THE HERDSMEN'S DILEMMA[1]

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Introduction

Migratory herding is still an important part of the livelihood of a significant section of the Bhutanese people; but it was central to our traditional pastoral economy. Cattle, grazing land, labour and cultivatable land were the four primary sources of wealth in the past. A balance among these four factors of production had to be struck for the agrarian society to be sustained. Obviously, the area of grazing land, and the number of cattle depended on it, could not have been so large as it was if forests were allowed to grow with rampant vigour, as we do now.

Migratory herding embodies considerable empirical knowledge about ecology, climate and topography among the herdsmen, although this is not widely acknowledged. This fund of knowledge have enabled the herdsmen to know the best grazing places and the most nutritious plants, which can be foraged by being at the right place in the right time, by moving with precision. Being always out in the open, the herdsmen, and to some degree their cattle, have acute perceptions of weather patterns. They have an acute sense of timing to move from one place to another to avoid frost at a pasture, or snowfall on a pass, or to escape the vampirish experiences of ticks and leeches drilling into their eyes, noses, and groins.

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[1] This article is a small fraction of information that exists among villagers and herdsmen. It has been further supplemented by reports relevant to the topic. I am grateful to a number of informants, in particular, Choeten of Trashi Yangtse; Dasho Karma Gayleg; Ap Wanghuck of Zursuna, Haa; Tshewang Darjay of Ura, the late Jowo Thinley Tshering and many others. I thank Dr Pema Gyamtsho for activating my interest on this topic.

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The traditional cattle breeding system has a marked preference for *jatsham*, a cross between *thrabam* and *bamin*, unique to Bhutan. *Jatsham* is the main breed adapted to long distance migration, as its characteristics are highly favourable when judged on the criterion of disease resistance, longevity, foraging ability, milk-fat content, fertility, mobility, and ease of management. Although jersey and brown-Swiss breeds perform better on the scales of milk yield as well as duration of lactation, farmers in many parts of the country rank *jatsham* above cross breeds of brown-Swiss and jersey. Issues about breed selection and grazing land on the one hand, and cattle breeds and organic farming systems on the other, can hardly be separated: they are closely interrelated. Besides several other desirable characteristics, *jatsham* breed fits the high milk-fat content and mobility requirements, and mobility in turn enables migration to optimise foraging across different regions.

Grazing land ownership ranges from holdings by villages or monastic institutions as corporate entities, to holdings by private individuals. There are conceptually six different kinds of holdings. Ownership is sometimes seasonal because of overlapping users: a patch belongs to a cattle herdsman in winter and a yak herdsman in summer.

The dissemination of exotic breeds is usually accompanied by exotic-fodder based pasture promotion around villages. This has far-reaching effects on land use and the farming system, especially in view of the expected decline in the number of native cattle that will reduce the supply of manure for organic traditional farming.

This article also discusses the Draft Livestock Policy (1995) and inquires into the consequences of its implementation, if it is passed as law. The divorce between forest and livestock that is underway will profoundly modify vegetation composition on the one hand and herd diversity on the other. The Draft Pasture Policy, if enforced, will dramatically tilt the breed selection towards jersey and brown Swiss crossbreeds;

the consequence of this choice will carry over into many other spheres, with outcomes that have not been contemplated.

Overview of Rangelands

Nature created open rangelands in the rugged mountains in the northern part of Bhutan where grassland dominates. But most of the rangelands in our country were fashioned by man for human and livestock uses. Rangelands have been developed, through human effort, by clearing and burning out undergrowth. Alpine rangelands in Merak, above 3,900 metres, were created several hundred years ago; according to its settlement history, the name Merak means "settlement created by burning out". Rangelands and pastoral activities have been a pastoral societies in the Himalayas. In our country, the concept of rangeland is not limited to open grassland as is the case elsewhere, but extends to forest floor grazing in lower elevations with chirpine, broad-leaf and sub-tropical forests. A registration document of rangeland or grassland (*rtsa 'brog khram*) specifically mentions what were traditionally entailed in the ownership of a rangeland: terrestrial surface, water, river, mountains and valleys (*sa chu klung phu mda*).

The area devoted to rangelands in the Hindu-Kush Himalayan region has a staggeringly large area of rangelands as a percentage of total land area. At 0.34 percent, Bhutan's own rangeland area is highly underestimated[2], and there is no credible basis for this estimate.

From a narrow economic point of view, which does not take account of ecological and environmental functions, rangelands have very low opportunity cost. Because of the

[2] See Miller D. et al, 1997. *Rangelands and Pastoral Development in the Hindu Kush-Himalayas*. Kathmandu: ICIMOD, 1997. Rangeland accounts for 60.8 percent of Tibetan Plateau, 19.4 percent of Pakistan, 9.7 percent of Afghanistan and 8.7 percent of India. Miller gives a figure of 0.34 percent rangeland for Bhutan, but in the absence of an accepted criterion for what constitutes rangeland, this figure cannot be assumed as accurate.

lack of an alternative use for agricultural or other purposes, and due to remoteness, steepness, and poor soil, rangelands are marginal land. It is therefore best to convert plant biomass into essential animal products.

In fact, wealth and prosperity in traditional society were generated by four primary sources: labour, arable land, cattle and grazing land. These four factors had to be kept in some sort of proportion for the society to be sustained. Excessive forest regeneration at the expense of grazing land can negatively affect cattle farming, and hence production of dairy foods.

Substantial knowledge, cults and rituals have developed around migratory cattle. A significant part of pre-modern administration was geared toward tracking cattle and yak populations for the purpose of in-kind tax collection. A good deal of empirical ecological and geographic knowledge has accumulated as a result of migratory herding, but it remains oral and localised among a group who do not find media or academic voice. This fund of knowledge has enabled the migratory herdsmen to find the best grazing places and the most nutritious plants for foraging, by being in the right place at the right time, which in turn depends on moving with precision. Being always in the open, the herdsmen, and to some degree the cattle, have an acute perception of climatic or weather patterns. They have to know when to move from one place to another on time, if they are to avoid frost at a pasture and snowfall on a pass, or if they have to escape the vampirish attentions of ticks and leeches drilling into their eyes, noses, and groins. Although there are research findings on certain aspects of pastoralism, a comprehensive analysis of how the whole sphere of pastoral activities is integrated within various eco-systems the herds frequent is yet unavailable. In contrast, research stations have devoted considerable time and resources on crossbreeds, and the improvements of their pastures near the villages.

Founding Grassland *(rtsa 'brog)* and Claiming Holding Title (*Thram*)

The establishment of Merak as a rangeland-based village by burning fir and juniper forests is mentioned in their origin history (*'byung rabs*). It mentions that Merak was named in that manner as fir forest was set on fire to establish the village ("*Merak zerwani spa mai nags la me rgyab nas grong chags pa la Merak tu thogs*")[3]. Merak's history gives a detailed list of grazing land patrimony (*brogs skal* meaning patrimonial share of rangeland) in Merak, Sakten and Sapo. A rangeland, like Throlemang, was bought by the herdsmen of Merak and Sakteng from a certain Rakha Jowo, who occupied it in those days, by paying gold dust measured in a bowl *("gser sder ma la jal nas nyos").*

Another rangeland called Jomo-choyi-nangi *'brogsa* was bought by paying 17 horses. Thus, rangelands were either created or bought. Those which were bought had already been created earlier. The notion that a grazing land *(rtsa 'brog*) is a free natural resource is only a half-truth.

The information on existence of rangelands so long ago is cited here mainly to illustrate their long history, and to suggest that continuity of pastoral culture and communities for hundreds of years implies sustainable use of grazing land. As in the case of the herdsmen of Merak, a rangeland has to be first claimed from nature by certain means and made fit for grazing. In the traditional lexicon, this process is known as 'creation of rangelands' (*gbrog gsar drup)* involving input of human labour. The creation of this resource by investing human labour is expressed in the phrase 'created by welding knife on the shoulders' (*'gri gnya wa lu 'bag ti drup drup yin'*). Grazing land is carved out of wilderness or forest which is not occupied, and not in any dispute or ambiguity over prior ownership, but which has water and potential for forage. No doubt water availability in the centre of a grazing land for *mithun*-cattle is the key requirement, as expressed in *ba 'brog*

[3] Untitled handwritten manuscript found with Dorji Tshering of Sakteng

chu dang blang 'brog rtsa, meaning water at grazing land for cows and grass at grazing land for oxen.

Tracks have to be opened for foraging and watering. Routes to forage and to water holes are opened by following tracks used by tahr (*jara*), *shou* and other wildlife. A good rangeland therefore presupposes herbivorous wildlife occurrence. As will be discussed later, *brog sar grup* (establishment of new rangeland) has to be followed by *brog gsal* or rangeland maintenance every year to keep up the quality of the rangeland and avert its constriction by vegetative growth. An absence of maintenance of grazing land (*brog gsal)*, will result in the rangeland being overtaken by regeneration of unpalatable plant species and the obstruction of routes to forage and waterholes by plants and trees.

But to continue on the origin of grazing land (*rtsa 'brog)*, physical creation of a rangeland was followed sooner or later with the effort to stamp it with legalization of ownership. The founder of a new rangeland (*brog gsar*) approached legitimate authorities for securing the title. A founder of *rtsa 'brog* was usually granted an order document (*bka shog*, which was sometimes known in compound phrase *bka' khra*) and it was registered in the land register (*sa yig khramo bskod de*). *Sa yig* now stands also for signature; originally it meant land record. Some of the *bka shog* or *ka thra* belonging to the people of Bumthang are known as *Chotsip*, meaning *khram* issued by *Trongsa Ponlop*, alias *Chos Zhab*. In other regions, *bka' khra* might have been issued by the respective *ponlop*. But it appears that eventually, the central authorities, such as the *Desi* who meted out the square red seal of the central government, had to be party to the legal recognition of land title. The *bka shog* (order document) with *dmartham chenma* (red seal) of central government, with druk imprint, validated the title completely. Land and *rtsa 'brog* title issued as *bka' khra khra moi rgyab gnon* (additional warranty for order) document were usually issued at the Palace of *sPunthang bdewa chen po*. In one particular land title dated 1887, who actually issued it is not mentioned. Such *khram* were

prepared in triplicate: one for the title-holder, one for record in Punakha, and one for the *ponlop* of the region.

Land title bearing red seal (*Khram gmar tham chenma*) for a rangeland mentions five essential pieces of information: year of issue in sexagonal cycle; name of the rangeland; extent of boundaries described in terms of landmarks though this is not always precisely defined; means of acquisition; and the name of the title holder.

As regards the means of acquiring rangeland, establishment of a new one, purchase, gifts or donations as *yo byed* (donations to religious institutions) and inheritance were not the only means. Some old *khram* refer to the transfer of *khram* by *khram bskred* (cancellation of *khram*), from *rtsa stongs* household (household in which family line has died out completely either through deaths or disintegration) to those people who agree to fulfil the obligations of the *rtsa stongs* household. A *rtsa stongs* household had literally ceased to exist due to lack of descendants to carry out the tax obligation.

The red-seal land titles were the sources from which the existing land register system was constructed. However, in the case of grazing land registration, in addition to demarcation based on natural landmarks, acreage of grazing land was estimated in a very imprecise way. Grazing land titles incorporated area measurements only in the 1960s and 1970s: but the measurements were carried out by direct ocular estimate, or were based on innocently misleading reports by the village headmen who were compelled to put a figure, with no attention paid to inaccuracy of measurements and its consequences in future. The purpose at that time was to systematise a form of new grazing land tax. Nominal tax on grazing land based on the area of holding was paid for a period of time during the reign of the third king, until the cattle owners were officially required to register for licences to use the grazing lands registered in their own names. The cost

of licence for a year is now Nu 100 irrespective of herd size or the extent of grazing land.

However, as already mentioned, the quantitative measurement of grazing land is unreliable because of the methods involved. To use the data on grazing land derived from the land register for such purposes as carrying capacity or livestock - grazing land relationship is highly erroneous. Until now, the vast extent of grazing land, stretching into jungles and mountains, has not been surveyed, in spite of bold figures cited in numerous documents.

Typologies of Rangelands in Land Register (*Khram*)

Having discussed the ways by which a title to a grazing land is acquired, a brief typology of grazing lands as reflected in *khram* is presented. This typology is the same as the present system of grazing land registration which took its current classification from the old typology, similar to the adoption of the old cultivated land typology in today's land registration. It must be clarified that the olden typology was based simply on uses of a *rtsa 'brog* and was descriptive, whereas when the olden typology was transposed into the current land classification, it became prescriptive. That is to say, that in the current system under the Land Act, 1979, there is a prescriptive interpretation. A dry land (*kamzhing)* must continue to be a *kamzhing, rizhing* (field far away from the village in the mountain used for swidden or bush - fallow cultivation) must continue to be *rizhing* and so forth. However the prescriptive rigidity has been relaxed in the Land Act, 1979, for certain types of land. It permits certain deviation from this prescriptive principle and allows construction and plantation in any land one owns, except grazing land, *sog shing* (leaf-litter wood lot land) and paddy fields.

Nye 'khor rtsa 'brog (Local Grazing Land or Local Commons)

The location of *rtsa 'brog* relative to the position of the livestock owner's village is the first approach to classification.

Rangelands can be classified on the basis of whether they are at the centre; close to the village; or at the periphery, far away from the village.

In every village, there are patches of grazing land at the perimeter of the village; these patches are conceptually equivalent to local commons, providing strategically located open spaces, necessary for the movement and grazing of village livestock. These collective grazing lands are designated in the land register (*khram*) as *nye 'khor rtsa 'brog* (local or neighbourhood pastures), and they are to be grazed as needed by everyone (*je mnyam 'za*). They are not registered in anybody's name, being understood to be traditional community grazing ground; they belong, in principle, to the state (*shungsa*). The Land Act (1979) defines *nye khor rtsa 'brog* as "government land within the radius of one mile from the village which has not been treated as registered in anybody's name". But one doubts precision of the radius of one mile, for the grazing land may lie at a distance beyond this prescribed radius.

Nye 'khor rtsa 'brog, fallow fields, and crop residue grazing are the most important grazing resources for sedentary livestock, as opposed to migratory livestock. These grazing lands which are the only buffer between national forest and untresspassable private properties, are foraged by a breed of cattle known as *Boed nor* in alpine regions, and by *thachong* cattle found in almost all villages. With the decline of the practice of grazing horses, tended usually by horse-seers in far flung rangelands, horses have come to graze year round also on *nye 'khor rtsa 'brog*.

Local commons are increasingly subject to pressure from multiple sources: they are host to many new things: schools, clinics, private saw mills, and market sheds are being built on them. Individuals seek kidu (humanitarian gift) land from the local commons. The establishment of animal pens outside the perimeter of a village, for sanitation promotion, has led to the local commons becoming occupied by structures. With the

advent of livestock-proof fencing and enclosure of the fields by barbed wire on one hand, and forest regeneration on the other, neighbourhood grazing lands or local commons have come under further pressure.

Blang 'brog (Oxen Pastures)

A bit further away from the perimeter of a village lies another kind of grazing land called *blang 'brog*, for the draught animals of a village. Some is exclusive grazing land, and not available to migratory or sedentary cattle of the village. Productive pasture within some hours' distance is set aside as oxen pasture or grazing land where draught animals may regain strength following intense energy expenditure during peak agricultural seasons. Oxen grazing lands have virtually disappeared on the ground because of forest regeneration, although they are intact on *khram* (land register). The disappearance of nutritive grasses in pastureland for oxen is perhaps accompanied by a corresponding deterioration in their general powers of endurance.

Migratory Cattle Pasture (*bla*)

At the furthest radius from the villages are the *rtsa 'brog* or *bla* for migratory cattle and yaks. The furthest *bla or rtsa 'brog* from a village, that I know of, lies at a distance of 15 days, but most of the migratory routes taken by herds belonging to the people of Paro, Haa, and Bumthang stretch for about ten days in one direction. If a herd moves at the speed of 15 km per day, this means that most of the migratory herds loop back on their pre-determined course after travelling 150 km or so in one direction. Some herds pause for varying durations, from ten to 30 days, in different places along a route. Other herds, which do not have their own rangelands along the way, travel without a break to their destination-rangelands.

Privately Owned or Individually Owned Rangeland (*Rang dbang or sger dbang gyi rtsa 'brog*)

Having shown the range of distance of grazing land from the owner's village, a typology of grazing land according to the regimes of property ownership, ranging from the individual to the institutional, is now described.

Firstly, there are grazing lands in the name of individual holders, which means that these are *rang dbang* or *sger dbang*, meaning privately owned rangelands, distinct from group, or institutional rangelands.

Rangeland of Specific Group Members (*mThoen Mong gyi rtsa 'brog*)

Secondly, there is multiple holders' rangeland described usually as *mthuen mong gyi rtsa 'brog*. This is not the same as a holding of an entire village. Here, the multiple holders are named individually, and may be a subset of all the households in a village.

Community Rangeland (*dMang spyi rup gyi rtsa 'brog*)

The third category of grazing land owners are villages as corporate entities. In contrast to the ownership of *sger dbang rtsa 'brog* by private individuals or *mthuen mong gyi rtsa 'brog* by a group of individuals, there are *rtsa 'brog* which are owned by the village as a whole, without going into the names of the owners in the village. These are qualified as *dmangs spyi rup gyi rtsa 'brog*. This definition leaves open the possibility that any new household established in the village will have access to the *rtsa 'brog* by virtue of being a member of the village.

Royal Family's Rangeland (*sKu khor gyi rtsa 'brog*)

There are two other categories of grazing land owners which transcend the tax paying households: the royal family and the monastic community. Thus, the fourth category of *rtsa 'brog* owners are aristocracy or *sku khor*. There are some such

grazing lands in western and central Bhutan, but none to my knowledge elsewhere.

Monastic Communities Rangeland (*sDra tshang mgon sde gyi rtsa 'brog*)

The fifth and last category of *rtsa 'brog*, by ownership, is that of the monastic establishments. Monastic establishments such as retreats (*mgon sde*), colleges (*sdratshang*), and lamas' estates (*bla drang*) possess rangelands, for their religious-estate-cattle (*chos nor*). They also have agriculture land called *chos zhi*. These properties were donated to them as offerings (*yo byed)* or bought from their corporate resources. One vivid recent example was a successful bid put by a monastic establishment, in 1997, for a rangeland auctioned by Bhutan National Bank. The Land Act (1979) exempts the need for obtaining license for grazing in rangelands for herds owned collectively by monastic establishments, although the rangelands must be theirs.

