is consumed after mixing it with enough water. It is believed to be useful in diarrhoea. The stem and leaves of the plant are also used as pickle.

Voucher specimen: Not collected

26. Rhododendron arboreum Smith

Synonym: *Rhododendron puniceum* Roxb.

Family: Ericaceae

Local name: Paramendo (Tamang)

Description: Tree, 7-14 m high. Leaves oblong-lanceolate, entire, acute. Flowers deep scarlet to pinkish white, campanulate, in many flowered head on branch tips.

Distribution: WCE (1500-3300m); Himalaya (Kashmir to Arunachal Pradesh), China (Xizang), NE India, Myanmar.

Habitat: *Abies-Rhododendron* forest

Part used: Flower

Ethnomedicinal uses: Flower is considered as an appetizer and tonic. Flowers are chewed to arrest profuse diarrhoea; flower juice is also taken in amoebic dysentery.

Voucher specimen: Not collected

27. Rubia manjith Roxb. ex Fleming

Synonym: *Rubia cordifolia* Linn. var. *mungista* (Roxb.) Miq.

Family: Rubiaceae

Local name: Tiru (Tamang)

Description: Climbing herb; root 5 mm wide, externally longitudinally striated, yellowish red. Leaves in whorls of 4, long stalked, 5-10 cm long, pointed. Flowers small, dark red in numerous, small cymes, terminal. Fruit 3-4 mm in diameter and didymous or globose.

Distribution: CE (1200-2100m), Himalaya (Himachal Pradesh to Bhutan), NE India (Meghalaya).

Habitat: Exposed slope, forest floor.

Part used: Root

Ethnomedicinal uses: Root is crushed and a paste is prepared, it is applied for the treatment of skin diseases.

Voucher specimen: Dhunche, 2000m, 7th Sep 2006, *D. Prasai, S. Yadav and N. Shrestha* 235 (TUCH).

28. Rubus ellipticus Sm.

Synonym: *Rubus gowreephul* Roxb.

Family: Rosaceae

Local name: Ainselu (Nepali)

Description: Scrambling shrub. Leaves alternate, leaflets sharply often irregularly toothed, lateral sessile, terminal stalked. Flowers white or pink, internal and axillary corymbose and solitary or in small clusters, fruit in achene, yellow.

Distribution: WCE (1700-2300m); Himalaya (Swat to Bhutan), NE India, Srilanka, Myanmar, East to West China, Philippines.

Habitat: Dry and exposed forest area.

Part used: Fruit, Root.

Ethnomedicinal uses: A concentrated decoction of ripe fruit is taken to cure dysentery. Ripe fruits are eaten as febrifuge. Root paste is applied on wounds.

Voucher specimen: Thulo Syabru, 2200m, 4th Sep 2006, *D. Prasai and N. Shrestha* 232 (TUCH).

29. Rumex nepalensis Spreng.

Family: Polygonaceae

Local name: Alpibi (Tamang)

Description: Annual herb. Leaves entire, lower ones long-stalked, oblong, ovate, petioled, base widely or narrowly cordate. Flowers bisexual, in whorls forming long, nearly leaflets racemes, reddish or green. Fruiting sepals 3, one large and two small, broadly ovate, fringed with comb-like hooked teethed, the mid vein of one thickened and forming an oblong tubercle. Fruit trigonous.

Distribution: WCE (1200-4200m); SW Europe, W. Asia, Himalaya, India, East to W. and C. China.

Habitat: Open fallow land.

Part used: Root

Ethnomedicinal uses: Root paste is used during fractures and sprains. Root is finely crushed and paste is prepared. It is then applied to the affected parts.

Voucher specimen: Not collected

30. Saussurea gossypiphora D.Don

Synonym: *Saussurea gossypina* Wall.

Family: Compositae

Local name: Bhutkesh (Nepali)

Description: Herb, remarkably looking like a snow ball. The whole plant more or less globular and densely covered with long white-or grey-wolly hairs. Flowers- heads, deeply embedded in wolly hairs, cylindrical 1.3-2 cm long, and with many purple florets, densely clustered at the apex of the stout.

