

Feeding the Herds

Improving Fodder Resources in Bhutan



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about ICIMOD

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Foreword

Bhutan is still a country of herders and farmers. Livestock rearing has always been an important source of livelihood for the Bhutanese, ranging from buffaloes in the southern foothills to yaks in the high altitude regions along the northern border. Traditional livestock production systems are largely based on free grazing on natural grasslands and forests. With the transition of the rural economy from subsistence to a cash economy, improvement of the feed and fodder resources will be vital for optimising returns from livestock rearing as poor animal nutrition is one of the major constraints in achieving higher levels of production.

Having realised the importance of fodder development in modernising the livestock sector, the Royal Government of Bhutan has carried out a well-focused research programme on temperate fodder production since the 1970s. This has had a substantial impact on livestock production in the country not only in terms of increased milk production and consumption, but also in reducing cattle migration, improving soil fertility and decreasing soil erosion. Without improved pastures, it would not have been possible to support the newly introduced breeds of cattle like Jersey and Brown Swiss.

Bhutan has limited resources for research and development activities. Yet the wide range of environments and the very diverse production systems pose a tremendous challenge to the research system entailing rigorous prioritisation of research areas. It is, therefore, of utmost importance to learn from the past and avoid repetition of efforts and wastage of the scarce resources. This document represents the first comprehensive review on feed and fodder development activities carried out in Bhutan, as such it will serve as an invaluable repository of knowledge in this field.

In successfully bringing out this publication, I would like to compliment the Renewable Natural Resources Research Centre, Jakar, in particular, the authors and the contributors. The farmers and herders who willingly shared their wealth of experiences also deserve our highest praise. I extend my sincere appreciation to ICIMOD for editing and publishing this valuable document. I am sure that this attractive book will be widely used within and outside Bhutan by farmers, herders, extension agents, researchers, planners and policy makers. Through ICIMOD's established network, I hope that the experiences from Bhutan will be accessible and useful to other regions that share similar agro-ecological and socio-economic conditions.



Lyonpo Kinzang Dorji
Minister for Agriculture
Royal Government of Bhutan
Thimphu, November 18, 2001

Foreword

The country of Bhutan, which is completely mountainous, faces many of the challenges inherent to neighbouring countries of the HKH. Inaccessibility and marginality characterise its landscape. However, the people of Bhutan exhibit an amazing ability to adapt and harness the country's rich resources, especially through their livestock, which form the basis for their diverse farming systems.

Although it is not facing the population pressures seen in other nearby regions, Bhutan is facing its own unique set of challenges as it modernises and enters the market economy, while simultaneously attempting to preserve its unique culture. The development of its livestock sector is of prime importance. As in other parts of the Himalayan region, fodder is a significant limiting factor for livestock production. The Royal Government of Bhutan recognised this issue long ago and initiated numerous livestock development programmes, of which fodder development has been and continues to be a significant component.

ICIMOD is committed to assisting countries like Bhutan with their efforts in livestock and pasture development and, with this aim, initiated a rangeland programme in 1995. In 1996, ICIMOD provided assistance to the Bhutan Ministry of Agriculture to compile a review of the literature on the significant advancements Bhutan has made in the forage development sector. This review was completed in 2001, drawing on over 40 years of research experience in the country. This publication reflects this rich knowledge base.

This review of forage and fodder research in Bhutan is a comprehensive document that provides both a wealth of technical information and also a good insight into the legislative and farming systems framework for Bhutan's forage development programme. Such information will be invaluable for anyone undertaking forage work within Bhutan, but is also of great interest for those attempting programmes in other parts of the region, where a less systematic approach is generally the norm. The volume of work completed and reported is remarkable, particularly so in the context of the major shortage of trained manpower. The historical sections provide evidence of the time frame needed to achieve significant results, and underlines the difficulties most programmes encounter with unrealistically short implementation periods and frequent changes in organisational structure.

The document represents an enormous effort in compilation and will be valuable for all of us in the region. We hope that it will lead to a more regular dialogue across the region among livestock and forage professionals, government policy makers and those working at the grassroots level.

