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Diversity of Fodder and Grasses in Sankhuwasabha

Bal K Joshi[1] and Krishna B Karki[2]

[1] Agriculture Botany Division, NARC Khumaltar <joshibalak@rediffmail.com>
[2] Soil Science Division NARC Khumaltar

ABSTRACT

Diversity assessment is essential at species and variety level for sustainable use, conservation and improvement of fodder and grasses species. Survey is the preliminary method to assess status of species and varieties. Field observation, farmers' responses and literature review were applied in this study to measure the diversity of fodder and grasses in Hatiya, Num and Pawakhola VDCs of Snakhuwasabha, Arun valley. Existence of great diversity in both fodder and grasses are supported by geoclimatic variations. There are 22 kinds of bamboo species and subspecies, 69 different species of fodder and more than 25 species of grasses. Farmers collect fodder and grasses from two places 1. from their own farm and homestead and 2. from forest. Lack of cultivation practices of fodder and grasses raised issue of conservation. All fodder and grasses available in these areas are indigenous except Napier and clover. Common fodders are Amrisho, Khanayo, Badahar, Tanki, Koirala, Kavro and Nivaro in farm and Paiyun, Chuletro and Jhingane in forest. Some of these fodder and grasses are endangered due to many factors. Major factors reducing the diversity of fodder and grasses are extensive cultivation of cardamom, invasion of banmara, slash and burn agriculture and over grazing. Farmers reported lost of very few species from these areas. Livestock is affected negatively by decreasing availability of Kharka, fodder and grass species. Diversity of fodder and grass is directly linked to number and kinds of livestock, wealth categories of farmers, land holding sizes and altitude. For the better management of livestock, fodder and grasses and for controlling soil erosion, different agro forestry systems eg sloping agricultural land technology should be identified and implemented suitable to specific area.

Key words: Diversity, fodder, grasses, Sankhuwasabha,

INTRODUCTION

Diversity and distribution of fodder and grasses reflect the status of livestock. Mid and foothills of Nepal have greatest types and number of fodder and grasses species. Indigenous species are found more in mid and high hills than in Tarai. Use of agroforestry system in hilly areas help to conserve and use these species. Almost a total of 170 species of fodder trees and shrubs can be found in mid and foothill ranges. All farmers' areas have different types of fodder and grasses that can be used directly to livestock after cutting or can be made hay and used later.

Feeds and fodder play an important role in the development of livestock. The yield whether reflected in the form of milk, meat or wool depends on the quality of feeds the animals are fed with. In a food deficit area, feeding nutritive diets to the animals is beyond question. Whatever grasses and fodders are available in the field or forest are fed to the animals. Farmers meet their fodder requirements by lopping fodder trees available in community and private forests. There are many government offices for pasture development or grasses seed production located from Tarai to high hills. Different kinds of pasture, alpine, arid cold, forest, open pastures exist in Nepal.

Fodder is one of the main components of the farming system in Nepal. Animals derive an estimated 35% of their feed from trees (Amatya 1990). The preference of fodder trees varies from one ecological zone to another. Farmers preferred a total of 44 different fodder tree species. With respect to the Development Regions, Western Development Region has the highest number of preferred fodder trees (Amatya 1990). Although exposure and precipitation influences the distribution of species many of the fodder species have a wide geographical distribution mostly growing in acid soil.

The Arun River Valley, located in Eastern Development Region and for being the deepest valley of the world, is rich in biodiversity both in terms of wild as well as domesticated life forms. There are 11 globally endangered mammals, and numerous plant species listed as endangered or threatened elsewhere (Shrestha and Joshi 1996). These days, there has been a variety of disturbances in the bio-diversity of this region due to poverty, increased population pressure, lack of knowledge in sustainable use of natural resources, slash-and-burn agriculture, bush fires, excessive wood extraction, and poaching (Shrestha 1989). Improper introduction of exotic crop varieties and modern inputs have led to the disappearance of the native varieties of crops (Thapa 1996). Native species have resistance to diseases and pests, and they also survive in adverse conditions, therefore study on existence of native crop plants is necessary.

This study evaluates the diversity of fodder and grasses in the Arun River Valley covering three village development committees (VDCs) of Num, Hatiya and Pawakhola in the Sankhuwasabha district (Figure 1). The major objective of this study is to assess the status of fodder and grass diversity and to understand and analyse the traditional knowledge of the local communities regarding the conservation and sustainable use of fodder and grasses in one of the world's unique mountain ecosystems with globally significant bio-diversity.

