

## BIODIVERSITY CONSERVATION ISSUES IN SIKKIM – II. HIGH ALTITUDE MULTI-PURPOSE ANIMAL SPECIES, THE YAK (*BOS MUTUS GRUNNIENS*)

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The Eastern Himalaya of India, revealing a great deal of diversity in flora and fauna, constitutes one of the richest regions on earth. High rainfall along with humid cold climate and other influencing factors such as altitude, manifest tremendous differentiation of ecosystems and provide refuge to a variety of unique life forms. On the western end of the Indian side of the Eastern Himalaya lies Sikkim, one of the smallest states of India. With a total area of 7096 km<sup>2</sup>, of which 2656 km<sup>2</sup> (36.3%) is under forest (Anonymous, 1994), Sikkim is located between North 27° 03' 47" to 28° 07' 34" latitude and East 88° 03' 40" to 88° 57' 19" longitude. With almost no flat land, this entirely mountainous state has altitude range of 300 to 8598 m above mean sea level (amsl). Mt. Khangchendzonga (8598 m), on the north-east border of the state, is India's highest and world's third highest peak. Administratively, the state is divided into four districts and the majority populace comprise four ethnic groups of *Bhutia(s)*, *Lepcha(s)*, Nepalese and *Limbu(s)*. Spread across a mere 114km north to south and 64km east to west, the state has an extraordinary range of climate, from hot subtropics to freezing cold alpine zone and beyond the Greater Himalaya, the Tibetan plateau. The relatively well-protected forest vegetation varies from the tropical pine forests, tropical broad-leaved forests, subtropical forests, temperate broad-leaved and coniferous forests to sub-alpine scrubs, alpine meadows and swamps-generally related to the high mountain flora of the North Temperate Zone. Some of the unique and endangered animals like Snow Leopard (*Uncia uncia*), Clouded Leopard (*Neofelis nebulosa*), Red Panda (*Ailurus fulgens*), Musk Deer (*Moschus moschiferus*), Great Tibetan Sheep (*Ovis ammon hodgsonii*), Tibetan Antelope or Chiru (*Pantholops hodgsonii*), Tibetan Fox (*Vulpes ferrilatus*), Wild Ass (*Equus kiang polydon*), Shapi or Eastern Himalayn Tahr (*Hemitragus jemlahicus schaferi*) and Yak (*Bos mutus grunniens*) are among the 150 odd mammals that enrich the state. As many as 690 species of butterflies have been reported from Sikkim Himalaya (Haribal, 1992).

The state of Sikkim serves as the catchment for the mighty river Teesta, of which Rangeet and numerous other rivers and rivulets are the tributaries. All the diversity in life forms and landscape make Sikkim a paradise for people of different walks of life. Proximity to the Bay of Bengal ensures that Sikkim remains the most humid region in the entire Himalaya. The rainfall ranges from 2000 – 5000mm. Monsoon brings heavy rain throughout the state from June to September. Subtropical climate prevails in the lower hills and valleys and with rise in altitude, the climate gradually changes to temperate and the alpine zone faces extremely harsh climate of low temperature, constant wind with heavy snowfall and scant rain.

### Ecosystem types

Sikkim's geographical position (tri-junction of the eastern Himalaya, central Himalaya and Tibet), high annual rainfall of 2000-5000mm, wide variation in altitude (300 to 8586m amsl) and topography, high constant relative humidity (70% and above throughout the year) and favourable temperature regimes make it one of the richest "hotspot" of biological diversity in the country. The forest types showed similarity with increase in altitude and

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varied from the typical tropical sal forests to temperate that climaxed to the alpine/arctic type at the highest elevation beyond the timberline (>4500m).

Tropical forests (up to 900 m amsl): Mainly comprise tropical moist deciduous to semi-evergreen elements with sal (*Shorea robusta*) as the dominant species. They occur along Teesta and Rangeet valleys at low altitudes. Along the riverbanks *Saccharum* sp., *Oroxylum indicum* and *Meizotropis buteiformis* are the common species.