The funding for this publication has been generously provided through a grant from the Federal Government of Austria for ICIMOD's Regional Rangeland Programme with some support from Helvetas-Bhutan.


J. Gabriel Campbell
Director General, ICIMOD

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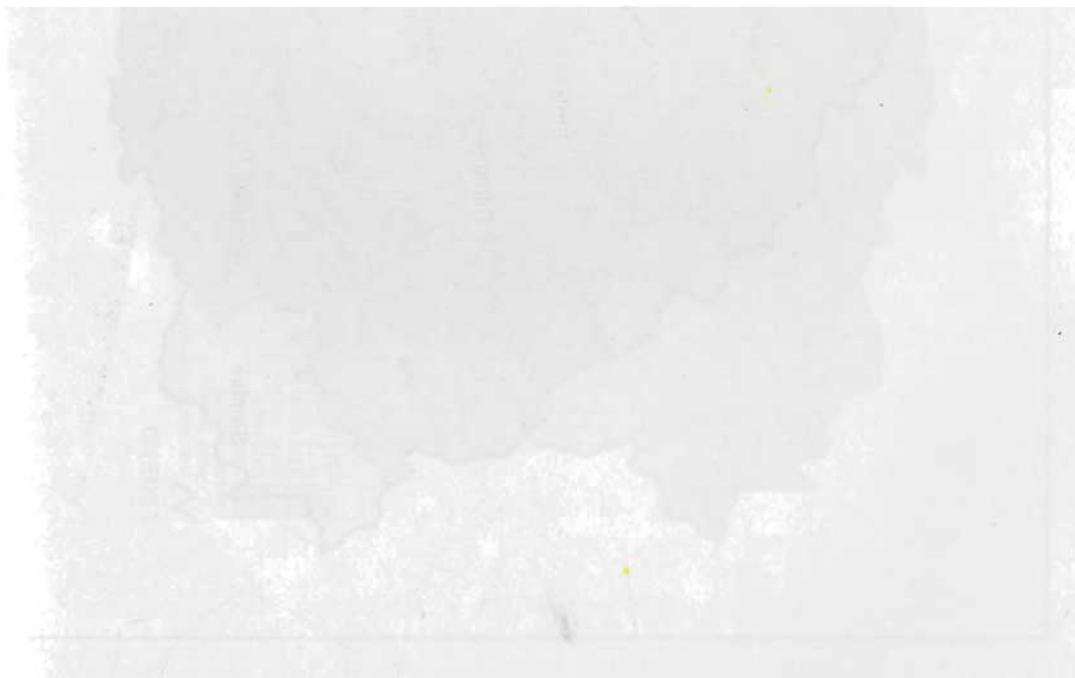
Reviewing the literature and carrying out the supporting field work was professionally both interesting and rewarding. It provided the authors with an opportunity to interact with farmers and herders as well as with researchers and extensionists. In the process of collection and compilation of the data and information, there were contributions from many people – too many to list separately. We would like to acknowledge all those people and organisations who shared information, provided documents, rendered financial or logistical support, or contributed in other forms towards the production of this book.

The authors would like to express their gratitude to H.E Lyonpo (Dr.) Kinzang Dorji, Minister, Ministry of Agriculture for his vision and encouragement. Sincere thanks also go to Mr. Sherub Gyaltshen, the former Director DRDS, and Dr. Pema Choephyll, the former Chief Research Officer of the Research Division, for their unstinted support and guidance.

Thanks to the support by ICIMOD for publishing this book, the experiences from Bhutan will become available to a larger readership. The editorial and layout input provided by ICIMOD enhanced both the quality and the appearance of the book.