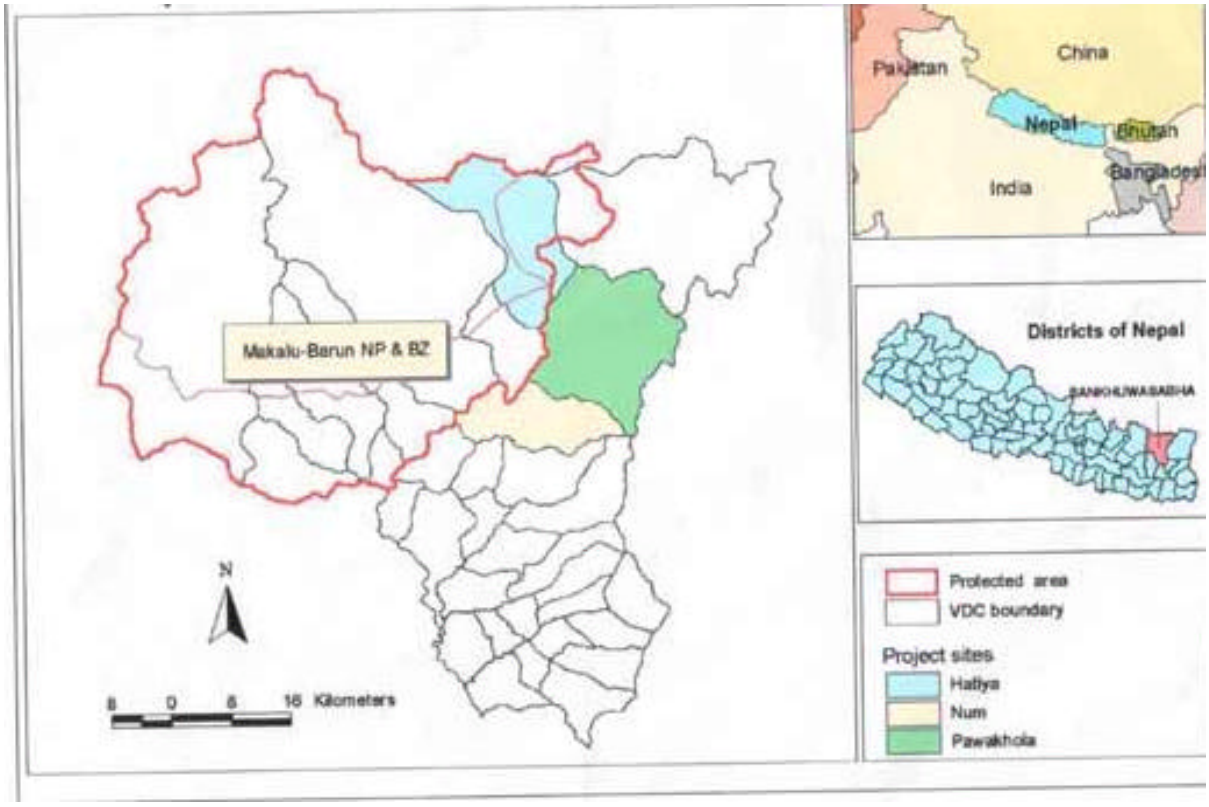

Figure 1. Location map of three VDCs of Sankhuwasabha district, where fodder and grass diversity was assessed.

METHODOLOGY

A desk study was conducted to collect and review relevant information regarding fodder and grasses in the study area. Libraries of The Mountain Institute (TMI), International Centre for Integrated Mountain Development (ICIMOD), World Conservation Union (IUCN), Nepal Agricultural Research Council (NARC) and King Mahendra Trust for Nature Conservation (KMTNC) were visited. Based on the gathered information, structured questionnaire and a checklist were developed for collecting relevant information from the field. The field visit itinerary is presented in Figure 2.