Distribution: CE (3500-3700m); Himalaya (Uttar Pradesh to Bhutan), China (Xizang, Yunan).

Habitat: Sub-alpine rocky slopes.

Part used: Root

Ethnomedicinal uses: Extract from root is consumed during fever. It is believed to act as an antipyretic.

Voucher specimen: Not collected

31. Swertia angustifolia Buch.-Ham. ex D.Don

Synonym: *Ophelia angustifolia* (Buch.-Ham. ex D.Don) G.Don

Family: Gentianaceae

Local name: Timda (Tamang)

Description: Annual herbs, 20-40 cm high, occurring in tropical and subtropical zones, with lanceolate to linear, rarely elliptic leaves, and white or bluish white flowers in panicles made up of cymes.

Distribution: WCE (600-2600m); Himalaya (Kashmir to Bhutan), N. India, Myanmar, S. China

Habitat: Forest floor, exposed area.

Part used: Whole plant

Ethnomedicinal uses: Whole plant is crushed and extract is prepared. The extract is taken in small amount during fever.

Voucher specimen: Cholangpati, 3600m, 31st Aug 2006, *N. Shrestha & D. Prasai* 226 (TUCH)

32. Swertia multicaulis D.Don

Family: Gentianaceae

Local name: Sharmaguru (Nepali)

Description: Annual herb, with many short spreading stems, 5-12 cm, arising directly from stout rootstock, leaves narrowly spathulate c. 5 cm, narrowed to a long winged leaf-stalk. Flowers slaty-blue, long-stalked, in a much-branched inflorescence.

Distribution: CE (4000-4900m), Himalaya (Nepal to Bhutan), China (Xizang).

Habitat: Sub-alpine pastureland

Part used: Root

Ethnomedicinal uses: Paste from the root of the plant is used to prevent profuse bleeding and infection from wounds and cuts. It is also applied in burns.

Voucher specimen: Not collected

33. Taxus wallichiana Zucc.

Synonym: *Taxus baccata* L. subsp. *wallichiana* (Zucc.) Pilger

Family: Taxaceae

Local name: Silding (Tamang)

Description: Tree, up to 8 m tall. Leaves sessile, linear, 2-3 x 2- 0.4 cm acute; 1-nerved. Male cone oval, creamy white. Fruit red when ripe.

Distribution: WCE (2300-3400m); Afganistan, Himalaya (Kashmir to Bhutan), NE India, N Myanmar, IndoChina, W. China, Malaysia.

Habitat: Dry and exposed area.

Part used: Leaves

Ethnomedicinal uses: Extract from the leaves is consumed for the treatment of asthma, bronchitis and other respiratory tract infection.

Voucher specimen: Not collected

34. Thallictrum foliolosum DC.

Synonym: *Thallictrum falconeri* Lecoyer

Family: Ranunculaceae

Local name: Bathuri (Tamang)

Description: Tall, glabrous herb. Leaves pinnately decompound; leaflets orbicular, crenate. Flowers blue, polygamous, in much branched panicles. Achenes oblong, ribbed.

Distribution: WCE (1300-3400m); Himalaya (Kashmir, Uttar Pradesh to Arunachal Pradesh), N. Myanmar, China (Xizhang).

Part used: Root

Ethnomedicinal uses: Root is finely crushed and mixed with enough of water. The juice is consumed during gastritis and stomach disorder.

Voucher specimen: Thulo Syabru, 2200m, 4th Sep 2006, *N. Shrestha & D. Prasai* 233 (TUCH)

35. Zanthoxylum armatum DC.

Synonym: *Zanthoxylum hostile* Wall.

Family: Rutaceae

Local name: Timur (Nepali)

Description: Shrub or small tree. Leaves usually pinnate, leaflets 2-6 pairs, elliptic-lanceolate, petioled and rachis usually winged. Flowers 3-4 mm in diameter, small,

yellow, in panicles. Fruit 4-5 mm in diameter, pale red. Seeds 2 mm in diameter, oval and dark.

Distribution: WCE (1100-2500m); Himalaya (Kashmir to Bhutan), N India, East to China, Taiwan, Philippines, Lesser Sunda Island.

