A systems study of livestock production in the Northern Areas of Pakistan

I.A. Wright[1], A.J Duncan[1], J. Clemens[2], A. Rahman[1], O.Raja[1], I.J. Gordon[1], A.J. Hester[1], S.M. Raffique[3], Atiq-ur-Rehman[4], F. Ali[5] and A. Baig.[5]

[1]*Macaulay Institute, Craigiebuckler, Aberdeen AB15 8QH, United Kingdom*

[2]*Department of Geography, University of Bonn, Meckenheimer Allee 166, D-53115, Bonn Germany(Present address: South Asia Institute, Ruprecht Karls University, Im Neuenheimer Feld 330, D-69120 Heidelberg, Germany)*

[3]*Pakistan Porest Institute, University Town, Peshawar, 25120, NWFP, Pakistan*

[4]*Pakistan Agricultural Research Council, Plot No 20, G5/1, PO Box 1031, Islamabad, Pakistan*

[5]*Aga Khan Rural Support Programme, PO Box 506, Gilgit, Pakistan*

Introduction Over 1 million people live in the northern areas of Pakistan, with 60% of income from livestock and agriculture, rising to 84% for the poorest families (AKRSP, 2000). Precipitation is only about 150 to 400mm per annum in the valley bottoms, but water from glacial snowmelt is used to irrigate parcels of land in the villages in the valley bottoms. Each household typically has about 1 to 3 ha of irrigated land supporting one or two arable crops per year, depending on the altitude, with maize, wheat and lucerne being the major crops. Outside the irrigated areas there is sparse scrub vegetation dominated by *Artemisia* spp. At higher altitudes, precipitation (mainly snow) is greater and temperate pastures and sparse coniferous woodland occur.

The agro-pastoral system includes subsistence arable cropping, fruit production, livestock production and, to an increasing extent, cash-cropping. Most households keep livestock, typically 4-6 cows, 15-20 goats, 6-8 sheep and 1-2 donkeys. Livestock are kept within the village during winter where they are stall-fed on cereal by-products, lucerne hay and kitchen waste (Wardeh, 1989) and allowed to graze freely on fallow arable fields and on winter pastures close to the village. The livestock enterprise is reliant on arable production in that winter feeding is dominated by arable by-products, while arable production relies on inputs of farm-yard manure from the livestock system. During summer, animals move in stages to high altitude alpine pastures where they are tended by family members. In the autumn, livestock are returned to the villages to complete the annual transhumance cycle (Nuesser and Clemens, 1996).

The construction of the Karakoram Highway linking Pakistan to China has led to a dramatic improvement in the communications infra-structure within the Northern Areas (Kamal and Nasir, 1998) and has spawned a network of "jeep" roads throughout the Northern Areas. There is now increased movement of commodities and people in and out of the region. The pace of development has not been uniform across the Northern Areas. Areas close to the Karakoram Highway tend to be at a more advanced stage of development than more remote areas. The Agri-Karakoram Project, was established in 1998 for 3.5 years to identify the opportunities and constraints to improving productivity in the livestock sector. The project comprised three main components: a) to quantify seasonal resource use by livestock and the outputs derived from the livestock enterprise, b) to quantify botanical composition, pasture productivity and utilisation of high pastures and c) to assess the influence of wider socio-economic issues on livestock production. The project adopted a systems approach to allow the impact of change in individual components of the system on the whole system to be assessed.

Study design Two transects were selected for the study: the more developed Karakoram Highway (KKH), which provides good communications, and the Gilgit Ghizer valley (GGR), a more remote, less developed area. Along each transect, three villages were selected, one in each of the single, transitional and double cropping zones. A baseline survey was conducted in each village on numbers of households, livestock numbers and general cropping patterns. Approximately 20 representative households in each village were then selected and information on household decision making and the role of livestock within the household economy was collected by questionnaire and interview. Six or seven of these households in each village were selected for the study of livestock productivity and nutrition. In these households, the liveweight, body condition score, and levels of productivity (milk production, reproductive rate) were monitored for a full year. The amount and quality of fodder available and fed to livestock was also measured. For a selection of the pastures used by these villages, including dry temperate and high altitude alpine pastures, the botanical composition and production and utilisation rates were mearured.