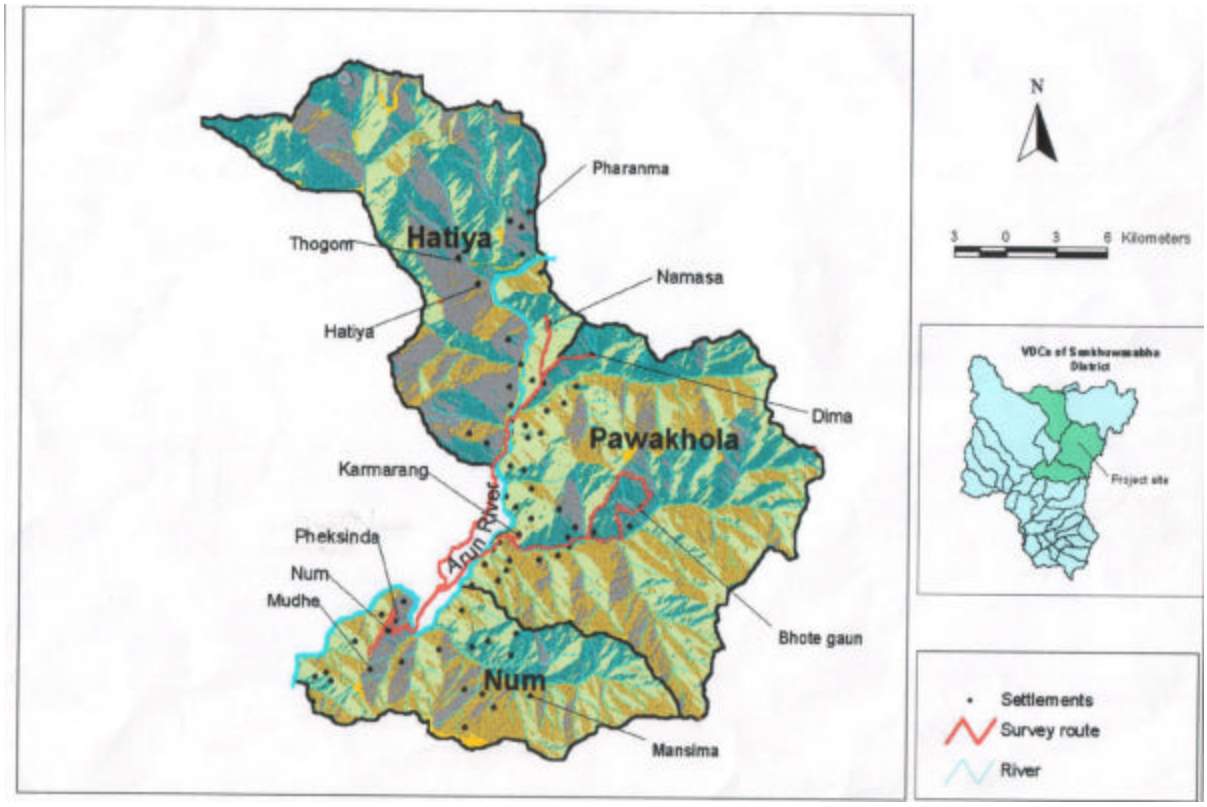

Figure 2. Survey route of agro biodiversity study in three VDCs of Sankhuwasabha district.

Groups of farmers were consulted for the purpose of holding discussion and collecting information by applying Rapid Rural Appraisal tools. Field observation, farmers' responses and literature review were applied in this study to measure the diversity of fodder and grasses in Hatiya, Num and Pawakhola VDCs of Sankhuwasabha, Arun valley. Additional information was collected from various agency officials working in Sankhuwasabha (Appendix I). Different plant species were listed related to livestock. Flora species richness was estimated at different land use systems.

FINDINGS

Study area

Num, Hatiya and Pawakhola are three VDCs of the Sakhuwasabha district of Koshi zone in the Eastern Development Region of Nepal. These VDCs lie between 27.30^o to 27.40^o North latitude and 87.15^o to 87.27^o East longitude (Figure 1). It takes 4 to 5 days of normal walking to reach these VDCs from Khandbari, the district headquarter. The altitude ranges from about 800 to 4,000 masl. The Bhotegaun settlement of Pawakhola lies at an altitude of 2472 m. The community forest of Jorkhabe Dada lies at an altitude of 4,192 masl. Because of the wide variation in altitude, this region has considerable biodiversity in agriculture.

Agro-climate

The study area lies in the high mountain physiographic region of Nepal (LRMP 1986). The vegetation line is below 5,000 m where biodiversity is very rich. The upper limit of agriculture goes to 3,000 m. This region enjoys a cool temperate type of climate with very high rainfall. It is said that this region is next to the Annapurna Region in terms of rainfall. The meteorological stations at Chepuwa at an altitude of 2,590 m and Num at an altitude of 1,497 m record an annual rainfall of 2,627 mm and 3,982 mm, respectively. There are instances when over 6,000 mm of rainfall has been recorded in these stations in some years (Kuwar 2000). The rainy season lasts for four months (June-September). Clouds cover the sky most of the time with rare sunshine during the monsoon period.