Habitat: Dry land

Part used: Fruit

Ethnomedicinal uses: Powered fruit is taken internally as stomachic and also used as curry and antimicrobial spices in cooking.

Voucher specimen: Thulo Syabru, 2200m, 4th Sep 2006, *N. Shrestha & D. Prasai* 234 (TUCH)

36. Zanthoxylum nepalense Babu

Family: Rutaceae

Local name: Timur (Nepali)

Description: The plant is more or less similar to Zanthoxylum armatum, but its flowers occur in short stalkless, flat-topped branched clusters. Leaf stalk and rachis unwinged, and with short or oval leaflets 1-3 cm long, with prominent lateral veins.

Distribution: CE (2700-3100m); Nepal.

Habitat: Dry and exposed forest area.

Part used: Fruit

Ethnomedicinal uses: Powered fruit is taken internally as stomachic and also used as curry and antimicrobial spices in cooking.

Voucher specimen: Not collected.

6. DISCUSSION

6.1 Tamang community and their ethnobotanical knowledge

Tamangs are the dominant ethnic group constituting about 65 percent of the total population in Rasuwa. Very small numbers of other ethnic people inhabit the area. The Tamang society residing in the area has retained their culture, tradition and life style. The culture and language, however, differ from place to place. Tamang living in the northern side close to Tibet border are influenced by Tibetan lifestyle. They are more close to Tibetan Sherpa and differ from Tamang inhabiting the central part of the district, in culture and language. People have rich traditional knowledge on utilization of plant resources for their subsistence and livelihood. A wide variety of wild species are utilized for food supplement, fodder, fuel wood, timber and medicines. The knowledge is possessed by elderly people and some "Lama". Kavrepalanchowk district in the central Nepal has some population of Tamangs. However, their culture and lifestyle are influenced more by Brahmin and Chhetri communities. Ethno-medicinal practices of Tamangs in the district have been studied by Manandhar (1991). He reported 95 species of both wild and cultivated medicinal plants from the area used for the treatment of various ailments. Similarly, 100 wild species have been documented from Kathmandu valley that are used by Tamang community for various purposes like food, fodder, medicine, firewood, timber, etc (Shrestha, 1988a, 1988b). Except in few places at lower elevation of Rasuwa, Tamangs are isolated from other castes and tribes in all parts of the district. This has prevented intermingling of cultures and hence the utilization of plant resources is based entirely on Tamang's culture and lifestyle.

6.2 Ethnobotanically important plants

Rich Tamang culture has enriched the traditional knowledge of the people. This has uncovered the use value of many species of wild plants. Several works have been done in Rasuwa and adjoining areas to document plants of high ethnobotanical value (Bhattarai, 1989; Bhandari and Shrestha, 1982; Shrestha, 1988a, 1988b; Joshi and Edington, 1990; Yonzon, 1993). Emphasis has been given on documenting plants having medicinal value. Altogether, 46 species of medicinal plants that are of high utilization in the area have been reported. In addition, 35 other species of plants widely used for firewood, vegetable, timber, incense, fruit, dye, etc. were reported. The use of *Myricaria rosea* as a ceremonial plant is a new report from the place. It is used in funeral in Rasuwa. This plant is used to treat cold and back pain in Manang valley. Decoction of stem is used to treat tuberculosis

at Manang and plant is prepared as a tea to prevent coughing at Rolwaling (Manandhar, 1987; Pohle, 1990; Sacherer, 1979). The whole plant of *Polygonatum cirrhifolium* is used as vegetables in Rasuwa. In other parts of the country, a similar species *Polygonatum verticillatum* is cooked as a vegetable (Bhattarai, 1992a; Manandhar, 1986b; Sacherer; 1979). Similarly the use of *Salix daltoniana* as incense is a new report of the plant from the country. The plant is called "Longmar" in Rasuwa and its inflorescence is used as incense.

