GRAZING MANAGEMENT IN BROADLEAF FORESTS

*Lungten Norbu**

Abstract

This paper aims to document the current situation of broadleaf forest management, and assess THE impact of cattle grazing on broadleaf forests around Gedu, a typical broadleaf forest where grazing and wood production are practiced. An attempt is also made to propose an adapted forest management planning system that would enhance the co-existence of cattle grazing and wood production, along with other forest functions in broadleaf forests.

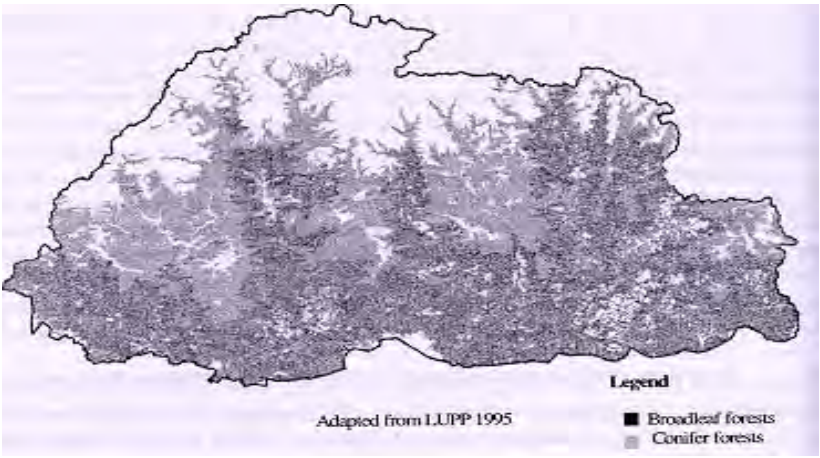
Broadleaf Forests in Bhutan

Forests in Bhutan represent the single largest natural resource. A large tracts of the natural forests are still intact, covering an area of 29,0044 km^2 which comes to 72% of the land area (LUPP 1995). About 35% of the forest is conifer, 52% broadleaf forest, 11.2 % scrub forest and the plantation forest is nominal. Broadleaf forests in Bhutan are located across the southern part of the country (Figure 1). They fall into three broad vegetation zones[1]- Tropical Broadleaf Forest Zone, Sub-tropical Broadleaf Forest Zone and Warm Temperate Broadleaf Forest Zone. Scattered patches of broadleaf forests (e.g. oak, maple and birch) also occur in the Cool Temperate Zone (2500-300m) in association with conifers. Nationally, the broadleaf forests are important assets as they provide goods and services to 80% of the population in the country (MoA, 1993). Broadleaf forests provide wood, fodder and non-wood products. Broadleaf forests are the "food-banks" of farmers living in remote settlements, for they provide buffers against famine when crops fail (Wagner, 1985). The well being of the people in the

* Program Director, RNR Research Center, Yusipang, Thimphu. This paper is the abstract of PhD. dissertation submitted to the Swiss Federal Institute of Technology, Zurich, Switzerland.

vicinity of broadleaf forest is directly linked to how well broadleaf forest resources are conserved and managed.

Figure 1: Broadleaf forest distribution in Bhutan



Forest, *Tsamdrog* and Livestock

Livestock is an integral part of the agricultural system, contributing about 21% of the agricultural GDP in 1996 (RGOB, 1996). Livestock provides butter, cheese, meat, draught power and farm manure for farmers. Cattle are owned by 90% of the households in the country and it dominates the temperate and subtropical regions of the country. In the alpine regions such as Laya and Lingzhi, yaks are the dominant animals, and the economy is solely based on livestock products (Gyamtsho, 1996).

Livestock grazing in forests in Bhutan is an age-old tradition. Livestock graze in forests and *tsamdrog*[2] that are either located near settlements or spread across forests. Most *tsamdrog* are owned individually while a few are registered in the names of communities (e.g. monk body). A large tract of *tsamdrog* is owned by the absentee landlords who sublease to

herders in some areas of the temperate and alpine regions (Gyamtsho, 1996). *Tsamdrog* are located at different vegetation zones and altitudes separated from one another by a weeklong walk with livestock. This allows farmers and cattle herders to migrate from one pasture to another with their livestock at different seasons. The tradition of seasonal migration is prevalent throughout the Himalayas, the Tibetan Plateau and the Alps, and it is a strategy to optimize the use of pastures by pastoralists (Hoon 1986, Miller, 1993).

Tsamdrog are forestlands, and their uses other than livestock grazing, are governed by the Forest and Nature Conservation Act 1995. Bamboo, bushes and leaf fodder in *tsamdrog* can be used when there is shortage of grass (RGOB 1978). Most *tsamdrog* are thought to be overgrazed resulting in deterioration of forage in quality and quantity as the livestock number has increased steadily over the last few years exceeding the capacity of the available grazing lands (Dorji, 1992). Presence of a large herds of livestock in *tsamdrog,* often extending into adjacent forests, has also raised concerns about overgrazing of forestlands.

General Views on Forest Grazing

Forest grazing is one of the silvo-pastoral systems based on the utilization of native forests by domestic animals, and it is a common type of use in the Mediterranean region (Bland and Auclair, 1996; Etienne, 1996). However, opinions on grazing as a forest management function are divided. Many foresters believe grazing and timber production are not compatible and management to maximize productivity for two products from one tract of land is complex. This notion has led to the separation of pastures and forests in several countries (Gillet and Gallandat 1996). Numerous reports also highlight damages caused by cattle grazing on trees and seedlings, and its ill effects on soil, water and environment (Bolt *et al.* 1978; Clary and Medin, 1990; and Kovalchik and Elmore, 1992). In

