

Forage Resources of Nepalese Hills and Strategies for Improvement

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Introduction

Contribution of rangeland in total annual feed requirement of livestock is immense. It varies from Sub-tropical grasslands in Terai and Siwaliks to alpine meadows in the mid-hills and high- hills. A cold dry steppe is found to the north of the main Himalayan range in parts of Nepal (Mustang, Dolpa, Mugu, Humla). Rangeland covers about 12% of approximately 1.76 million hectares of geographical area. More than half of the total rangelands are in high mountains while Terai and Siwaliks together have only 4% of total rangelands.

Agroecological Zones

The vertical subdivision from tropical to arctic are related purely to temperature and do not take into account the zonation of the trans-Himalayan region. One important factor is that the region has intense insolation on south aspect hill-land, cropping can go as high as at 3,500 m. In Dolpa hill, rice can be grown as high as at 3,400 m. The two major limiting factors concerning the growing season are the radiation of cold air in lower valleys and shortage of irrigation water.

The moisture regimes for the cool temperate zone have been determined as follows:

Prehumid	>1,500 mm of precipitation
Humid	800 - 1,500 mm
Sub-humid	400 - 800 mm
Semi-arid	400 mm

Types of Rangeland

(a) Open grazing in mid-hills (sub tropical & temperate)

Barren/open grazing lands constitute about 34% of the total rangeland. These grazing lands are scattered over a large area from subtropical to cool temperate zone in patches. Excessive free range grazing, clearing area for cultivation, burning, tree felling for fuel and timber, etc., have converted scattered forest or shrubland into open grazing land. Sub-tropical rangelands are mostly associated with *Pinus roxburghii* forests. They are heavily grazed and are infested with *Eupatorium adenophorum*, *Pteridium aquilinum*, *Utrica parviflora* and *Artemisia vulgaris*. These grasslands are termed as Themeda- Arundinella type. The main forage species of these rangelands are: *Arundinella bengelensis*, *A. nepalensis*, *Bothriochloa intermedia*, *B. pertusa*, *Chrysopogon gryllus*, *Cynodon dactylon*, *Heteropogon contortus*, *Apluda mutica*, *Brachiaria decumbens*, *Imperata cylindrica* and *Eragrostis pilosula*.

Temperate rangelands are associated with oak or mixed broad leaf, *Quercus* or bluepine forest types. These rangelands are very important to pastoral systems and due to heavy grazing for years, less palatable forage species are found here. In many areas, *Andropogon tristis* has been replaced with *A. rundinella* hooker) *Andropogon concinna*, *Festuca* spp, *Cymbopogon* spp, *Bothriochloa* spp, *Desmodium* spp and *Agrostis micrantha*.

Carrying capacity is estimated to be 0.54 livestock unit per ha whereas the present stocking rate is about 13 times more than the carrying capacity. There is a tremendous pressure of grazing animals in mid-hills which gives little chance for regrowth and regeneration. Palatable species have been replaced by non edible weeds such as *Eupatorium*, *Rumex*, etc. Burning of open grazingland has become a common practice and has reduced chances for natural reseeding and a stand of desired species. Growth pattern is seasonal and is productive mainly from May to October. Grazinglands in mid-hills are gradually being converted into terraces and the forage productivity is in continuous decline.

(b) Alpine meadows

Alpine meadows exist in the high Himalayan ranges above tree line between 3600 and 5400 m amsl and constitute about 54% of the total rangeland. Sub- alpine rangelands are associated mostly with shrubs. The common genera are: *Berberis*, *Caragana*, *Hippophae*, *Juniperus*, *Lonicera*, *Potentilla*, *Rosa* and *Spiraea*. In many areas, *Pipithanthus nepalensis* has heavily invaded once productive rangelands. The common grasses found are: *Elymus*, *Festuca*, *Stipa*, *Bromus*, *Chrysopogon*, *Cymbopogon* and *Koeleria*. *Danthonia* grasslands are dominant in sub-alpine zone. *Elymus nutans*, a native species is of great importance to the pastoral systems in high elevations.

These native grasslands are the main grazing areas for sheep, goat and high altitude cattle (Yak/ Chauris). As a matter of fact alpine meadows are the homeland of yak. About 80% of sheep, 40% of goat and 23% of cattle population in high hills are estimated to be grazing in alpine meadows for a short duration of 4-5 months. Carrying capacity is estimated to be 1.42 livestock unit (L.U.)/ha and the utilization is just 45%.

(c) Steppe

Steppe rangelands are associated with *Pinus excelsa* forests. Major types of plant species found in these rangelands are: *Caragna*, *Andropogon*, *Calamagrostis*; *Cymbopogon*, *Deyeuxia*, *Melica* and *Poa* species.

Continuous dry winds and high solar radiation with very little or no cloud interception increase evaporation rate resulting in very little moisture in this low rainfed zone. *Caragna*, *Artemisia* and *Lonicera* are the main dwarf shrubs found. Ground vegetation cover is very poor ranging from 12-22%.

Pashmina goat is the main grazing animal and the carrying capacity is estimated to be 0.06 L.U./ha. Stocking rate is over three times more than the present carrying capacity.