Results and discussion The socio-economic survey identified reasons for keeping livestock as being for (in approximate order of importance) milk, dung, butter, meat, transport, income, fibre, draught, tradition. It is worth noting that although tradition was rarely mentioned by householders as a separate issue, it cut across most of the other outputs. There were some differences between the two transects, in that draught power from animals did not feature in the KKH transect, but was more important in the more remote GGH transect, especially in the remotest village. It is noteworthy that the second most important output was dung, which was used for fertilisation of cropped land. A feature of the livestock performance was the large seasonal fluctuation in live weight and body condition of animals. For example, mean body condition score of mature cattle in September was 3.2, which dropped over winter to 1.8 by March. During summer when the majority of

livestock are moved to mountain pastures the cattle recovered body condition. The households in the KKH transect had higher supplies of winter fodder available per unit of livestock metabolic weight (expressed the ratio of metabolisable energy (ME) available to the ME requirements for maintenance in winter) and this was reflected in higher levels of animal performance (Table 1), suggesting, as has been shown in previous studies that the provision of winter fodder is a severe constraint on improving livestock performance (Wardeh, 1989)

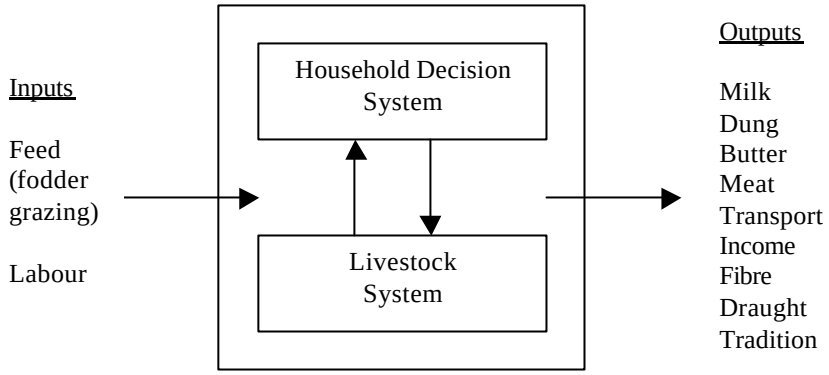
Table 1 Livestock performance in winter

Transect	Winter feed sufficiency index	Cow milk yield (l/day)	Goat kidding %
GGR	0.8	2.3	79
KKH	1.2	2.9	99

The measurements of pasture productivity and utilisation along with the botanical composition, showed that the levels of utilisation of the dry temperate pastures, which are at intermediate altitudes and are grazed by livestock in spring before moving to the higher alpine pastures, were significantly less than the biomass production in spring. This indicates that the pastures might be able to sustain higher use at that time, perhaps by moving animals to them earlier than is current practice. However, more than one year of data would be required to check whether this occurs regularly before recommending major changes in patterns of use which affect the whole transhumance system. The levels of utilisation of the alpine pastures on the KKH transect were lower than those on the GGH transect, and people in the majority of people questioned thought that they could carry more animals in summer. Although the levels of pasture utilisation in summer were higher in the GGR pastures, the animal performance was slightly higher, suggesting that from a livestock perspective they were not over-utilised.

One of the key socio-economc differences between the transects was the amount of household labour available for livestock husbandry in the two transects (109 vs 74 hours per animal per year in the GGH and KKH transects respectively). This was related to the better communications infrastructure in the KKH transect which provided opportunities for the marketing and production of cash crops, especially seed potatoes. The level of education on the KKH households was also generally higher, with the result that in the short term fewer children were available for livestock husbandry because they were at school, and in the longer term the aspirations of young people are probably higher.

Figure 1 Conceptual model of the household livestock system



Conclusions The study has allowed the construction of a conceptual model of livestock production at the level of the household. It has identified that two of the key constraints to the improvement of livestock productivity are the shortage of winter fodder and the availability of labour in some areas. More winter fodder could be produced by bringing more land under irrigation and cultivation, by introducing new fodder species or changes in cropping practices such as growing more winter cereals. Alternatively, a reduction in the numbers of animals in each household would allow higher levels of productivity from each animal and a higher overall output. Less labour would also be needed. If animals were moved from the villages to the dry temperate pastures earlier in spring this would reduce the winter feed requirements, because of a shorter winter feeding period and also allow the animals longer to gain in body condition.

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