Grazing behaviour, habitat use and diet selection of domestic animals on the high pastures in Basho valley, Baltistan

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Struggle for subsistence by mountain farmers in Baltistan, a region of the Northern Areas of Pakistan, is based on agriculture and animal husbandry. Summer farming is an important and integrated part of the production system, enabling the villagers to utilise the rich high altitude pastures, as seen in many marginal mountain areas worldwide. Increase of population, irrigation which give more cultivated land and external innovations are rapidly effecting changes throughout the region and rise question if the utilising of natural resource management is sustainable.

The introduction part describes grazing dynamics and seasonal pastoral migrations of the high pastures in Basho valley, Baltistan. Basho is found within a semi-arid and rugged mountainous landscape. Cultivation is limited, especially in the upper part of the valley which lies within a single-cropping zone about 3,200 m.a.s.l. This pastoral migration system has evolved in order to utilise seasonal changes in vegetation at different altitudinal gradients, and reflects generations of adaptation to the environment.

The main objective of this study is to single out the most critical factors influencing grazing behaviour of small and large ruminants on alpine summer ranges in Basho. Knowledge of the factors influencing the animals feeding strategies and an understanding of how the species interact will provide a basis for developing management strategies aimed to optimise a sustainable use of the natural rangeland.

Grazing dynamics and seasonal pastoral migrations

Basho farmers keep local breeds of sheep, goats, cattle, yak and crossbreeds between cattle and yak. The female off-springs from crossing cow and yak (dzomos) are healthy, fertile and good milking animals, while the male off-springs (dzos) are sterile and used mainly as draft animals for ploughing and threshing. Livestock products like meat, milk, milk products, fibre, hide and manure are essential for the agro-pastoral economy. Livestock are also held as insurance and sold if there are special needs for cash. Different forms of lease, exchange and co-ownership of livestock provide spread of risk and establish ties between households within Basho and also with people from other valleys.

The lower summer settlements (broqs) often have multipurpose function, mainly by increasing the area of land under cultivation and for grazing young and weak animals and sheep, goat and lactating cattle in the surrounding pastures. Elevation limits cultivation at the higher broqs. The higher broqs are therefore mainly production units making it possible to utilise the more remote higher pastures for milk and meat production.

The entire family, including women, children and elders and their grazing animals may move to the lower broqs. Village household leaders and village representatives decide when to move and the entire village or even several villages may move at the same day. The date of moving depends on grazing pressure close to the village, vegetation growth at the pastures and when weeding of cultivated fields in the village is finished. Livestock are not permitted to return until the village representatives decide.
In summer time, while most people stay at the broqs, the cultivated fields near the village still require labour input. All fields need to be weeded several times during the growing season and the crops should be watered every day. For this reason large households divide their labour force among two or more altitudinal levels. Smaller households are forced to change location frequently, visiting the village fields only during daytime or to delegate duties to relatives.

The time for moving to higher broqs depends on available vegetation in the areas, but also on the progress of important work like weeding at the lower broqs. At this time the women’s work on the lower broqs is finished and all women, girls and younger children, accompanied by older men move back to the village. Only men and boys move to the higher broqs. Normally one collective khlas is used by all herders and animals belonging to the village or the co-operating households. The men co-operate in all operations; herding the animals, processing the milk and cooking.

Alpine pasture is common grazing areas above pastures connected to the higher broqs. The alpine pastures are only available for a short period in late summer/early autumn. The quality of the vegetation is probably high but the access is difficult. This leads to less competition for forage resources. The uppermost alpine pastures are mainly grazed by free-ranging animals.

The autumn retreat towards the village is triggered by low temperatures reducing biomass production and forage quality. On their return they stop at the lower broqs where most of the family members stay until crops are harvested, normally in the end of August to mid September. The pastures which not have been grazed heavily during the stay at the higher broqs are now grazed again. There are common waiting areas at lower elevation where the animals are held in order to limit grazing of the pastures close to the villages and meadows and harvested fields which are grazed during the winter. If weather is cold and snow prevents grazing the animals have to be stall-feed with hay and crop residues.

Healthy and not milking large ruminants are free ranging at higher altitudes through the summer season but are pushed upwards by people and lactating animals moving to the broqs. The dzos are taken down to the broqs or villages for ploughing or other heavy work when needed. Lambs, kids, calves and sick animals are kept in the villages or near the khlas while the rest of the herds are taken to the grazing areas early in the morning and brought back to the broqs or villages in the afternoon. The main reason for keeping the herds in enclosures at the khlas or in the villages at night is, beside having them gathered for the evening and morning milking, to protect them from predation mainly by wolves. The animals are herded by a male member of the family. Normally relatives and/or neighbours join together in herding cooperation’s and the herding responsibility is circulated among the households in a fixed order. Small ruminants are herded strictly together and guarded all through the day and may perform vertical movements of up to 1000 m, whereas lactating and weak cattle are being directed to the grazing areas in the morning and gathered and returned for milking in the evening. In the meantime the animals remain unattended and allowed to spread out while grazing.

