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Geomatics based study of Yak rearing tracks of north-eastern Himalayan grasslands

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Abstract

Grassland utilization is an important component of the high hill livestock farming. Yak is the main animal for the highlanders of north-east India for their food and livelihood security. The hill people raise the yak under transhumance system of livestock farming. Therefore, the temperate and alpine pastures are the major feed resource for the yak. Sustainable production of yak is possible only when the natural pastures are in good condition. In this study, an attempt was made to evaluate the alpine and temperate pastures of yak rearing tracks of north-east Himalayan states of India *i.e.*, Sikkim and Arunachal Pradesh. High resolution GPS and remotely sensed satellite imagery were used for the identification and characterization of temperate/ alpine pasture lands.

Key words: Alpine Pasture, Arunachal Pradesh, GPS, Grasslands, Remote sensing, Temperate pasture, Sikkim, Yak,

Introduction

In the difficult terrain of north-eastern Himalayas, yak (*Poephagus grunniens*) is a multipurpose animal that can survive at high altitude under low oxygen climate. It is inherently associated with the culture, religion and social life of the pastoral nomads of highlands of this region for their food and livelihood security due to rare existence of other natural resources. In north-eastern Himalayas, the yak is distributed in the high reaches of Arunachal Pradesh and Sikkim, where two main pastoral communities; *Monpa* and *Bhutia* are rearing this animal. These communities rear the yaks under transhumance system of livestock farming. In summer, yaks graze on highland pastures dominated by natural temperate and alpine grasses and small plants. During winter, the animal returns to areas nearby their respective villages at lower altitude. Therefore, the temperate and alpine pastures are the major feed resource for the yak. Sustainable production of the yak is possible only when the natural pastures are in good condition.

Materials and Methods

The assessment of alpine and temperate pastures was undertaken in the yak rearing tracks of north-east Himalayan region of India *i.e.* Arunachal Pradesh and Sikkim. Both, Sikkim and Arunachal Pradesh covers about 91,000 km^2 areas at altitude ranging from 300 m amsl to more than 7000 m amsl (Fig.1). About 1700 km^2 area is under snow cover. All the yak rearing pockets of the west Kameng and Tawang districts of Arunachal Pradesh and north Sikkim district were purposively selected for this study. During the field survey, representative samples of pasture grasses and tree fodder were collected from each yak rearing pockets. Two sites were selected at Lhagyala Gonpa (at about 2800 m amsl), Morshing and Merkmu (3000 m amsl), Mandala in West Kameng district of Arunachal Pradesh.

For the generation of base map of grasslands, unsupervised classification done using IRSP6L3#B2,3,4&5 of the year 2009 &10 supported with some QB scenes. This map was used for survey purpose. During the field survey (grasslands, soil, grazing animals, pastoral community, grazing system *etc.*) high resolution GPS (Garmin GPS Map 273) was used.

The chemical composition of the composite grass and tree fodder samples were estimated following the standard procedures of AOAC (1990).

Results and Discussion

Natural pastures and their utilization strategies:

The area under temperate/ alpine pasturelands in north-east Himalayan region was estimated as 1396100 ha (15.36%), 162600ha (22.27%) in Sikkim and 1233500ha (14.75%) in Arunachal Pradesh. During the field survey, it was observed that above 25-30 major pasture land/ grazing grounds with an area of 2748 ha were used for yak grazing in west Kameng and Tawang districts whereas in Sikkim about 834 ha of pastureland was used for yak

Table 1: Average per cent proximate composition of pasture grasses (on DM basis)

Pasture location	OM (Organic matter)	CP (Crude protein)	CF (Crude fibre)	EE (Ether extract)	TA (Total ash)	NFE (Nitrogen free extract)
Mandala Phudung	91.42±1.25	9.58±2.54	18.50±1.22	2.86±1.21	8.58±0.63	60.48±0.85
Lubrang	97.6±0.79	5.35±3.10	20.85±2.00	1.12±1.10	2.36±1.09	70.32±1.02
Chander	92.91±1.96	12.06±5.33	23.57±3.24	2.92±0.57	7.09±1.96	54.35±0.48

grazing. The yak herdsmen practice two pasture utilization strategies *viz.*, winter pasture and summer pasture. Grazing in summer pasture is from May to September while in December to February winter pastures are utilized. The rest of the period is spent on transit from winter pasture to summer pasture. Similar findings were also reported by Chatterjee (2003). Grazing on winter pasture extends for about 138-150 days (May-October) and the summer pasture for about 190 days (November-April). The availability of the herbage, its growth stage and nutritive value largely influence the production performance of yaks, as the supply of supplementary feeding is limited. The lactating yaks tend to peak in yield in July and August, when grass is at its best in terms of quality and quantity. Before July, though the grass starts to turn green and grow, the amount of grass available for grazing is not enough. After August, the nutritive value declines as the grass seeds wilt, and the content of crude fiber of the grass is high. The natural grasslands are degrading due to overgrazing and growth of unwanted plants and weeds like *Rumex acetosa*.