contrast to these beliefs, some authors viewed that moderate use of forage by cattle in forests is not detrimental to wood production (Tanner and Brantley, 1998). Others advocate that a cattle grazing is an effective management tool for reducing competition to tree seedlings by eliminating unwanted shrubs and grasses and at the same time these "weeds" provide forage for livestock (Allen and Bartolome, 1989, and Sharrow and Fletcher, 1994). In the Mediterranean regions, cattle grazing are successfully used as a tool to reduce fire hazard (fuel) in forests (Rigolot and Etienne, 1996). Grazing in forest plantations is a well-documented integrated form of land use. Integration of ruminants into coconut and rubber plantations is a potential land use system in Southeast Asia (Stür, 1994; Ismail and Thai, 1994, and Castillo, 1994). However, all reports in favor of forestland grazing stressed the point that grazing has to be planned and coordinated, should it be used as a tool for forest management. A FAO study carried out far back in 1953 sums up in support of forest grazing by stating that "grazing on the commercial timberland offers few complications as long as grazing is managed so that forage is not damaged. If forage is not damaged, there will be no damage to timber and the two can proceed together without major conflicts and to every one's economic advantage." The above statement still holds true as the multi-use forestry concept is increasingly being pursued.

Broadleaf Forest Management in Bhutan - Issues and Problems

A large part of the broadleaf forests is still intact in their natural state[3]. Broadleaf forests have a diverse flora and fauna sub-types resulting in innumerable complex ecosystems. There is a little knowledge on ecological and silvicultural characters of broadleaf forest types, and intervention to manage them on a sustainable basis has been challenging and uncertain (Subba and Uphadya, 1992).

From times immemorial, local resident graze their cattle in broadleaf forests, and in winter cattle from the higher altitude forage in numerous tracts of *tsamdrog* spread across the

extensive broadleaf forests. No clear demarcation exists between the *tsamdrog* and forests, and in practice, livestock invariably graze in both. Increasing cattle population over the years has made the sustainability of the traditional grazing system in broadleaf forest questionable. About 13,600 ha[4] of broadleaf forest is estimated to be degraded annually and, allegedly, cattle grazing is partly responsible for this; the others being fuel wood collection and expansion of agricultural land (MoA, 1991). Although, cattle grazing is known to be wide spread in all broadleaf forests, the extent, nature, intensity and impact of grazing have not been adequately quantified (MoA, 1993).

Lately, with the advent of development activities, broadleaf forests have been systematically managed for wood production. While optimizing wood production, other important social and economical uses of broadleaf forests have been overlooked. For example, no adequate attention is paid to the grazing issues during forest management planning process apart from recognizing that grazing is prevalent in forests. Much to the dismay of foresters, cattle continue to graze in forest areas where there should be no grazing. On the other hand, farmers and herders are resentful of foresters when they discover that their traditional grazing grounds are fenced off to establish plantations or regeneration.

In the quest to improve forest stands, lack of important tree regeneration and change of species composition in broadleaf forests is attributed to cattle grazing (FAO 1985; Millar 1986, Janze, 1990; Ijssel, 1990, World Bank, 1996; Sangay 1997) and accordingly, dependence on natural regeneration to rejuvenate logged broadleaf forests is thought to be unreliable. This notion has prompted the change of the silvicultural system in broadleaf forests from the selection-cum-improvement system to the clear felling system followed by re-forestation. Unfortunately, the new system is proving very expensive as barbed wire for fencing must be imported

(Sangay, 1997) and the cost of fencing amounts to 40% of the total expenditure for a forest plantation (Wangchuck, 1997). Grazing exclusion from the fenced plantations is causing resentments among the cattle herders as their grazing grounds are reduced (Wangchuck *et al.* 1995). Fencing of the plantations and regeneration areas is economically unfeasible to the forestry sector and socially unacceptable to herders.

A Case of Broadleaf Forest Utilization and Management Around Gedu in Chukha

Broadleaf forests around Gedu represent the present scenarios of broad leaf forest in general and Cool Broadleaf Forest in particular, where forests are utilized for wood production and grazing. Forests around Gedu were managed for industrial timber production while at the same time traditional practice of cattle grazing continues. Forests around Gedu are winter grazing grounds for large migratory cattle herds from the north, and they are also used throughout the year by small herds of local residents.

Forage and timber resources in broadleaf forest around Gedu
In forest stands, shrubs and forbs are abundant forming the bulk of the understorey herbage composition while grasses constitute a small part of it. Conversely, in open *tsamdrog*, grasses make up the major portion of the ground vegetation while shrubs and forbs are negligible. Native grasses recorded in abundance are *Paspalum* and *Digitaria* species. Other occasionally encountered grasses are *Isachne, Saccarum, Miscanthus, Panicum* and *Oplismenus*. Kikiyu grass (*Pennisetum clandestinum*), introduced in the nearby government livestock farm for forage is gradually invading the open *tsamdrog* and forest clearings. A spine-node bamboo, *Chimonobambusa callosa*, is a common bamboo while *Yushania* species and *Arundinaria racemosa,* which are important forages for cattle and yak replace *Chimmonobambusa* on the higher reaches.

Palatable forbs/shrubs species such as *Viola, Pilea, Elatostema, Aporasora, Persicaria*, *Girardinea, Aconogonon,*

Rubia, Rubus and Solonum form the bulk of the cattle-feed. The number of *Viola, Pilea, Elatostema and Aporosa* are high but their contribution to herbage production for animal intake is very little as they are tiny herbaceous plants. Shrubs such as *Girardinea, Aconogonon, Rubia, Rubus and Solonum* make up the major feed for the cattle. These shrubs are indicators of the succession to the shrub land and they die back in winter making the forage situation critical.

Small tree seedlings (<40 cm in height) form a small part of the ground vegetation composition and also negligible cattle forage. The pioneer tree species of *Eurya*, *Casaeria*, *Symplocos*, *Lindera*, *Walsura, Maesa* and *Viburnum* represent a major part of the small tree seedling population. Small tree seedlings of the primary species of *Quercus*, *Acer, Persea*, *Castanopsis* and *Elaeocarpus* are low in number.