Table 1.Bamboo species and subspecies found in Sankhuwasabha

SN	Nepali name	Common name	Scientific name
1.	Ban bans	-	-
2.	Bans	Bamboo	Dendrocalamus strictus
3.	Bet	-	Calamus acanthospathus Griff.
4.	Bhalu bans	-	-
5.	Bhedh bans	-	Calamus tenuis
6.	Bhude bans	-	
7.	Chitrebans	-	Dendrocalamus sp.
8.	Choyabans	-	Dendrocalamus sp.
9.	Deu nigalo	-	-
10.	Dhanu bans	-	Dendrocalamus strictus
11.	Ghode	-	-
12.	Ghove bans	-	-
13.	Kalo bans	-	-
14.	Kalo nigalo	-	-
15.	Malbans	-	Bambusa nutans
16.	Malingo	-	Arundinaria maling
17.	Nigalo	Himalayan bamboo	Arudinaria falcate
18.	Nigalo	-	Arudinaria hookeriana Murno
19.	Singane bans	-	-
20.	Tama bans	Tufted bamboo	Dendrocalamus hamiltonii
21.	Thankre bans	-	-
22.	Tite nigalo	-	-

Table 2. Tree and shrub fodder species diversity in Num, Hatiya and Pawakhola, Sankhuwasabha

SN	Nepali name	Common name	Scientific name
1.		Calliandra	Calliandra calothyrsus
2.	Amriso	Broom grass	Thysanoleana maxima
3.	Anreli kanda	-	Mimosa rubicaulis
4.	Arkhaulo	-	Quercus fenestrata
5.	Badhar	Monkey jack	Artocarpus lakoocha
6.	Badhare	-	-
7.	Bainsh	-	Salix babylonica L.
8.	Ban kimbu	Mulberry	Morus sp
9.	Banjh	-	Quercus lanata Sm.
10.	Banmara	-	Eupatorium adenophorum
11.	Bar	-	Ficus bengalensis L.
12.	Bhate kaulo	-	Machilus odoratissima Nees
13.	Bhatmase	Flemengia	Flemengia congesta
14.	Bhimsen pati	-	Buddleja asiatica
15.	Bhorla	-	Bauhinia vahli
16.	Chulatro seto	-	Brassaopsis glomeulata
17.	Chulatro, kalo	-	Brassaopsis hainal
18.	Daar	-	Boehmeria rugulosa
19.	-	Desmodium	Desmodium intortum
20.	Dhalne katush	Chest nut	Castonopsis indica
21.	Dudhilo	-	Ficus nemoralis
22.	Ghayo	Cudaph almond	Bridelia retusa
23.	Ghurbisa	-	-
24.	Ghuyala	-	Callicarpa macrophylla
25.	Gogan	-	Saurana nepaulensis
26.	Guelo	-	Elaeagnus parviflora
27.	Jhingane, sano	-	Eurya japonica
28.	Jhingane, thulo	-	Eurya acuminata
29.	Kaulo	-	Machilus gamblei
30.	Kavro	-	Ficus lacor
31.	Khanyo	-	Ficus semicordata
32.	Khayer (Khair)	-	Acasia catechu