Summer and Winter Rangelands (*dGun 'brog dbyar 'brog*)

Rangelands can be further categorised on the basis of seasonal usages. Many peripheral *rtsa 'brog*, that is, those which are not local commons, can be seasonal grazing lands for two different owners. They can be winter grazing land (*dgun 'brog*) for some and summer grazing land (*dbyar 'brog*) for others. The right of access is season-specific, resulting in dual access rights on rangelands in temperate and alpine regions. A grazing land registered as summer pasture in a cattle owners' *khram* (land register) appears simultaneously as winter pasture in, say, a yak herdsmen' *khram*. Synchronization of migration of cattle and yaks enables such pastures to be grazed without conflicting use of resources. As cattle vacate their summer pastures in autumn, yaks start descending from their pastures in elevations as high as 5000 m and conversely, as cattle reach temperate regions in May, yaks go upwards to forage on very high mountains.

Taxes Related to Cattle and Yaks

At present cattle tax amounts to Nu 5 per head. Cattle tax should yield over Nu 1.5 millions, but only a fraction of this is collected, due to reasons not yet clear enough. A feature of tax administration in pre-modern Bhutan was that there was no tax on grazing land, whereas there were taxes on cultivated land with a great deal of variation within the country. In the past, before in-kind taxes were abolished, high rates of tax was imposed on pastoral communities on the basis of ownership of cattle or yaks, which might be closely correlated to communal, institutional or individual ownership of grazing land. This obviated the problem of identifying who actually owned communal or institutional grazing land, since the grazing land property regimes were complex from the point of view of taxation. A substantial part of grazing land was communal holding characterised as *mnyam za myam mthung* (equal grazing and equal drinking).

There was a form of cattle or yak tax known as *martrel* (butter tax) in certain areas like La Gongsum, Dagala, Bumthang and Kurtoe, where pastoralism predominated. Other districts paid taxes depending on their specialization of production, whether it was cereals or textiles. In the case of Bumthang, which was predominantly pastoral before forest regeneration changed the land's productive capacity, and before the third king reformed the tax system, there were two types of butter taxes, namely, annual and monthly butter taxes. The monthly butter taxes were further divided into two types: *benda* and *khodrup* butter taxes. The annual butter tax was levied according to the number of milking cows in the herd. 1.5 kg (five *sang*) of butter was paid as taxes for each cow in a year. It was three *sang* a cow in Kurtoe. For the two monthly butter taxes in Bumthang, the tax-paying households had to collectively pay one hundred *sang* of monthly butter levy as *benda* butter tax, and another one hundred *sang* of monthly butter levy as *khodrup* butter tax.[4]

[4] Tshewang Darjay gave a different quantity paid as butter tax. According to him, in Bumthang, Kurtoe, Merak Sakteng, seven *sang* of butter tax was

Butter tax was not the only form of direct taxation on cattle or yak wealth in Bumthang. It was estimated that a tax of approximately 40 live cattle was paid as beef animal tax to the meat master of Jakar dzong from the district as a whole. This meat tax was meant for a hierarchy of officials: Tongsa *Ponlop*, Jakar *zimpon* (chamberlain), Jakar *gorap* (gate master), *tsa gnyer* (fodder keeper), and of course the *sha nyer* (meat master) himself. These live animals were not slaughtered but exchanged for carcasses of cattle that had died through natural or accidental causes. To enable this exchange to take place, it was mandatory for the people of Bumthang to declare the death of their cattle. During butter tax collection, there was an informal fee that had to be paid directly to the official known as *nortsi sgar pa* (official for cattle census). who came to collect butter taxes and assessed the cattle tax base. He pocketed one *shiki* (25 paise) levied on every *yarma* - a cow below fourth year - that did not yet have a full set of teeth.

Butter and meat taxes were probably prevalent under every *ponlop*, though not under every fort-governor (*dZongpon*). The administrative organization of the country was on a regional basis controlled by the *dZongpons* in Punakha, Wangdue and Thimphu; and three *ponlops* in the rest of the country. Each region ran on a north-south axis, which allowed it to cover all agro-ecological zones. Whether the north-south axis arrangement could have been motivated by the aim to have a diversity of tax base, including taxes on cattle and yaks, remains an interesting question.

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levied for every cow which had turned *so-nyis* (two-teeth). Further, one extra *sang* had to be paid for every seventh cow, as a kind of progressive tax on cattle holding. This butter tax was paid on the first day of the 8th month every year. He also said that *benda* butter tax for *Lhamoi Domchoe* in Punakha amounted to four *sang* on every third cow and it had to be paid on the 9th day of the 10th month. This must have been the individual liability for collecting 100 *sang* a month in Bumthang as a whole.

Choice of Breed Based on Mobility: *'tha steng and 'tha skyong*

Based on whether a breed of cattle is highly mobile over a long distance, or forages around the village, travelling only a short distance from it, cattle breeds are broadly divided into mobile (*mtha steng*) herds and sedentary (*mtha skyong*) herds. The term *sgo nor* (domestic door cattle) is also used for *mtha skyong* herds because they are cattle who live, so to speak, by the door, often penned in the ground floor, immediately at the main entrance.

Choice of breeds which can wander and forage on their own is extremely important for migratory livestock. Jersey and brown Swiss crossbreeds are part of the sedentary *mtha skyong* herd - though not native - and an increase in their numbers will have immense implications for the nature of cropping patterns and also increase pressure on neighbourhood commons (*nye 'khor rtsa 'brog*).

The classical breeding system, on the other hand, has focussed on rearing *jatsham* by crossbreeding *bamin* with *khrabam*. Mobile or migratory herds consist mainly of *jatsham*. *Jatsham* have strong appeal to the herdsmen because of several noteworthy traits they possess. *Jatsham* display relative immunity from diseases; this is a vital consideration for risk-averse small farmers. They are not only disease resistant but also have a longer life span. There was, in 2001, a *jatsham* in Pema Gatshel which was already 31 years old and had calved 21 times[5]. The comparative longevity of *jatsham* and their fecundity are significant considerations. The butter fat content of *jatsham's* milk is the highest among all breeds of cattle. They have skilful foraging capabilities in jungles or different terrain. When they are in jungle, they cruise with their nozzles at a height of four feet, gobbling creepers and foliage. They have a fine instinct, as though developed by training, to set out foraging in the morning and

[5] For this information I thank Dasho Phuntsho Wangdi, a well known *jatsham* breeder, of Chungkhar, Pema Gatshel.

to return to *bla* or camp in the evening without the necessity for the herdsmen to round them up. This is highly advantageous for a herdsman who usually has to manage a herd of 50 to 60 heads of cattle in jungles and thickets. While milk yield and fat contents have been examined as parameters for comparisons of one breed against another, other criteria have rarely been taken into account in any comparative analysis. Comparisons of performance of different breeds on selected parameters are summarized in the table below.

Table 1: Average productive and reproductive parameters of different breeds according to farmers from Chaskhar and Tsakaling gewogs of Mongar dzongkhag.

Parameter	Siri (*Thra Bam*)	Jatsham	Jatsham X Jersey Cross	Jatsham x Nublang (*Yangkum*)	Jersey Cross
Weight Gain	Slow	Fast Under Nutrition of Free Grazing	Same as Jersey Cross When Well Managed	Slow	Fast Under Nutri-tious Grazing
Age at Puberty (Years)	2.9	2.4	2	2.8	1.9
Age at First Service (Years)	3.3	2.8	2.4	3.2	2.3
Age at First Calving (Years)	4.2	3.6	3.4	4	3.2
Length of Lactation (Months)	10	8	8 - 9	10	8
Average Milk Production Per Day in Litres	1.3	2.5	4.8 - 5.2	1.5 - 1.9	5.3

Parameter	Siri (*Thra Bam*)	Jatsham	Jatsham X Jersey Cross	Jatsham x Nublang (*Yangkum*)	Jersey Cross
Lactational Yield Per Litre	390	600	1350	519	1272
Butter Yield Per Litre of Milk	Low	Highest	Second Highest	Second Highest	Third Highest
Inter-Calving Period	2 Calvings in 3 Years	Yearly Calving Under Good Manage-ment	Yearly Calving with Good Feeding and Manage-ment	2 Calvings in 3 Years	Yearly Calving

Source: Temsina, M.P., Dr. 1999. Farmers' Views on Cattle Breeds and Breeding: A Survey, RNR Khangma: MoA, RGOB, p. 6.

Note: Although gestation period of cattle is on an average nine months, the difference between age at first service and age at first calving is sometimes more than nine months. This can be explained by the fact that not all cows conceive at the first service.

Table 2. Average productive and reproductive parameters of different breeds according to the farmers from Menji and Menbi gewog of Lhuentse dzongkhag.

Parameter	Siri (*Thra Bam*)	Jatsham	Jatsham X Jersey Cross	Jatsham X Nublang (*Yangkum*)	Jersey Cross
Weight Gain	Slower than *Jatsham* Hybrid	Fast Under Local Conditions	Depends Upon Manage-ment and Feeding	Slower than *Jatsham* Hybrid	Depends Upon Feeding and Manage-ment
Age at Puberty (Years)	3	2.5	2.5	2.7	2.6

Parameter	Siri (*Thra Bam*)	Jatsham	Jatsham X Jersey Cross	Jatsham X Nublang (*Yangkum*)	Jersey Cross
Sexual Maturity/ Age at First Service (Years)	3.5	3	3	3.2	3.1
Age at First Calving (Years)	4.4	3.9	3.9	4.1	4
Length of Lactation (Months)	8 – 9	10	10 -11	9.5	9 – 10
Average Milk Production Per Day in Litres	1.75	2.8	4.2	2	3.3 - 3.5
Lactational Yield in Litres	446	840	1260	534	1020
Butter Yield Per Litre of Milk	Low	Highest	Second Highest	Second Highest	Low

Source: Temsina, M.P., Dr. 1999. Farmers' Views On Cattle Breeds and Breeding: A Survey, RNR Khangma: MoA/RGOB, p. 7

Table 3: Body size (in cm) of mithun, native breeds and crossbreeds

	Mithun Cow	Jatsham	Sechen Jatsham	*Siri* Cows	Jerseyx Siri Bulls	Indian Zebu*
Wither Height	144.0	122.5	120.5	117.3	121.6	97.6
Heart Girth	203.0	162.9	177.3	153.6	151.0	130.4

Shoulder to Hoof	102.8	86.8	96.4	88.9	96.5	71.6
Rump Length	44.5	38.3	39.9	37.2	35.0	30.0
Metacarpus Circumfe-rence	0	16.2	16.5	14.6	17.0	11.8
Radius Length	0	32.3	33.1	31.5	34.0	27.2
Between Eyes	0	16.6	18.5	16.1	18.0	0

Source: C. G. Hickman et al. The Classical Breeding System in Bhutan. The Journal of Animal Husbandry, Volume 5, (Thimphu: RGOB, 1982).

Its productive and reproductive capacities place the *jatsham* breed on a very high preference level. The *Jatsham* breed was central to the traditional pastoral production system. However, *jatsham* breeding is threatened by the decline in pure female *siri* (*thrabam*).

In this context, particular attention needs to be drawn to two short but important articles: "The Classical Crossbreeding System in Bhutan" and "The Present Cattle Breeding Structure in Bhutan" both of which were contributed by C. G. Hickman and Dorji Tenzing to the *Journal of Animal Husbandry*, Volume 5, September 1982. The authors were the first to work out conceptually and mathematically the interdependence of numbers of *jatsham* and pure *siri*. To breed best *jatsham*, pure *siri* is needed to crossbreed with *bamin*. They worked out mathematically whether the population of *siri* would be stable. The question they raised was that if majority of the pure *siri* are crossbred with *bamin* to produce *jatsham* or *jatsha*, "there will not be enough female *siri* replacements and the *siri* population will decline." This problem is not resolved by obtaining *thrabam* as replacement by backcrossing because "continuous backcrossing ... does not even come close to substituting for the internal *siri* population replacements." The change in the

status of Sombay district in the early 1990s, where no crossbreeding with *siri* was allowed to protect pure *siri* breeding, further increased the risk to the instability of good *jatsham* breed which depends on pure *siri* cow population.

Migration Towards Sub-tropical Forests

With this brief discussion of rangelands and breeds, the ground is laid to discuss the movement of cattle and yaks between summer and winter rangelands, with particular attention to the forage availability in each place and ecological reasons why they migrate seasonally. Examples are drawn from herds migrating from Bumthang to Kheng and Mongar and herds migrating from Paro and Haa to Samtse.

There are four *gewogs* in Bumthang: Choskhor, Chumey, Ura and Tang. Winter pastures for Chumey *gewog* are in Mongar, Zhemgang, and Tongsa; winter rangelands belonging to Choskhor *gewog* are in Mongar and Tongsa; winter rangelands of Tang *gewog* are in Lhuentse and Mongar; and winter rangelands of Ura *gewog* are in Mongar and Kheng.

The migration of herds from Paro and Haa to Samtse follow three routes. One route goes to Samar *gewog* by the Selela route: through Pangtsakhar, Zhigokha, Nyintsa Dongko, Togchena, Jeluna, Denchukha, Machupharkha Dophuchen, Zamkhar and Yawala. It takes ten days to reach Yawala from Pangtsakhar. The Jabana route goes through Tsip Lakha, Domtsho, Shingphukha, Namnana, Kharina, Do Zholmo, Gyango, and Namthakha, taking seven days. This route is taken by seven herds. The Zurtsuna route goes through Tshopaga, Kyabzhi, Bazhikha, Chumgo, Zusbji, Cholegkha, Pajikha, Zula, Tshochena and Dolepchen, taking ten days. Five herds come up to the two Zurtsuna villages of Jungzhikha and Jago. Another five herds migrate further south as far as Dolepchen.

Winter grazing areas exclusive to migratory cattle of the people of Haa consist of Lamtsa, Gangtsekha, Guchey and Shingkathang. Winter grazing areas, which belong jointly to

Haa and Paro, include Nugathasa, Dorithasa, Benphentona, Kadoree, Dumthodu, Yabala, Bumtaringu and Samtseringu (mountains above Samtse).

The rhythm of migration follows the rhythm of plant growth processes that vary between temperate and sub-tropical regions. The cyclical movement of cattle between their summer and winter pastures take place to optimise foraging opportunities. The concept of grazing land is not limited to grassland, as is the case elsewhere, but include forest floor grazing in lower elevations in chir-pine, broad-leaf and sub-tropical forests. Migratory cattle spend roughly seven to eight months in sub-tropical region. Summer pastures in the temperate region are grazed for relatively shorter duration, giving more time for grasses to recover, as the growth period in summer grazing land is short.

In Bumthang and Haa, as in other areas of temperate region, grasses flower between late July and August, and wither in October. It is crucial for the cattle to leave the summer pastures well before grasses stop growing. If the withdrawal of cattle is delayed, grazing undermines the pre-winter nutrient storage of grasses, and their growth in the following summer can be adversely affected. This is the reason behind the departure of cattle before the autumn has fully arrived. Some herds' start leaving for warm places in August and all are gone by the end of September. Frost falls soon after migratory cattle leave; migratory cattle cannot tolerate the frigid night temperature, unless they are penned deep in insulated ground floor, as it used be done in the past for a few heads of cattle that were detained.

The furthest grazing land of a herd going away from its owner's village lies roughly at a distance of 15 days. Most of the migratory routes, taken by herds belonging to, say, the people of Paro, Haa, and Bumthang take about ten days in one direction. The migration of herds from Paro and Haa to Samtse follow three different routes: the Selela route takes ten days to Samar, ending at Zamkhar and Yawala; the

Jabana route takes seven days, ending at Gyango and Namthakha; and the Zurtsuna route takes ten days, ending at Tshochena and Dolepchen. If a herd moves at the speed of 15 km per day, this means that most of the migratory herds loop back on its pre-determined course after travelling 150 km or so in one direction. Some herds pause for varying durations, from ten to 30 days, in different places along a route. Other herds, which do not have their own rangelands along the way, travel continuously, to their destination-rangelands.

At the height of winter, cattle reach the furthest point in their southerly migration toward broad-leaf or sub-tropical areas. These places may be somewhere in Mongar, Kurtoe, Samtse, Sarpang, Kheng or Chukha. What can be foraged by cattle depends exactly on the type of forest. A winter pasture, say in Mongar, consisting of chir-pine or broad-leaf forests has numerous fodder trees. Cattle are fed lops of *omshing, phoseng, les, moram, guli* (wild avacado), *zho rufi* (a creeper), *domzim, karsingla* (hard wood often used as pillar timber) c*ha lampa*[6], *tekar* and *tshartung* (two creepers that flower and die out once in 12 years). Fodder trees and creepers, which are the main sources of forage, give more shoots if they are headed back every year. In open patches in broad-leaf winter pastures in Mongar, cattle graze on many kinds of grasses: *posola, laptang, clamtor, ngoseng, ja chagpa, khari kang kong* and *koi* (nettle).

If a herd is kept near any sub-tropical hamlets, cattle feed on crop residues in *kamzhing* (rain-fed fields) in autumn, and on crop residues in wetland in winter. Cattle manure is a vital input into the farming system, and allowing cattle to graze in fields after the harvest is reciprocated by direct manure delivery to the fields. The economic and social benefits that migration promotes are not only limited to herdsmen themselves, but extend to a multi-layered symbiotic

[6] The names of fodder plants are given in the dialects of Bumthang and Kurtoe.

relationship between sub-tropical and temperate communities.

While the cattle forage on foliages, grasses, shrubs, creepers, and crop residues, herdsmen extract from forests various kinds of cane *(rey, craat, wawa)* - to make household goods for barter and sale. Herdsmen support their families through handicraft production like *rung, thakpa* (rope), *ju zhai* (bucket), *tshang* (basket), rattan shoots, *damparu* (vegetable), *paan* etc. even when there is little income from diary production during the winter. A herdsman is able to supply a stream of edible forest produce to his relations, and markets the surplus, especially in alpine region where perishable foods are scarce for half a year. And while attending to all of these tasks, a prayer-oriented herdsman profits spiritually from keeping his mind focussed on prayers in the tranquillity of wilderness.