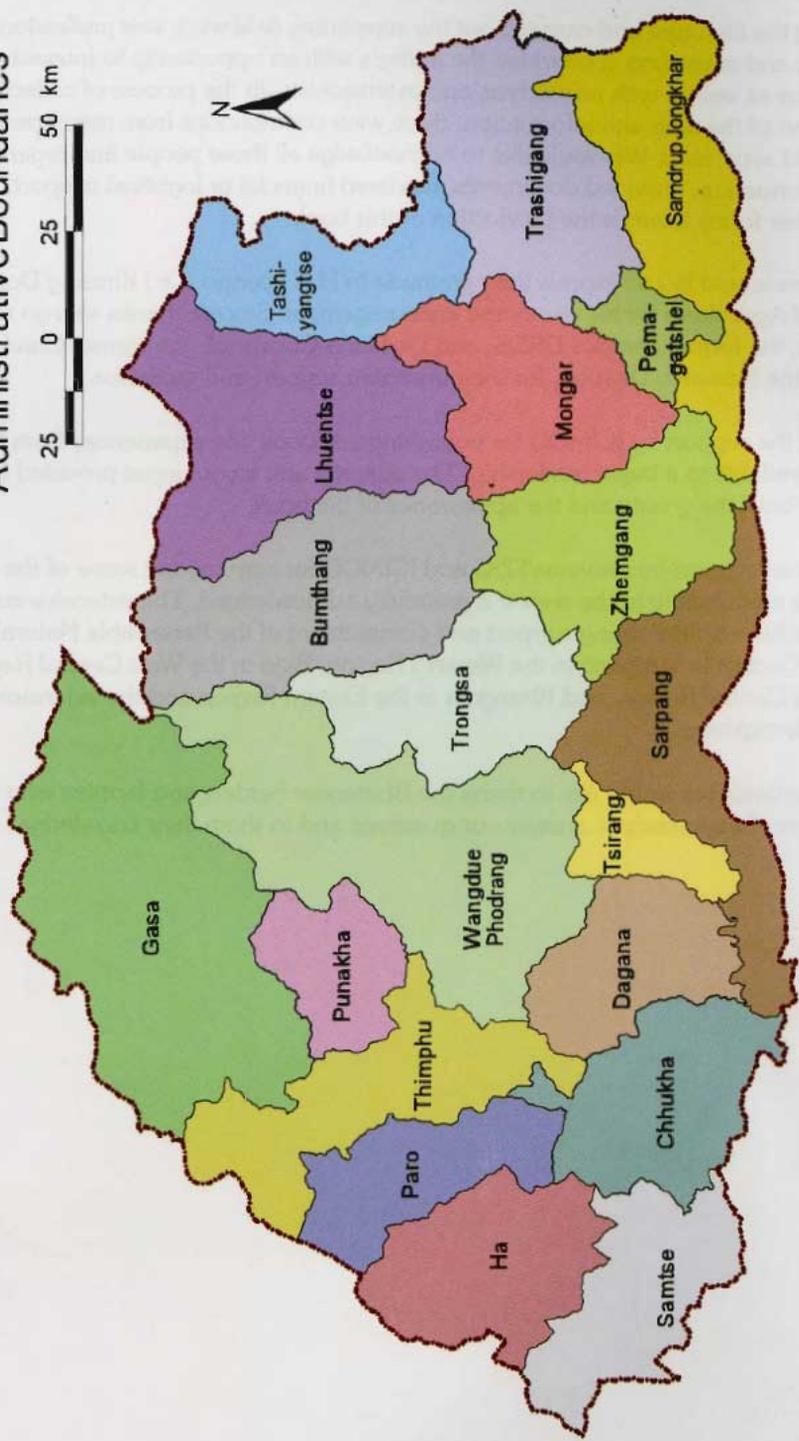
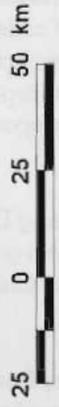
The financial support by Helvetas/SDC and ICIMOD for carrying out some of the surveys and other tasks contributing to the review is gratefully acknowledged. The extensive surveys were made possible with the strong support and commitment of the Renewable Natural Resources Research Centres in Yusipang in the Western Region, Bajo in the West Central Region, Jakar in the East Central Region, and Khangma in the Eastern Region and the extension staff of the different dzongkhags.

Most importantly we would like to thank the Bhutanese herders and farmers who worked with us and were always ready to answer our questions and to share their knowledge.