SN	Nepali name	Common name	Scientific name
33.	Khosreto	-	Ficus hispida L.
34.	Kimbu	Mulberry	Morus sp
35.	Koiralo	Mountain ebony	Bauhinio veriagtaa
36.	Kunyel	-	-
37.	Kutmero	-	Litsea polyantha
38.	Malingo	-	-
39.	Mayal	Wild pear	Pysus pashia
40.	Musure katush	-	Castonopsis tribuloides Sm. ADC
41.	Nibharo	-	Ficus rosberghii
42.	Nundaki	-	-
43.	Painyun	Cherry	Prunus cerasoides
44.	Pakhuri	-	Ficus glaberrima
45.	Patle katush	-	Castonopsis hystrix
46.	Phalat	-	Quercus glauca Thunb
47.	Phaledo	-	Erythrina arborescens
48.	Phaleto	Coral tree	Erythrina variegata L.
49.	Phirphire	-	Acer oblongum
50.	Pipal	-	Ficus religiosa
51.	Punwale	-	Ilex doniona DC
52.	Rapase	-	-
53.	Salime	-	-
54.	Sano bhatmase	Campylotropsis	Campylotrop sis speciosa
55.	Saur	-	Betula alnoides Buch. Ham ex. D.Dam
56.	Seto khasru	-	Quercus sp
57.	Seto koiralo	Camel's foot	Bauhinia variegata
58.	Simal	-	-
59.	Simsime	-	-
60.	Sindure	-	Mallotus philippinensis Muell. Arg.
61.	Syal phorse	-	Grewia tihialfolia
62.	Tanki	Camel's foot	Bauhinia purpuria
63.	Thosne	-	Ficus hispida L
64.	Thotne	-	Aconogum molle
65.	Thulo bhalayo	-	Rhus succedanea L.
66.	Thulo Falant	-	Quercus lamellose Sm.
67.	Tooni	-	Cedrela toona
68.	Tusare	-	-
69.	Utish	-	Alnus nepalnesis

Natural vegetation

Altitude plays a major role in the temperature variation in this region. Since the study area ranges from about 800 m (Pheksinda of Num) to 4,200 m (Gorjure Danda of Pawakhola), the natural vegetation also exhibits a successive pattern of change along the slope. Based on the vegetation composition and climate, forest types are categorized into five different groups as follows:

1. Tropical belt gorge forest (<1,000 m)
2. Subtropical belt Castanopsis forest (1,000-2,000 m)
3. Temperate belt Schima and Castanopsis forest, oak forest (2,000-3,000 m)
4. Sub alpine fir forest (3,000-4,000 m)
5. Alpine belt juniper scrub (>4,000 m)

Fodder and grass diversity

All plant species related to livestock are grouped under seven categories. These are bamboo species, tree and shrub species, grasses, leguminous species, cultivated crop species and protected/endangered species. There are 22 bamboo species and sub species (Table 1). Nepal has more than 36 species of bamboos in twelve genera. Farmers reported all these are used for livestock. Variation on quality exists among these bamboo species. Most of the bamboo species have multipurpose value. These are adapted to different environments. Some of them are grown in private land and some species exist under forest. Farmers collect leaf of bamboo from forest as well as private land for livestock.

Table 3. Grass species diversity in Num, Hatiya and Pawakhola VDCs of Sankhuwasabha

SN	Nepali name	Common name	Scientific name
1.	Babiyo	-	Eulaliopsis binata
2.	Banso	-	Eragrostis tenella
3.	Berseem	-	Trifolilum alexandrinum
4.	Bhote jhar	-	-
5.	Buki	-	-
6.	Dhude harkat	-	-
7.	Dubo	-	Cynodon dactylon
8.	Ghode banso	-	-
9.	Gongleto	-	-
10.	Halhale	-	-
11.	Harkat	-	-
12.	Khar	-	Themeda arudinaceae (Roxb.) Ridley
13.	Khar	-	Themeda vilosa (Poir.) A. Camus
14.	Khari	-	Celtis australis
15.	Kharuki	-	Capioedium assimile
16.	Kode jhar	-	-
17.	Kure jhar	-	-
18.	Kuro	-	-
19.	Lajmanti	-	Mimosa pudica
20.	Nepier	Elephant grass	Pennisetum purpureum
21.	Phurke	-	Arunduella nepalensis
22.	Pire	-	-
23.	Siru	-	Imperata cylindrical
24.	Titepati	-	Artemisia vulgaris
25.	Titre banso	-	-

Table 4. Grassland categories according to climatic zone

Zone	Remarks
Tropical	Grasslands grazed almost all the year round
Subtropical	Non- palatable species such as ferns, stinging nettle, and Eupatorium species are becoming dominant because of heavy grazing
Temperate	Winter grazing for cattle, sheep and goats. Burning to improve grasslands is a common practice, causing increased soil erosion.
Sub alpine	Seasonal grazing because of heavy snow covers in winter. Burning of grasslands at the end of the grazing season and in early spring is common.
Alpine	Grasslands are grazed only during the summer (June-September)