Impact of grazing on forage resources, seedlings and forest stands

The increasing dominance of invader species and the species at the bottom of the succession table of grasses and shrubs shows that forage resources are declining in quality due to continued grazing. *Paspalum* is increasingly being replaced by *Digitaria* species[5] in the open meadows. Unpalatable forbs and shrubs such as *Eupatorium*, *Pteridium*, *Artemisia*, *Ptericanthus*, *Plantago* and *Rumex* are gradually replacing the palatable forbs and shrubs in the open forest clearings. Presence of *Girardinea, Aconogonon, Rubia, Rubus* and *Solonum* also show that the forage situation is deteriorating. However, growth, ingress and mortality patterns of small tree seedlings are complex. Some species appear in summer and disappear in winter, while others perform just the opposite way. It is unclear whether the pattern of appearing and disappearing of small tree seedlings is due to its natural cyclic seasonal phenomenon or due to grazing.

Figure 2: Number of seedlings (no ha^{-1}) by group/genus in October 1997 and in March 1999

Group/genus	Seedlings in October 1997		Seedlings in March 1999	
	Total ha^{-1}	%	Total ha^{-1}	%
Primary	320.51	21.64	275.56	22.16
Cinnamomum	6.41	0.43	6.41	0.52
Acer	6.41	0.43	6.41	0.52
Castanopsis	6.41	0.43	6.41	0.52
Elaeocarpus	6.41	0.43	0.00	0.00
Beilschmiedia	32.05	2.16	32.05	2.58
Alcimandra	12.82	0.87	12.82	1.03
Quercus	19.23	1.30	19.23	1.55
Persea	230.77	15.58	192.23	15.46
Secondary	51.28	3.46	32.05	2.58
Sloanea	6.41	0.43	0.00	0.00
Eriobotrya	6.41	0.43	6.41	0.52
Macropanax	12.82	0.87	0.00	0.00
Ficus	25.64	1.73	25.64	2.06
Pioneer	1,108.98	74.90	935.90	75.27
Daphniphyllum	19.23	1.30	0.00	0.00
Viburnum	147.44	9.96	134.62	10.83
Eurya	198.72	13.42	198.72	15.98
Casaeria	19.23	1.30	12.82	1.03
Symplocos	724.36	48.92	589.74	47.43
Total	1,480.77	100	1,243.51	100

The average numbers of total seedlings per hectare vary across the forest sites and it appears to be associated with the grazing pressure at the individual sites. Seedlings of the pioneer tree species constitute the major part of the total seedlings. On the other hand, the seedlings of primary and secondary tree species are low in number (Figure 2). The reason is that seedlings of the primary and secondary groups are highly palatable to the grazing animals, making them susceptible to the wandering cattle. In general, tree species are less resistant to browsing than grasses, forbs and shrubs and are easily eliminated by browsing. However, it appears that cattle do not graze indiscriminately in the forests since certain parts of the forests are left untouched by cattle. These

"untouched" areas are located at a distance from the settlements and cowsheds.

Signs of browsing damages on the seedlings are evident across all sites but the intensity of damages vary across the sites depending on the number of cattle grazing on the site. Most seedlings are either completely browsed off by cattle or removed by cattle herders while others have broken tops and branches due to browsing and trampling by cattle and slashing by herders. Damages are not confined to palatable tree species; unpalatable tree seedlings of *Symplocos, Eurya, Viburnum* and *Lindera* are affected too. This suggests that seedling damages are not only due to browsing by cattle but also due to trampling by animal hooves. From the other end, this can also be taken as evidence of declining forage resources where trampling of seedlings have been resulted because of cattle foraging around in forests. Therefore, we can say that mortality of seedlings and damages on seedlings are not directly linked with cattle grazing *per se.*

Figure 3: Number of trees per hectare in Gedu forest in 1982 (Subba) and 1998

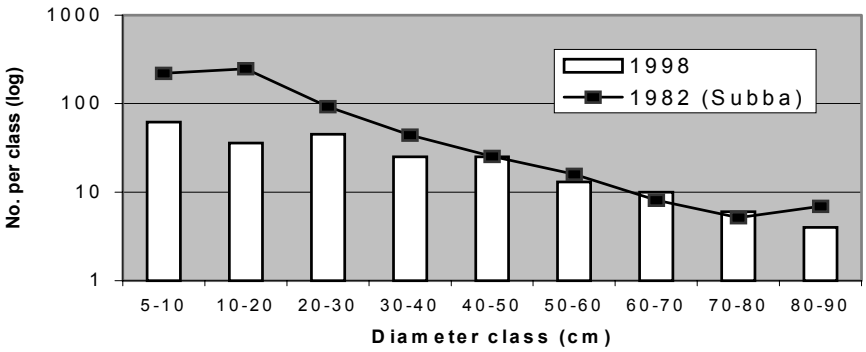
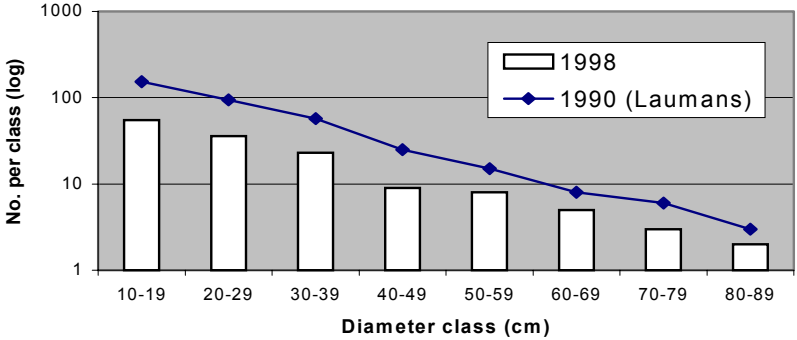


Figure 4: Number of trees per hectare in Dungna Road forest in 1990 (Laumans) and 1998