Existing pasture quality

Pasture grasses: The yaks receive their nutritional supply through grazing on alpine pastures and other herbages of high altitudes. Some of the natural edible grass species found in the yak rearing tracks of NE-India are *Kyllilnga monocephala*, *Poa annua*, *Fimbristylis squarrosa*, *Erogrotis leioptera*, *Alopecurus* spp., *Pogonatherum crinitum*, *Eriochloa* spp. *etc.* The proximate composition of the pooled pasture grasses of some of the pastures is given (Table 1).

Basu *et al.* (2005) reported similar values for the average crude protein; ether extract and crude fiber contents of 11.9, 1.65 and 22.89%, respectively for the composite pasture herbages of Sela- pass (4242m amsl).

Tree fodder: Due to lack of enough arable land in the yak rearing hilly tracts, cultivation of fodder crops is not a common practice. Tree fodders occupy a major portion of the green roughages fed to the Yaks, primarily during the scarcity period when availability of other green fodders becomes low. In Arunachal Pradesh and Sikkim, the forests are endowed with various species of tree fodders.

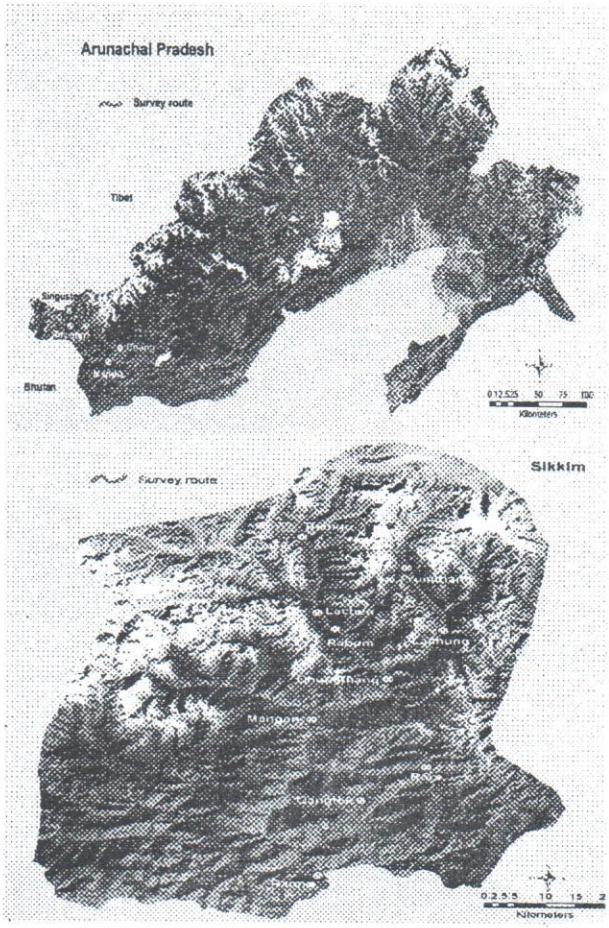

Fig. 1

The average crude protein (CP) content varied from 6.9±0.2 to 18.4±0.6 % (on DM basis) with the highest amount found to be in *Quercus walliasehiana* in Arunachal Pradesh. But in Sikkim, it ranged from 19.43±2.04 to 6.81±1.02 with the highest amount found to be in *Reevesia pubescens*. The average EE (ether extract) and TA (total ash), NFE (nitrogen free extract) and organic matter ranged from 0.7±0.04 to 5.0±0.3; 4.5±0.08 to 11.0±0.06; 70.7±1.4 to 85.5±2.0; 89.1±2.0 to 95.5±2.1 respectively. In Sikkim's tree fodder, these ranged from 1.02±0.21 to 3.28±0.07; 5.00±0.56 to 14.96±1.57; 18.72±2.01 to 63.42±6.22; 83.4±9.65 to 95.0±10.89 respectively. Similar findings were reported by Basu and Chatterjee (2002), Kumar and Sharma (2003) and Buragohain *et al.* (2006).

Pasture regeneration and assessing pasture production potential

Temperate grass (*Dactylis glomerata*) and legume (*Trifolium repens*) were successfully transplanted in beds for testing their suitability and biomass production potential at the selected field sites in Arunachal Pradesh and north-Sikkim. The results showed that the growth of the *D. glomerata* at high altitude of 3650 m amsl is slow. It was also recorded that 30% of the transplanted sapling died in Yhathang. Beside the specific trial of grass, the total above ground fresh biomass was recorded 1.733 kg/m^2 (173.3 q/ha) for the field site Lhagyala Gonpa. The above ground biomass yield for the present study was much higher than the 50.07 q/ha total herbage production of Sela-pass grassland (4242 m amsl) as reported by Basu *et al.*, (2005). The reasons for this variation in production are the different soil and climatic conditions.

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