Forage and Cattle Population Decrease

A herdsman is often not a family member as it used to be. A sibling or patriarch of the family was the principle herdsman, and his or her superintendence helped to maximise output from a herd. Hired herdsmen, who are not kinsmen, are a cause of lower dairy output. A hired herdsman can falsify output by under reporting diary produce, to divert it elsewhere. Therefore, there is a tendency among herd-owning families to sell off their herds due to lack of herdsmen whom they can trust. The population of migratory herds have, thus, declined.

Grazing land maintenance, or *'brog gsal*, to keep up the quality of the rangeland and avert its constriction by vegetative growth is an important routine for herdsmen while they are at the winter pastures. Grazing land and its network of routes will otherwise be overtaken by unpalatable plant regeneration. Hence, a herdsman spends a good portion of his time on *'brog gsal* to improve it, by repairing tracks, bridges and felling non-palatable fodder plants. Yet, forage has been getting progressively scarce over the decades, in spite of the

decrease also in the number of cattle. Livestock Master Plan (1995) noted that cattle population is almost static at 0.5 percent annual growth rate. Protection of forest by the Department of Forest has prevented effective maintenance of grazing lands in traditional ways, resulting in the deterioration in quality and carrying capacity.

The overall shrinkage of grazing land is caused by several factors. Rangeland clearing activity has decreased due to its prohibition, coupled with shortage of labour to free grazing lands from clogging by undergrowth and canopies that screens out sunlight. Pasture used to be burnt once a year through a practise known as *brogshed* around January in both temperate and sub-tropical regions. Undergrowth in chirpine (*thingdo shing*) forest used to be regularly cleared by fire. There is no periodic burning to sterilize the soil and stimulate new grass growth. Certain species of plants and animals whose habitats depend on periodic fires for clearing are dying out due to cessation of burning. In alpine region, there is a well-founded suspicion that diminutive annuals - floral and medicinal plants - are becoming less abundant due to colonization of the meadows by coniferous forest. Although forest fire is prohibited, a Royal Edict issued in 1981 makes exception to yak herdsmen who are permitted to burn alpine pastures under the supervision of the Departments of Forest and Animal Husbandry. This is, however, rarely done: supervision is difficult to provide. The last contributing factor to deterioration of forage potential of grazing lands is the change in migratory routes. Attracted by the ease of walking along motor roads, herdsmen are re-routing their journeys to stay close to motor highways, quickening the reversion of far-flung grazing lands to forests.

Return to Temperate Grazing Land

At the end of the Spring, forage resources gets exhausted in the winter grazing lands and this becomes obvious from several indications, most of all from the agitated behaviour of cattle. Cattle return early in the evening to the *bla* or camp and stray further from the grazing boundary during the day.

Shoots of grasses disappear. Milk yield decreases but butter yield decreases faster than milk yield. All of these signify the time to leave for temperate region so that the sub-tropical pastures can have a spell of regeneration. Moreover, by April, the air begins to buzz with teeming insects and flies, falling dreadfully into milk, water and food kept in any storages in the camps. Flies and insects like *fuyongma, brocktula, sheybrang*, and *nyongkha* feed on cattle making them restless and driving them away in the direction of cooler places. In extreme cases, herdsmen resort to smoking out the insects and flies by burning greens beneath the twitchy cattle. Not only flies, tick vectors clamp on the tender the parts of cattle. There are four types of ticks, which are carriers of diseases, of which boophilus microplus is the main tick prevalent below an altitude of 1000 feet above sea level. More severe threat appears in the form of leeches - both *zaang paat* and *sa paat* - that multiply exponentially in wet conditions and cause external haemorrhage by boring into cattle. The weather becomes too hot and milk goes off every day; curdling prevents milk from being turned into butter and cheese unless it is churned instantly. An average herd has only five to six milking cows: that means the quantity of milk is not sufficient to be churned into butter daily. At the same time, planting season commences for summer crop while winter crops are ready to be harvested in sub-tropical places. Migratory cattle's continued presence is a nuisance and a source of conflict when they stray into mellowing fields.

There are other reasons for cattle to move away from settlements in the sub-tropical areas by May or June. Grazing is stopped by customary practices in local commons (*nye 'khor rtsa 'brog)* in many villages in sub-tropical region. Ladam (mountain-closure) is imposed, for example in Digala and Langdurbi (550 to 1100 metres above sea level) in Zhemgang in the fifth month corresponding roughly to June. Similar suspensions of grazing are prevalent in several districts including Tashi Yangtse and Tashigang. For instance, *ridam* (mountain-closure) is observed from late March onwards in Gortsham village in Metsho *gewog* in

Kurtoe. This kind of embargo stops people and cattle from interference in the germination and sprouting, and enhances natural regenerative capacity of forest fodders.

By May, all the migratory herds move up from Samtse to Haa and Paro; and from Kheng, Mongar and Lhuntse to Bumthang. All over the country, herds move from many other hot places to cool mountain zones, whence it came some eight months ago, last October. Grasses in the temperate region becomes most palatable and nutritious by this time, reaching a height of 5-10 cm by April in altitude ranging from 2500 to 3500 metres. Grasses reach the same stage of growth only a month later, in May, in altitudes above 3500 metres. If cattle reach their summer pastures earlier, it will damage the pastures, for they can be grazed before they reach their full potential. However, this is the right moment, we noticed, when the herds arrive in temperate areas, for example, of Bumthang and Haa.

For the next four months (fourth to seventh Bhutanese months), coinciding roughly with June, July, August and September, herds graze in summer pastures. Numerous nourishing wild fodder trees are found in summer pastures in Bumthang. Cattle are fed foliages of *zhaoku* (yoke timber-tree), *leksengma, takpa, gokham, thrangluwa*. They graze on several species of grasses and bushes: *dyalma* (resembles spinach), *dyalchen, dyalchung, tsigar* (the most nutritive grass), *singmi tewa, jamtewa, wamtewa, zhingkham tewa* and *clam*. Grasses grow continually during this period, in response to rain and warmth. It is a period of abundance of grasses, foliages and water and is known among herdsmen as the time of *tsa 'bot chu 'bot* (abundant grass, abundant water). A cycle of migration is completed by September, and it is time again to head south.

The processes of migration described above pertain to transboundary migrations, involving different districts and different ecological zones. But on a scale of shorter distance, it happens throughout Bhutan, because of the foraging

opportunities offered by vertical micro-climatic variations. Over a year, livestock are moved to different ecological zones for a fixed duration.

There are mini-migrations of cattle travelling a shorter distance from their villages. For example, in Tama, Kyekhar, Berti, Buli, and Dakpai in Kheng, cattle are grazed in chirpine forest from May to June to partly avert infestation of leeches and ticks found in broad-leaf forest. Chirpine forest offers lemon grass, spear grass, *bauhinia, pochongla, brangdula, saguncha* (broom grass), and *karmala*[7]. In June, cattle migrate to the bed of the Mangdechu. In July and August, cattle are let out in *kamshing* (dryland or rainfed fields growing maize, wheat or millet) and *tseri* (swidden cultivation field) to feed on crop residues and stubble. And later on, cattle are let loose into the forest floor, which forms part of grazing lands. This pattern is followed in many sub-tropical regions, but the distance involved is very short.

There are several reasons for cattle to be away from settlements in the sub-tropical areas by June. Grazing is stopped by customary practices in neighbourhood pastures or local commons (*nye 'khor rtsa 'brog)* in early summer in some villages. Ladam (mountain closure) is imposed in Digala and Langdurbi (550 to 1100 metres) in the fifth month corresponding to June. Nimshongpa are barred from going up the Malaya slopes, Shingkharpa are barred from crossing Kuji temple, and Wamlingpas are barred from going beyong Purji hill. These embargoes probably stop the people and cattle from interference in the germination and sprouting of forage, and enhance natural regenerative capacity of the forest fodders. Similar suspension of grazing is prevalent in many places including Trashi Yangtse and Trashigang. For instance, *ridam* (mountain-closure) is observed from late March onwards in Gortsham village in Metsho *gewog* in Kurtoe.

[7] The names of these plants are given in the Kheng dialect.

How Communal Rangelands are Divided

Grazing land owned collectively by a village need fair rules of access and utilization to be devised. How this is done is illustrated through two cases. One among herdsmen of Ura, Bumthang and the other among herdsmen of Haa. The procedures for dividing communal pastures are different in each of these two places, partly because the livestock species are different in each place.

The Mongar Omdaar Model

The allocation of summer pastures belonging to Ura *gewog* in Bumthang is not carried out according to any rules. Herdsmen can camp wherever they prefer in any of the communal rangelands. This latitude is explained, according to a well-known herdsman[8], by the fact that there is no forage constraint in summer. The herdsmen see no reasons for allocating pastures according to any strict rules. They are free to take their herds wherever they want.

However, winter pastures in sub-tropical and broad-leaf forests have to be divided fairly because the herds are in a smaller grazing area for a longer period. To divide communal pastures located in Mongar, but owned by the herdsmen of Ura village, the herdsmen will take into account only milking cows (*zhoma*). All others type of cattle are excluded when grazing lands or pastures are allocated so that unproductive cattle heads are not given any weight in the division of grazing lands or pastures. There are five main pastures and each rangeland has a predetermined stocking rate, which is 40 lactating cows for Namling; 40 lactating cows for Samdang Yajadi; 80 lactating cows for Gorzombi; 40 lactating cows for Mongleng Medchiri; and 50 lactating cows for Lingmethang. A fixed stocking rate for each rangeland suggests knowledge of the carrying capacity of each rangeland.

Herds are amalgamated to form the right number according to the stocking rates given above, so that the herdsmen

[8] Tshewang Darjay of Ura, Interview, August 22, 2001.

forming a particular group can bid for a rangeland the group wishes to get. An excess of five milking cows is accommodated during the division of rangeland. These pastures are, as far as possible, allocated by consensus. But allocation can rarely be determined through discussion when it comes to good pastures, which are vied for by many herdsmen. Then, the herdsmen resort to allocation by lottery. The names of pastures are written on pieces of paper and thrown in a jumble in a bag. Who gets which piece of pasture depends on blind chance. The allocation is valid only for a season. A large number of herdsmen from central Bhutan, who own communal pastures, are said to use an allocation mechanism relying on the drawing of lots.

The Haa Gyechukha Model

Another model of division of pastures for yaks occurs in Gyechukha village in Haa[9]. In this version, both the summer and winter pastures of yaks are taken into account. A winter pasture is paired with summer pasture as shown in Table 4 after the ranking of pastures has been done individually by consensus in a meeting. Twinning of winter and summer pastures aims to equalize the access to pastures in all seasons and among all herdsmen in a systematic way. The best summer pasture is paired with worst winter pasture and the second best summer pasture is paired with fourth best winter pasture and so forth. Individually ranking both summer and winter pastures and then pairing the most preferred summer pasture with the least preferred winter pasture is a mechanism which compensates the loss a herdsman may find in winter by gains in the summer.

[9] For full text, see Karma Ura (1995), "Nomad's Gamble", *South Asia Research Journal*, Vol. 13 No. 2, pp. 81-100

Table 4: Paired ranking of summer and winter pastures communally owned by Gechukha village in Haa.

Summer pastures ranked by preference	Winter pastures ranked by preference
1.Jatekha	5. Richey
2.Lungkhamekha	4.Shungkhatho
3.Pamling	3.Phodeytshang
4.Jangbana	2.Hingtho
5.Chala	1.Yangathangkha

Source: Communication with the late Jow Thinley Tshering, a noted herdsman from Haa, Talung.

Pairing is done prior to allocation of a pair of pastures. During the pasture ranking and pairing stage, all are ignorant about who will get a particular pair of pastures. Anonymity of the recipient at that time ensures that there will be no personal incentives to mismatch the summer and winter pastures in a biased way.

Since there are five patches of summer pastures and five patches of winter pastures for the Gyechukha community, for the purpose of allocating pastures, the yaks of Gyechukha community are also grouped into five equal sized herds. Thus, five groups of herdsmen are formed. When the allocation was done in 1993, the size of each herd was about 300 yaks. The size of each herd in any given year is dictated by the total yak population in Gyechukha since total yak population of the Gyechukha community must be divided into five groups corresponding to the number of pastures. A household usually does not have as many as 250 yaks, so several herdsmen join together so as to be able to fulfil the numerical requirement of yaks and be eligible for the allocation of a pasture. Herdsmen who are related to each other or have some other basis of solidarity with each other form a group to compete in pasture allocation. This does not mean that they

will merge their yaks together to form one large herd or that they will put up together in *jaa* (black tents of yak herdsmen). It means that they will camp in the neighbourhood of each other and move their herds together to the allocated pastures. With the formation of five groups of yak herdsmen and five pairs of winter and summer pastures, a day long ritual is conducted in the community shrine. At the end of the ceremony, dice are cast to randomize the allocation of pastures. One member of each group of herdsmen (usually the one who has the greatest number of yaks) is given the privilege of throwing dice on behalf of his group. Each of the five selected group representatives casts three dice at a time in turn. The herdsman who scores the highest can pick up the best paired winter and summer pastures. The second choice is given to the herdsman who scores the second highest dice and so forth. The allocation is valid for three years in Gyechukha, but the duration has been increased to 11 years in certain parts of Haa.

Lease of Rangelands and Herding Arrangements

It is to be expected that distribution of cattle, pasture and family-labour are not correlated perfectly. Those who own rangelands may not necessarily have labour to tend and manage them. Those who have cattle may not necessarily have any pastures. A family may possess two of these resources but lack the third. In theory, eight different combinations are possible, from having all three resources to none of the three resources. Such deficiencies and mismatches in asset portfolios of households emerge particularly in a dynamic situation when resources can shift both within and between households. Therefore, institutional solutions develop to mediate these disequilibriums.

Privately owned pastures are, like any capital or resource, able to be taken on lease for a fixed period of time. Those who do not own any patch of rangelands, or find their holdings insufficient, rent rangelands. The fee paid to the *khram* holder is known as *rtsarin churin* (forage charge water charge). A written lease contract is rarely drawn up and fees do not

seem to be based on herd size, or duration of stay in a rangeland. Rangelands are leased for lump sum payment, for labour services, or for in-kind payment like dairy goods. However, the renting out of rangeland is now legally forbidden (though this is not heeded) except among pastoralists, such as those living in Laya, Lunana, Merak, Sakteng, Sephu, Soi and Naro, who do not own any other type of land.

Where a family owns rangeland and cattle, but is without manpower for herding, the whole herd is handed over for management and grazing by another family on the owner's rangeland. Two types of arrangements exist between the contract herdsman and the herd's owner in such a case. These arrangements are known as *skyesmed chimed* (no birth, no mortality) and *skyesyod 'chiyod* (birth and mortality present).

According to *skyesmed chimed* herd management, a fixed quantity of dairy produce is paid to the owner on the basis of the original number of cattle handed over to the contract herdsman, irrespective of increase or decrease in the number of cattle when the herd is handed back. For instance, 20 *sang* (6 kg) of butter is usually liable to be paid to the owner for each milking cow at the time of handing back the herd to the owner. The balance of the produce accrues to the contract herdsman. At the end of the management term, the herd is returned in original size by making up the loss, while the herdsman retains the increment in herd size. However, in *skyesyod 'chiyod* management, allowance is made for fluctuation of herd size within a certain percentage range, say, one-tenth of the original number of the cattle per year. If the loss within a herd exceeds the limit, the contract herdsman has to give substitute cattle to make good for the missing cattle.

There are other variations between the two main schemes of management, in which herd management is carried out on contract. A herd is managed completely by a contract herdsman on the owner's rangeland, in which case his only

obligation is to pay a fixed quantity of butter, say, 20 *sang* for each milking cow or yak, in addition to giving up the meat of dead animals to the owners of the rangeland. This is more popular than other arrangements because the risk is less biased against a herdsman.

Lastly, there is an arrangement prevalent in Haa, Paro, Chukha and Samtse known as *normthus;* it is close to a rotational herding scheme between households located near summer and winter pastures. The management of a herd alternates between certain households, say, of Haa in summer and of Sambay in winter. For the period a herd is in summer pastures, it is managed by a Haa household and for the period the herd grazes in winter pastures in Sambay, it is tended by a household in Sambay. It will be noted that the herd management period of a household in Sambay is twice as long as that of its Haa or Paro counterpart. This obviates the need for the people from Haa or Paro to stay with a herd in sub-tropical places. The produce of the herd is shared equally between the two households. Initial investment to purchase the herd is made by the households of Haa or Paro.

Nature of Disputes Over Rangelands

There are a variety of disputes and conflicts in rangelands. Conflicts are now mostly resolved in courts of law, but a number of minor disputes are settled by intermediaries (*barmi*), out of court. Verbal sanctions may be meted out to minor defaulters. In serious cases, defaulters have to compensate the owners of rangelands in cash or kind.

A brief description of the nature of disputes about rangelands follows. Rangelands are delineated by natural landmarks. For example, the rough coordinates for a *rtsa 'brog* (rangeland) around Kyekyela pass between Choskhor and Chumey is described as: this side of Kyekyela, below the central trunk road, this side of Pharzhur stream. These coordinates presume other reference points, by which 'this side of' and 'below', which are not explicit in *khram,* can be understood.

Coordinates of rangelands are also defined in relation to other rangelands and so on, forming a chain of references in a mosaic of rangelands. However, for the purpose of herding, the landmark boundaries help to restrict the movement of livestock. Cattle, especially *jatsham*, retain memories of forage boundaries after repeated seasonal cycles of herding and do not overrun into adjacent rangelands. Nevertheless, there are occasional grazing overlaps along the borders of two rangelands, described as 'overreaching legs and hands' (*rkangthel lagthel*), which are taken in good faith among the herdsmen.

The second instance of letting others use a rangeland is when their herds are in transit. An area specified in a *khram* and owned privately is occasionally not under the exclusive domain of the owner, because of the temporary right of way that has to be provided. This happens when the rangeland is on the migratory routes of the herds of others. Herds in transit can usually stay between one to three nights at a place on the migratory route. But a breach of this limited duration of stay in a rangeland belonging to others on a migratory route is considered an offence.

The third instance when some one else's herd is allowed, by custom, to use a rangeland is for grazing on residual forage. When a sub-tropical rangeland on the fringes of a village is owned by a herd-owner from the alpine or temperate region, its accessibility to the local cattle combined with the absence of the rangeland owner's herd for four months or so, makes it highly tempting to the local cattle. In many parts of the country, local cattle owners have customary right, although not reflected in a *khram*, to graze on residual forage (*rtsa bshul*), after the rangeland owner's herd has departed from these pastures. However, disputes have often arisen because of the illegal grazing by local cattle before the arrival of migratory herds. Illegal grazing on first sprouting (*rtsa ngo*) is considered theft of rangeland.