BHUTAN

Administrative Boundaries



BHUTAN Physiography



LEGEND

 International boundary

 Major rivers

Elevation (metres)

 1000 - 2000

 2001 - 3000

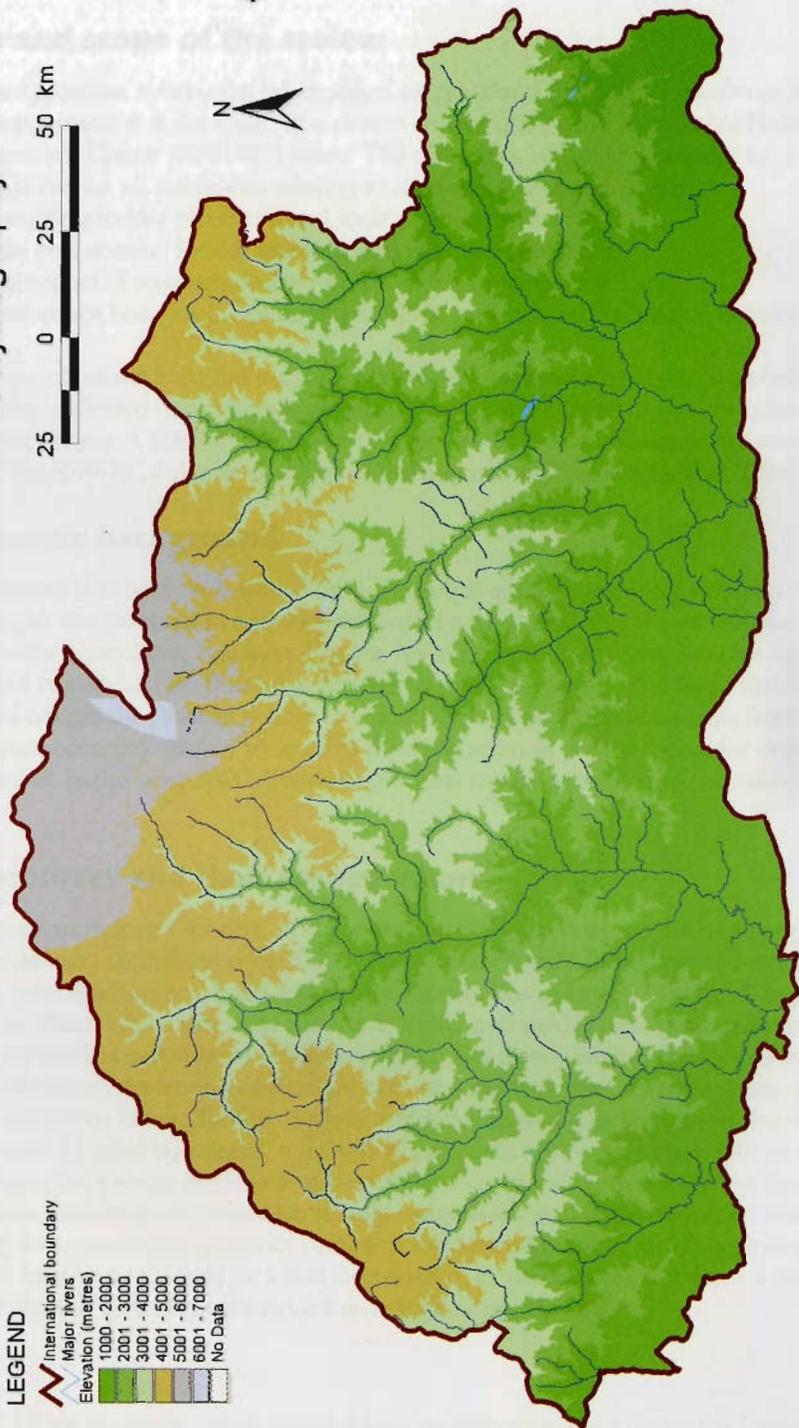
 3001 - 4000

 4001 - 5000

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 No Data



Executive Summary

Objective and scope of the review

This document provides substantial information on grassland and fodder resources in Bhutan and their management. It is the result of a review carried out by the Renewable Natural Resources Research Centre (RNR-RC) Jakar. The objectives of this review were to

- list and summarise all references relating to fodder resources in Bhutan;
- describe existing fodder resources and their management;
- summarise and analyse fodder research and extension activities;
- assess the impact of research and extension at the farmers' level; and
- create a reference base for the planning of future research and extension activities.