Table 5. Leguminous trees and shrubs at Num, Hatiya and Pawakhola

SN	Nepali name	Common name	Scientific name
1.	-	-	Campylotropis speciosa
2.	Bhatmase	Flemengia	Flemengia congesta
3.	Desmodium	Desmodium	Desmodium gyroides
4.	Kalo siris	-	Albizia lebbeck
5.	Koiralo	Mountain ebony	Bauhinia variegata
6.	Kure	Gliricidia	Gliricidia sp
7.	Phaledo	-	Erythrina arborescens
8.	Rato siris	-	Albizia julibrissin
9.	Seto siris	-	Albizia procera
10.	Siris	-	Albizia chinensis
11.	Tanki	Camel's food	Bauhinia purpuria

Bamboo is one of the most useful plants for the people of Nepal. Out of the 170 fodder trees, thirty are used extensively and *Dendrocalamus* spp seems to be one of the best species. Farmers of Baglung and Parbat districts pay upto Rs500 per clump per year for leaf fodder of *Dendrocalamus* and *Bambusa* spp (Shrestha and Tiwari 1992, cited by Paudyal 1993). Similarly farmers of these areas value bamboo species. In the higher altitudes, cattle are allowed to graze in the natural forest of bamboo species. Large diameter bamboos are adapted to lower altitudes and small diameter bamboos to higher altitudes.

Farmers reported 69 species of tree and shrub fodder in these VDCs (Table 2). Nepal has 170 species of tree and shrub fodder. A total of 75 species of tree and shrub fodder exits in Arun basin (Shrestha 1989). Diversity in fodder is found mainly due to variation in climate, and livestock species. There may be many more fodder and grasses species to be explored. Both trees and shrubs have been used for livestock in all areas. Farmers produce year round green fodder and grasses to their livestock. There is lack of cultivation practices of fodder and grasses. There are no private nursery on fodders and grasses. Every household has some kinds of fodders and grasses. Most important species are Kahniyo, Gogan, Amriso, Nivaro, and least important are Arkhaulo, Patle Katush.

There is a lack of information about the number of grasses species available in Nepal. Possibly greatest diversity may exist in grasses. Everywhere from Tarai to high mountains grasses grow well. More than 25 species of grasses are found in these areas (Table 3). Different types of grasses eg annual, perennials, creepers, climbers, scented, saprophytes with different colors have contributed especially to livestock management in these VDCs. Some species are adapted to grazing and some are to cut. Priority was given to leguminous grasses. Expansion of a single species eg clover and napier to large areas has reduced the grasses diversity. Initiation of cultivation and management practices at farmers level may be basic strategy to maintain indigenous species.

Table 6. Cultivated crop species used for livestock

SN	Nepali name	Common name	Scientific name
1.	Alu	Potato	Solanum tuberosum
2.	Bhatmans	Soybean	Glycine max L.
3.	Dhan	Rice	Oryza sativa L.
4.	Ghahat	Horse gram	Dolichos biflorus
5.	Ghau	Wheat	Triticum aestivum
6.	Jai	Oat	Avena sativa
7.	Jau	Barley	Hordeum vulgare
8.	Kaghuno	Italian millet	Setaria italica
9.	Kodo	Finger millet	Elusine coracana
10.	Makai	Maize	Zea mays
11.	Mans	Black gram	Vigna mungo
12.	Phapar	Common buckwheat	Fagopyrum esculentum Moench
13.	Philingo, Jhuse til	Niger	Guizotia abbysinica
14.	Tite Phapar	Tartary Buckwheat	Fagopyrum tataricum
15.	Tori	Rape seed	Brassica campestirs
16.	Masyang	Rice bean	Phaseolus radiatus
17.	Pharsi	Pumpkin	Cucurbita moschata
18.	Rayo	Leaf mustard	Brassica napus
19.	Kera	Banana	Musa paradesica
20.	Kakro	Cucumber	Cucumis pepo
21.	Simi	Bean	Phaseolus sp
22.	Mula	Radish	Raphanus sativus
23.	Bodi	Cowpea	Vigna sp
24.	Banda	Cabbage	Brassica oleracea var capitata
25.	Cauli	Cauliflower	Brassica oleracea
26.	Uwa	Naket barley	Hordeum nudum

The grasses and fodder species can be grouped into two categories: those available in farms and homesteads, and the others available in the forest. Common fodder species available in the vicinity of the animal sheds are Amriso, Khanayo, Badahar, Tanki, Koiralo, Kavro and Nivaro. Other species like Paiyun, Kango, Chuletro, Jhingane etc are found in the forest. Some of the domesticated species are also available in the forest. Since the farmers extract fodder from forest trees heavily, plant population in the forest is also decreasing. Because of the limited availability of fodder, the livestock population in these villages is low.

