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# Unconventional animals in rural development: 2 Domesticated autochthonous species

Martina Gerken and John M. King

Institut für Tierzucht und Haustiergenetik, Albrecht Thaer-Weg 3, D-37075 Göttingen, Germany (mgerken@gwdg.de)

## Abstract

The present globalization of a few domesticated species is the result of a historical dynamic process. The example of South American camelids (llama and alpaca) illustrates how existing, well adapted authochthonous domesticated species were marginalized to less favourable areas thus leading to the underestimation of their genetic potential. This process is discussed in the context of the clash of different cultural systems which have very different concepts of the role of domestic animals.

Keywords: domestication, autochthonous species, llama, alpaca, cultural systems

## 1 Introduction

The domestication of a variety of wild animals occurred spontaneously in separate locations e.g. in South America and Asia (Herre and Röhrs, 1973). During the following millenia waves of invaders introduced their own livestock into these different habitats despite the presence of autochthonous domesticated species. The present distribution of the domesticated species represents a dynamic stage of an ongoing historical process as shown for e.g. cattly by Rifkin (1992). However, compared with earlier times, modern breeding technologies and economic globalisation seem to accelerate the replacement of authochthonous domesticated species by a limited number of domesticated, highly selected species.

The present paper develops some thoughts on the reasons for this globalization. Several programmes have claimed sustainability as desirable long term aim in particular for tropical countries (e.g., FAO, 1990). In general, autochthonous domesticated species have co-evolved together with their ecosystem for a much longer time than introduced species and may be considered as better adapted to their environment. Thus the hypothesis is made that these species might be more suitable for a sustainable production than introduced ones.

Table 1. Unconventional domesticated autochthonous species (examples)

| Continent of origin | Species |
|---|---|
| Africa | Ostrich, Guinea fowl |
| America | Llama, Alpaca, Guinea pig |
| Asia | Asian Elephant, Bactrian camel, Yak, Bali cow |

Examples for unconventional domesticated autochthonous species are given in Tab. 1. Some of these species are conventional in their regional use, such as the Bactrian camel, but are unconventional with regard to the general importance given to them.

## 2 Loss of genetic diversity in autochthonous domesticated species

Several reasons may lead to the loss of genetic diversity of autochthonous domesticated species. The introduction of new domesticated species may exert detrimental effects by the hybridisation with exotic breeds and the radical reduction in number of breeding animals. The latter may be due to:
- introduction of new lethal diseases (e.g., Rinderpest with *bos indicus* to Africa)
- competition for limited food resources
- deliberate killing/ extinction (e.g., South American camelids during the Spanish conquest (Bonavia, 1996))
- loss of indigenous human population breeding these animals.

The development and introduction of new technologies is a more recently emerging impact which may induce rapid changes. Not all autochthonous domesticated species are suited for new breeding biotechnologies such as artificial insemination or embryo transfer. For example, in the South American camelids reliable techniques are still under development (Fowler, 1989).

New western technologies affect the traditional transport function of domestic animals. Modern machines replace many autochthonous species as source of regenerative energy for work as e.g. in the case of the Asian elephant. Asian elephants were used as a beast of burden for more than 5,000 years (Sukumar, 1990). In the last century tens of thousands of working elephants were used, the number droppped to 13,390 by 1950 and to less than 5,000 in the early 1990s. Today, most of the domesticated elephants are working in timber extraction in Burma, while other Asian countries use them for tourism and transport (Kemf and Jackson, 1996).

## 3 Distribution as a historical process: the example of the South American camelids.

Together with the Old World camels, South American camelids belong to the suborder of Tylopoda (Herre and Röhrs, 1973). The domesticated New World camelids are divided into llamas and alpacas and are mainly used for meat, leather, fibre (in particular alpacas) and as pack animals (llamas). In llamas there exist two though not clearly differentiated types. The Ccara

(Pelada) is short haired type characterized by a double coat fleece and is mainly used for meat and as pack animal. Even in the 30s of this century specialized very large llamas existed in some Andean mining areas and where ocasionally used for riding (Bonavia, 1996). The woolly llama (Thampulli, Chaku, Lanuda) resembles more a single coat type and may have excellent fibre quality (Ayala, in press).

The alpaca is much smaller than the llama and has a single coat fleece. There are two clearly distinct fibre types: 90% of the population belong to the Huacayo type, similar to the Corriedale sheep, while 10% represent Suri alpacas comparable to angora goat with regard to its curly and lustrous fleece.