6.3 Medicinal and aromatic plants

Medicinal and aromatic plants are vital to the rural livelihood of the people of Rasuwa. People largely depend upon these resources for their primary healthcare needs. A number of medicinal plants have been reported from the area from previous researches (Yonzon, 1993; Shrestha and Shrestha, 2000; Shrestha *et al*., 2002; Dangol, 2002). The present study has documented 46 species of highly utilized medicinal plants used for the treatment of 24 different medical ailments. The medicinal use of *Lonicera myrtillus* is a new report from the area. Root paste of the plant is used in fever in Langtang village. It is known by the name "Taktak". There is no report of medicinal value of the plant from other parts of the country. In Central Nepal, however, fruits are eaten (Pohle, 1990). Similarly, roots of *Boshniakia himalaica* which is known as "Kangdol" is used for cuts and wounds. The medicinal value of the plant from the area is a new report. *Jurinea dolomiaea*, one of the threatened species, is found only in Saraswatikunda region. The root of the plant is used for diarrhoea. The use of this species for medicinal purpose has not been reported from the area previously. In Jumla, plant is kept in the house to wand evil spirits (Manandhar, 1986a). Regarding the parts used, roots of about 47 % of the plants are used for medicinal purpose, followed by leaves and stem (13 %), fruit and bark (8 %), whole plant (6 %), flower (3 %) and seed (2 %). The plants whose roots are utilized are more vulnerable and are more likely to become threatened because, uprooting causes the destruction of the whole plant and if it is before the fruiting season; there is even more chances of destruction. This implies that about 47 % of the utilized species of plants in the area are subjected to high threat risk.

6.4 Dependency of Tamang community on medicinal plants

Due to lack of modern facilities, local people largely depend upon wild medicinal herbs for their primary healthcare. About 90 % of the total utilized species of medicinal herbs are wild collected in Thulo Syabru village. The remaining 10 % comes from cultivated products. The cultivation is limited to only few medicinal herbs and that, too, for commercial purpose. It is believed that the cultivated products have low medicinal value in comparison to wild products. Thus, people opt for collecting from the wild rather depending upon the cultivated products. In addition, the challenges faced by farmers in growing these herbs have disappointed many growers and they have eventually abandoned the practice. Cultivation and domestication has been identified as the most effective solution for conservation of rare and threatened species. It is the only viable option for the resource and for the income of the traditional people who depend on it (Farooquee and Saxena 1996; Shrestha *et al.*, 2003; Sharma *et al.*, 2005). Currently there are very few households that are cultivating medicinal herbs in their farm lands. In Thulo Syaphru village, only 6 households out of 120 households have adopted medicinal plants farming. The grown species include *Swertia chirayita, Rheum australe, Valeriana jatamansii* and *Paris polyphylla*. The cultivation is in preliminary phase and limited to few species only. Thus, people have to depend upon the wild resources to meet the growing demand. Higher dependency of the local people towards forest resources has increased the chances of species being more threatened and vulnerable. Most of the species of medicinal plants occurring in the area are already threatened both globally as well as locally (Shrestha, 2007). The continuation of the casual factors and unmanaged harvesting practices can seriously degrade the resources.

6.5 Preference analysis

Preference analysis was carried out to evaluate the most preferred species of medicinal plants in the area. It was accompanied by calculating the preference index value for a particular species. Least the preference index value, higher is the preference ranking of the species. Ten species of medicinal plants were found to be the most utilized and highly preferred species. They are *Neopicrorhiza scrophulariiflora, Dactylorhiza hatagirea, Swertia chirayita, Nardostachys grandiflora, Valeriana jatamansii, Rheum australe, Bergenia ciliata, Rhododendron anthopogon, Aconitum spicatum* and *Paris polyphylla. Neopicrhorhiza scrophulariiflora,* locally called "Kutki", was the most preferred species of all, followed by *Dactylorhiza hatagirea, Swertia chirayita* and

Nardostachys grandiflora. The least preferred species was *Paris polyphylla.* The preference ranking of these species was based on the number of respondents placing the species in first preference level. *Neopicrorhiza scrophulariiflora* is abundantly found in Laurivinayak and Gosainkunda region. Due to easy availability of the species in the area and its high efficacy in treating fever, it is the most commonly utilized medicinal herb. *Swertia chirayita* is the next preferred species in the area. It occurs in wild in the forests as well as in agricultural lands as cultivated medicinal herb. High market demand has made this species popular among the local people and consequently, the quest for its cultivation and collection has increased tremendously. In addition, its medicinal properties have been well recognized in the area. It is known by the name "Timda" and is the most common herb utilized after Kutki for the treatment of fever. Similarly, medicinal properties of all other preferred species of medicinal plants are well established and people prefer to use these plants for their primary health care needs.