Pastureland is found in Hatiya and Pawakhola. Different types of grassland from tropical to alpine support the livestock (Table 4). Cattle, sheep and goats are the major animals depend on these grasslands. In subtropical zones, grassland area (kharka) is increasingly going to cover by non-palatable species as ferns, stinging nettle and *Eupatorium.* Farmers believe that burning grassland help to grow grasses well in next seasons. There are no grassland management systems. The monsoon is the only season when plenty of local grasses are available in the pastureland of high hills. Popular local grasses in high hills are Sunbuki, Dhudhbuki, Danklabuki, Minodhuki, Brapang and Padang. Some farmers produce hay from these selected grasses. Many types of grasses are found in pastureland. Some grasses are cut and used in stall-feeding. Some are cut and dried and later used during lean

period. Grazing grasses are more in number than cut grasses. Similarly wild/natural grasses are significantly higher than cultivated species. Generally imported grasses are under cultivation practices.

Table 7. Plants species poisonous to livestock at Num, Hatiya and Pawakhola

SN	Nepali name	Common name	Scientific name
1.	Alaichi	Cardamom	Cardamom subulatum
2.	Angeri	-	Lynia oralifolia
3.	Balu	-	*Pieris formosa*
4.	Bikh	Aconitum	Aconitum napallus
5.	Chimal	-	*Rhododendron barbatum*
6.	Darsane	-	-
7.	Dudhe lahara	-	-
8.	Ghungring	-	-
9.	Ilame, Ghandhe	-	*Ageratum conyzoides*
10.	Kalo siris	-	Albizzia odoratissima Benth.
11.	Kosre	-	-
12.	Lalighuras	Rhododendron	Rhododendron sp
13.	Pahelo siris	-	-
14.	Simal tarul	-	Manihot esculenta
15.	Suktuk	-	-
16.	Unyu	-	Ptteridium sp
17.	Utish	-	Alnus nepalensis D. don

Table 8. Nepal's protected, rare, endangered and endemic fodder and grass species found at Num, Hatiya and Pawakhola (Shrestha and Joshi 1996, Chaudhary 1998, M Siwakoti IUCN 2002, Pers. Comm.)

SN	Nepali name	Common name	Scientific name
1.	Arkhaulo*		Quercus fenestrata
2.	Kakro (Seto, Hariyo)**	Cucumber	Cucumis pepo
3.	Dudhilo*	-	Ficus nemoralis
4.	Gogan*	-	Saurana nepalensis
5.	Jau*	Barley	Hordeum vulgare
6.	Jinghane*	-	Eury sp
7.	Kaghuno**	Italian millet	Setaria italica
8.	Karunke ghans**	-	
9.	Kharuki*	-	Capioedium assimile
10.	Kodo (Bhojpure, Fyakure)**	Millet	Eleusine coracana
11.	Kurilo	Asparagus	Asparagus racemosus
12.	Lamche khursani*	Chilly	Capsicum sp
13.	Makai (Yangrupe, Thulo seti, Phalendo, Paheli makai)**	Maize	Zey mays
14.	Majitho	-	Rubia manjith
15.	Phaper*	Buckwheat	Fagopyrum sp
16.	Dhan (Marshi, Yanseere, Guture)**	Rice	Oryza sativa
17.	Utish*	-	Aluns nepalensis
18.	Uwa*	Naket barley	Hordeum nudum
19.	Khayer	Catch tree	Acacia catechu
20.	Okhar	Walnut	Juglans regia
21.	Simal	Silk cotton tree	Bomex ceiba
22.	Vyakur	Dioscorea	Discorea deltoidea

* Locally endangered, ** Locally extinct.

Different species of leguminous tree and shrub supported both soil fertility and livestock. Some of them are very useful for sloping agricultural land technology (SALT) (Table 5). Most of the residual or by product of cultivated crop plants are used to livestock (Table 6). Among cultivated species, dhan, kodo, makai and bhatmas are common for livestock use.

Some plants available in the forests are poisonous to grass eating animals (Table 7). When the tender leaves are eaten, they are poisonous. Angeri is poisonous to all animals, and ilame is deadly to sheep. By mistake, they eat these plants and fall sick. It causes shooting diarrhoea and death due to dehydration. If bhakimlo dust is available in time, it can be cured. Angeri causes stomach swollen for a day or two and the animal dies. Some poisonous

plants affect the throat. Animals cough and die with a breathing problem. The farmers report that they do not have remedy to cure their animals of these problems.