The information obtained from the numerous available references has been supplemented with information collected from various surveys planned and carried out as complementary activities for the review. A total of 276 references are listed. These references are available in the library of the RNR-RC Jakar and copies of the majority will also be held at ICIMOD.

Socioeconomic background

Bhutan's economy is strongly influenced by its historical and geographical isolation. Over 80% of its people are involved in activities related to agriculture; only 8% of the country is suitable for arable agriculture, however. Bhutan has a comparative advantage for livestock production and has about 336,000 large ruminants (cattle and yak). The large variations in environmental conditions provide a wide range of livestock production systems from the high altitude transhumance yak system to systems in which animals are used only for draught and manure purposes. In the year 2000, livestock production was estimated to provide about 8% of GDP.

Fodder resources and their management

Permanent grasslands, forest grazing, and the grazing of fallow land are the most important sources of fodder and contribute over 70% of total fodder needs. Other important fodder resources are crop residues and tree fodder. The country has over 400,000 ha of registered grazing land or about 1.2 ha per large ruminant (cattle and yak). These grazing lands belong to the state and herders only have the grazing rights. The dominant fodder species vary according to elevation, environmental conditions, and management. Grass species usually dominate at elevations below 3500m. Sedges and broadleaved species are dominant at higher elevations. Limited by rainfall, available phosphorus (P) and nitrogen (N), as well as grazing practices, the annual dry matter production of grasslands is generally less than 2t per ha. Furthermore, fodder quality declines rapidly towards the end of the monsoon season. Forest grazing is an important source of ruminant fodder and fertiliser for crop production (manure). It is frequently blamed for forest degradation or destruction, but there is increasing evidence that grazing is not harmful in well-managed conifer forests.

Research

Until the mid-1990s livestock fodder research was mostly carried out under the Department of Animal Husbandry (AHD) and by various projects associated with this department. The first planned experimental activities to focus on fodder resource development were initiated by the

Rural Development Programme (RDP) (Bumthang) in 1974. The Ministry of Agriculture was reorganised in 1995, when four Renewable Natural Resources Centres (RNR-RCs) were established. Research activities in the livestock sector (including feed and fodder) are coordinated by the RNR-RCs Jakar, which is located in the temperate region of central Bhutan. The major research findings are as follow.

Evaluation of native species – The plant communities of the major grassland ecosystems remain poorly documented. An indication of nutritional qualities is available only for the two grassland species *Schizachyrium delavayi* and *Lespedeza* sp, and for less than 20 woody perennials. Of all the native species, willow (*Salix babylonica*) has received the most attention.

Germplasm introduction and testing – Since the mid 1970s, 75 grass species and 157 legume species have been introduced and evaluated. About 50% of all the species evaluated were introduced into Bhutan before 1983. Similarly, all species – except for ruzi grass (*Brachiaria ruziziensis*), which is presently being recommended for extension – were selected before 1982. Generally, white clover (*Trifolium repens*), red clover (*T. pratense*), lucerne (*Medicago sativa*), and lotus (*Lotus pedunculatus*) have been the highest yielding legumes under temperate conditions. The highest yielding grass species have been cocksfoot (*Dactylis glomerata*), tall fescue (*Festuca arundinacea*), and Italian rye grass (*Lolium multiflorum*).

Establishment – Investigations into the establishment of fodder species led to the recommendations for the introduction of white clover by direct seeding or transplanting, and establishment of recommended species by relay seeding in cultivated crops.

Fertility management – Poor P availability strongly limits plant growth in the temperate regions. Studies have focused on P rates, P fertilisers, local P fertiliser substitutes, legumes' P requirements, N effects on yield and species composition, and K requirements in subtropical regions. At elevations of between 2600 and 3700m, P application can result in dry matter yield increases of between 6% and 800%.