## 3.1 Loss of populations due to the Spanish conquest

The present distribution of a few domesticated species is mainly the result of a historical process and does not necessarily reflect the suitability of these species in their present environment. The example of South America was chosen for its geographical isolation and because quite reliable information is available through the numerous chronicles of the Spanish conquest (Bonavia, 1996).

Today cattle, horses and sheep are very familiar domestic animals in South America (Table 2). However, the only large domesticated mammals existing before the conquest of the Spaniards were South American camelids, which were domesticated between 7,000 and 6,000 years ago (Wheeler, 1991). The breeding was very efficiently organized during the Inca empire (Dedenbach-Salazar, 1990). There exists no complete census from Spanish colonial time with regard to the total number of camelids existing in South America. However, several chroniclers stated: ‘In those kingdoms there was an immense number of camelids and so numerous that is was incredible. Frequently flocks of 12 and 15 and 20 thousands of heads existed’ (Las Casas, cited after Bonavia, 1996).

For an approximation of the figures that might have existed in Peru and Bolivia (the main area of the former Inca empire) prior to the Spanish conquest a very simplified estimate was made (Table 2). Present livestock numbers in Peru and Bolivia were converted into metabolic body mass (average live weight$^{0.75}$). Expressed as percentage of total, most metabolic body mass comes from cattle, whereas camelids only contribute 6.3 to 7.6 % Conversion of total metabolic body mass into camelids, would result in 69.2 millions of llamas or 107.5 millions of alpacas across both countries. The present figure of about 6 millions of camelids underline the dramatic loss in genetic diversity which has taken place after the Spanish conquest.

## 3.2 Marginalisation to less favourable areas

As pointed out earlier, the survival of autochthonous species is closely connected to the survival of the indigenous ethnic groups. Frequently, these ethnic groups are pushed together with their domesticated species to marginal areas. Thus the impression emerges, that the autochthonous species are specialized to the region where they are presently found. The comparison of the present and the historical distribution during the conquest clearly shows a very different picture (Figure 1).

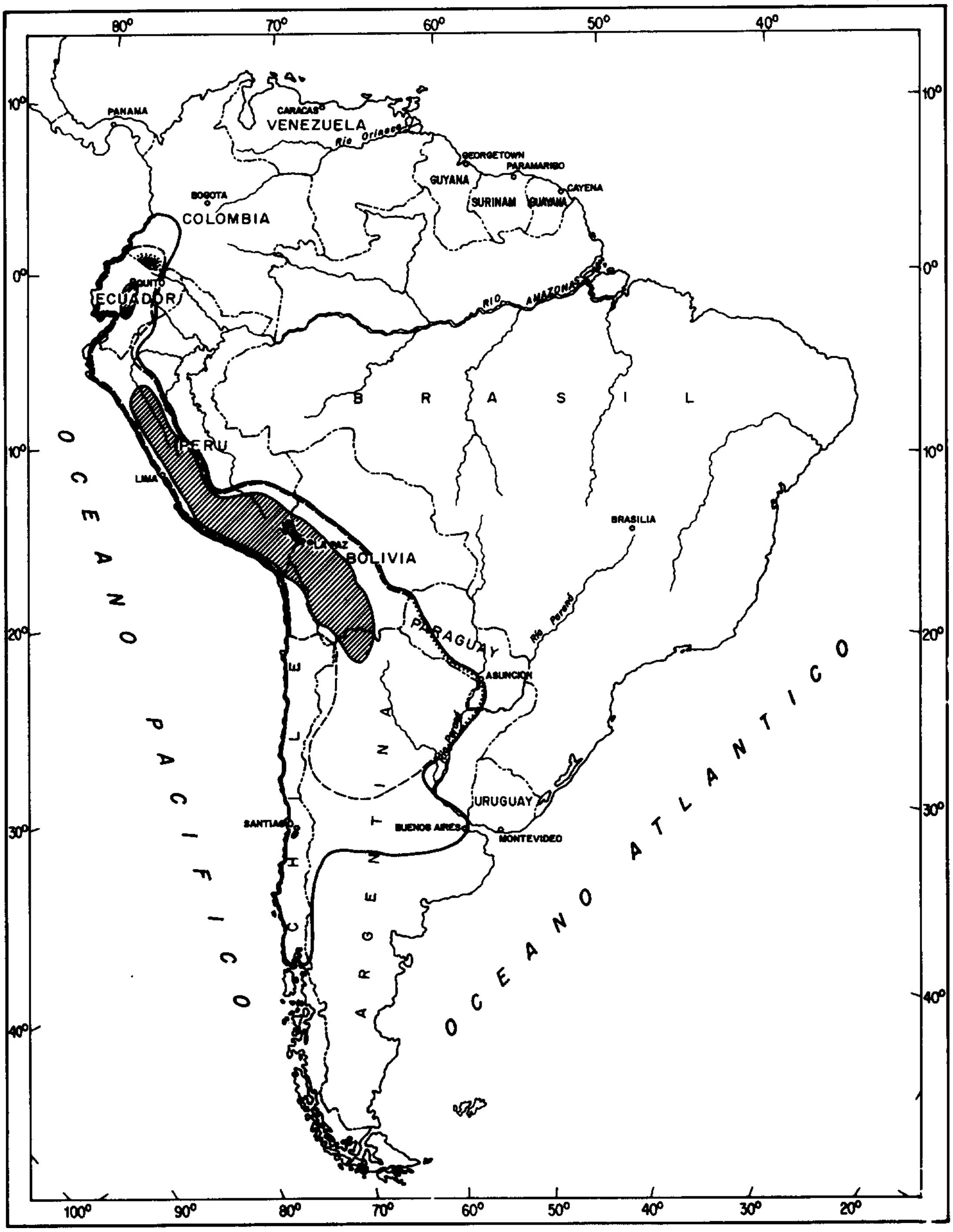
Llamas lived from the high Andes ("puna") to the coast at sea level, in the eastern jungle, and also covered parts of the Argentinean grassland ("pampa") which is now crowded by cattle. Similarly, the alpacas were marginalized to the high Andes, where they survive better than sheep or other introduced species (Bonavia, 1996).

