



Stated preferences of llama keeping functions in Bolivia

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ABSTRACT

Bolivia accounts for approximately 63% of the South American llama population. Llamas keep playing an important role in the subsistence of smallholdings in the Andean regions fulfilling various functions in the productive, social and cultural life of the people. The present study evaluates functions of llama keeping as a prerequisite to the formulation of a community-driven breeding programme. A ranking approach was applied with 75 farmers in 6 villages. Sampling considered the factors gender and central versus remote communities. The different functions were presented visually. Each farmer was asked to arrange the illustrations according to his preference order. In total, 10 functions were suggested, covering the categories transport, sale or use of products, integration of animals in cultural events and herd size as capital asset. Ranking frequencies of stated preferences were calculated. A rank-based *t*-test was applied for multiple pair-wise comparisons within ranking groups gender and community provenance, respectively. Between-group comparison was performed by non-parametric Wilcoxon rank-sum test. The capital function was most important (14.6% of total ranking frequency) followed by the transport function to cultivated areas (13.7%) and the transport function for other purposes in third place (10.8%). All pair-wise comparison analysis indicated a significant difference for the two highest ranked functions. Functions ranked from 3rd to 9th position showed poor separation due to similar means with high variance. Bottom ranked function with significant separation for all ranking groups was the 'Integration of animals in cultural events or rituals'. Women appreciated the dung of the animals more than men ($p=0.0376$), whereas men put higher value on the sale of live animals for cash generation in case of emergency ($p=0.0006$) and for cash availability ($p=0.0371$). It is concluded that traditionally important functions of llamas like wealth accumulation and the close integration of the animals in mixed farming systems prevail. Breeding policies and breeding decisions will be more suitable when taking into account farmers' preferences and gender-specific perceptions.

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1. Introduction

Many of the world's poorest and marginalised people depend directly on livestock as a key component of their livelihood and social security strategy. Livestock in complex, diverse and risk-prone livelihood systems, with often low and unsteady resource availability, need to fulfil multiple functions to meet the requirements within the farming systems (Anderson, 2003; van't Hooft and Wanyama, 2005).

Since the domestication of the llama (*Lama glama* L.) in pre-Hispanic times, camelid husbandry in Bolivia remains an essential survival strategy for local indigenous people in the Andean highlands. Although the population of llamas had been steadily decimated with the Spanish invasion, which resulted in their disappearance from the greatest part of their reign, they survived within the framework of a traditional, socioeconomic organization¹ and continue to play the most

¹ The term 'socioeconomic organization' describes the interconnection of the animals (llamas) and their herders (Andean societies or communities); the importance the animals receive from native Andean communities, in social and economic terms, contributes to their survival.

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reliable nutritional and economic resource available to the peasants who inhabit zones at, or above, the upper limit of crop cultivation (Sumar, 1988). Bolivia holds 60% of the llama population worldwide. All of the estimated 2.4 million llamas are kept by approximately 54,000 smallholder families in marginal areas (UNEP/CA et al., 1999).

In these smallholder Andean communities, the animals contribute to the economic and social life of their herders by a variety of functions and products. They do not only provide food and fibre, but also dung for fuel, a means of transport and fulfil cultural, social and capital functions (Sumar, 1988; Flores Ochoa and MacQuarrie, 1995; Camino and Sumar, 2000; Nürnberg, 2005).

Despite recurring statements of the various functions and products provided by llamas in the relevant literature, little is known about the order of magnitude of the specific functions. However, to identify starting points and strategies for the improvement of peasant livestock systems, measures are required that allow to describe the relative importance of the multiple livelihood functions of the animals. This holds especially true when aiming at breeding activities and breeding plans. Animal breeding in the Andean region has been considered secondary in most development programmes. Improvement in management, nutrition and animal health produces favourable short-term results and therefore prevail in development and improvement issues (Iñiguez, 1998). Short-term effects, however, often require additional inputs that resource-poor farmers cannot afford, whereas genetic change is permanent and does not require a continuous use of expensive input factors (Van der Werf, 2000; Nakimbugwe et al., 2002).

Knowledge about the importance of the multifunctional roles that llamas play in smallholder systems in mountainous regions, as well as farmers' preferences in this regard, is a useful input in designing breeding strategies and a prerequisite when formulating sustainable breeding goals (Jabbar et al., 1999; Olivier et al., 2002). Therefore this study assessed the relative importance of the functions llamas fulfil in smallholder Andean communities in Bolivia from the farmer's point of view.

2. Materials and methods

2.1. Study area

The study area is located in the eastern Andes cordillera (Cordillera de Cocapata), in the Province of Ayopaya, Department Cochabamba, Bolivia, approximately 120 km north-west of the city of Cochabamba. The large and remote province of Ayopaya is among the poorest areas in Bolivia with high infant mortality rates, prevalent malnutrition and low income (PAHO, 1998). The tropical highland climate (tierra helada) is characterised by an average annual precipitation of 600 mm and an average annual temperature of 3.3 °C. The rainy season is between December and March. Frosts can occur all year round with an average of 150 days per year. The central community of the present study in the north of Ayopaya province is accessible by one single road. Although infrastructure has considerably improved during the last years, the road frequently turns inaccessible during the rainy season. Transportation from the central community to the provincial

capital of Quillacollo takes approximately 9 h by truck. The remote villages in contrast are either not accessible by heavy vehicles or transportation facilities are considerably less frequent, resulting in a different market access.

2.2. Data collection

Primary data was collected from August to November 2005 in 6 peasant communities located at altitudes between 3400 and 4300 m above sea level. The 6 communities are composed of one central community in terms of infrastructure and transportation possibilities from and to the provincial capital, and 5 remote villages. The criterion for the selection of communities was the service area of the farmers' organization ORPACA (Organización Regional de Productores Agropecuarios de Calientes) that has been cooperating in former research activities initiated by the University of Hohenheim. A total of 75 farmers were interviewed, of which 48 were men and 27 women. It was intended to survey an equal number of men and women, which was, however, not accomplishable due to language constraints. Participating farmers were selected according to their past or present experience in llama husbandry and their village provenance. Hence, all farmers were keeping llamas or kept llamas in the past.

2.3. Study material

Ten important functions of llama keeping have been selected based on survey and literature results presented by Nürnberg (2005), as well as preliminary interviews. The selection covered the categories transport, sale or use of products, integration of animals in cultural events and herd size as capital asset. To the sales function of live animals a purpose of use was added to account for emergency situations. Hence, the following ten functions were suggested: i) means of transportation to cultivated areas, ii) means of transportation for other purposes, iii) llama dung as energy source, iv) sale or consumption of fresh or dried meat, v) sale of live animals for cash availability, vi) sale of live animals in case of emergency, vii) sale of fibre, viii) domestic use of fibre, ix) integration of animals in cultural events or rituals, and x) herd size as capital asset. The functions of llama keeping were presented visually in the form of illustrations prepared by a local painter. The illustrations were explained to each respondent, who subsequently ranked his or her reasons (first to tenth) for keeping llamas.

2.4. Statistical analysis

Data analysis was performed using SAS 9.1 (SAS Institute Inc., Cary, NC, USA). Considered factors were gender (2 subgroups) and village provenance (2 subgroups). Ranking frequencies were calculated for total respondents and the different subgroups to obtain a general ranking order. Rank-means and their standard deviations were calculated for within- and between-group comparisons. Importance of functions within groups was investigated by paired *t*-test statistics for dependent data based on ranks for all pair-wise comparisons following an approach described by Brunner and Langer (1999). This is a non-parametric test for equality of

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