The fourth kind of conflict, which often led to serious litigations in the past, results from the establishment of swidden cultivation (*rtseri*) or permanent settlement in rangeland. This is different from a threat to grazing land from illegal entry of others' cattle, without paying water charge and grass charge (*rtsarin churin*). The threat arises from expansion of the frontiers of land for illegal occupation by settlers.

The fifth and last kind of dispute concerning rangeland is international or transboundary in nature, with its resolution dependent on bilateral negotiations. Substantial parts of rangelands in Haa, Trashi Yangtse, and Kurtoe, which were accessible to Bhutanese herds, are now grazed by Chinese herds. In Haa alone, several pastures such as Tsegangkha, Sinchong, Nangjumo, and Phartoe, which were originally owned by the herdsmen of Haa, are no longer accessible to them.

Impact of Land Law and Forest Act on Pastoral Institutions

With the enactment of the Land Act, 1979, which drew heavily from 1957 Thrimzhung, rangelands became the asset of the nation, i.e. state property. Herdsmen were given right to graze only. Burning of rangeland had already been prohibited long before this Act came into force. Thus, there was a shift in property relations between individuals and the state. This was further reinforced by forest legislation, which defined forest in a vague way. Tree cover was not a condition for forest: forest was any land, including rangeland, where private individuals have only right to graze.
The Land Act, 1979, includes a number of principles related to rangeland:

Registration Principle. The validity of rangeland ownership depends on recognition by official land register (*sa khram*).

Usufruct Principle. There is no ceiling over usufruct rights over pastureland, woodlot (*sogshing*) for collection of leaves and roofing material plants (*kharbari*).

Exchange and Transaction Principle. Rangeland may not be bought or sold, since the owner has only usufruct right.

Land Conversion Principle. Land registered as grazing land, cash crop, *sogshing* and *kharbari* should not be converted to another category. Other types of land may be converted to specific categories for land use.

Tree Ownership Principle. The government owns all trees found growing on private land with the exception of fruit trees growing in the orchards. This provision was deleted from the Forest Act, 1991. It is still part of the Land Act, introducing a certain degree of inconsistency between the two.

Crop and Rangeland Depredation and Compensation Principle. Although not directly bearing on rangeland, the Land Act has a whole section on crop depredation by livestock and compensation. The rates of certain compensations have not been revised since 1979, and that has been perhaps one reason for the high level of out-of-court settlements. The livestock owner is liable to pay back the value of a destroyed crop in full, after mutual assessment of the field. Deliberate grazing of livestock in a field is punishable by a fine amounting to Nu 400 per animal, plus three months of imprisonment for the livestock owner with compensation for the destroyed crop. This penalty provision is equally applicable to deliberate illegal grazing in other people's rangeland. If a field is rented out, the compensations accrue to the lessee. In case of share-cropping, compensation likewise accrues to both the sharecropper and the landlord. Leaving livestock to range freely without concern for crop depredation, in spite of reminder, is liable to a fine ranging from Nu 50 to Nu 300.

The declaration and expansion of protected areas represent another shift in rights over rangelands. Protected areas now comprise more than a quarter of the country's total land area. And a large part of protected areas are also rangelands where

herdsmen have legal rights to graze. Conflict between courses of action that may be taken to effectively manage the protected areas within the framework of western-style conservation, and continuation of grazing rights cannot be ruled out in future. The potential for conflict can be avoided only through introduction of a new management system for protected areas that recognizes that total protection is never to the advantage of conservation. Failure to act now may well lead to complete dominance of a few species in the course of time. Controlled grazing, which largely characterizes current practices, will contribute to the maintenance of balance between plant species for a very long period of time.

Draft Livestock Policy, 1985

The Draft Livestock Policy, 1985, is titled as such though its content constitutes an act in the sense that it will overwrite the Land Act. The Policy not only lays down the goal and objectives but also defines the broad strategies, implementation methods and enforcement mechanism. The main objectives of the Draft Livestock Policy, 1985, are to sedentarise the migratory cattle by giving tenurial or lease rights to improved pastureland for A duration of 30 years. The Policy states that leased pastureland is to be improved by the planting of exotic grasses over a period of five years, or else it will revert to government ownership and a fine will be imposed.

The salient features of the Draft Livestock Policy are as follows:

Nationalization and Compensation Principle. All registered private and community pasturelands will be nationalized. Registered private pastureland will be acquired at the rate of Nu 200 per acre and registered community pastureland (*nye 'khor rtsa 'brog*) will be acquired without compensation.

Tenurial Redistribution Principle. Pastureland will be reallocated to farmers on lease for a period of 30 years at a time. The allocation will be made at the rate of 10 acres per

livestock unit in the alpine region; one acre per livestock unit in the temperate region; and half an acre per livestock unit in the sub-tropical region. One adult head of cattle is considered one livestock unit. Two calves below two years or five sheep or eight lambs are considered equivalent to one livestock unit.

Ceiling Principle. Maximum leased pastureland per household will depend on the altitudinal zone to which the household belongs. The upper limits are: 1000 acres per household in alpine regions; 50 acres per household in temperate regions, and 10 acres per household in sub-tropical regions.

Mixed Holding Principle. Alpine herdsmen will be allocated 50% pastureland in alpine areas and 50% pastureland in sub-alpine areas. In the livestock priority areas, a farmer who owns less than 15 livestock units will be given 300 acres in the alpine region, or 15 acres in the temperate region, or 3 acres in the sub-tropical region.[10]

Allotment of Open Grazing Land Principle. Surplus land in an area that remains after allotment will be made into open grazing land to which access will be given by licensing.

With the exception of alpine herdsmen, whose livestock migration is recognized as unavoidable and natural, a rigorous implementation of the Draft Pasture Policy is envisaged to sedentarise the herdsmen and change them into western style dairy farmers.

The Draft Pasture Policy opts for a 'hands off' approach to the forest so that migratory cattle, and hence the herdsmen, and the forest will eventually have no interdependence. The Draft Pasture Policy is meant to be conservation oriented by keeping highly productive animals near the homestead and providing pastures to produce enough forage and feed for them.

[10] Ministry of Agriculture & Forestry Animal Husbandry Department. 1985. Draft Pasture Policy, p. 5.

Yet it is now very clear that a strategy for promoting a new livestock policy needs to be considered more on its own ground, rather than in terms of environmental conservation. The Livestock Master Plan, 1995, noted that, given the data, the average annual rate of increase for cattle was 0.5% for 1986-1990. This implies that the cattle population is almost static. It is tempting to speculate that the over 10,000 heads of cattle slaughtered yearly in border towns are actually cattle from our own herds being recycled as beef, demand for which has shot up with income growth. And a static population raises the question whether cattle really are an increasing threat to the environment in general.

The Livestock Master Plan further noted that an average family needs two draught animals, two milking cows, a dry cow, and as many cattle as possible for manure purposes. It concluded that "any programme to reduce cattle numbers in line with grazing resources cannot be introduced among small holders, who need all the cattle they have[11]. The spillover effect of shortage of manure that changes the organic farming into high input chemical fertilizer-based farming will fundamentally impinge on our consumption of naturally grown foods, and the hazards of chemical-based farming will be much more acute in mountainous areas.

Despite all the childhood experience we have of tending cattle, pastoralism is indeed a difficult topic to understand in its totality. Pastoralism is a vivid example of "interdependence across spatial, ecological, sectoral and institutional boundaries"[12], as it has been aptly described. Any activity that cuts across as many borders as migratory herding involves - spatial, ecological, sectoral and institutional - is bound to be complex. Any activity that is imperfectly understood can provoke measures to clarify and simplify it by the development planners. However, pastoralism in Bhutan

[11]Ministry of Agriculture. 1995. Livestock Master Plan, RGOB: Thimphu.
[12] See Miller D. J. Rangelands and Pastoral Development in the Hindu Kush-Himalayas. Kathmandu: ICIMOD, 1997

seems to be a highly sophisticated and symbiotic land and animal management system.

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GRAZING MANAGEMENT OF TEMPERATE GRASSLAND AND FALLOWS

Walter Roder[*]

Introduction

The paper provides a general overview of fodder resources and their management in temperate Bhutan (altitude range of 1500-3000m). The terms are used as defined by RC-Jakar (RNR-RC-Jakar, 1996). As per these definitions, temperate pasture can include any kind of land used for grazing. When referring to registered grassland or *tsamdro,* only the term *tsamdrog* is used. Where possible, the term pasture is replaced with more specific or more appropriate terms.

Overview of Fodder Resources in Temperate Bhutan

The fodder resources used vary with climate, farming system and season. No reliable data is available on the relative contribution of individual fodder resources towards the total requirement at the national level. Different authors, however, do agree that natural grasslands and forest provide the highest proportion (Table 1). A recent survey carried out in selected gewog of Paro, Wangdue, Trongsa, Zhemgang and Bumthang supported these estimates [Figure 1; Roder, et al. 1998].

This survey also showed that:

1. Depending on elevation and cropping systems, the most important winter feed are paddy straw, buckwheat straw, and turnips;
2. Grazing in crop fields (after crop harvest) received the highest overall ranking as a winter feed; and
3. Fodder trees are not as important as generally believed.

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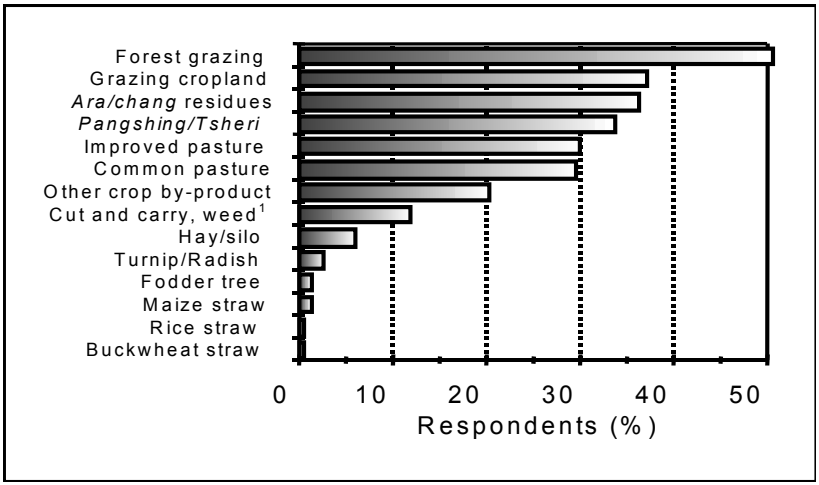
Table 1: Contribution of fodder resources towards national fodder requirement

Fodder Source	Relative contribution (%)	
Forest grazing	22	23
Natural grassland	22	38
Improved pasture	1	9
Shifting cultivation and fallow land	15	-
Fodder trees	20	15
Crop residues	20	13
Source	Roder, 1990	RGOB, 1994

Figure 1: Main fodder resources during the summer period



([1]Fooder from cut and carry systems or weed collected in crop fields)

Fodder from improved pasture has received surprisingly high ranking, especially in Wangdue, Trongsa and Paro. Similarly, hay as a fodder resource for winter feeding received high rankings from cool regions of Paro, Wangdue and Bumthang.

Management of Grazing Resources in Temperate Bhutan

The main grazing resources currently used in temperate regions of Bhutan are:

1. *Tsamdrog* used in the traditional way;
2. Forest;
3. Unregistered grassland;
4. Crop land (*kamshing, chushing, pangshing, tseri*) grazed during fallow periods; and
5. Improved grassland.

Individual households may have one or more of the five categories.

Tsamdrog, forest land and unregistered grassland
Although these three categories have different legal status, they are similar in vegetation cover and potential fodder production. Most references discussing plant communities, production and production potential of grazing resources do not specify the legal status of the area observed. The country has over 400 thousand ha of *tsamdrog*. The natural grassland area estimated based on aerial photography is considerably lower compared to the area of registered *tsamdrog*. In the estimate based on the aerial photography, a large proportion of the registered *tsamdrog* is probably classified as forest due to substantial tree cover. While the most extensive natural grassland areas are found at altitudes above the tree line ranging from 4000-5000m, the *tsamdrog* does not follow the same trends [LUPP, 1995]. Although we lack specific information, we can assume that large areas of *tsamdrog* are situated in the temperate parts of Bhutan.

A large proportion of the *tsamdrog* and other grazing resources are used by migrating herds taking advantage of

the variation in climate and vegetation. Typically, alpine, temperate and subtropical areas are included. High altitude pastures are grazed during the summer, while lower elevations (usually in the south) are used for winter grazing. Therefore the system cannot be discussed by focusing on the temperate component only and there may be some duplication between this paper and the material discussed under the alpine and the subtropical systems.

Our understanding of the grassland communities and their production in temperate Bhutan is limited. List of species may exist but little is known of their relative importance or their value as grazing resources. Documented observations are influenced by seasonal trends in vegetation cover and personal bias. Dry sites ranging from 700 to 2100m are frequently dominated by *Cymbopogon* type grassland [Miller, 1989]. Major grass species at these sites include: *Cymbopogon khasianus, Cymbopogon* sp. *Cymbopogon gryllus, Apluda mutica, Arundinella nepalensis* and *Heteropogon contortus.* Above these elevations *Schyzachirium delavayi, Arundinella hockeri* and *Eragrostis* sp. become dominant [Roder et al. 1998]. Estimates of dry matter yields range from 0.7-3.0 t ha^{-1}.

In order to differentiate between forest grazing and *tsamdrog* a separate survey was carried out in three villages each of Bumthang, Trongsa and Zhemgang (Table 2). Fifteen or more households were visited in each village and information collected from households with and without *tsamdrog*.

Tsamdrog was considered as an important source for summer fodder in five villages. Much of the *tsamdrog* is communally owned and often not utilized by some of the owners. Others are far away from the village. Both these factors are major detriments for optimal utilization. Most *tsamdrog* owners are therefore not willing to invest in improvement or maintenance.

Table 2: Importance of tsamdrog in temperate farming systems

Location	Farming System	Tsamdrog Holding and Using (%) Households			Summer Fodder (Based On Ranking Importance)[1]
		Private	*Com.**	*Using*	
Shingkhar	Wheat, Barley, Semi-Nomadic	13	100	100	*Tsamdrog* - 0.93 Cropland - 0.35 Improved Pasture-0.26
Phamrong	Wheat, Barley, Buckwheat	27	-	7	Community Pasture - 0.44 Forest - 0.42 Cut and Carry-0.37
Gyetsha	Wheat, Barley, Buckwheat, Potato	7	100	53	Cut and Carry-0.50 Improved Pasture-0.47 *Tsamdrog* - 0.46
Tangsibi	Rice, Barely	40	20	40	Cut and Carry-0.46 Improved Pasture-0.42 Crop land- 0.33
Bemji	Rice, Maize	-	93	73	*Tsamdrog*-0.57 Crop Land-0.41 Cut and carry-0.33
K. Rabten	Rice, Maize	7	93	60	*Tsamdrog*-0.64 Maize Stalks/ Young Maize-0.39 Field Borders-0.35
Zurphy	Rice, Maize	-	Not Clear	33	Forest-0.64 Crop Field-0.29 Field Borders-0.13
Dunkhar	Rice, Maize	47	20	40	Improved Pasture-0.62 Forest - 0.32 By-products - 0.32
Berthi	Rice, Maize	40	80	80	Forest - 0.52 *Tsamdrog*- 0.46 Crop Land- 0.43

**Com.= community*

Tsamdrog was considered as an important source for summer fodder in five villages. Much of the *tsamdrog* is communally owned and often not utilized by some of the owners. Others are far away from the village. Both these factors are major

detriments for optimal utilization. Most *tsamdrog* owners are therefore not willing to invest in improvement or maintenance work (Table 3). Only about 20 out of 120 respondents reported to carry out some maintenance or improvement work. This maintenance consists largely of slashing unwanted maintenance before it was prohibited.

Table 3: Improvement/maintenance work carried out for tsamdrog

Location	Dis-tance	Improvement, Maintenance Work Carried Out (HH No)				Why No Improvement?
		S	*P*	*IP*	*N*	
Shingkhar	1-200	1	-	-	14	Community Owned, Burning No More Allowed
Phamrong	50-140	3	-	-	1	Wild Boar, Long Distance
Gyetsha	1-200	-	-	1	14	Community Owned, Distance too Long, Tree Covered
Tangsibi	1-10	3	1	2	4	Community Owned, Distance too Long
Bemji	1-4	1	-	-	12	Community Owned, Burning Not Allowed, Not Utilized
K. Rabten	3-10	2	2	-	12	Community Owned, Not Utilized
Dunkhar	1-20	1	1	1	7	Community Owned, Long Distance
Berthi	1-33	6	-	-	5	Community Owned, Not Allowed by Park

S: slashing, P: planting, IP: improved pasture; N: none

There is a variation in gazing methods. Many of the community owned *tsamdrog* are continuously grazed with little control over the grazing livestock. In one village (Kunga Rabten) a *tsasungpa* is appointed to control grazing. High elevation and remote *tsamdrog* are usually used by migrating herds. The grazing methods for these *tsamdrog* are generally sound.

Recently introduced changes made it possible for households with non or insufficient *tsamdrog* to lease the same through the *dzongkhag*. Over 90% of the respondents in the survey said that they were not aware of these regulations. Most would have liked to have *tsamdrog* but it should be close to the village. Some of the households having *tsamdrog* had leased it out to other households against payment in kind.

Fallow land

In most production systems, cattle are allowed to graze freely after crop harvest. Depending on crop, weed flora and harvesting systems, the quantity and quality of fodder available after harvest can vary substantially (Table 4). The grazing period varies with crop and cropping system, but it is generally extensive during the dry winter season. Fallow systems, which provide substantial quantities of fodder, include the seasonal fallows (2-8 months) in maize systems and the long-term fallow (2-20 years) in the *pangshing* and *tseri* shifting cultivation systems.