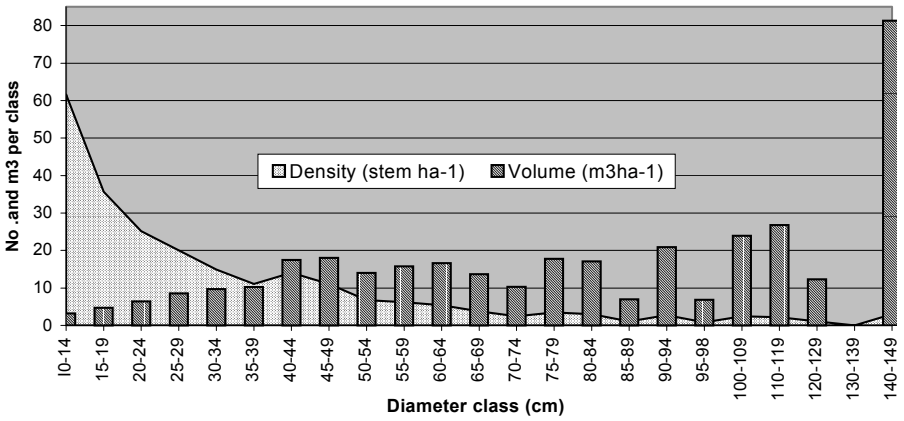


The stand density and growing stock of forest stands vary depending on sites ranging from 125 stems ha^{-1} to 238 stems ha^{-1} with corresponding gross volumes ranging from 163.64m^3 ha^{-1} to 362.58m^3 ha^{-1}. Subba (1982), on writing the first management plan for Gedu forest estimated the stand density at 665 stems ha^{-1}. The current estimate (1998) of stand density is only 238 stem ha^{-1}, showing that the stand density has been reduced drastically through the years (Figure 3). Similarly, the stand density in Dungna road forest has also been considerably reduced through the years. Laumans (1990) estimated it at about 365 stems ha^{-1} for a similar forest adjacent to Dungna forest while the current stand density is estimated as low as 125 stems ha^{-1} (Figure 4). Logging operations are mainly responsible for the present general low density and growing stock as these forest stands were subjected to selection for logging for industrial wood production.

In general, the species composition of the forest stands is skewed towards the pioneer species of *Symplocos, Eurya, Viburnum* and *Daphniphyllum*, and they dominate the lower diameter class trees. The dominant climax tree species of *Persea, Quercus*, *Castanopsis* and *Michelia* are little represented in the lower diameter class and a few of them in the higher diameter class are old and dying (Figure 5). In an

undisturbed natural condition, the forest should have a high number of lower diameter trees of the primary species (*Quercus, Persea* and *Castanopsis*) which continuously ingress into the higher diameter class[6]. Ohsawa (1991) described a similar retrogressing ecological succession in one of the broadleaf forests at Lingmithang (east Bhutan) where the pioneer species (*Engelhardtia* and *Schima)* dominate the primary species (*Castanopsis* and *Lithocarpus*) of the area and he attributed this to disturbances of forest floors due to heavy grazing. The similar impact of grazing on species and diameter distribution is also reported from the broadleaf forests of eastern Bhutan where the majority of 30 cm dbh trees in the forest are unpalatable *Symplocos* and *Rhododendron* (Chamling, 1996). These observations suggest that, apart from logging operations, the current species composition and stem-diameter distribution in forest stands around Gedu can be associated with cattle grazing.

Figure 5: Number of trees and standing volume per ha in Gedu Forest



Trees in *tsamdrog* and forests are lopped to supplement the feed of cattle in winter. The intensity of lopping is relatively high on the trees of the secondary species that occupies the middle canopies of forests. It is likely that the trees of the secondary species with stunted heights and low branches have facilitated climbing and lopping for herders. Incidences of lopping vary from 6 to 15% standing trees depending on the location of the forest sites. Fodder trees are important around Gedu for they are the only source of forage for their cattle in winter when grasses and other edible herbage dry up.

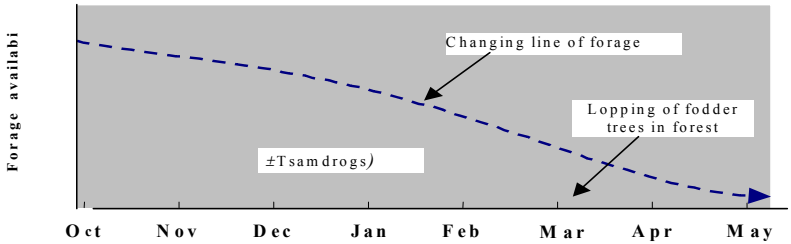
Tsamdrog and grazing practices around Gedu

Every household owns grazing right to at least two tracts of *tsamdrog* at each of the summer and winter grazing grounds. Some households with big herds have 3-4 tracts of *tsamdrog* that are usually located at different altitudes. Each tract of *tsamdrog* is a distinct being separated from each other by ridges, rivers, gorges and cliffs. These boundaries are respected and every herder confines his herd to his *tsamdrog*. *Tsamdrog* are individually registered in the names of the heads (wives) of the households and they are known by names often depicting their locations and physical features. The ownership of grazing rights to *tsamdrog* has been handed down from mothers to daughters.

Herders have considerable knowledge of the forest and ecosystem they depend upon. They have learnt to devise indigenous grazing practices to optimize their uses of *tsamdrog*. They know when and for how long each of their *tsamdrog* tracts can be grazed. Every year, on their return to the broadleaf forest area around Gedu in November, they usually start grazing *tsamdrog* located at the lowest altitude and move uphill. In the first days of their stay in *tsamdrog*, cattle are left to graze for a short length of time. Cattle are rounded up in the evenings and restricted them in makeshift enclosures to prevent excessive use of forage overnight. In time, cattle are left to graze overnight in and around *tsamdrog*. The time when pastures begin to show evidence of

decline in forage, cattle are taken to another tract of *tsamdrog* and the same system of grazing is applied there.