Paudel (2000) carried out preference analysis of medicinal plants, fodder plants, firewood plants and timber plants among the Tharu community living in the central part of Dang. He identified 5 species of medicinal plants, 11 species of fodder plants, 7 species of firewood plants and 7 species of timber plants as the most preferred species in the livelihood of Tharu community. The preferred medicinal plants in Dang were different from those reported from Rasuwa. The topography and altitudinal variation of the places have produced different plants in these areas. In addition, the two distinctly different communities have their own way of utilizing medicinal plants for local therapeutics.

6.6 Status of highly preferred species of medicinal plants

The highly preferred species of medicinal plants in the area refers to their high popularity as medicines among the folk people. From the present study, ten species of medicinal plants were identified to be the most preferred ones in terms of their utilization in local therapeutics. Except *Neopicrorhiza scrophulariiflora* and *Rhododendron anthopogon* all other eight species were poorly distributed. *Neopicrorhiza scrophulariiflora* is abundantly found in Gosainkunda region towards the south of the lake in open alpine pastures. Despite its easy availability and exploitation by human and livestock, the species has flourished well in the region. Recent study carried out by Shrestha (2007) showed a good population density of the species (17.5 plants per m^2) in Gosainkunda region. This shows *Neopicrorhiza scrophulariiflora* as well established species in the Gosainkunda area. *Dactylorhiza hatagirea* known by the name

"Ompolakpa" was the most threatened species of all having its distribution only at Laurivinayak area. *Dactylorhiza hatagirea* is banned by the Government of Nepal for collection, transportation and trade. It is placed under the endangered category by CAMP workshop (Bhattarai *et al.*, 2002). However, there is increasing demand of this species among the local people due to high medicinal properties of its tuber. The species prefers specific habitat and soil condition. It is found in rocky sub-alpine slopes and in places not easily accessible. Very less population density of this species in these areas clearly states that slight human intervention can seriously destruct the species' number and frequency.

7. CONCLUSION

Langtang National Park, which lies in the Central Himalayan region, is a repository of a large number of highly valuable medicinal plants. It is a chief hotspot area in Central Nepal that harbors many threatened and endemic species. Diverse altitudinal variation ranging from 792 to 7245 m, coupled with complex topography and geology have produced a rich biodiversity and a unique patchwork of vegetation. The major portion of the park lies within Rasuwa district. It covers almost 56 % of the total area of the park. Tamangs are the dominant ethnic group in the area. Tamang community constitutes about 65 % of the total population of Rasuwa. The community possesses rich traditional knowledge on utilization of plant resources for their general subsistence and livelihood. Day to day life in these mountain villages is crucially dependent on plant resources. The present study has documented 46 species of highly utilized medicinal plants being used in local therapeutics in the area. Other ethnobotanically significant plants include those used for vegetables (8 species), firewood supplement (6 species), timber and incense (5 species each), edible fruits (4 species), dye (1 species) and miscellaneous uses (4 species). Thus, there is greater dependency of the local people on wild resources for their daily needs.

People have no access to modern facilities and hence, they rely largely on wild resources for local healthcare. Of the total persons interviewed, eighty percent of the people used local medicines for their primary healthcare. The use is self administered and only in some severe cases, the help of a trained practitioner is sought. About 10 % of the people in the area depend upon cultivated products and the remaining 90 % utilizes forest resources. Cultivation of medicinal plants is in preliminary phase and is limited to few households and few medicinal herbs only. Out of 120 households in Thulo syaphru village, only 6 households have cultivated medicinal herbs in their farm lands. The species that are in cultivation includes *Swertia chirayita*, *Rheum australe*, *Paris polyphylla* and *Valeriana jatamansii*.