Subtropical forests (900 – 1500 m amsl): These mixed forests consist *Adina cordifolia*, *Alangium chinense*, *Bischofia javanica*, *Callicarpa arborea*, *Castanopsis indica*, *Eurya cerasifolia*, *Franxinus floribunda*, *Ficus* sp., *Gynocardia odorata*, *Helicia nilagirica*, *Macaranga denticulata*, *Magnolia hodgsonii*, *Michelia velutina*, *Mangifera sylvatica*, *Saurauia nepalensis*, *Schima wallichii*, *Vernonia volkammeriaefolia*. Predominant shrubs include *Buddleja asiatica*, *Clerodendrum*, *Embelia floribunda*, *Mussaenda roxburghii*, *Melastoma malabathricum* and *Vitex negundo* and others. Climbers like *Piper* sp., *Smilax* sp., *Tetrastigma* sp., *Cissus* sp., *Pothos* sp., *Rhaphidophora* sp. are common in this zone. Ferns and fern allies with many orchid species enrich the epiphytic flora of this region. *Mus* sp. and *Pandanus* sp. form dense patches in humid and exposed areas. Tree fern *Cyathea* sp. is randomly found in moist shady places. Exotic weeds like *Eupatorium* sp. and *Mikania micrantha* have naturalized in considerable parts of this region.

Temperate forests (1500 – 3500 m amsl): Such forests are differentiated as broad-leaved temperate forests and coniferous forests. Main constituents of broad-leaved forests in Sikkim are *Alnus nepalensis*, *Acer campbellii*, *Betula utilis*, *Engelhardtia spicata*, *Exbucklandia populnea*, *Ilex dipyrea*, *Juglans regia*, *Populus ciliata*, *Prunus nepalensis*, *Malus sikkimensis*, *Quercus lineata*, *Q. lanata*, *Q. lamellosa*, *Q. ixodon*, *Q. glauca*, *Lithocarpus pachyphyla*, *L. elegans* and others. Shrubby vegetation, which is dense and diverse predominantly comprise *Berberis umbellata*, *B. wallichiana*, *Elaeagnus umbellata*, *Gaultheria fragrantissima*, *Piptanthus nepalensis*, *Prinsepia utilis*, *Rhododendron* sp., *Hippophae salicifolia*, *Maddenia himalacia*, *Rubus macilentus*, *Viburnum erubescens*, *Zanthoxylum oxyphyllum* and so on.

Alpine vegetation (3500 – 5000 m amsl): The lower altitudes of this zone are dominated by trees of *Abies densa*, *Tsuga* sp., *Picea morindoides*, *Salix* sp., *Larix griffithii*, *Juniperus* sp., *Betula* sp., *Sorbus* sp. and shrubby species of *Rhododendron*(s), *Berberis*, *Aconitum* sp., *Cotoneaster* sp., *Diapensia* sp., *Euonymus* sp., *Panax* sp., *Gaultheria* sp., *Salix* sp., *Thalictrum* sp., *Anaphalis* sp., and *Vaccinium* sp. While the prostrating *Rhododendron anthopogon*, *R. lepidotum* and *R. setosum* form dense tussocks in the upper parts of the alpine zone. In the higher elevations of alpine zone, the vegetation is typical alpine moor land type where tree growth is completely arrested and the stunted bushy and cushionoid growth forms are a revelation.

In the existing land use of Sikkim, agriculture comprised some 11% of the total geographic area and 16% under alpine pasture, gaucharan and khasmal forests (Anonymous 1994). Wide ranging crops are cultivated on well-established terraces up to 2000 m elevations. Thereafter, there is a drastic reduction in the crops' variation. Irrespective of the agro-ecological zone, farm animals are an integral component (Table 1). Alpine pastures constitute the majority of the grazing or fodder gathering areas in the state (Table 2) where the rate of natural regeneration is slower than at the lower elevation forests. There is a quantitative difference in the quantum of animal fodder availability at the alpine zone where a small population of domesticated animals is in competition with the wild goats/goat-antelopes. The temporal changes in the livestock census revealed that highest number of animals were recorded in 1988 and declined in 1997 (Table 3) except the cattle population that increased among the large animals whereas yak numbers decreased in 1997. The fall in the strength of yaks led to a corresponding rise in the horses and ponies population. At the

higher elevations (3000 to 5000 m amsl) one comes across herds of grazing animals shepherded by one or a group of men. The biggest and most prominent among them are the yaks. There are two species, one the original, wild yak and the other, semi-domesticated yak locally known as *dzo* (vernacular, *Bhutia*) It may be necessary to mention about the ancestor or the descendents of the yak before proper perspectives of the animal are highlighted. It seems that a close relative of the yak is aurochs (Sub-genus *Paephus*) as per the Grzimek's Encyclopaedia - Mammals - IV. However, there are strong opinions of the Tibetans that the animal was inherited from wild species similar to yak but much bigger in size known as "Dong". The species had the same morphological and anatomical construction.