Figure 6: Schematic diagram to show the change of forage availability in tsamdrog during the stay of the cattle herd in winter grazing ground



Despite the fact that the Forest and Nature Conservation Act 1995 clearly states that the *tsamdrog* belong to the

By February, all palatable grasses and shrubs have either dried up or been eaten by cattle. Cattle wander into the adjacent forests scavenging for forage and this is the time when tree seedlings and saplings are either browsed or trampled upon. Cattle even debark trees to supplement their feed[7]. Herders then start lopping the fodder trees that are growing in their tracts of *tsamdrog* to supplement the cattle fodder. Some herders also travel into the forests to harvest two head-loads of tree fodder every day for the calves that are tethered at the camps. Gradual thinning out of the forests adjacent to the herders' camps is attributed to this practice

The government, the farmers and herders view them as their absolute properties. However, the tradition of cattle migration around Gedu, with the changing time and surrounding, is

coming to a halt. The change is beginning to upset the sustainable use of *tsamdrog*. Forage resources are deteriorating as cattle spend more time grazing in a tract of *tsamdro*. In such cases, farmers and herders turn to native fodder trees in the forests to supplement the fodder shortage. Herders around Gedu do not make efforts to improve *tsamdrog* because legally *tsamdrog* are only for grazing and they cannot be used in any other ways. Gibson, 1991 suggested that some *tsamdrog* near roads should be permanently settled. Hocking *et al.* 1999 (in press) observed that putting in place a policy of conversion of *tsamdrog* rights to permanent ownership rights (case-by-case) would be a step towards minimizing grazing pressure in broadleaf forests.

Current Forest Management Planning Process

Forest management planning in Bhutan was institutionalized as early as the 1950s with the creation of the Forest Department in 1952. The legal framework for forest management planning was established with the enactment of the Bhutan Forest Act in 1969. The foundation to scientific management of forests was laid with the start of the Pre-investment Survey (PIS) of forest resources in the 1970s with the assistance of the Government of India that inventoried forest resources throughout the country. Following the promulgation of the National Forest Policy in 1974, the preparation of scientific management plans for various forest areas was started. In 1977, Management Division has been established within the Forest Department with a mandate to prepare forest management plan. Since then, the forest management planning activities took a center stage in the forestry sector, and by 1992, the forestry sector had developed a capacity allowing it to prepare at least three management plans a year (Subba and Upadhyay, 1992). At present the forest management plans for 289,923 ha of forests, that corresponds to 32% of the operable forests are operational throughout the country[8].

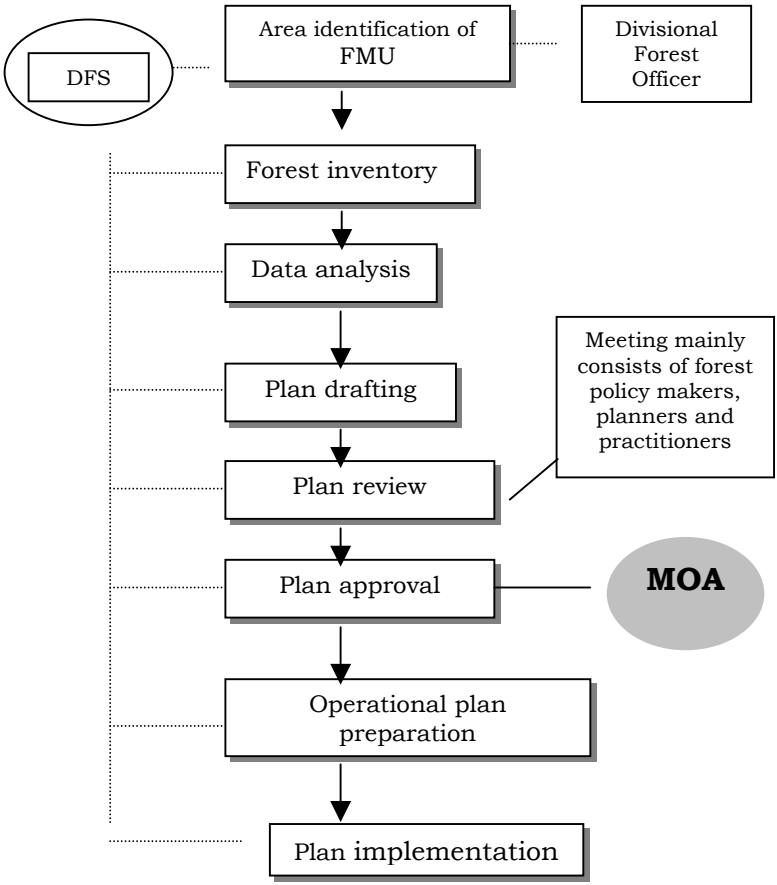
Forest inventory and forest management planning are carried out centrally in cooperation with the forestry staff in the

districts within the scope of sustainable forestry principles and goals elaborated in the policy statements. A forester, by virtue of being a government caretaker of forests, takes a leading role in forest management planning[9]. Forest planning is concentrated at the Forest Management Unit (FMU)[10] with some participation from other stakeholders. The current forest planning is a one-level planning system (Figure 7) and the size of the FMU varies from 1000 ha to 30,000 ha (Richen and Määttä 1992).

Generally, forest planning is forestry-centered focusing on wood production and protection, paying little attention to other forest uses. However, foresters are aware that the present management planning fails to include the participation of all forest users, as the National Workshop on Forest Inventory and Management in 1992 observed " …to take a holistic approach to management planning, plans must take into consideration the people living around and inside the units. Views of people must be reflected in plans". The concept of multi-use forestry is gaining importance with the changing demands and these emerging issues were discussed in important national forestry fora[11] and they are now manifested in the national forest program and plans.

Recently, attempts were made to include conservation aspects and other social functions other than wood production, into the forest management planning process (Salter, 1995; Dick and Yonten, 1996; and Dhital, 1998). The forest management program of the current five year plan focuses on sustainable management for multiple uses as one of its main activities with emphasis on traditional community uses of forests (RGOB, 1996). The Forest and Nature Conservation Act 1995 has provisions and bylaws[12] to bring in active public participation in the conservation and management of forest resources.