Higher dependency of the local community on wild resources and less availability of these resources in nature has made them more vulnerable. In addition, unsustainable harvesting practices and habitat loss due to human intervention and natural causes have imposed serious threat to these species. Many of the species occurring in the area are already threatened and continuation of the casual factors can put them under high threat risk. Wise and sustainable utilization of the resources and promotion of the species into cultivation practices seems to be the only viable option for their effective management.

8. RECOMMENDATIONS

Based on the present study, following recommendations have been outlined for the sustainable management of natural resources and conservation of traditional ethnobotanical knowledge of ethnic community on plants utilization.

- Primary healthcare by locally available medicines should be encouraged. The utilization of local herbs for common ailments could greatly enhance their utility and conservation.
- Awareness campaigns and trainings on sustainable harvesting practices should be launched.
- Cultivation practices should be expanded to other highly utilized and commercially valuable medicinal herbs.
- Alternative sources of income should be developed in the area. This will reduce dependency of the people on wild resources.
- Effective monitoring of the wild resources should be carried out by National park authorities, community members and researchers.

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Appendix-1
Medicinal plants reported from study area (Rasuwa)

S.N.	Species	Family	Locality	Altitude (m)
1.	*Aconitum spicatum* (Bruhl) Stapf	Ranunculaceae	Laurivinayak	3800
2.	*Acorus calamus* L.	Araceae	Dhunche	2000
3.	*Artemisia vulgaris* L.	Compositae	Singompa-Laurivinayak	3600-3800
4.	*Asparagus racemosus* Willd	Liliaceae	Syabrubensi	1700
5.	*Astilbe rivularis* Buch.-Ham ex D.Don	Saxifragaceae	Dhunche	2000
6.	*Berberis aristata* Roxb. ex DC.	Berberidaceae	Cholangpati	3600
7.	*Berberis asiatica* Roxb. ex DC.	Berberidaceae	Thulosyabru, Brabal	2200
8.	*Berginia ciliata* (Haw.) Sternb	Saxifragaceae	Brabal	2200
9.	*Betula alnoides* Buch.-Ham ex D.Don	Betulaceae	Cholangpati	3600
10.	*Boschniakia himalaica* Hook. & Thomson ex Hook.f.	Orobanchaceae	Kyanjin	3800
11.	*Cordyceps sinensis* (Berk) Sacc.	Hypocreaceae	Kyanjin	3800
12.	*Dactylorhiza hatagirea (*D.Don) Soo	Orchidaceae	Laurivinayak	3800
13.	*Delphinium himalayai* Munz	Ranunculaceae	Cholangpati	3600
14.	*Ephedra gerardiana* Wall. ex Stapf	Ephedraceae	Kyanjin	3800
15.	*Eupatorium adenophorum* Spreng.	Compositae	Dhunche, Deurali	2200
16.	*Fragaria nubicola* Lindl. ex Lacaita	Rosaceae	Cholangpati	3600
17.	*Fritillaria cirrhosa* D.Don	Liliaceae	Cholangpati, Gosainkunda	3600-4400
18.	*Hippophae salicifiolia* D.Don	Elaegnaceae	Langtang village	3600
19.	*Hippophae tibetana* Schlecht.	Elaegnaceae	Langtang village	3600
20.	*Juniperus recurva* Buch.-Ham ex D.Don	Cupressaceae	Kyanjin	3800
21.	*Jurinea dolomiaea* Boiss.	Compositae	Saraswatikunda	4300
22.	*Lonicera myrtillus* Hook.f. & Thomson	Caprifoliaceae	Kyanjin	3800
23.	*Lyonia ovalifolia* (Wall.) Drude	Ericaceae	Thulo Syabru, Brabal	2200
24.	*Mahonia napaulensis* DC.	Berberidaceae	Thulo Syabru-Cholangpati	2200-3600
25.	*Myrica esculenta* Buch.-Ham ex D.Don	Myricaceae	Thulo Syabru	2200
26.	*Nardostachys grandiflora* DC.	Valerianaceae	Laurivinayak	3800
27.	*Neopicrorhiza scrophulariiflora* (Penell) Hong	Scrophulariaceae	Gosainkunda	4400
28.	*Paris polyphylla* J. E. Sm.	Liliaceae	Thulo Syabru	2200
29.	*Pieris formosa* (Wall.) D.Don	Ericaceae	Brabal	2200
30.	*Potentilla peduncularis* D.Don	Rosaceae	Gosainkunda	4400
31.	*Rheum australe* D.Don	Polygonaceae	Cholangpati, Langtang village	3800
32.	*Rheum moorcroftianum* Royle	Polygonaceae	Gosainkunda	4400
33.	*Rhododendron anthopogon* D.Don	Ericaceae	Laurivinayak, Gosainkunda	3800-4400
34.	*Rhododendron arboreum* J.E. Smith	Ericaceae	Below Cholangpati	3000
35.	*Rubia manjith* Roxb. ex Fleming	Rubiaceae	Thulo Syabru, Dhunche	2200