**Table 1.** Agro-ecosystems of Sikkim

Area	Climate (Altitude m)	Ecological adaptation	Crops
			Agriculture and horticulture
Lower hills	Tropical (300 – 900 m)	Wet and dry agriculture, sedentary farming, horticulture, livestock	Rice, maize millet, wheat, pulses, oilseeds, vegetables, potato, guava, lime, lemon, mango, ginger, mandarin
Mid hill	Sub-tropical (900 – 1800 m)	Wet and dry agriculture, livestock, horticulture and minor forest produce	Rice, maize, millet, wheat, pulses, oilseeds, vegetables, potato, mandarin, plum, peach, pear, large cardamom
High hills	Temperate (1800 – 2700 m)	Dry agriculture, <i>Bhutia</i> transhumance	Maize, barley, vegetables, potato, apple, plum, peach, peas
High hills	Sub-alpine (2700 – 4000 m) Alpine (4000 – 5000 m)	Yak herding, horticulture, pastoral economy (wool, cheese, butter, hides, and potato are commercial commodities)	Mainly used for rangelands, seed potato and vegetables
Very high hills	Alpine (> 5000 m)	Yaks, sheep, horses/ponies based transhumance. Crops grown include potato, cabbage, leafy mustard ( <i>Brassica juncea</i> var. <i>regusa</i> ), and radish.	Mainly used for rangelands, seed potato and vegetables

**Table 2.** Area under gorucharan, khasmal and alpine pastures in Sikkim (ha)

District	Alpine pasture	Khasmal	Gaucharan	Total	Percentage
North	90861	21607	1200	113668	73
South	3022	9778	1082	13892	9
West	6487	9189	1086	16762	11
East	6	10500	902	11408	7
Total	100386	51074	4270	115730	100

Source: Anonymous, 1994

**Table 3.** Temporal changes in the livestock population of Sikkim

Livestock	Livestock census		
	1977	1988	1997
Cattle	157546	183385	195327
Buffaloes	5438	3088	1970
Sheep	16104	10933	5023
Pigs	18596	31207	26975
Goats	88986	98210	82938

Horses and ponies	1186	1409	5436
Poultry	220927	256841	221406
Yaks	3995	5354	4781
Rabbits	-----	-----	357
Total	512778	590427	544213

Source: Anonymous, 1998

### Wild Yak

The wild yak is much bigger in size than the domesticated yak. It is massive, shaggy and well - built, structured with a big head and broad face. It has long coarse hairs at the flanks and busy tuft between its horns and a great mane upon its neck. The male measures at HRL up to c.325 cm and BH is over c.200cm. It weighs between 1200 - 1500kg (Grzimek's Encycloepadia 1000kg). Yaks have 14 pairs of ribs unlike other oxen that have 13 pairs. Their long legs have strong enlarged hoofs and pseudo-claws, which serve as support when the animal wanders on the high mountains. It has a bushy tail covered with long hair from the base and ends in tassel. The coat on head withers and back is rather short but densely mated. It inhabits the North Tibet desert steppes, which have no tree and bushes and are located around 5000 m amsl. In the month of June they shed their winter coats in large patches. Yaks have excellent sense of smell but average eyesight. The famous Russian explorer - Prezewalski, who found that the wild yaks generate strong grunting during mating but they are silent during rest of the period, gave the scientific name for yaks, the name *mutus*, the 'Mute'. The gestation period is of nine month and they give birth every second year because their young ones are dependent on them for one year. Distribution of wild yak extended from Glacier point to north-east Siberia and reached south to headwaters of the Hwang Ho and Yalung rivers in Chinese province of Tsonghai. But then, gradually its distribution was narrowed down by the well-armed, rapacious, highland nomads from Tibet or Mongolian pastoral tribes from the north. Today, Yaks are reported from North Tibet to the Karakoram in the west, inward along the south slopes of the Altyn Tahg over the Kuenlum Mountains to Manshan Mountains.

### Domesticated Yak

#### *Distribution and characteristics*

The Tibetans of western Kuenlum Mountains or East Pamir had probably first domesticated the yak in the first millennium B.C. The domesticated yak (*Bos mutus grunniens*) is much smaller than its wild ancestor. They are found in different colours viz., brown, yellow, grey in addition to the black and white colours. Their coat resembles the wild one, although in most cases they have even larger stomach mane. Their horn is weaker while even hornless are not too rare at a ratio 1:100. The domesticated yak is widely distributed than their origin form. It occurs in the west approximately as per Buchra, in the south to Bhutan and Nepal where the animals were kept in the pasture farming in the east and north up to the interior of the Mongolia and to the mountain chains south of Lake Baikal. Because of its frequent grunting sound compared to wild relative they are called 'Grunting Ox'. The oestrous is irregular and domestic yak female have calves every year. The food consumption of domestic yak is less than wild yak and is insensitive to cool temperature; hence it is the best-suited domestic animal in Asia at elevations above 2000m amsl.