Maize systems

Maize is the most important cereal both, in terms of area and production. Cultivated mostly on dry land, it can be found at elevations up to 3000m. The main maize growing areas are in eastern and southern Bhutan. Depending on the elevation, rainfall and soil fertility, maize cultivation is combined with a variety of other crops in intercropping and/or sequential cropping systems. The fallow period and the fodder available depend on the cropping system, elevation and moisture. Livestock is generally allowed to graze immediately after harvesting the cobs. The stems may be harvested and stored for winter feed. Because of the large acreage, substantial quantities of fodder are available from maize cropping systems.

Table 4: Fodder from fallow land and selected characteristics from the major crop/fallow systems

Type	Maize system	*Tseri*	*Pang-shing*
Area (ha)	55000	40,000	10,000
Altitude range (m)	300-2600	300-2500	2500-4000
Major fallow vegetation	Annual weeds	Shrubs, trees	Grasses, blue pine
Fallow period	4-8 months	2-8 years	6-20 years
Main feed	Annual weeds Crop residues	Annual weeds Shrubby species	Grasses
Dry matter (t/ha)	0.1-1.0	0.2-3.0	0.1-1.5

Slash and burn-Bush fallow (tseri) system

This system follows the widely used slash-and-burn system found in many subtropical and tropical regions of Asia [Roder et al. 1992]. The vegetation, consisting of trees, shrubs, other perennials and annuals, is cut during the dry season, allowed to dry and burned shortly before planting the seed. Seeds are either dibbled or broadcast without incorporation. Crops include maize, millet, rice and buckwheat.

Grass Fallow (*Pangshing*) System

The fallow vegetation evolving under grazing consists of short grasses, sedges and forbes, interspersed with blue pine (*Pinus wallichiana*). Prior to cultivation, the topsoil layer is cut with a hoe about 5-7 cm deep and is allowed to dry for several months. Dry topsoil is collected in conical mounds about 2-3 m apart (1200-2500 mounds ha^{-1}). Small quantities of fuel consisting of blue pine needles collected at the site or brought in from nearby forest and/or dry manure is added to each mound. After the fuel is ignited, the organic material in the dry soil mounds continues to burn slowly; temperatures eventually reach 500°C or higher [Roder et al. 1993]. Burning lasts several hours resulting in high losses of organic matter and Nitrogen. Because almost all the vegetation is killed, the soil is fully exposed to the force of erosion. Buckwheat seeds

broadcast in April may be covered using a traditional bullock drawn plough or manually with a rake. Labor inputs are high with about 150-400 days per ha. Most of the labor (65-85%) is required for land preparation. No weeding is necessary. The fodder production is small in the initial year after cultivation, but because of the long fallow period (up to 20 years) *pangshing* are important grazing resources at higher elevation in Haa, Wangdue and Bumthang.

Other cropping systems
Fallow land from other cropping systems, although locally important, contributes less to the overall fodder production due to limited area (wheat, barley) and/or shorter fallow periods. Fallow fields of wheat, barley and buckwheat systems are important at higher elevations, while rice fallow provide some grazing at an elevations of <2500 metres.

Cultivated fodder/improved pasture
Over the last two decades many farmers have sown legume-grass mixtures as recommended by the Ministry of Agriculture. These introduced fodder species were sown on *pangshing, tseri, kamshing*, orchards or *tsamdrog*. Although the area under introduced fodder species may be relatively low, the contribution to the overall fodder requirement is significant as demonstrated in the two recent surveys. In spite of land limitations farmers rarely used the *tsamdrog* for growing improved fodder species. Using *tsamdrog* was not possible because of communal ownership and/or uncertainties about rules and regulations.

G**razing effects on forest systems**

In Bhutan, environmentalists and foresters routinely view cattle grazing as a serious threat to the environment and a main constraint for good forest management (Roder et al. 1998). The livestock producers may disagree but their voice is rarely heard. Although science is often evoked, arguments on the issue are routinely given without any quantitative proof for either side of the debate.

Observations made by White (1909), during a trek in Paro valley may be among the earliest references available. He noted: "On either side and at our back was a deep fringe of fine trees of every age, from the patriarch of the forest down to young seedlings. The Bhutanese seem to have acquired the secret of combining forests self-reproduction with unlimited grazing, far from the time we left Rinchengong (near Sikkim border, Haa) we passed through forests which, without exception, were self-reproducing".

A ban on the use of fire for grassland improvement introduced in 1969 decreased the area and quality of the traditional grassland used by herders (Gyamtsho, 1996). The reduced fodder quantity available from traditionally used grasslands may have increased the pressure on the forest systems.

Following the results of a recent study in mixed coniferous forest in Bumthang (RNR-RC Jakar, 1997, Table 5) using six pairs of fenced and un-fenced plots, it was concluded that:

a. grazing increased the proportion of good quality blue pine plants;
b. browsing damage due to grazing animals is negligible for conifer species;
c. grazing reduced damage (debarking) by small rodents; and
d. grazing reduced the number and density of broadleaf species.

Table 5: Effect of fencing on regeneration and quality of seedlings (study with 6 pairs of fenced and unfenced plots)

Species	Good quality Plants (%)		Browsing damage (%)				Other damage (%)			
			Lateral branch		Terminal bud		Debarking		Biotic damage	
	F*	**G	F	G	F	G	F	G	F	G
Hemlock	82	68	0	0	0	1	7	1	11	30
Fir	91	85	0	0	0	0	0	0	9	15
Bluepine	77	91	0	0	0	0	8	0	15	9
Rhodo-dendron	90	84	1	0	0	0	0	0	10	16
Betula	78	57	0	20	0	6	0	0	22	17
Other broadleaf	59	46	0	3	0	4	2	0	39	48

**F-fenced; **G-grazed*

The fact that grazing favours blue pine regeneration is painfully felt by many households which have lost large proportions of their cultivation land due to vigorous colonisation by this species in spite of heavy grazing pressure.

Yushania microphylla, a spreading bamboo species common at elevations of 2300-3700m, is often found to impede regeneration in coniferous forests disturbed by logging or other interruptions. The species is browsed by yak and cattle and the competition to regenerating coniferous species can be greatly reduced through the grazing animals. Gratzer et al. (1999) found that the density of fir seedlings increased threefold when the height of the bamboo (*Y. microphylla)* cover was reduced by grazing from a height of 150 cm to 100 cm.

Opponents of forest grazing often make an argument that grazing in the forest is backward. This is a serious misconception. Forest grazing and silvopastoral system are widely accepted as modern forest management tools. Clason and Sharrow (2000) estimated that one quarter of all forestland in the USA is grazed by livestock. Silvopastoral

systems should be particularly interesting for hilly environments and they may offer the best economic and ecological options for many Bhutanese farmers who are finding it difficult to compete with lowland farmers in the production of agriculture crops.

Dukpa et al (1997) estimated that silvopastoral systems combining the fast growing blue pine with dairy production could generate cash returns of 1000-2000 US $ ha^{-1} $year^{-1}$ from land presently used for shifting cultivation. Combining livestock with timber production will generate faster returns than systems limited to timber production only. Managing systems integrating timber and livestock production will be more demanding than systems focusing on a single output only. Farmers and herders, however have convincingly demonstrated that they can manage complicated systems provided they get the benefit from the outputs produced.

Nutrient Transfer and Alternative Nutrient Sources

Bhutanese farmers produce reasonably good crop yields with minimal inputs of chemical fertilizers. This is only possible due to the input of plant nutrients collected by the cattle. The animals grazing in the forest or on grasslands during the day are confined in houses or in crop fields during the night. This practice results in a continuous export of plant nutrients from the grazed areas. Soils in northern Bhutan are extremely poor in available phosphate. Burning the topsoil to increase availability of phosphate and burning manure to reduce the bulk and speed up the release of phosphate are indigenous practices devised by the Bhutanese farmers to optimise the use of the limited phosphate pools.

Growing on low phosphate soils, the plant material consumed has a relatively low phosphate content. In spite of this, the phosphate quantities transferred by the grazing animals is in the range of 3-6 kg per gazing animal (depending on the number of days, and hours per day grazed in). With about 250-400,000 animals depending on grazing in forest and on grasslands, the amount of phosphate transferred from these

systems to agriculture systems is in the range of 300-900 t per year corresponding to 900-2000 t single super phosphate fertilizer.

Opportunities and Problems for Present and Future Management of *Tsamdrog* and Grassland

Tsamdrog and other permanent grassland or forests were the main resources for the traditional livestock production systems where few households had large herds of cattle. These systems evolved under a social and political setting favouring large herds owned by feudal lords and monasteries. In the last three decades the social structure of Bhutan has changed dramatically. This has also influenced the livestock production system. While large migrating cattle herds have declined in the temperate and subtropical regions, small and medium size farms have increased their livestock numbers. Rules and regulations governing the use of grazing resources need to be adapted to these changes. Changes attempted were based on a realistic assessment aiming at making resources available to a broader group of livestock producers. For various reasons, the average livestock producing households did not take advantage of the changes in the legislation and the overall development in the livestock sector is far below the general expectation. Although Bhutan's environment is favourable for livestock production, the country has become a net importer of livestock products. The trend continues despite a strong commitment and support by the government towards the development of the livestock sector.

What Has Gone Wrong?

The overall poor performance of the livestock sector is the result of complex interactions of many of factors. Some of these factors relating to the utilization of fodder resources and the resulting problems are listed in Table 6.

Table 6: Examples of factors influencing utilization of tsamdro and other fodder resources

Factors	Resulting problems
Confusing/ conflicting/ inadequate policies, rules and regulations	Herders/farmers could not take advantage of new regulations introduced. Herders/farmers are not motivated to optimize production of *tsamdrog*. *Tsamdro* which cannot be utilized due to logistic problems (distance) are not available for other herders/farmers. Communal resources are poorly managed and utilized leading to degradation of the resources. Herding practices make the introduction of changes in the fodder resource management impossible. Conflicts with forestry rules and regulations. *Tsamdrog* quality is deteriorating.
Strong influence of culture and traditions	The herders/farmers decisions are only partly based on economical and environmental concerns. Problems in culling. Community owned resources are not equally shared. Some of the traditional practices (migration, cross-breeding mithun) may have been detrimental to a sound development in the livestock sector. Improved fodder patches have to be protected from stray animals.
Marginal resources	Limited scope for increasing production. Low return on investments and labor. High expectations from the government side (production increase) and the herders/farmers side (increased income) cannot be satisfied.
Training and extension programs emphasizes animal health rather than fodder and nutrition	Herders/farmers do not get appropriate support. Extension system has lost credibility. Expensive health care system often treating secondary problems of nutritional deficiencies.
Free resource/common resource	Communal and private *tsamdrog* are not valued as they are there for everybody to use and abuse. Households without or with less livestock cannot profit from common resources.
Conservation related issues	Conflicting priorities. Limited options for management intervention.

How can we improve the benefits from tsamdrog and utilization of other fodder resources?

The current rules and regulations and the traditional management methods are probably adequate for alpine grasslands and *tsamdrog* but they are inadequate for *tsamdrog* in the temperate and subtropical regions. When formulating rules and regulations in the temperate and subtropical regions we need to consider the following:

Specific rules for lower regions. Tsamdrog in temperate and subtropical areas requires specific rules.

Clear rules dissemination. Rules should not allow room for misinterpretation. There is a need to disseminate new rules more effectively eliminating room for introducing personal bias. In the event that *tsamdrog* resources are nationalized, this should be carried out clearly, uniformly and speedily.

Optimal resource use/conversion. The rules and regulations should favour optimal resource use. If production potential and environmental considerations are in favour of other utilization (state forest, private forest, social forest, improved pasture, horticulture, mixed farming), the conversion should be supported.

Land ceiling. Tsamdrog holdings per household could be limited by appropriate land ceiling regulations.

Communal properties. Special attention has to be given to communal properties. If these properties can be better utilized/preserved by private use there should be opportunities to do so.

Distance. Distance from the household is a major constraint for proper utilization of *tsamdrog*. Mechanisms (land ceiling, tax structure etc) should be created to encourage owners to surrender such fields.

Increase value/appreciation of tsamdrog. Mechanisms have to be created to increase the perceived value of the *tsamdro*. This could be achieved through taxes, land ceiling etc.

Other fodder resources/synergistic effects of fodder
There is a need to create a suitable legal/social environment to optimise benefits from growing improved fodder. This would also include benefits from synergetic effects of growing fodder in field crop, horticulture and forest systems. Mechanism could include: subsidies for phosphate fertilizer, taxes for nitrogen fertilizer, strong rule on stray animals etc.

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[1] Average of 1/rank given for a particular fodder resource e.g. if all households would rank a particular fodder source as the most important the fodder would receive the ranking 1.0

GRAZING MANAGEMENT IN NATIONAL PARKS AND PROTECTED AREAS: SCIENCE, SOCIO-ECONOMICS AND LEGISLATION (TENURE)

Sangay Wangchuk[*]

Abstract

The formulation of natural resource management policy generally involves science, socio-economic environment and legal framework. The thrust of the management policy is to derive maximum benefits from the natural resources while at the same time ensuring that the ecological integrity is not compromised. The basic scientific process elements such as ecological stability, resistance levels, resilience, restoration, enhancement, and carrying capacity have been discussed in relation to livestock grazing. These processes determine the sustainability of the pastures under use.

The socio-economic environment under which a policy is framed and implemented has a direct bearing on the effectiveness of the policy. Besides formal laws, important elements that have influence on the use, access and sustainability of pastures are social structure, the role of the livestock in the socio-economic development, social organizational capability, flow of physical and social energy within and outside the communities, hierarchical structure of the communities, and patron-client relationship. Therefore, it becomes difficult for most of the formal laws to change the relationships relating to resource use and access patterns among the communities once such relationships are embedded in the social structure.

The laws of the country such as the Thrimzhung Chhenmo, the Land Act, the Forest and Nature Conservation Act and the

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National Assembly resolutions protect property rights over pastures. Besides such laws, customary sanctions on the use of and access to pastures have also evolved over the years. To amend such laws involving property transfer rights from private to state or common may be a complicated process as proven in the past. Some examples are nationalization of pastures and sharecropping. More innovative approaches will be necessary to rationalize the relationship between productivity of natural resources, and property rights ownership.

Introduction

Grazing by livestock has been an important issue for the management of the national parks and protected areas. Generally, it has been observed that grazing has negative impact on the ecological stability of the grazing area, albeit at varying levels. This impact results primarily from two sources- browsing of the ground flora and erosion as a result of hove marks. Several studies have been carried out to assess the impact of grazing on the resiliency of the eco-system. While most studies have revealed that there is a negative impact on the eco-system, the issue of separating it from the resource use patterns of the rural households and communities has been difficult to reconcile.

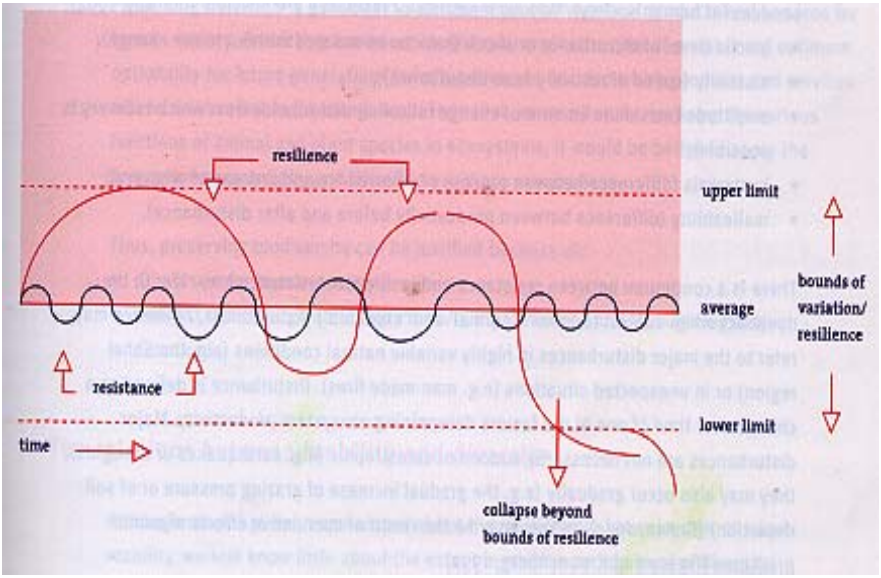
It must be recognized that livestock is a part of rural livelihood, and it forms a part of the fabric that links other elements of socio-economic structure of individual households and communities. The traditional livestock species has evolved to adapt to rugged and a wide range of areas available for grazing. This has resulted in the adoption of tending and management practices that involves minimum inputs, particularly the practice of letting the livestock stray into the forest without any restraint.

Individuals, households, communities, *dratshang* (state monastic body), etc have grazing rights over pastures that may be inside or outside national parks and protected areas. These rights are legitimated by the Thrimzhung Chhenmo,

the Land Act of 1979 and the Forest and Nature Conservation Act of 1995. The National Assembly has also often passed resolutions relating to ownership and management of grazing land/pastures from time to time. All these rights are recorded in the main *thram* (land register) maintained by the Ministry of Home Affairs and a copy held by the owner. Therefore, the property rights regime relating to grazing/pasture is unambiguous.

Ecological Stability/Integrity

Fig.1: Ecological Stability and Bounds of Variations /Resilience



Adopted from SEAN

The two final goals of eco-system management are stability and diversity. Ecological stability can be defined as the capacity to maintain a certain level of optimum productivity, thus the capacity to buffer and regulate disturbances and variation of determining conditions. Stability includes both the concepts of resistance and resilience.

Resistance is a system's capacity to buffer fluctuations in determining factors of the surrounding environment (e.g. variations in rainfall, temperature, sedimentation, and others). As a result of these processes, productivity of the system goes up and down within limits around an average level. Such fluctuations can be considered a normal, although, as eco-systems are evolutionary rather than mechanistic, they exhibit a limited degree of predictability (Constanza et al., 1993). Resistance can be measured by the coefficient of variation in productivity (Conway, 1994). This implies that levels of equilibrium, for instance of a pasture eco-system can be defined within certain margins. The average value is not a real equilibrium, but only an empirical mathematical average of observed fluctuations. As all natural processes are characterized by great variation and a certain level of unpredictability, levels of equilibrium can only be defined within certain limits. Although the average value is sometimes referred to as the natural level of equilibrium, a situation of absolute stability is seldom encountered, since there are always fluctuations and gradual changes. Therefore, what are commonly accepted are transition processes and fluctuations around average values.

Under some extreme conditions and use, eco-systems productivity may fall well below the average level and normal fluctuations. If productivity falls, it may recover either to its original level or to a new lower level, or in extreme cases it may cease to exist altogether.