Figure 7: Current forest planning process



Broadleaf Forest Management Planning: Concept and Proposal

Forests provide numerous goods and services to an array of stakeholders and forest users. These goods and services are inter-linked and need coordination amongst the concerned stakeholders in order to plan and implement the sustainable

management programs. The present one-level planning process does not allow all stakeholders (RNR sub-sectors and other sectors) in the *dzongkhag* and local people in the *gewog*/villages to be informed and involved in the management of forest resources. Also, with the approval of the Private Forest Rules and Community Forestry Rules 2000, local participation in managing forests is expected to grow. This paradigm shift would demand or is demanding a new planning system that would offer a base to local people to participate actively in the social and community forestry programs.

Basis for a new broadleaf forest planning system

Broadleaf forests attend to a wide variety of stakeholders and often the interests are conflicting. For example, foresters view the goal of timber production more important than cattle grazing whereas the veterinarians and herders perceive the importance vice-versa. There is a need for a planning forum to discuss the objectives and activities of forest management with all stakeholders so that the differences and conflicts, if any, are negotiated or resolved.

Besides timber, the rural population looks upon broadleaf forests as sources of forage, firewood, non-wood forest products and as a necessity for water conservation in contrast to priority needs perceived by forest planners, environmentalists and development workers. For example, around Gedu, as the majority of people depend on cattle for a livelihood, grazing in forests is one of the most important uses of forests for local people. Many evidences indicate that local people are dissatisfied with the forest development programs because their needs and aspirations are not reflected in the programs. Involving the local people at the appropriate planning level would help in defining the right goal of broadleaf forest management which would in turn result in forestry programs that would benefit local people.

Forage resources in *tsamdrog* and broadleaf forests are declining in quantity and quality due to increasing numbers of grazing cattle. In order to take the pressure off the forests, the *tsamdrog* in broadleaf forests must be improved in their productivity, and at the other end, the number of cattle must be reduced. These programs have to be planned and coordinated with other RNR sub-sectors (e.g. animal husbandry, pasture) at the *dzongkhag* and at the *gewog*/villages as they call for expertise of pasture agronomists and veterinarians.

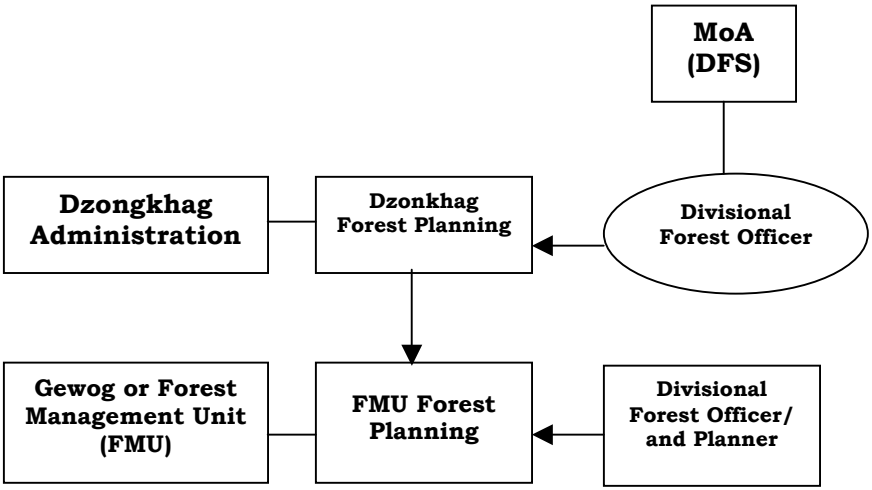
Browsing tree seedlings and damages to larger trees are becoming evident in the areas where there are large herds of cattle. It is unlikely that cattle rearing will disappear from broadleaf forests in the future. To ensure that grazing coexists with wood production, banning or regulating grazing periodically in prime forests and certain degraded forests, are essential to restore forest ecosystems. Therefore, grazing regulating plans have to be formulated in coordination with pasture/range experts and herders.

Integrating cattle grazing into broadleaf forest management is complex and goes beyond the forester's domain as it involves management of forests, pastures, cattle and people. Foresters need the support of veterinarians and pasture agronomists to plan programs on pasture and cattle breed improvement. Co-operation of farmers and herders is necessary to plan and implement forest management programs which are sensitive to the local needs and which would ultimately bring about sustainable management of broadleaf forests. This needs a new approach to a forest planning system that brings together pasture agronomists, veterinarians, foresters and local people working closely together and drawing support from one another to manage broadleaf forests.

In view of the above arguments, two levels of planning are proposed (Figure 8): the *dzongkhag* forest planning at the *dzongkhag* and the forest planning at FMU.

The aim of the proposed two-level forest planning is to bring about active participation of all stakeholders, including local people, in the planning and management of forest so that conflicting issues such as forest grazing can be integrated in the forest planning. It will operate within the existing organization in the Ministry of Agriculture and in the *dzongkhag* and it does not impose any additional structure.

Figure 8: Proposed two levels of forest planning



Dzongkhag Forestry Planning

The goal of the *dzongkhag* forest planning is to plan and coordinate the relevant activities of the RNR sub-sectors (e.g. agriculture, irrigation, livestock and forestry) and other sectors (energy, industry etc.) that interface with the broadleaf forest management in the *dzongkhag* through discussions. The interests of all participating sectors in the *dzongkhag* will be solicited and the appropriate actions

planned, if required. Broadly, at this level of planning, forest uses and activities (e.g. grazing, wood production, watershed protection, local consumption of wood, fuel wood and non-wood forest products) that are most important to the individual *gewog*/forest area could be discussed. Should there be conflicting interests either on forest uses or the means of carrying out the proposed activities among the sub-sectors, they will be resolved or compromised through dialogue. The unresolved issues that need policy attention will be put to the government (MoA) for consideration. Furthermore, discussion and planning will be done on how and who will undertake the agreed programs/activities in the subsequent lower level planning and implementation. The expertise of the animal husbandry sub-sector relating to forest grazing and *tsamdrog* is needed in the planning of grazing management at the *gewog* forest planning level and such inputs will be sought.