Winter fodder – Studies have been conducted on methods of conservation, the introduction of arable annual fodder crops, and the use of tree fodders. Keeping dry matter standing in the fields for grazing between December and February appears to be the most economical form of conservation for temperate regions. Oats (*Avena sativa*), swede (*Brassica napus*), hairy vetch (*Vicia villosa*), and rye (*Secale cereale*) have been identified as suitable winter fodder crops for temperate regions.

Nutritional qualities – Analytical data and information on intake and animal production was generated for a range of tree fodders.

Seed production – Seed production studies were carried out and suitable seed production techniques were developed for white clover, cocksfoot, and greenleaf desmodium (*Desmodium intortum*). Additional research is necessary for the other species.

Integrated studies – Studies have been carried out on crop rotation, cropping sequences, combinations with fruit trees, and silvopastoral systems.

Extension and its impact

The AHD began to build up a network of extension centres in the 1970s. The earliest documented and sustained extension activities focusing on fodder development started in

Bumthang dzongkhag (administrative district) in 1978. The species promoted at present are white clover, Italian rye grass, cocksfoot, tall fescue, ruzi grass, molasses grass (*Melinis minutiflora*), greenleaf desmodium, oats, and hairy vetch.

The extension activities during the Fifth to Seventh plan period (1982-1997) resulted in the development of 13,760 ha of pasture and the planting of 735,819 fodder trees. In addition, white clover has been spread naturally by grazing animals and through manure application.

The strongest impacts have been achieved through the introduction of white clover combined with the application of P-fertiliser. It has been estimated that in some areas fodder development activities have increased dry matter production by 10%, the quality of fodder during the summer by 50%, the quality of fodder during the winter by 200%, and milk production by 500%. The increased milk production has improved nutrition in rural and urban areas and provided substantially increased cash incomes for many households. The promotion of tree fodders has been another important component of the extension programme. Activities in subtropical regions have been less successful. The treatment of paddy straw with urea has not been adopted.

Constraints

Limited landholdings and problems related to land tenure are often cited as the major constraints to fodder development activities, but a range of factors contributes to the situation. They include difficulties with the rules and legislation, social customs, and traditions; competition for other land use; unsuitable technologies; and the difficulties in processing and marketing of livestock products. Most farmers give a low priority to fodder resource development because their animals are not productive enough to respond to better feed and because the technologies offered are sometimes inappropriate. The socio-religious taboo that forbids the killing of animals, the concentration of large cattle herds with a limited number of households, and the traditional seasonal migration of livestock further slow the transition to a more productive system.

Future directions

The Royal Government of Bhutan is strongly committed to improving the nutrition and increasing the incomes of its rural population, while at the same time maintaining or improving the biophysical resources of the country. To achieve this goal, livestock production systems will have to

- produce livestock products for a fast growing urban population;
- make a positive contribution towards maintaining the overall biophysical resources;
- provide equitable income opportunities for the rural population; and
- complement field crop, horticulture, and forestry production systems by exploiting synergistic effects, optimising labour efficiency, and accelerating nutrient cycling.

Research and extension have an important role to play in transforming production systems. The limited resources available for research across Bhutan's wide range of environmental conditions demands a rigorous setting of priorities. Future research programmes need to be flexible, realistic, and simple. Whilst drawing up future plans, imaginative interventions should be given as much attention as drawing on the experiences of earlier extension programmes. The success of future extension activities will largely depend on the availability of human resources and of appropriate technologies generated by the research programmes.