Resilience is the ability of the system to return to a former state, after being affected by major disturbances (Connel and Slatyer, 1977). Connel and Slayter describe various measures of resilience as:

1. Inertia (level of disturbances or shock that can be resisted without major change);
2. Elasticity (speed of recovery from disturbance);
3. Amplitude (maximum amount of change following disturbance and process of recovery);

4. Hysteresis (difference between process of disturbance and process of recovery); and
5. Malleability (difference between productivity before and after disturbance).

There is a continuum between resistance and resilience: resistance may refer to the dynamics when an eco-system is subject to minor disturbances, and resilience may refer to major disturbances in a highly variable natural conditions or in unexpected situations (e.g. man-made fires). For instance, the bound of variation or resilience levels for forest fires between Pinus wallichiana and Pinus roxburghii forests will differ. The bound of variation or resilience will determine the collapse of eco-system. So long as the forest fires are not repeated or the pastures are used within the carrying capacity, the eco-system will recover. However, if forest fires occur before the eco-system can recover or the pastures are over-used, the process may push the eco-system beyond the bound of resilience, and therefore, lead to the collapse of the eco-system. The process of destruction of the biomass by forest fires, followed by browsing of the spring vegetation will push the eco-system beyond the bound of variation or resilience. This example can be observed along the Thimphu-Paro highway wherein the eco-system seems to have almost collapsed beyond the capability to support the recovery of any vegetative growth. Cumulative effects of such disturbances (change over time of one of the factors determining eco-system productivity) have led to the gradual (e.g. the gradual increase of grazing pressure or of soil depletion) (Brown, 1994) degradation of the eco-system along the Thimphu-Paro highway.

Although little empirical evidence has been published, it is evident from general observation that cumulative impact of forest fires and grazing are the two main sources of environmental degradation. This can be demonstrated if one observes the difference in quality and quantity of vegetative cover between inside and outside a fenced plantation, particularly on steep slopes and high intensity grazing areas.

The evidence of intensive grazing is obvious as reflected by the criss-cross of trampling marks, in some cases resulting in permanent tracks. Such level of grazing intensity will lead to the process of irreversible environmental degradation whereby the eco-system is incapacitated to support regeneration.

It also shows that the eco-system has been used beyond its carrying capacity. Therefore, grazing frequency, intensity and maintaining the carrying capacity of the eco-system are critical elements of eco-system resiliency. This has been amply revealed by studies carried out in some of the national parks described later.

Environmental degradation, regeneration processes and carrying capacity

Changes in the environmental functions result from pressures on such functions, such as human interventions, natural processes and events, or both. Generally human interventions include exploitation, destruction or disposal of waste materials. The relationship between regeneration processes and pressures determines to what extent such processes lead to degradation of the environmental functions. Therefore, reproduction and regeneration processes influence the capacities to maintain stability, and include regulation processes such as reproduction rates of animals, re-growth and succession of plants, soil formation, purification and decomposition and recharge of water storage. Kesseler, et al have recognized basically three degradation processes of environmental functions as:

1. *Depletion.* Taking out (utilizing, exploiting) environmental resources (e.g. plants, nutrients, animals, etc.) in excess of regeneration rates;
2. *Pollution.* Putting in quantities of damaging elements in excess of rate of decomposition, break down and purification processes; and
3. *Disruption and manipulation.* Changing or destroying the natural conditions (e.g. construction of roads, introduction of exotic species or variants by genetic engineering).

It is also generally accepted that there are limits to the resilience of the environmental capacities to provide goods and services. Concepts of environmental utility space and carrying capacity are used to explain this phenomenon. Some examples are the capacity to:

1. Provide a certain amount of nitrogen for plant growth;
2. Produce certain amount of energy;
3. Purify a certain amount of polluted water; and
4. Provide a certain amount of water.

While it is generally believed that grazing has negative impacts on the eco-system, some experience of positive aspects in national parks and protected areas have been discussed.

Studies carried out in the Thrumsingla National Park showed cattle grazing in broadleaf forests tends to alter forest species composition as cattle browse all large tree species except non-palatable species such as *symplocos*, *daphyniphyllum*, rhododendron, litsea and persea. When a large number of cattle graze over a long period, the impact is shown by an increase in weed and unpalatable tree species frequency. Further changes in forest composition may occur with the proliferation of Laportea spp., Viburnum spp., fern and bamboo by which forests are permanently altered. The study also showed that there is only a limited time for the cattle-preferred species to grow as the area is grazed by cattle in summer and yaks in winter. Effects of grazing is minimal and forests resilience to regenerate increases when cattle population density is low, and grazing is effectively managed and regulated in areas with high cattle density. However, cattle eat so much of palatable biomass that there is very little left for the free-ranging ungulates.

Impacts of disturbance induced by grazing over time depend on the type of eco-system. For instance, human influences on the landscape through the introduction of burning and grazing have probably led to the replacement of relatively

species-poor habitats by more species-rich ones. This was observed in the Jigme Dorji National Park (Laya) wherein Rhododendron setosum dominated vegetation, typically supporting only three or four species of herb or grass. Assuming that R.setosum dominated vegetation is a relatively natural and largely unmodified eco-type, it appears that after the introduction of grazing, the effect of trampling opens up the ground cover to other species. Under these circumstances, around 30 species were recorded. Similarly, on an adjacent area of R. setosum, burned around 15 years ago, 48 species were recorded and there was greater cover by palatable grass species. However, on a very steep slope burned at the same time, the survey team noted less grass cover, more exposed soil and more moss cover together with associated land slippages. Therefore, species richness is often the result of a subtle interplay between management practices and the ecological response of grass and herb species to the changes imposed.

A similar study carried out by Renewable Natural Resource-Research Centre (RNR-RC) in Bumthang, revealed that moderate level of grazing in conifer forest seems to benefit the forests, and activates natural regeneration. However, in broad leaf forests, grazing definitely impacts negatively on natural regeneration.

Socio-economic

The issue of grazing cannot be discussed from ecological or legal point of view only. The role of livestock in the socio-economic structure of the various households and communities has to be examined before putting forth any policy based on "technical fix" approach. There are issues such as "can any meaningful change be facilitated by the government which primarily involves the lifestyle of the rural households and communities"? How can this change, if at all possible, link to other patterns of livelihood amongst the households and communities? What viable/sustainable and acceptable options can be offered for the proposed change? Since the present practice of grazing by the rural people is

considered detrimental to the ecological stability, what type and level of government intervention is considered appropriate and adequate?

The functioning of the socio-economic structure at the micro-community level needed to be analyzed, particularly the traditionally accepted mode of access to and use of pastures based on client-patron relationship.

Livestock rearing is a private sector enterprise sustained initially through some support from the government such as improvement of breed, health care, feed, etc. Otherwise its functioning has little bearing on the government, except some policy decisions impact on its sustainability. It is in this context that discussion on socio-economic issues related to grazing is focused?

Like many agricultural enterprises, livestock rearing is a private undertaking. This may be practiced at individual, household, or community level. This practice has not undergone any major changes in Bhutan as some societies have experienced wherein the state has intervened, and nationalized all livestock and managed as central farms or limit the holding back of benefits from livestock farming. Government has not fixed any upper or lower limits of price of livestock products except for meat to adjust to structural dis-functioning of economics of supply and demand in urban areas. There is also no limit to the size of the herd of the livestock. Furthermore, all rights to pastures have been conferred to individuals, households, communities and institutions by the laws of the county such as the Thrimshung Chhenmo, the Land Act, the Forest and Nature Conservation Act, and other by-laws. It is therefore, to a large extent and under some limitations, a free enterprise. The state comes to picture only when the functioning of the enterprise impacts negatively on the environment, i.e. pastures, as it is considered to be the mandate of the state to protect the environment of the country for larger interest.

While discussing either a pasture management strategy or a national pasture policy, the participation of the livestock owners and pasture/grazing right holders is crucial for any meaningful impact of such decisions. The normally accepted approach of taking many things for granted has to a large extent ground many strategies and policy decisions. When one is dealing with a private enterprise such as livestock it becomes even more imperative to consider the participatory approach to decision-making. However, in the context of Bhutan, the term participation has to be viewed from a realistic perspective. To participate one would also need to negotiate (Wangchuk, S. 1997). And it is at this stage of participation one runs short of negotiating partners. For instance, we have little insight into as to how households that comprise a community are organized, the patron-client relationships, and flow of natural resources and social energy within and outside these communities. The social organizational pattern and capability are other important elements that determine the level of participation in the development of strategies and policies that are assumed to particularly benefit them, and the government to certain extent.

Private property rights regime has been established through legitimacy conferred by the Thrimzhung Chhenmo and various other laws of the country. Grazing rights clearly figure as one of the main rights and concessions conferred upon individuals, households, communities, and institutions by these laws. These rights and concessions are deeply founded and well entrenched in the inheritance mindset of the right holders and will not forfeit or give up such rights under normal circumstances. It may take adequate financial incentives or national interest for the right holders to give up the rights. The concept of *phazhing* and being able to hold on it could also influence decision of the right holders. For instance, if one analyze the reasons for not being able to get the National Pasture Policy even past the government agencies, this can be attributed to a large extent to such reasons. It may have been a difficult proposition for the

pasture/grazing right holders to agree to the nationalization of their pastures without adequate financial compensation, which the government could not afford at such magnitude. For instance, the government approved compensation of Nu 200 per acre of grazing/pasture rights withdrawn by the government. Assuming that at least such rights cover 10% of the country, the compensation amount could run into millions that the government may not be able to pay.

The issue of changing the property rights regime was discussed in the 74th Session of the National Assembly in 1996. This was in relation to sharecropping of agricultural land in Trongsa Dzongkhag. The people's representative of Trongsa had pleaded for transferring the ownership rights to the share-croppers as the share-croppers have to share the crops with the land owner although they have done all the hard work in the field. It was also submitted that the practice of sharecropping discourages sharecroppers to invest in land development such as soil conservation programme, proper maintenance of irrigation, etc. Amendments to the Land Act relating to sharecropping were suggested as:

1. People dependent on share-cropping should be given independent land holdings;
2. All land owners should be made to cultivate their land by themselves and not by others; and
3. If landowners are engaged in business or government service, their land should be sold to the sharecroppers. If the sharecroppers cannot buy the land, such land should be bought by the government and sold to them at subsidized price.

Not a single member of the National Assembly supported the proposal, and in fact it was felt that such a proposal would involve drastic change from the existing provisions of the Land Act. It was argued that the law should not be amended for the benefit of a few individuals. The National Assembly therefore resolved that the proposal does not warrant any discussion and that the sharecroppers should follow the

provisions of the Land Act. The resolution is a reflection of the complexity of property rights and tenure systems, and that sometimes logic (optimal land use policy) does not make much sense.

Another example of such a case can be seen in Laya, a community dependent entirely on livestock rearing. A study carried out by the Jigme Dorji National Park in 2000 in Laya showed a similar trend of land ownership pattern. One of the main findings was a skewed distribution of pastures, the *dratshang* being one of the major owners. Given an option, the local community would like to take over the pastures owned by the *dratshang* and distribute among themselves, depending on the herd size. Although the *dratshang* does not maintain any livestock, past experience shows that this is most unlikely to happen.

Legal Framework and Tenure

The legal framework on the use of and access to pasture is unambiguously laid down in the Thrimzhung Chhenmo, the Land Act of 1978, Forest and Nature Conservation Act of 1995, the Forest and Nature Conservation Rules of 2000 and various resolutions passed by the National Assembly from time to time. Based on the provisions of the laws, technical regulations such as management plans, guidelines, etc. have also been approved by the government. Discussions relating to the legal and tenure aspects of grazing and pasture management have been carried out below.

The Land Act of 1978

Ownership of Grazing Rights
The Land Act 1978 recognizes the right to hold grazing rights by individuals, households, communities, and the *dratshang*.

The chapter on Use of Grazing Rights/Pastures states:

Section Ka 8 “An owner of a registered grazing land in Thram can be issued a permit to use enough pasture of his choice

for his cattle out of his own grazing land. If a person has surplus grazing land after grazing his cattle or a person has no cattle but uses his registered pastures for grazing of other's cattle on payment then it can be taken over and permit for grazing can be issued to the traditional users. In the absence of any previous user, permit for grazing will be issued to the owners of the cattle in villages in the vicinity of the grazing land. Priority of grazing will be that of those nearest to the grazing land, nobody is permitted to graze the lands wherever they like." Further under section Ka 8.6 says " Owners of grazing land having no cattle cannot let out their pastures" and that "A person or a member of a family without having cattle is allowed to maintain the grazing land registered in his Thram. However, people who own cattle but not enough pasture can use the grazing land and water after obtaining permit from the government. The Thram holder can neither let out his grazing land nor graze others cattle pretending to be belonging to him."

Ownership of grazing rights cannot be withdrawn even if the right holder does not posses any cattle. Section 8.7 of Chapter VIII protects his rights as "Rights of ownership of grazing land - If an owner of grazing land has lost all his cattle and later on buys cattle and needs the grazing land then he has full right over the grazing land registered in his Thram as per Ka 8.4"

The Act has recognized the nomadic life style of the nomads (*Dropa*) and provides a clause under Section Ka 8.8 as "Use of grazing land by nomads who have no cultivable land - nomads who has neither cultivable land anywhere nor cattle and is entirely dependent on the grazing land as his livelihood, can let out his grazing land on *Tsarin Churin.* However, the owner must get a permit from the Dzongdag/Dungkhag of the area and give it to the person who wants to graze his cattle. *Dropa* who have grazing land but very few cattle and no cultivable land can also let out their balance of grazing area on *Tsarin Churin*."

The use of grazing rights/pastures owned by goendey have also been explained in the Land Act under Section Ka 8.9 "Use of pasture land belonging to *goendey* -Grazing land registered in the main *Thram* in the name of *lhakhang*, *goendey* and *theptsa yojay* etc. can be grazed without permit. However, if such land is registered in the name of individual persons instead of *lhakhang*, g*oenkhang*, *theptsa yojay* etc. then action should be taken according to rules. Likewise for the use of grazing land belonging to *goendey*, *dratshang*, *rabdey*, royal family etc., permit will have to be obtained as per rules."

People can use unregistered grazing land under Section Ka 8.10 but will be guided by Ka 6.14 even if one posses a *kasho*. The Section further states "If a family is using a grazing land which is not registered in the *Thram* but has a *kasho* in their possession, then the right of ownership will be guided by Ka 6.14. (Sl. No.3 of the 46th Tshogdu, 1977)."

All land including pastures have to be registered within 360 days, and as per Section Ka.6.14 "Allotted land not registered in the *thram* within 360 days shall be treated as Government land" This also includes "Land inherited, purchased, allotted through *kasho*, received as gift, new allotment by Government etc. if not registered in the main *Thram* within 360 days from the day of acquisition will be treated as Government land and the owner will not have any claim on it."

The Forest and Nature Conservation Act 1995

The Forest and Nature Conservation Act 1995 has also provided a section on grazing. Chapter VI of the Act has a provision on the establishment of protected areas that have implications on grazing in parks and protected areas. Section 21 (a) states "The Royal Government may declare any land in the country to be a National Park, Wildlife Sanctuary, Wildlife Reserve, Strict Nature Reserve, Protected Forest, Research Forest, Conservation Area, Cultural or Natural Heritage Site, Biosphere Reserve, Critical Watershed or other category of Protected Area for the preservation of national importance, protection of biological diversity, management of wildlife,

conservation of soil and water and related purposes. If any private registered land is taken under this section, compensation or alternative land rights shall be provided in accordance with section 9." Chapter VII Section 30 (a) states "The Ministry (Agriculture) may issue rules regulating grazing in Government Reserved Forests, subject to such conditions as may be prescribed." And Section 30 (b) states " Where the head of the department determines that the land located in Government reserved forests is suffering from soil erosion or other environmental degradation, he may, after consulting with the appropriate local authority, order that grazing on such land be stopped for specified time or be permitted only under specified conditions" and Section 30 (c) "Cattle trespassing in a Reserved Forest which has been lawfully closed to grazing shall be deemed to be doing damage to plantations, regeneration and catchment areas and may be seized and a suitable fine as prescribed by the Ministry will be levied." Further Section 21 (c) states "The Ministry may issue rules to regulate or prohibit any activity within a Protected Area."

In accordance with the authority vested by the Act, the Ministry of Agriculture has framed rules on the implementation of the provisions (the Forest and Nature Conservation Rules of 2000 Vol. I). And rules relating to grazing states as under Section 62 (2) "grazing permits within the Protected Areas may be issued only for traditional grazers, who must, comply with all regulations under Chapter VIII of this Rule". Chapter VIII of the Rule states as " These Rules observe the following under the purview of section 30(a) of the Act.

Grazing in Government Reserved Forest
Cattle grazing in the government-reserved forest may be allowed as long as the following regulations are complied:

a) The department as per section 30(a) of the Act can stop the grazing in specified location for a specified period;
b) Grazing is restricted in an area which is fenced for natural regeneration or in a plantation area with or

without fencing in a given period or till the seedlings are well established;

c) The Department, if required under this chapter, shall issue orders to effect the grazing in the forest on rotational basis at any time as per the plans prescribed under chapter II of these Rules; and

d) Cattle trespassing in the Government Reserved Forest shall be treated as per Section 30(c) of the Act. However, this chapter shall not affect the existing path *tsalam* and *chulam*, traditionally used during the migrating season provided such paths are within the fencing established by the government.

The department may impose ban on grazing in a registered *tsamdrog* whether located within or outside government reserved forest for a specified period if there is a good reason to believe that such steps are required to safeguard the land from degeneration.

The Rules have prescribed penalties for violation of rules including grazing as under:

Section 84 Sub-section 6 (g) states "for grazing livestock within a Core Zone, except by traditional grazers with proper permission under Chapter VII (and such other provisions that may apply), a penalty of Nu 500."

Section 84. Sub-section 8 (f) states "for grazing in the restricted areas, a fine of not more than Nu 500 or compensation equivalent to Nu 50 per livestock head."

Technical Regulations

As per the authority conferred by the Forest and Nature Conservation Act 1995, technical regulations on the use of natural resources including pastures have been framed as under.