Keeping large numbers of animals has long traditions and herd size directly reflects the owner’s prestige and status in the society. A large part of the herds is unproductive, partly due to few females in the herds but may also indicate low fertility rates. Only half of the cows give birth each year. Probably due to fodder shortage during the winter and unfavourable age composition of the herds. This indicates that the peasants’ objectives keeping livestock are complex and not marked
Factors influencing grazing behaviour

Twelve small and ten large ruminants were selected for the behavioural study and recorded for 10 days. The animals were observed during the entire daily grazing period; from morning when they were released and until they returned in the evening. All the individuals were scanned every 45 min and their activity, behaviour and habitat use were recorded. Information on the diet selection was collected using the focal sampling technique. The plant groups; graminoids, herbs and leaves, selected were recorded every 10 seconds until 30 observations were gathered at each focal. In addition date, time of the day, climatic parameter, habitat type, altitude and behaviour were recorded both during scan and focal observations. Statistical analysis procedures were run using General Linear Models.

Small ruminants were herded together and the habitat use was directed by the herder. As a consequence goats and sheep used the same habitats for the same amount of time. Altogether 8 habitat types were used and the most dominant type, moraine slopes with Artemisia sp. was most frequently (45 %) grazed. Sheep spent less time walking (58 %) compared to goats (70 %). While not-walking sheep preferred standing compared to goats which more often lied down. Sheep also spent less time grazing (55 %) compared to goats (67 %). Grazing by sheep was heavily reduced when temperature raised during the middle of the day, whereas goats seemed less affected. If no shadow was available the sheep formed groups and tried to hide under each other to find protection against the sun. We conclude that diurnal and daily variation in activity and behaviour between sheep and goats was partly related to sheep’s sensibility to heat-stress.

Since a new herder was responsible for the animals each day, daily grazing time did vary, ranging from 38 % to 84 % by the goats and between 29 % and 79 % by the sheep. But the percentage of time spent grazing does not always correspond to forage intake. Some of the herders pushed the animals around and the main part of the animals forages were snatched while walking.

Little variation was found in activity and behaviour of large ruminants. Walking accounted for 83 % and 79% of the total activity of cows and dzomos respectively, whereas both species spent about 75 % of their time grazing. The large ruminants grazed heavily in the morning followed by a period of rumination in the middle of the day starting a new grazing period in early afternoon. Cows and dzomos grazed only in three habitat types and the most frequently grazed type was abandoned cultivated fields (cows; 62% and dzomos; 64%). Since all large ruminants were followed to the same pastures in the morning and left on their own during the day, no effect of herder on behaviour, habitat use or diet selection of cows and dzomos was found.

Since small ruminants normally use the pastures at higher altitudes, cattle will follow and graze pastures earlier grazed by small ruminants when they are moving to the higher broqs. This multi-species grazing system might increased animal output per unit area since small ruminants depend on high quality forage whereas large ruminants are better adapted utilising bulk forages of lower quality.

The sheep selected more graminoids (79 %) compared to the goats (62 %). No difference was found in goats and sheep selection of herbs, 25% and 21% respectively. In addition, goats selected 13 % leaves. This is in accordance with the classification of sheep as a selective grazer and goat as an opportunistic feeder. Habitat type influenced diet selection of both species. In addition, date
affected diet selection of graminoids and herbs in both species, but did not affect selection of leaves. This might be explained by the fact that the habitat type offering leaves was passed on the way to the pastures every day, while the frequency of visiting typical graminoid or herb dominated habitats varied daily dependent on herder. No differences between cows and dzomos were found in diet selection, their diet consisted of approximately 35% herbs and 65% graminoids and indicate potential interspecific competition for forages.

Totally 18 different species of herbs were recorded eaten by both small and large ruminants and as expected diet overlap on plant species level was low compared to on plant group (i.e. graminoids, herbs and leaves) level. While 63% of the large ruminants diet of herbs consisted of Thymus sp., small ruminants selected this species occasionally. Artemisia sp. composed 11% of the small ruminants diet, but was rarely selected by the large ruminants. Bistorta sp. was selected by all animals species, but was twice as common in the diet of small ruminants, probably because Bistorta sp. is more common at higher altitude where small ruminants grazed more frequently.

Maximum daily vertical movement was 1000 m for small ruminants and 300 m for large ruminants. Energy cost of moving up these slopes should be lower compared to the extra energy gain grazing at higher pastures.

The dynamic multi species grazing system is a complex and integrated part of the agro-pastoral system where the households try to optimise the total outcome taking into account pasture characteristics, as well as social and cultural factors.

Our findings that sheep, goats, cattle and dzomos all selected quite similar diets leads us to conclude that the available quantity of forage limits animal production and that the animals have to graze whatever plant material available. Low quantity of available forages results in that a typical opportunistic feeder (goats) select less herbs than expected and grazers (cattle) eat more herbs.

Based on chemical analysis of some of the most important forage plant species, it seems like the arid pastures are dominated by forages that are relatively high in quality during early vegetative stages but quickly declines in quality as the forages mature.

The seasonal grazing system with summer settlements and vertical movements, as well as the animals grazing behaviour seems to be well adapted strategies to utilise seasonal changes in vegetation at different altitudinal gradients thorough the changing season. But while forages of high quality are found at early vegetative stage, it seems like there is little biomass available of palatable forages in Basho.