Glossary

Bhutan specific terms

ara	home-made alcoholic beverage distilled from fermented grain of wheat, barley, maize, rice or millet
chang	any alcoholic drink; in this document 'chang' refers to fermented wheat, barley, maize or millet
dzongkhag	administrative district; Bhutan has 20 dzongkhags (see map)
geog	sub-unit of a dzongkhag (also called block)
lac	resinous secretion from the insect <i>Laccifer lacca</i> , used as a dye
maund	unit of weight, in Bhutan 1 maund is approximately 40 kg
mithun	(<i>Bos frontalis</i>) a semi-domesticated animal reared in Arunachal Pradesh in India which has been used in cross-breeding programmes with Bhutanese cattle breeds
ngultrum (Nu)	Bhutanese currency unit
pangshing	Bhutanese term for a grass fallow shifting cultivation system used in temperate areas
Shabdung	title of the unifier of Bhutan and his reincarnations (literally 'at whose feet one prostrates')
tsadrog	land registered as grazing land; it is state property and herders and farmers only have grazing rights
tsheri	Bhutanese term for a shrub-fallow shifting cultivation system used in sub-tropical areas

Terms specific to grazing land and fodder resources¹

arable fodder	fodder species grown on land commonly used for crop production
crop residue	the part of plants remaining after harvesting the main produce
cut and carry	systems in which fodder is cut and brought to the animals for consumption
feed	any fodder for livestock, especially concentrates, grains, by-products of milling, and other types
fodder or forage	non-woody plant biomass that is potential food for farm animals
fodder resource	any plant biomass used as fodder
forest grazing	herbaceous undergrowth in forests (land registered as forest with variable tree cover) consisting of grasses, sedges, broadleaved species, and shrubs palatable to grazing animals
grassland	land on which grasses, sedges, and/or herbaceous broadleaved species such as legumes constitute the dominant vegetation

¹ Glossary of terminology adapted from the terminology suggested in RNR-RC Jakar (1996a): Proceedings of the 1st National Feed and Fodder Workshop, pp. 57-59, Annex 4.13 Suggested Terminology

grazing land	any vegetated land that is grazed or has the potential to be grazed by animals
grazing	the direct consumption of (unharvested) fodder by animals
improved pasture or improved grassland	grazing land which has been improved through species additions and/or management interventions, or which has been established on shifting cultivation or cropland
natural grassland	land used for grazing with a vegetation community dominated by grasses and sedges as a result of some natural biophysical limitation — including effects of grazing animals — that precludes the growth of shrubs or trees; also includes high elevation grazing lands above the tree line, which often have a significant shrub component, thus the term 'grassland' is used here in a broad sense to refer to natural rangeland ecosystems (naturally existing grassland or shrubland)
palatability	plant characteristics that stimulate a selective intake response by the animal
pasture	another word for 'grazing land'
permanent grassland or permanent pasture	similar to natural grassland but also includes improved grasslands that are maintained continuously as grassland pasture (also those maintained by human disturbances such as fire)

Acronyms and Abbreviations

AHD	Animal Husbandry Department
ARC	Agriculture Research Center
CSO	Central Statistical Office
DM	dry matter
FAO	Food and Agriculture Organization of the United Nations
FSP	Forages for Smallholders Project
GAFRC	Grassland and Associated Fodder Research Centre
GDP	gross domestic product
HAADP	Highland Altitude Area Development Project
HLDP	Highland Livestock Development Programme
IFDP	Integrated Forestry Development Project
ISDP	Integrated Sustainable Development Programme
LUPP	Land Use Planning Project
MOA	Ministry of Agriculture
NEC	National Environment Commission
NES	National Environment Secretariate
NRTI	Natural Resources Training Institute
NFSPC	National Fodder Seed Production Centre
PPD	Planning and Policy Division (RGOB Ministry of Agriculture)
RDP	Rural Development Programme
RGOB	Royal Government of Bhutan
RNR-RC	Renewable Natural Resource Research Centre
SDR	summed dominant ratio
STFRC	Subtropical Fodder Research Centre

NOTE

Currency

The Bhutanese currency unit is the Ngultrum (Nu). It is tied to the Indian rupee at par:

1Nu= 1 IR

Approximate rate of exchange in 2001: \$US 1 = 47.5 Nu

Five-Year Plans

Planning is based on a five-year cycle. The year runs from July to June

The relevant dates are as follow.

5th Five-Year Plan Period	1982 - 1987
6th Five-Year Plan Period	1987 - 1992
7th Five-Year Plan Period	1992 - 1997
8th Five-Year Plan Period	1997- 2002

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