The yaks in Sikkim were originally inherited from Bhutan, Chumbi valley and Nepal, which are presently found at Lachung valley in North, Nathu la, Kupup, Gnathang, Thegu in East and Yuksom-Dzongri in West Sikkim. The quality of yak bred from Bhutan heritage is better and has high adaptation significance. The yaks found in Lachen valley, Thanggu and Muguthang valley originated from Tibet. However, the ancestor of yaks of Bhutan and Nepal were also from Tibet but in the process of evolutionary history they have developed certain intrinsic characteristic for the existing environment. Every alternate year an offspring per

animal was born through inbreeding. Breeding season extended from July to September and the newborn weaned till they could graze (Avasthe, 1996).

### **Utility value**

Yaks of Sikkim are multi-purpose animals that can be used completely! It shared a special relationship and performed a pivotal role in the life of the residents. Observations revealed that yak is a semi-domesticated animal that requires minimum traditional maintenance. Yak produces milk (maximum 1 kg per animal), meat (200-300 kg per animal), fur, dung manure, hides and the like. The yak milk has high nutritious value with fat content of 7-8%. A kilogram (kg) of its milk yields 0.25kg "churpi" (butter) from a "dhongmo" by the traditional process that involves the entire family. Lesser amount of ghee (clarified butter) is generated. This "churpi" and its smoke-dried form are relished and are in great demand. Meat is also smoke-dried and preserved for winters. Yaks shed their hair once a year, which is converted into blankets, tent, bags, ropes, slings, mats and shoes, etc. The fine wool of the yak is used for under garments, which is very soft, gentle and of highly priced wool. The furs from other different parts of the animal are used as: belly fur for making tents, moulted fur for tents and ropes, tail is used as such during prayers, and decorative items are manufactured from its fur, which are dyed in natural dyes obtained from plants growing in the local surroundings. Horns and heads form house decorative pieces (trophies) and chopped horns are used for salt and medicine. Yak skin is tanned before use for purposes such as storage of ghee. The dung of yak can be used as fuel energy like the cattle dung in the plain areas. The yaks can also be cross-bred with cattle and the progeny has great market as it has proved to be very strong and good natured animal for ploughing, used in caravan, riding, etc. If properly trained, yak is found to be the most reliable mode of transport and travel. Prices of yak ranges from Rs. 4000-8000 per yak in the local sales. All the yak products are marketed at Gangtok. Residents of Muguthang (c. 4545m) conjectured that blood of yak was man's last food in times of heightened desire to survive!

### **Conservation concerns**

A famished yak could reportedly survive for almost 20 days in acute winter! The 1994-95, 1995-96 and 1997-98 winters experienced some of the heaviest snowfalls in recent times that resulted in the death of almost 20-25 per cent of the yak population of Sikkim. Grazing in open pastures was the normal feeding procedure among yaks, sheep and horses. Grazing in the open pastures was controlled; community meetings decided that for one-month animals would graze on one pasture and then would move to next in following months. Food shortage during winter was the major cause for natural deaths here (Bhutia, P., 1996 *Pers. Commun.*). Additionally, yaks were diagnosed to suffer from foot and mouth disease (FMD), tempanitis, common diarrhoea, respiratory problem, poisoning, ringworm and fungal infections. Internal parasites such as flukes, tapeworms' and external parasites like lice and ticks and faulty/mal-nutrition were common. Although the Department of Livestock and Veterinary Services, Government of Sikkim had put in appreciative efforts to reach FMD vaccinations and medicines to this difficult area with good efficacy, the actual problem management still needs more attention. The male offsprings of all cross-bred are said to be sterile. Inbreeding has caused a fall in the standards of the yaks in Sikkim that can be related to quality and quantity of their products. This is the major concern as the residents are heavily dependent on the yaks. It has great potential for milk and meat production, thus their decline will trigger erosion of this significant species the "undisputed ship of the high altitudes of Sikkim". Designing urgent *ex situ* and *in situ* conservation measures for *vis-à-vis* the future of this majestic animal of the high altitudes is the call of the hour. Measures such as Establishment of a High Altitude Yak Breeding and Improvement Centre, creation of winter fodder centres at identified locations and winter yak monitoring and rescue teams if embarked upon by the State Government will promote the cause of the yak in Sikkim.

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