Based on status of species and literature review, 22 species and varieties of crop plants useful to livestock are categorized under protected/ endangered/ endemic (Table 8). Four protected flora, which are useful to livestock and found in this area are Khayar, Okhar, Simal and Vyakur. Few species and varieties were lost and some are locally endangered. Farmers reported that a Karunki grass was lost. Locally threatened species are Musure katush, Utish, Katush, Nigalo, Malta, Arkhaulo, Jhingae, Karauki, Gogan and Dhudilo.

Threats to fodder and grass diversity

- Cultivation of cardamom in forest area has decreased the diversity.
- Exotic plant species *Banmasa* (*Eupatorium odoratum*) in the lower areas and *Banmara* (*E. adenophorum*) in the higher are quickly invading the habitats and replacing the local species.
- Slash and burn agriculture system is the major threat to diversity loss.
- Fragmentation, encroachments of natural forestland by human activities cause heavy loss of diversity.
- Over grazing and over looping retard the species regeneration.
- Due to unconsciousness of the farmers for sustainable use of these species some of them has been under threat to extinct.
- Sweeping /uprooting of species due to landslides and floods cause the lands barrens.
- Disease and insects are the natural factors in decreasing the agro biodiversity.
- Overgrazing change the grassland into unpalatable lands.
- Due to over exploitation of some species having multipurpose uses there are decreasing trend in the number of such species.
- Due to lack of cultivation practices of most commonly exploited species eg medicinal, and fodder plants, they are under threat to extinct

Slash and burn agriculture is common practices in these area. Khoria where slash and burn agriculture is practiced is also important source of fodder grasses. Due to the high species richness of khoria (Figure 3), farmers give importance of kharka to collect diverse form of fodder and grasses both in number and quantity as well as quality from khoria. Most of the lands of these areas are slopy. For better management of soil and livestock, agroforestry as well as SALT system should be applied. Agro forestry/ SALT should e initiated using locally available species in sloppy area. Slash and decompose rather than slash and burn agriculture system should be developed. Special program for threatened species be designed. Occupation of large areas by a single spp is not a good way. Site specific/ farmer specific technology considering the species evenness may be good systems of crop plants conservation and utilization. Cultivation system of fodder and grasses and pastureland management systems also be initiated for fodder and grass genetic resources management.

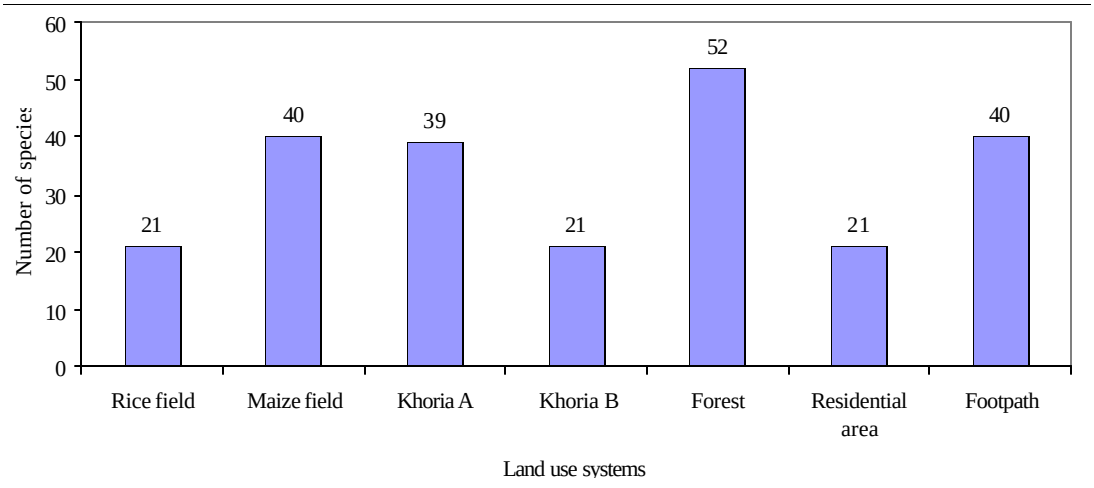

Figure 3. Species richness in different land use systems (Khoria A, with standing crops and Khoria B, after 2 years of crop harvest).

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