36.	*Rubus ellipticus* Sm.	Rosaceae	Above Dhunche, Thulo Syabru	2200
37.	*Rumex nepalensis* Spreng.	Polygonaceae	Dhunche, Cholangpati	2000-3600
38.	*Saussurea gossypiphora* D.Don	Compositae	Gosainkunda	4400
39.	*Swertia angustifolia* Buch.-Ham ex D. Don	Gentianaceae	Singompa-Cholangpati	3500
40.	*Swertia chirayita* (Roxb. ex Fleming) Karsten	Gentianaceae	Thulo Syabru	2200
41.	*Swertia multicaulis* D.Don	Gentianaceae	Gosainkunda	4400
42.	*Taxus wallichiana* Zucc.	Taxaceae	Kyanjin	3800
43.	*Thallictrum foliolosum* DC.	Ranunculaceae	Thulo Syabru-Cholangpati	2200-3600
44.	*Valeriana jatamansii* Jones	Valerianaceae	Thulo Syabru, Brabal	2200
45.	*Zanthoxylum armatum* DC.	Rutaceae	Thulo Syabru	2200
46.	*Zanthoxylum nepalense* Babu	Rutaceae	Ghoda tabela	3300

Appendix-2
Ethnomedicinal Field Notes Form

Date:

Collection Number:

Scientific Name:

Family:

Local Name:

Location:

Community:

Altitude:

Long/ Lat:

Climate:

Vegetation type:

Life form: a) Herb b) Bush c) Trees d) Grass e) Vine/others

If tree/ bush or vine, then height of the plant:

Color of flower:

Plant appearance:

Flowering season:

Fruiting season:

Medicinal use:

Plant parts used:

Time of collection:

Method of collection:

Quantity of plant part used:

Amount and name of other ingredients used:

Appendix-3

Plants used in traditional medicinal practices

S.N.	Species	Local Name	Ailment	Parts used	Mode of use

PHOTO PLATE 1

Neopicrorhiza scrophulariiflora (Pennell) Hong
(Gosainkunda: 4400m)

Rheum australe D.Don
(Langtang village: 3600m)

Maharanga emodi (Wall.) A.DC.
(Deurali:2700m)

Rubia manjith Roxb.
(Above Dhunche: 2200m)

Paris polyphylla Sm.
(Thulo Syabru: 2200m)

Valeriana jatamansii Jones
(Brabal: 2200m)

PHOTO PLATE 2

Aconitum spicatum (Bruhl) Stapf
(Laurivinayak: 3800m)

Lomatogonium carinthiacum (Wulfen) Rchb.
(Gosainkunda: 4400m)

Swertia chirayita (Roxb. ex Flem.) Karstn
(Thulo Syabru: 2200m)

Artemisia vulgaris L.
(Singompa: 3400m)

Zanthoxylum acanthopodium DC.
(Thulo Syabru-Cholangpati: 2600m)

Potentilla peduncularis D.Don
(Saraswatikunda: 4300m)

PHOTO PLATE 3

Cultivation of medicinal plants
(Thulo Syabru: 2200m)

Tamang settlements in Rasuwa
(Dhunche: 2000m)

Team members pressing the collected specimens (Laurivinayak: 3800m)

Team members interviewing local healer
(Thulo Syabru: 2200m)

Indigenous Tamang people
(Thulo Syabru: 2200m)

Hotel Red Panda
(Singompa: 3400m)