The *dzongkhag* forest plan will give an overview of land use patterns, socio-economic conditions and forest and forestry situations in the *dzongkhag*. The plan would include the interests of RNR sub sectors and other sectors outside RNR in the broadleaf forest management as well as job responsibilities of all participating stakeholders in the subsequent planning level and implementation.

The planning will be undertaken at the concerned *dzongkhag* through a series of meetings and reviews among the stakeholders of the *dzongkhag* and Divisional Forest Officer (DFO) in the region. The DFO will decide who should be the participants after considering the main scope of the plan. In general, the participants would consist of all the RNR sub-sector heads in the *dzongkhag* who are responsible for management of RNR activities. Accordingly, the *dzongkhag* forest planning team will comprise Dzongkhag Planning Officer, Dzongkhag Extension officers of Forestry, Animal Husbandry and Agriculture, Dzongkhag Irrigation Engineer and Divisional Forest Officer (DFO) in the region.

The DFO will take the lead and initiate planning processes by arranging the meetings at the *dzongkhag*. He will introduce the planning concept, and present the background information in the meetings. DFO will draft the plan based on the outcome of the planning meetings and other sources in the MoA and in the *dzongkhag*. The *dzongkhag* planning team at the *dzongkhag* headquarters will review the first draft plan. After necessary amendments, the draft plan will be sent to the Department of Forest Services (DFS), Research, Extension and Irrigation Division (REID) and Department of Agriculture and Livestock Services (DALS) for review. The reviewed plan will then be submitted by DFO through DFS to the Ministry of Agriculture for approval.

Forest Management Planning in FMU

The main goal of this planning level is to involve local people in identifying their needs as well as setting the objectives of the broadleaf forest management plan of the unit/forest along with other concerned RNR sub-sectors. The conflicting interests with the farmers and herders will be either resolved through discussion or negotiated to a mutual benefit. For example, a farmer may be allowed to keep a certain forest area (*tsamdrog*) for grazing but he must agree to refrain from grazing his cattle in areas where it is prohibited or he must reduce the number of his unproductive cattle. The forest areas set aside will be subjected to management prescription to improve the forage resources. The outcome of the planning will be a forest management plan for a FMU, which will provide organized forest management for the sustainable production of wood, forage and other important forest uses for local and industrial purposes. At the same time, environmental and watershed values of the forest unit will be safeguarded. The management plan will guide various management activities. The management plan must be revised even before its validity period (after five years) should there be changes in the *dzongkhag* forest plan.

The present planning in the forest management unit in Bhutan corresponds to this level of planning. Yield regulation, silviculture, harvesting plans, infrastructure development, conservation and protection of watersheds, wildlife and nature are the key contents of the management plan. In essence, the proposed content of the forest plan will not differ from the content of the existing FMU plan. In the existing forest management plans, grazing is included as one of the management issues that needs attention but there is no elaboration on the management strategy. Therefore, in the FMU, where cattle grazing would form an important forest use, grazing regulations and a forage improvement program will be added to the plan. A grazing regulation, forage improvement and animal breed improvement plans will be prepared in association with the Animal Husbandry and Agricultural staff.

The FMU forest planning team will consist of the RNR extension agents of the concerned *gewog*/villages, the DFO, forest planner, farmers and herders of the unit/locality. The presence of a particular RNR extension agent will differ from one forest unit to another depending on the *gewog*/forest units and the interests expressed by the RNR sub-sectors in the *dzongkhag* forest planning. In some units, all RNR extension agents need to be involved in the planning exercise while in other units only a representative from one sub-sector (e.g. Animal Husbandry) will participate in the planning. The forest planner will take the lead in the FMU forest planning taking the *dzongkhag* forest plan as the base of the planning. The forest planner, in coordination with the DFO, will arrange the meetings and field trips to the proposed FMU along with other concerned RNR extension agents and discuss the local needs and views and set the objectives of the plan with the people at the sites. Forest inventory will be carried out using the inventory teams to collect forestry information on the forestry unit. The concerned RNR extension agents will be involved in the information collection on other RNR sub-sectors. The forest planner along with the concerned RNR representatives will undertake data analysis, and the

preliminary findings will be discussed with the *gewog* forest planning team including farmers and herders and subsequently the plan will be written. The first draft of the plan will be reviewed at the *dzongkhag* with the *dzongkhag* forest planning team. Then, the draft plan will be reviewed at the FSD for technical details. The final plan will then be submitted to the government Ministry of Agriculture for approval.

Grazing Management in FMU of Broadleaf Forests

The case in Gedu broadleaf forest illustrates that unregulated grazing and its related activities (such as lopping and clearing undergrowths) are associated with deteriorating forage resources, eliminating and damaging seedlings that eventually result into reduction in density and change in species composition of broadleaf forest stands. If this trend continues, there is a danger that broadleaf forests along with *tsamdrog* will gradually decline both ecologically and economically. Therefore, grazing in broadleaf forests needs to be regulated either by segregating grazing areas from timber producing areas or by integrating grazing function as part of forest management practices. The first option has been successfully applied in Western Europe, parts of America and New Zealand where livestock is virtually banned from timber producing forest areas. The first option is successful in the West because the social and economic factors are conducive to its applications. Livestock raising is a specialized industry and there were large tracts of land that were converted to extensive pastures. However, in Bhutan, a cattle rearing is a subsistent economy and it is closely intermingled with other farming systems to allow specialization. The ownership conflict of pasturelandS (*tsamdrog*) is another problem in segregation of grazing area from timber producing area. *Tsamdrog* are government owned and they are only intended for grazing and their conversion to other uses poses legal implications. In our context, considering that forest grazing

cannot be banned in certain areas for socio-economic reasons, the second option of integrating grazing, forage and fodder management as parts of forest management is the way to manage broadleaf forest resources in the areas where cattle rearing is the sole socio-economic activity.