Table 2. Livestock numbers in Peru and Bolivia, 1998

| | | | Peru | | | Bolivia | | |
|---|---|---|---|---|---|---|---|---|
| | ∅ live weight/ animal[1)] | ∅ metabolic body mass/ animal (kg)[2)] | Stocks (1000)[3)] | Total met. body mass (1000 tons) | % of total | Stocks (1000)[3)] | Total met. body mass (1000 tons) | % of total |
| Horses | 450 | 97.7 | 665 | 65.0 | 6.5 | 322 | 31.5 | 3.1 |
| Asses | 300 | 72.1 | 520 | 37.5 | 3.8 | 631 | 45.5 | 4.4 |
| Mules | 400 | 89.4 | 224 | 20.0 | 2.0 | 81 | 7.2 | 0.7 |
| Cattle | 450 | 97.7 | 4,656 | 454.9 | 45.8 | 6,387 | 624.0 | 60.8 |
| Sheep | 40 | 15.9 | 13,558 | 215.6 | 21.7 | 8,409 | 133.7 | 13.0 |
| Goats | 40 | 15.9 | 2,023 | 32.2 | 3.2 | 1,496 | 23.8 | 2.3 |
| Pigs | 120 | 36.3 | 2,547 | 92.5 | 9.3 | 2,637 | 95.7 | 9.3 |
| Camelids[4)] | | | | | | | | |
| Llama | 90 | 29.2 | 989 | 28.9 | 2.9 | 2,022 | 59.0 | 5.7 |
| Alpaca | 50 | 18.8 | 2,510 | 47.2 | 4.7 | 324 | 6.1 | 0.6 |
| | | | Total | 993.8 | | Total | 1,026.5 | |

[1)] Live weights were tentatively estimated taking into account effects of age, sex and breed [2)] Average live weight$^{0.75}$ [3)] FAO 1999

[4)] for authors see Wheeler (1991)




Approximate distribution in prehispanic times. Dotted line indicate region without information.

Approximate distribution during conquest and Vicekingdom.

Actual distribution.

Figure 1. Actual and historical distribution of llamas in Southamerica (Bonavia, 1996)

Frequently, autochthonous species are claimed to be superior with regard to the use of marginal land thus justifying keeping them on very limited food resources. There are very few studies available to test this assumption under experimental conditions.

The study of Hintz et al. (1973) revealed a greater efficiency of llamoids in digesting poor quality forages compared to sheep and ponies. Similarly, Moseley (1994) fed good and low quality hay to camelids (guanaco) and sheep under European conditions. The only significant difference he found was that sheep had a higher DM intake, but his animal numbers were small. (Table 3).