Activity	Core Zone	Multiple-Use Zone (Within Park Boundary)	Buffer Zone (Outside Park Boundary)
Construction (Including Roads, Fences, Any Physical Structures)	No	With Permit	Yes
Industry	No	Cottage	As Per EIA Report
Settlement or Cultivation	No	Yes, But Only For Residents	Yes
Commercial Logging	No	No	Based on Approved Management Plan and EIA
Non-commercial Logging	No	Yes, For Use by the Residents	Yes
Grazing	No, Except for Traditional Users With Permission From the Park	Yes, With Permit	Yes
Migration of Cattle	Yes for Passage	Yes	Yes
Pasture Improvement	No	Yes	Yes
Collection of Dry Firewood	No	Yes, For Use by the Residents	Yes
Collection of Green Firewood	No	Yes, For Use by the Residents With a Permit	Yes with a Permit
Camping and Visitors	No	Yes With A Permit	Yes
Research	Yes	Yes	Yes
Taking of Wildlife	No	Yes With A Permit	Yes with a Permit
Extraction of Soil, Sand, Stones	No	Yes Within 2 Km Radius of Domestic User's Residence	Yes, Within 2 Km Radius of Domestic User's Residence
Extraction of Non-Timber Products	No	Yes, For Domestic Use/Consump-tion	Yes, For Domestic Use/Consump-tion

Core Zone shall mean fully protected zone within a Protected Area, designated in accordance with Technical Regulations in which human related activities are not permitted, except for regulated research and monitoring programs.

Protected Area shall mean an area, which has been declared to be a national park, conservation area, wildlife reserve, nature reserve, strict nature reserve, research forest, critical watershed or other protected areas in accordance with the Act and Rules.

For example, the Jigme Dorji National Park (JDNP) has used the technical regulations approved by the government to protect the core zone of takin habitat. In Tsharijathang, the park management and the local yak herders have agreed to demarcate the takin grazing area from that of the yaks. While the Thrimzhung Chhenmo and the Land Act ensure that the rules of the law are respected, and that individuals' rights over property are protected, the Forest and Nature Conservation Act 1995 focuses to maintain the ecological integrity of the country. Therefore, the two Acts differ both in focus and spirit.

Grazing/pasture Management Policy for National Parks and Protected Areas

Since grazing involves use of a renewable natural resource, it is imperative to have a good knowledge of the processes involved in maintaining the eco-system productivity of this renewable natural resource. Many studies have been carried out in other countries on the eco-system management and ecological stability, and limited studies carried out in Bhutan. It is important to have a clear understanding of the impact of various human interventions, and the expected response of the eco-system to such interventions. Policy decision on the level and intensity of the use of the pastures should therefore be based on the scientific knowledge on the ecological processes – its ability to recover or its resilience, cost of restoration and enhancement, etc.

A living eco-system is a dynamic system that can take certain amount of stress. Therefore, pastures in the national parks and protected areas should not close up the entire area for grazing. The level and extent should, therefore, be based on the resilience of the particular area. The guidelines of the management plan may be a useful source of direction and scope.

The social structure and the patron-client relationship are important elements to decide the use of and access to pastures in the communities. Regulations originating from the state on any resource use involving community are rarely effective. Grazing/pasture policy will need to look deeper into such social arrangements, and not rely entirely on logical sequence and productivity of a particular natural resource.

Pasture is a private property conferred on the right holders by the Thrimzhung Chhenmo, the Land Act, the Forest Act of 1978 and the Nature Conservation Act of 1995. Any intervention by the state in the rearrangement of the private property (pasture) will entail careful planning and active participation by the right holders. Such need was amply reflected by the response of the landowners when the issue of sharecropping was discussed in the National Assembly. Therefore, it becomes imperative to address the tenure aspects, and involve the pasture/grazing right holders before taking any major policy decision, particularly if it involves a shift in property rights regime.

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CONDITION AND POTENTIAL FOR IMPROVEMENT OF HIGH ALTITUDE RANGELANDS

Pema Gyamtsho[*]

Introduction

This paper is an extract from the Ph.D. thesis of the author "Assessment of the Condition and Potential for Improvement of the High Altitude Rangelands of Bhutan". It deals with the factors influencing the degradation of rangelands in the high altitude areas of the northwest Bhutan, and proposes possible legal and technological measures to improve rangeland conditions.

Definition of Rangelands

Rangelands have been described as those areas of land, which by reason of physical limitations, low and erratic precipitation, rough topography, poor drainage or extreme temperatures, are unsuited for cultivation, and which are a source of forage for free ranging native and domestic animals as well as a source of wood products, water and wildlife (Stoddart et.al. 1975). In Bhutan, it is known as *ri* which literally means a range shed, when used in the context of a source of grazing, collection of firewood and non-edible products, medicinal or incense plants. Hence the term *rikha* means 'on the range' and *rikhaley* means 'from the range'. The term *tsamdrog* is nearly synonymous with rangelands, and it means grasslands.

Role of Rangelands

In addition to their roles as wildlife habitat, source of quality water, rich biodiversity and natural beauty, the high altitude areas of Bhutan's rangelands must continue to provide food, fibre, fuel, timber, water, and shelter for the local people, in addition to fulfilling increasing new demands for recreation

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and tourism. The ability of the rangelands to meet the traditional and new demands would much depend on the way it is managed for any one purpose as this will invariably influence the ability to meet other demands.

Criteria for Condition Assessment of Rangelands

According to American standards, prime rangeland is defined as the best rangeland because its soil, topography, vegetation, water, and related attributes make it better than other rangeland in its ability to produce forage for grazing animals without degradation of related values and environmental quality (USDA, 1978). Prime rangeland must have slopes less than 50%, produce annual DM yields of at least 750 kg per ha, have adequate water supply, and not contain high proportions of plants with toxic imbalance of minerals.

If the above criteria are strictly applied to the high altitude rangelands of Bhutan, than one would surely come to the conclusion that the rangelands are in poor condition as most of them would fall short of meeting the first two criteria. However, since the natural conditions as well as the purpose of rangelands and the methods of utilization are different from the standard use of rangelands in the West, criteria for judging must vary. Vegetation type, ground cover, fodder production and species diversity are most important parameters in the high altitude areas of Bhutan. Further, one must take into account that the criteria used by the herders and agronomist for assessing rangeland conditions do not always coverage with those used by conservationists, and therefore, the relative weightage given to an individual criterion will vary.

The following pictures clearly emerge from the preliminary assessment of the rangeland condition of Laya, Lunana and Lingzhi:

i) Most rangelands are located on steep slopes above 40%, and altitudes above 3500 m;

ii) The vegetation status is influenced by altitude, slope angle and direction, past and present management of grazing, fire and nutrients;
iii) The condition of rangeland deterioration varies considerably from very poor to good based on ground cover and biomass production; and
iv) The causes of rangeland deterioration are not easy to define, and vary from natural flash floods from glacial lakes to overgrazing.

Causes of Rangeland Deterioration

Natural Causes
Erosion includes all processes that result in the physical wearing down of the earth's surface. These processes are complex, consisting of natural (geological) and accelerated (man-induced) erosion. Natural erosion is characterized by different forms of mass wasting such as mass movement of fractured rocks, saprolite and other unconsolidated materials, rock failures, landslides, slumps, and riverbank cutting-including soil movement from slopes and gullies.

The rangelands of Lunana were severely damaged by past and recent flash floods from glacial lakes, particularly the winter grazing sites along the bottom of the valleys. In the Tarian valley which was subjected to flooding about 40 years ago (Gansser, 1983) by the rupture of the terminal moraine of one of the glacial lakes at the South-eastern base of the Tsendagang mountain, the present vegetation consist primarily of low lying shrubs of Hippophae and Myricaria species, which are of little use of grazing but provide adequate ground cover. The main Lunana valley from Thansa to Hedi was badly affected by the October 1994 flash flood, which not only washed away substantial area of land in its wake but also covered most of the flat areas by sand rendering them unsuitable for grazing. Gansser warned that these events must have happened frequently during the last 100 years, are still happening now, and will continue to happen in the near future.

The other cause of natural deterioration is from scree erosion due to the easily erodible rock types (shale). The high intensity of rainfall during the monsoon season is another major cause of erosion over which man has little direct control.

Grazing by Herbivores

Grazing of both wild and domestic animals exert an influence upon the productive rangeland systems by their defoliation of plants through eating and physical damage, by their digestive processes, and by their movements (Heady and Child, 1994).

The estimates of grazing pressure from yaks alone on the rangelands of Lingshi (Gopula and Jarila) and Laya (Lungo, Omtsa, Rodophu) at less than 2 ha per yak adult equivalent (YAE) per year with estimated standing biomass yields of less than 400 kg DM ha^{-1} are reasons enough to be alarmed. In addition, there is a high density of blue sheep and marmots found in these rangelands. There is no question that overgrazing by a combination of wild and domestic animals is a serious problem. The evidence of overstocking is also abundant from the dense network of vertical and horizontal treks seen in all these rangelands near villages such as Gopula and Zumeri in Lingshi, Lungothang and Omtsa in Laya and Pangtegang in Lunana. This probably led to substantial surface soil erosion. The alignment of the cattle tracks in grasslands have a major influence on the amount of soil erosion as a result of paths formed for running water when rainfall rates exceed infiltration rates.

An interesting preliminary finding from this assessment, which warrants further investigation, was the inverse relationship between severity of grazing and the number of species. While this may be partly due to the difference in timing of assessment, and the precision of the visual estimation, there is enough evidence to indicate that species richness or biodiversity is not improved by grazing exclusion as seen in the case of the lightly grazed rangelands of Lunana (Ganglakachu and Nyisharling). As Heady and Child (1994)

suggested, moderate intensities of grazing may be stimulatory and beneficial to the continued well-being of rangeland ecosystems.

While adequate information to enable quantification of the extent of competition between yak and blue sheep are not available as yet, there is little doubt that they have a high degree of overlap in their habitats and diet selection (Wangchuk, 1994). Two flocks of blue sheep between 150 and 200 in numbers continually move up and down the slope of Laya village, which is also continually grazed by yaks. Similarly, a large flock of blue sheep was seen in Jarila and Gopula, grazing on the same ranges.

The destructive impacts of marmot burrowing and browsing are particularly evident in the rangelands of Tsherijathang and Jarila as well as in many other rangelands not included in the survey. In Tsherijathang, entrances of marmots burrow (old and new) are encountered within a radius of 30 m in the stony meadows between 4000 and 4500 m and in Lungothang at every 40 metre's radius. These entrances are used by yaks to sharpen their horns and further expansion of the soil serve as resting pits for yaks. Eventually, they become large blotches of open scars on the alpine landscape and set off the soil erosion processes.

The above evidences clearly show that grazing animals influence the condition of the rangelands and that, in the severely affected areas, immediate steps need to be taken to limit further deterioration to eventual desertification of the rangelands through appropriate policies, research and development strategies for grazing control and re-vegetation.

Poor Nutrient Cycling

The analysis of soil samples from the rangelands show that the soils become increasingly acidic from east to west orientation, and vary from moderately acidic in Lunana and Laya to highly acidic in Lingshi (ph<5.5). Acidic soils in Bumthang have been considered as one of the limiting factors for the lack of response to pasture improvement treatments

through reseeding with legumes and fertilization. This raises serious questions to the possibility of restoring vegetation through improvement measures such as protection from grazing, re-seeding or manuring in the highly deteriorated rangelands in Lingshi.

Generally, the soils also indicate very low levels of available P(<6 ppm). This will be one of the major limiting factor for improvement of rangelands since N deficiency which is also observed in most of the areas is expected to be overcome once local legume respond to P supply. There are two reasons behind the very low levels of soil fertility. Firstly, there is no practice of manuring the pastures by herders. Instead, yak dungs are removed from the pasture for use as fuel in Lingshi and as manure in Laya and Lunana.

The study clearly identified the sources of inputs, the flow through the components and the avenues of loss of nutrients from the rangeland ecosystem. The removal of dung for manuring crops and for fuel, and removal of nutrients in animal products are major avenues of nutrient loss while the invasion by shrubs slows nutrients in herbaceous species. Currently the major sources of input into the soil nutrients pools appear to be from animal urine, fixation from atmosphere and mineral decomposition.

Only a small fraction of the nutrients used by crops are returned through crop residues like barley straw, and the nutrients removed in form of animal products and dung are completely lost from the system.

Secondly, unpalatable species of shrubs directly compete with the herbaceous plants for soil nutrients and block these nutrients from entering the active soil-plant-animal nutrient cycling path. Lastly, the exposed soils in heavily grazed rangelands are susceptible to loss of topsoil and therefore soil nutrients are poor particularly on steep slopes.

In Lunana the main cause of poor soil condition in the flat areas was due to flooding which left thick layers of sands. Such rangelands will take years to recover unless intervened with appropriate nutrient inputs. Manure from night camps and milking yards are either left on the ground or heaped into piles around the herder's camp and not used for any purpose. Consequently, the areas around the camps are very fertile and infested with weeds.

Shrub Encroachment

In the past, shrub invasion has been periodically eliminated through burning. Following the ban of fires in early 1970s, encroachment by shrubs particularly, unpalatable species of Rhododendron, Junipers and Berberis have increased. This has brought the following consequences.

i) Spatial reduction of grazing areas thereby increasing pressure on the accessible areas;
ii) Competition for light, nutrient and moisture with meadow species;
iii) Blocking of nutrient from the active natural cycling process in the range ecosystem;
iv) Probable reduction of habitats and food supply for rodents and other herbivores like musk deer; and,
v) Reduction of animal movements between grazing areas thereby increasing pressure on stock paths.

The encroachment by inedible shrubs and trees into semi-arid rangelands represent a plant community change that may be viewed either as a change for the better in terms of ground cover and soil erosion control, or as a change for the worse if considered for grazing due to reduction in grazing areas. Across the sites assessed in this study, moist and dry alpine shrubs (MAS and DAS) accounted for an average of 10 and 15% respectively, but with ranges between 0 and 50% for MAS and 0 and 30% for DAS. However, the north facing slopes which are mainly covered by MAS have little economic value since they are not suitable for grazing. The sunny faces which are generally south facing are the most critical ecological sites of the rangelands which are nearly always

subjected to continuous grazing by both wild and domestic animals. On these sites shrubs occupy an average of 18% of the ground in the 16 locations surveyed ranging from 0 to 60%.

Herding Systems
The type of land ownership and grazing rights dictates the present herding system. Grazing lands were registered in an ad hoc manner based on visual estimation of areas by non-technical personnel from the government in the early 1970s. It was not revised since then. No cadastral surveys were carried out on the areas allotted to individual and groups, and no legal provisions exist as to the use of the lands apart from declaring that grazing lands are not to be used for other purposes (Land Act, 1979). The Draft Pasture Policy (1985) aimed at addressing this problem is yet to be rectified and approved. As a result, most traditional herding systems are breaking down under increased pressure from new herders over whose sharing of the resources the traditional herders have little control, particularly when the new herders are offshoots from the traditional herder families.

Improvement of Rangelands

Guiding Principles and Justifications
The guiding principles of rangeland improvement should be the environmental compatibility and long-term sustainability. The evaluation of a programme of rangeland development must be based not only on profitability, but also on the effects of the proposed development on soil conservation and animal welfare. It must also be looked upon as a means of retaining a way of life for the herders rather than just the profits that keep them farming. The conservation of assets, particularly the primary asset, soil, is also important. The improvement of highly eroded lands and poor soils may imply substantial financial investment and will not be profitable to herders. However, substantial technological and financial support for such improvement could be justified in terms of the conservation of land, the prolongation of the effective life of

the water heads and catchment areas which are highly vulnerable to erosion and silting.

Several surveys and studies have been conducted on the possibility for improvement of the rangelands (Roder, 1983 & 1990; Gibson, 1991; Gyamtsho, 1996). Based on the findings of these studies, several measures can be taken to improve the rangelands

Land Ownership and Property Rights

Any change in yak rearing system, however, must begin with a systematic survey to determine exact areas of grazing lands, and a review of land tenureship arrangements. Ultimately it should aim to allocate winter grazing lands on permanent ownership basis to herders in order to facilitate fodder conservation systems, and allocate summer pastures on long-term leases to individuals or a group of herders based on the present status of the use of each site. Once the information on area and ownership is established, institutions must be built into the community organisation to oversee the proper use and maintenance of grazing lands. The formation of User Group Associations (UGA) for different rangelands to oversee the timing and duration of grazing, management and maintenance of the pastures, control of stock numbers etc. must be given priority. The park management could monitor the functions of these UGAs with administrative and legal support from the *dzongkhag* administrations. This is not a new concept but an improvement on the systems which exists in a loose form in the use of some pastures in Laya, e.g Omtsa and Tsherijathang.

There is enough evidence from this study to show that policies have a lasting effect on the condition of the rangelands. The uncertainty concerning land ownership of grazing lands needs to be resolved in favour of vesting more responsibility with herders. This will be the prerequisite for any success in the improvement measures discussed in the pasture policy. The leasing systems need to be revised and regularised, and complimented by an appropriate in-built grazing right distribution and utilisation system. Selected

winter pastures could be allocated to an individual herder or a group of herders on private ownership basis if the benefits from improvement measures are to be reaped. Such a delineation of property rights would have a long lasting impact on the future sustainable use of the rangelands for farming as well as the conservation of biodiversity.

Grazing Management

The introduction of appropriate measures to control grazing within the natural limits of the rangelands will be crucial in halting the degradation of rangelands. Protection from grazing is the cheapest means of range recovery and reclamation. It was seen from the experiment that protection from grazing alone has the potential to increase herbage biomass and ground cover. Similar results were obtained from alpine pastures in Pakistan where Mohammad (1986) reported that one-year closure resulted in four times forage yields and reseeding increased the density of grasses by 15%, and increased plants cover by about 30%. Rafi (1965) recommended a minimum period of five years of complete protection before initiating proper grazing management practices.

Although conventional grazing management systems as practised in the west will not be applicable, several options appear promising for improving rangelands through the adoption of better grazing management practices. The formation of UGA for each of the major summer and winter grazing areas should be the triggering point for improvement. This UGA should be entrusted with overseeing the number of animals per herd, the movement of animals in and out of pastures at prescribed times, participation in range improvement measures and the collection of grazing fees on an annual basis. The management of the Jigme Dorji National Park should have the capacity to advise and monitor the functions of the UGAs. The allocation of grazing rights to individuals must be based on stocking capacity of each site. Stocking capacity is determined usually in terms of Adult Units (AU) per area. However, the difficulty will lie initially in adopting suitable criteria for defining AU.