Rural Communities and Animal Movement

The livelihood of communities of northern region is derived from three interrelated occupations: animal husbandry, agriculture and trading. Before 1949, there was free movement of livestock across the borders. In the western districts these migrations involved the movement of animals during late autumn into the drier grazing areas of Nepal. In the eastern districts, which receive the full impact of the summer monsoon rains, animals tend to migrate into Tibet during the summer months and return to Nepal before winter. Animals used by traders spend the winter in central Nepal and along the Indian border, moving north into Tibet as the snow clears from the high passes in spring.

Livestock in the high altitude zone is highly mobile. Yak, hill cattle and their hybrids follow a transhumance pattern of movement. Sheep, goats, equines and dzoppa are used as pack animals and follow complex seasonal movements between their villages of origin, Tibet and the Indian border. Sheep and goats in the southern districts serve as pack animals for carrying government materials or merchandise to be bartered or sold. Goats are often sold for meat. Overgrazing in many areas could lead to further deterioration of this fragile environment. While most of the border areas are affected, the feed deficit is more acute in some localities than in others.

Vegetation

Profound changes have taken place in the high altitude ecosystems. Centuries of gradual forest clearance, particularly in the west, has caused reversion to extensive grasslands. Selective grazing has rescued palatable species. The grasslands tend to be dominated by a few genera: *Themeda*, *Elymus*, *Calamagrostis*, *Arundinella*, *Danthonia* and *Koeleria*. Grasslands have a very low component of legumes. In the semi-arid steppe lands, low cushioned and prostrate legumes pioneer the eroded soils. These plant communities are maintained by available phosphate deposited by circulating loessial fragments from high winds.

Under the current system of management, grasslands in humid forest ecosystems are unstable and are reverting to scrubland. Average production of animal-feed resources from the surveyed districts is as follows in terms of tonnes of dry matter per ha:

Per-humid grasslands	3.0-4.0
Sub-humid grasslands	1.0-1.5
Semi-arid steppes	0.15-0.35
Pre-humid, humid forests	8.75
Sub-humid forests	0.50

Rangeland Productivity

In Nepal, approximately 12% of the total land area is under rangelands and they provide 34% of the total feed requirements for livestock in the country (Rajbhandari & Shah 1981). Estimated forage production of natural high altitude grazing lands varies from place to place. The dry matter biomass production (t/ha) from various sites amount to 0.65 (Dolpa), 1.53 (Mustang), 2.36 (Sindhupal Chowk and Dolkha), 3.2 (Tuten), 3.6 (Terhathum), 0.79 (shading) and 1.5 (Myagdi). The carrying capacity of various grasslands, based on their production figures is given below:

Type of rangeland	Area (sq.km)	Productivity (TDN t/ha)	Carrying capacity	Present stocking rate (LU/ha)
Subtropical & Temperate	6293	0.58	0.54	7.07
Alpine	10141	1.54	1.42	0.64
Steppe	1875	0.06	0.09	1.19

R & D Activities

A number of exotic germplasms were evaluated at various sites and following developmental activities were undertaken with the farmer's participation:

- I. Grassland improvement by using improved pasture grass and legume species.
- II. Opening of new grazinglands by constructing bridled paths.
- III. Construction of drinking water facilities on migratory routes for optimum forage utilization.
- IV. Conservation of forages for lean periods.

Achievements and Recommendations

Trials conducted at Taringdanda indicated that introduced forage legumes and grasses outproduced the indigenous forage species by 60-100 per cent during the few seasons of testing. It was also found that white clover is successful in the prehumid and humid zones, particularly in relation to establishment and the severe grazing regime. White clover seed appears to establish readily in closely grazed grassland in humid bioclimates. This also checks weed growth.

The most versatile grass species suitable for moisture gradient from subhumid conditions was cocksfoot (*Dactylic glomerata*). Growth trials of *Holcus* and *Agrostis* indicated delayed establishment and slow growth, but they persisted in the long run.

Ryegrass can only be regarded as a hay species grown on extended bunds and in hay paddocks. *Lotus pedunculatus* cv *Maku* establishment was poor. *Medicago falcata* is well adapted to the neutral and alkali soils of semi-arid Mustang. Although the indigenous grasses have been severely grazed, there are many that should be collected and propagated. The important species are: *Pennisetum flaccidum*, *Stipa breviflora*, *S. gungeana*, *Themeda anathera*, *T. tiandra* and *Deyeuxia* spp. *Themeda* species along with *Trifolium* should be encouraged.

In Mid-hills, *Dactylis glomerata* (Cockfoot), *Phalaris tuberosa* (Canary grass) and *Trifolium subterranean* (Sub clover) should be sown.

In the case of steppe grazinglands, specially in Mustang, sowing of *Agropyron desertorum*, *Elymus junceus* and frost tolerant cultivars of *Medicago falcata* are recommended.

Future Strategies

- In order to improve the cool semi arid region's fodder situation, a strong infrastructure is needed in each country and it should be field based.

- Net working outside the nation is vital. Therefore a Regional Forage Development Programme should be established by FAO/UNDP which should have the mandate of addressing the problem of herders, livestock, and the environment.

- Under RFDP, a sub-regional working group should be established having the mandate to address the problem of farmers, livestock and the environment in different ecozones.

Reference

Rajbhandari, H.B. and S.G. Shah. 1981. Trends and Projection of Livestock Production in the Hills of Nepal