Table 3.Intake and digestion of ryegrass hays by camelids and sheep in Europe (Mosely,1994)

| | Good quality hay | | Low quality hay | |
|---|---|---|---|---|
| | Camelids n = 3 | Sheep n = 3 | Camelids n = 3 | Sheep n = 3 |
| *DM intake* | | | | |
| g/kg $W^{0.75}$ | $54.9^{a}$ | $68.4^{b}$ | $39.8^{c}$ | $45.1^{c}$ |
| *Apparent digestibility (%)* | | | | |
| Dry Matter | $58.0^{a}$ | $61.4^{a}$ | $53.3^{b}$ | $51.0^{b}$ |
| Organic Matter | $60.6^{a}$ | $62.3^{a}$ | $55.7^{b}$ | $52.7^{c}$ |

Numbers with different superscripts on the same row are significantly different at P<0.05

3.3 Underestimation of genetic potential for production

The previous observations focus the attention to the problem of underestimation of the genetic potential of autochthonous species. Frequently, the comparison between introduced and autochthonous species is not valid, because results where not obtained under identical experimental conditions. As shown for many domesticated species, suboptimal nutrition largely influences growth rate (Parks, 1982).

Furthermore, modern western and autochthonous domesticated species have a different genetic status. In general, artificial selection pressure for productive traits has been much lower in autochthonous species. Thus, llama populations may be characterized as primary populations in an early stage of domestication similar to the situation of many land races during the last century in Europe (Sambraus, 1994). The huge variety of colour mutations found in llamas may be used as indicator of this primarity within the context of domestication (Lauvergne et al., in press). Based on this theory, alpaca populations are more homogeneous with regard to colour and fleece characteristics due to more intensive artificial selection than llama populations.

Inbreeding depression due to small herd numbers may also strongly influence productive traits. The rather frequent observation (Sumar, personal communication) of congenital defects (e.g., polydactyly) in traditional camelid herds may indicate that adverse inbreeding effects act on present production levels.

Table 4. Regional differences in productive traits of camelids

| | Llamas | Alpacas |
|---|---|---|
| Adult body weight (kg) | | |
| South America[1)] | 108-155 | 56-63 |
| USA/Europe[2)] | 103-243 | 55-80 |
| Reproduction[3)] | | |
| South America | seasonal | seasonal |
| USA/Europe | non-seasonal | non-seasonal |

[1)]for authors see Wheeler (1991) [2)]Fowler (1989)
[3)]Sumar, personal communication

Table 4 is not a valid comparison in a scientific sense, but gives support to the idea that the genetic potential of South American camelids is underestimated under present high Andean conditions. Adult llamas and alpacas in South America are only three quarters of the weight of those in USA or Europe, and have a restricted breeding season. As the populations in the USA are mainly kept as pet animals, a high selection pressure for very heavy animals is unlikely and the comparison may indicate a better growth under optimal feeding and environmental conditions.

## 3.4 Cultural context

The neglect of autochthonous domesticated animals may be explained as a consequence of the encounter of different cultural systems. One example is the lack of understanding in cultural differences in breeding strategies. External and economically determined western breeding goals are imposed on autochthonous species without understanding their socio-economic and cultural role. In the Inca empire, breeding goals also involved the use of the animals in religious rituals, especially as sacrifice (Dedenbach-Salazar, 1990)). Even today, symbolic and economic aspects are narrowly interwoven in traditional camelid breeding. One example is the Argentinean pastoral community of Huancar, where male camelids are considered to represent the luck of the family, thus restricting the willingness of the owners to exchange males between different villages (Göbel, in press).

Frequently, livestock are a better investment for many rural households than a bank deposit in their local currency. There is also a strong attitude of colonists to consider autochthonous animals as inferior to their own domesticated species. For example, in Peru the commercialization of camelid meat was not legalized until 1995 (Concha Delgado, in press).

A major constraint for the promotion of the autochthonous species is a frequent lack of political infrastructure including: no central herd book, insufficient statistical data (number, distribution and type of animals) and a limited basic scientific knowledge of the species concerned.

## 4 Conclusions

The aim of the present paper was to highlight a slightly different perspective of autochthonous domesticated species. The present globalization of few domesticated species is the result of a historical dynamic process. The genetic potential of authochtonous species is frequently underestimated. This may be attributed to the encounter of different cultural systems with very different concepts of the role of domestic animals. Therefore, it may be unwise to assume that, for the longterm sustainable exploitation of many tropical eco-systems, modern livestock of western colonial origin are superior to autochthonous species.

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