Improvement of fodder conservation through establishment of high yielding hay meadows in winter pastures will greatly facilitate grazing management and reduce pressure on winter grazing grounds. When such a scheme is successfully implemented in place, the productive units of animals can be fed with hay in feedlots near the camps, and would reduce pressure on the limited area of exposed meadows following snowfall.

Manipulation of yak herd composition offers another opportunity to indirectly improve grazing management. However, this is a long-term approach, and it has to be preceded by measures to reduce mortality in young replacement stock over winter and spring to build up herders' confidence and meet their need for security.

Species diversification of livestock has the potential to reduce pressure off the rangelands from high levels of competition between domestic and wild ungulates. Rearing of cattle and horses around the villages in Laya and Lingshi, and sheep in Lunana will reduce the dependence on yaks, and thereby, the level of competition that exist between yaks and blue sheep which share the same habitats.

Nutrient Management

The experiment clearly showed that nutrient deficiency is a major factor limiting growth and productivity during the short growing period between May and September when temperature and soil moisture conditions are favourable. The application of mineral N and P fertilisers resulted in highly significant increase in yields. However, high rates above 48 kg $P_20_5ha^{-1}$ per year does not appear to be beneficial since the plants may not have been able to utilise all the mineral P during the short growing season. The biggest benefit, however appear to be the increase in legume content of the sward following protection and P application.

It is apparent that improvement of the soil nutrient cycling would result in the minimum increase in biomass production and range condition improvement. Therefore, methods of

improving nutrient inputs into the soil such as reduction of dung removal through better crop husbandry practices and alternative sources of fuel needs to be given priority. Better distribution of dung on the pastures from stock camps needs to be advocated.

While the high cost and logistics of transportation of mineral fertilisers to such remote areas rule out any large scale pasture improvement using fertilisers, there is merit in selective and discriminate use of chemical P fertilisers for initially favouring legumes for improving intensively managed protected hay meadows. There is no reason why individual households cannot transport a horse-load of superphosphate for this purpose. Once P levels are replenished, maintenance supply can be achieved from manuring with yak dungs. Such a system is successfully practised in the management of pastures in the Swiss Alps with similar growing conditions (J Noesberger, personal communications, May, 1996). The extent of leaching is not known but expected to be high in summer and hence non-water soluble from a P fertiliser may be of benefit.

In highly nutrient deficient and acidic soils, as found in Lingshi rangelands, it may be worth investigating the possibility of lime application besides fertiliser P if any meaningful recovery of vegetation is to be achieved. If found beneficial, the argument against the cost and logistics of such a practice may not be as valid as it sounds if the plots allotted for improvement per household are less than half a hectare. However, the long-term effects of liming of soil fertility needs to be borne in mind as it has a history of impoverishing the soils in the long run (Robson and Pitman, 1983). Once satisfactory levels of ground cover by desirable species are achieved, maintenance can be achieved through intensive manuring with regular checks on fertility status. On high altitude summer pastures, better distribution of dungs at the end of each grazing season would greatly enhance pasture growth in the following season. This could be achieved

through herder education, and implemented under the supervision of the UGAs.

The sand covered winter pastures of Lunana present special problems of soil structure and fertility building. A strategy to hasten the process of reclamation would be to allot small plots from the affected areas to individual herders for establishing hay meadows. This can be achieved by camping of yaks overnight on the plots for a period of time to accumulate dung and urine which can be reinforced with mulch and composts from forests and shrubs in the surrounding slopes to build up soil organic matter and nutrient content. Such plots can be sown with high yield seeds introduced and local species of legumes and grasses, and intensively managed as hay plots.

Regular monitoring of the status of nutrients in the soil will be required in managing the soil fertility. Chemical soil analysis- soil testing- is a comparatively rapid and inexpensive procedure for obtaining information on nutrient availability in soils as a basis for recommending fertiliser application. Fertiliser trails in different locations would be required to test the information gained from the soil analysis.

Introduction of Exotic Legumes

The results show little value in introducing exotic high producing species like white clover and lotus. Promising local legumes like gueldenstadtia and vetch are productive with no apparent difference in herbage quality. While the results did not reflect the aggressive colonization by white clover in 1995 due to early spring defoliation and root damage in some plots by blue sheep, there is enough evidence to suggest that indiscriminate use of this species may result in competing out native species. More long-term research will scale adoption for high altitude pasture improvement. From observations on the demonstration plot which was established through soil cultivation, red clover was found to be very high yielding and may be a useful plant for establishing hay meadows in mixture with local grasses. Since it does not spread like white clover, it may be used safely in the winter pastures. In the

summer pastures, it may be best to work with local legumes only.

Shrub Control

The control of shrubs in areas where soil erosion is not a threat needs to be taken up not only to open space for grazing but also to improve the nutrient cycling process and create habitat for plants and animals. Shrubs can be controlled either through prescribed and supervised burning. This is a standard rangeland management tool adopted in the United States and Australia. Gibson (1991) indicated that there is little harm in burning alpine brush areas on slopes less than 25% in the high altitude areas of Bhutan.

Evidences from the United States show that prescribed burning results in effective decrease in competition from shrubs, shrub cover, stem densities of shrubs, improved access to forage and better grazing distribution by livestock rather than remaining along the trails (Cook et al. 1994). However, depending on the shrub species, unless appropriate post-burn measures are taken, abundant shrub regrowth occurs and livestock distribution problems emerge as animals show preference for grazing in burned areas.

Success of burning depends on willingness of resource managers to understand and appreciate the importance of fire in maintaining a desired ecosystem. Pre-burn vegetative composition, soil moisture and fertility, fire intensity, precipitation and grazing following burning, and other factors are likely to contribute to variations in vegetative response among studies (Wright, 1985). Burning generally increases the production of herbaceous species. In one study in the United States, the total herbaceous current year's production averaged 2.2 times higher on the burns compared to controls until third year (Cook et al. 1994). Shrub survival varied among species and the type of burns. However, shrub cover declined between 35 to 50% of pre-burn levels. Burning significantly increased crude protein of herbs in all years and sites sampled, the protein content on the burns averaging 60% higher than on control.

When considering prescribed burning as a means to improve habitats for ungulates the short and long-term effects of fire on dietary and habitat needs of ungulates should be considered. In the United States repeated burning at frequent intervals (e.g. 5 years) is recommended to maintain high forage quality, and herbaceous productivity in general are unknown.

In the fragile terrain of the study area, where steep topography necessitates the retention of vegetation cover, introduction of goats would not be a sound measure for shrub control. The Royal Government of Bhutan has a rigid policy restricting the rearing of goats in free ranching conditions and this should be observed. Blue sheep were not seen browsing on shrubs. They preferentially graze on meadows. However, more studies need to be done on the woody diet habits of both domestic animals and wild herbivores in the high altitude rangelands. Mechanical clearing through slashing may not be practically and economically viable due to high labour demands. Hence burning offers the only alternative for controlling scrub vegetation. However, the introduction of prescribed burning systems should be preceded by thorough survey on the suitability of local topography, climate, soil and vegetation for such treatments.

Reseeding

The need to reseed is apparent in the heavily overgrazed pastures around Lingshi and the flood-washed valley floors of Lunana. Reseeding should, however, be carried out by local species as far as possible and discriminate use of exotic legumes and grasses except in the hay meadows where higher yielding exotic species can be used less discriminatorily. Appropriate mixture of grasses, legumes and herbs should be used in the seed mixture for such purpose. It is possible that mixtures of species with different root characteristics (distribution or function) could be used to exploit the soil volume more efficiently than monoculture of the component (Cornish, 1987). This could be achieved by exploiting different

depths of the soil profile, or with roots intermingling in the same volume but exploiting different resources, mixtures of grasses and symbiotic legumes being the obvious example.

There are several local grass species which could be used for reseeding purpose to increase herbage production. The most promising are *Eymus, Bromus, Festuca* and *Calmagrostis* species. Species for forbs like *Bistorta* and *Cyananthus* may also have a place since they are valued highly as forage and seed production should be relatively easy. In Pakistan *dlymus Juncus*, *Festuca spp., Lolium pereme, Poa sinaica, Phleum alpanlcum, Medicago falcate, T. pratense, Artemesia marita and Indigofera gerardiana* are recommended for reseeding alpine rangeland (Mohamed, 1989). To facilitate the supply of seeds, a seed production scheme should be initiated whereby seeds collected by local people could be purchased by the government along the same terms as practised by the National Fodder Seed Production Centre in Bumthang.

Conclusion

The high altitude rangelands of Bhutan have sustained generations of yak herders, providing them forage for their herds and income from the collection of medicinal and incense plants. More recently, they have become important areas for recreation with the advent of tourism. Their importance in maintaining the integrity of Bhutan's river systems are getting increasing recognition. In order to ensure that the goods and services by these rangelands are sustained and further enhanced, urgent policy, legal and technical interventions are required.

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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

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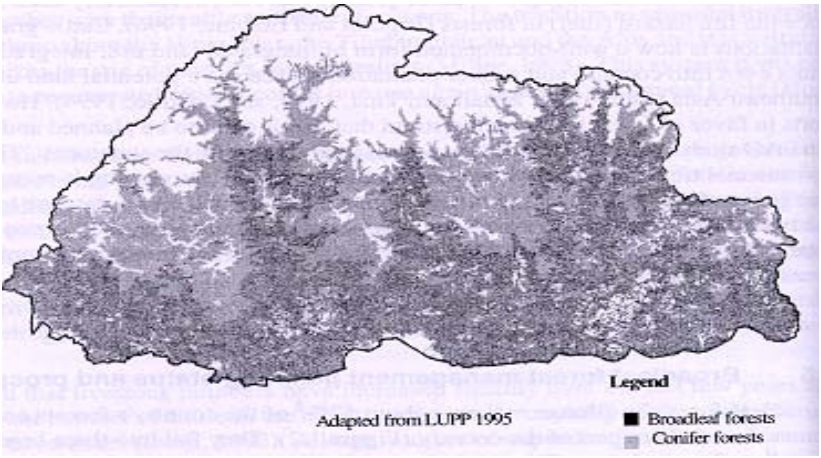
vicinity of broadleaf forest is directly linked to how well broadleaf forest resources are conserved and managed.

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

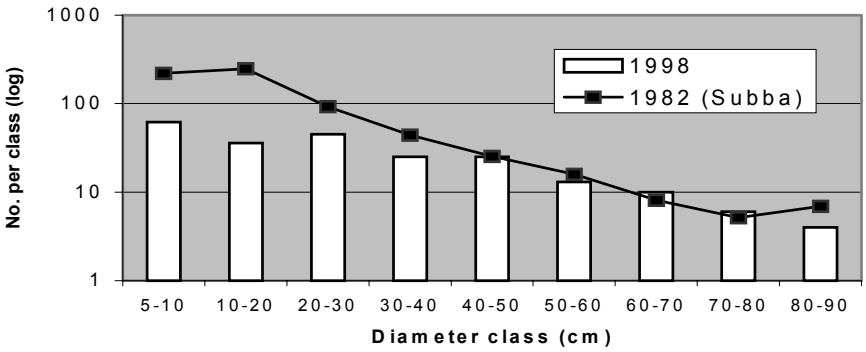
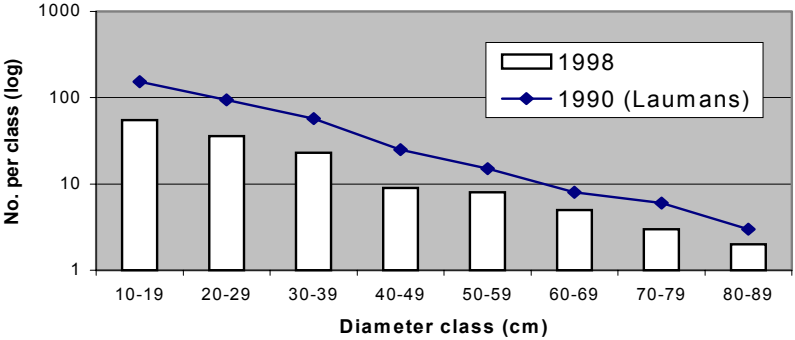


Figure 4: Number of trees per hectare in Dungna Road forest in 1990 (Laumans) and 1998

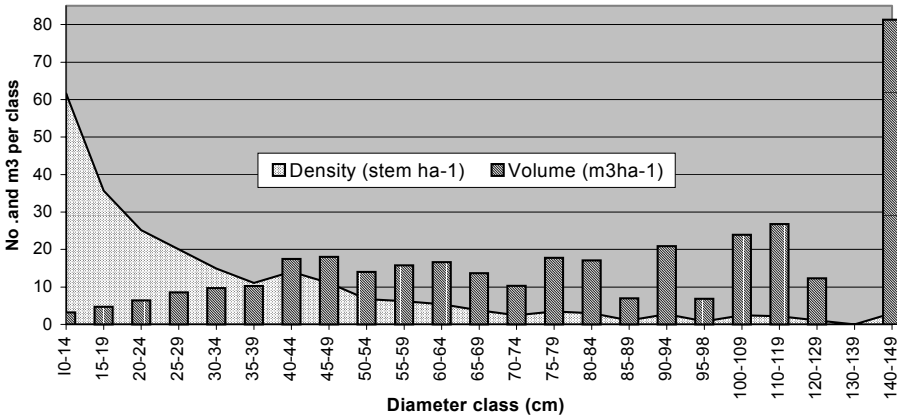


The stand density and growing stock of forest stands vary depending on sites ranging from 125 stems ha^{-1} to 238 stems ha^{-1} with corresponding gross volumes ranging from 163.64m^3 ha^{-1} to 362.58m^3 ha^{-1}. Subba (1982), on writing the first management plan for Gedu forest estimated the stand 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.

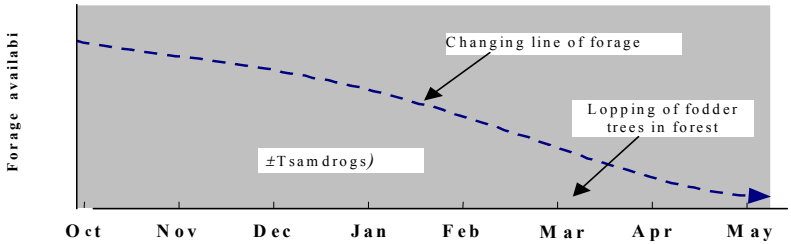
Tsamdrog and grazing practices around Gedu

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].

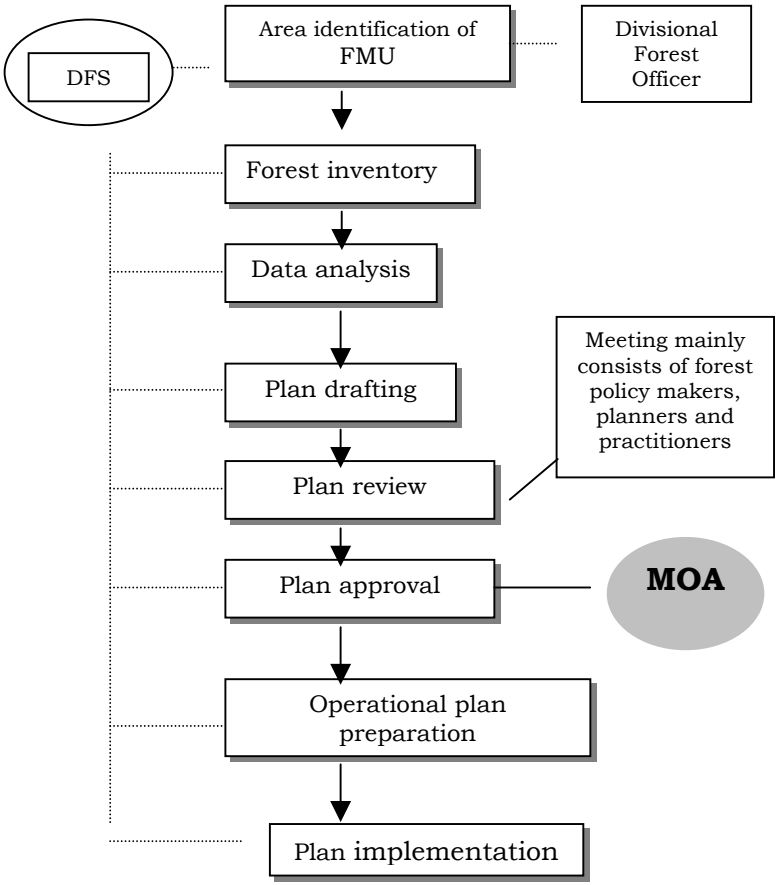
Forest inventory and forest management planning are carried out centrally in cooperation with the forestry staff in the

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.

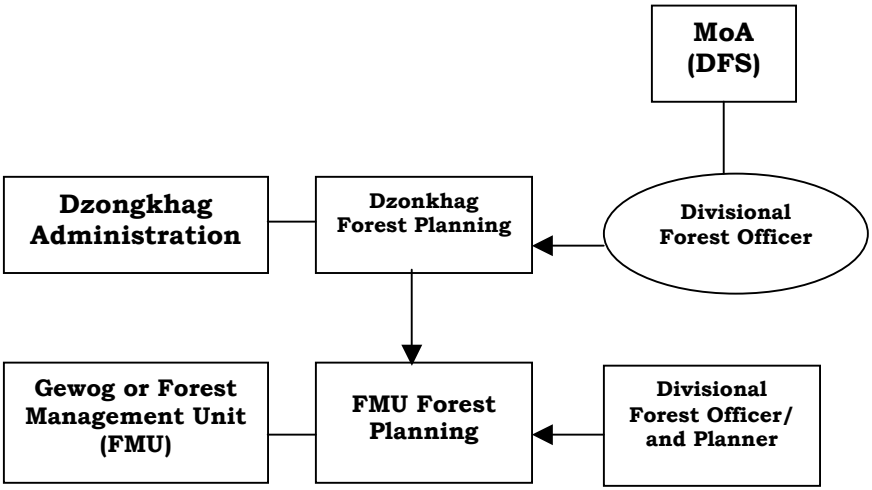
Browsing tree seedlings and damages to larger trees are becoming evident in the areas where there are large herds of cattle. It is unlikely that cattle rearing will disappear from broadleaf forests in the future. To ensure that grazing coexists with wood production, banning or regulating grazing periodically 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).