Some of the components to be included in the management plan of FMU to reduce or control grazing are:

a) Improvement of forage resources and animal breeds
Forage resources in *tsamdrog* and forest are low in quantity and quality. The numbers of native forage grasses species and plants are limited and introduction of exotic forage plants in open *tsamdrog* has to be explored. Open *tsamdrog* are gradually replaced by unpalatable plants and they have to be cut back to induce palatable forage plants.

Generally, local breeds make up the main component of the livestock population and productivity in milk yield is relatively low if compared with Jersey cross breeds. Also, people keep large herds with only a small number of milking cows. The unproductive animals be slaughtered according to Buddhist culture and beliefs. Plans and strategy should be in place to introduce improved breeds and reduce the number of cattle in the herds. Foresters and animal husbandry people need to work together on these aspects.

b) Management and utilization of native fodder trees
Forage resources are critical in winter when green herbage dries up. It was observed that usually cattle browse seedlings and herders lop trees in winters to supplement the cattle feed. Planting and managing fodder trees in *tsamdrog* is another strategy to improve forage resources. It has a high chance of adoption by farmers and herders as many of them are already raising fodder trees in their *tsamdrog*. Most native trees are high yielding and green leaves are available in winter.

c) Regulate grazing in tsamdrog and forests

The observations around Gedu shows that the forest stands at higher altitudes are relatively lightly grazed while *tsamdrog* and adjacent forest stands near the settlements at lower altitudes are intensively grazed. This suggests that cattle distribute themselves according to the availability of forage resources. Therefore, the most important management consideration for regulating grazing is matching foraging with the availability of forage in forests. Broadleaf forests have complex ecosystems and calculation of the potential stocking rate (carrying capacity) for broadleaf forests is difficult if not impossible. Many reports (Miller, 1993; Gibson, 1991 and Karmouni, 1997) also question the relevance of stocking rate when applied to natural ranges (e.g. forests) as grazing takes place in complex ecosystems coupled by varied micro-climates, seasons, flora and herd composition. Therefore, the application of the above stocking rate to control herd pressure is uncertain and it is not applicable at this point of time when large herds of cattle graze in forests. Controlled rotation[13] of herds that relies on both temporal factors and the state of *tsamdrog* and forage regime may work as a kind of rotational grazing in-built in the traditional grazing practice in some areas of broadleaf forest[14]. During the good season, herds can be kept in a tract of *tsamdrog* for a short period followed by a quick rotation to another tract of *tsamdrog*. In lean seasons, the herds can be kept for as long as the *tsamdrog* tracts have vegetative cover. Watching appearance of plants that are associated with the decline can monitor the control over the state of *tsamdrog*. *Ageratum, Eupitorium*. *Artemesia*, *Rumex*, *Dichroa Ptericanthus* and *Pteridium* are the indicators[15] of the deteriorating condition of forage in open meadows and forest clearings. Increasing dominance of *Symplocos*, *Eurya*, *Lindera*, *Daphniphyllum, Casaeria* and *Viburnum* shrubs are characteristics of grazed and disturbed forests.

Main Features of the Proposed Forest Planning System

The present broadleaf forest-planning concept is founded on the principles that livestock and trees along with other vegetation are all part of the broadleaf forest ecosystem and management must provide a suitable environment to all. The joint production of wood and dairy products upon which a number of rural people are dependent for their livelihood, will largely depend on sustainable management of broadleaf forests. The underlying converging point is that a broadleaf forest is a common base for sustainable production of both commodities, and maintaining and developing it at a sustainable level is in the collective interest. It is also based on the premise that wood production and cattle grazing are compatible provided grazing is regulated.

DFO at the *dzongkhag* or region is made responsible to plan and co-ordinate the *dzongkhag* forest-planning meeting instead of the forest planner at the center (FSD) as DFO is more conversant with the prevailing situations in the region. Also, the proposed system does not undermine the present forest management planning system as the lower level of planning (FMU forest plan) is entirely founded on the present forest management planning system. The planning proposal is considered in consonance with the decentralization policy, in the spirit of integration of RNR sub sectors and to accommodate social forestry programs. Although, the two-level planning system is proposed for a broadleaf forest, it has a relevance to all forest types throughout the country. The main contents of *dzongkhag* and FMU plans will differ from one *dzongkhag* to another, but the same planning process should be applicable to all *dzongkhag* in the country.

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End Notes

[1] Vegetation zoning by Ohsawa (1987).
[2] A tract of forestland with or without trees belonging to the state and people have rights to pasture their livestock on the payment of an annual fee.
[3] Ohsawa 1991 stated that such montane broadleaf forest types in Nepal and Kalimpong (India) to the west of Bhutan are disappearing.
[4] MoA 1991 estimated the total degraded open forest land area about 230,000 ha.
[5] Tsuchida (1987) stated that *Paspalum* retrogresses to *Digitaria* under heavy grazing.
[6] According to the study conducted by Ohsawa 1991, the broadleaf is composed of three principle types of canopy species-emergent, sporadic and inverse J-type. The inverse J-type is shade tolerant trees represented by number of population in smaller class that recruit larger diameter class continuously.
[7] Personnel observation in March 1999.
[8] Personal communication, Wangchen, 1999, Forest Resources Development Section.
[9] Referring to Forest Management Units (FMU) not to the protected areas.
[10] Forest area of 1000-30,000 ha (Määttä and Rinchen, 1992).

[11] For example, the Workshop on Forest Inventory and Management held on 4-10 May 1992.
[12] Social Forestry Rules 1996- Rules for Private forests and Community Leased Forests are approved for implementation. Rules for Community Protected Forests are still under review.
[13] Alternative concept to loading tried in forest rangeland in Morocco (Karmouni, 1997).
[14] Not applicable to other broadleaf forests where *tsamdrog* are limited and community-owned.
[15] *Ageratum*, *Eupitorium*, *Artemesia* and *Pteridium* grow in the overgrazed pasture between 1500-2500 masl (Tsuchida, 1991).