Compensating Pastoralists for Conserving Animal Genetic Resources: The Case of Borana Cattle in Ethiopia

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ABSTRACT

The Borana cattle in northern Kenya and southern Ethiopia have unique traits that make them suitable for the harsh environment in the lowlands and have ever been part of the pastoralists' identity. Almost all the traditional and cultural rites of the pastoralists in these areas revolve around the Borana cattle, which are also the main source of their income. However, genetic erosion of this cattle breed has been occurring at unabated rate due to lack of incentives for conservation and driving factors such as population pressure, ecological changes, natural catastrophes and adverse economic conditions. This depletion contributes immense threats to the livelihoods of the local pastoral communities. Thus conservation efforts of these important animal genetic resources (AnGRs) by governments and other stakeholders would ensure not only the well-being of the pastoralists but also prevent losses in genetic materials for future use.

At the moment, there are no compensatory mechanisms targeting pastoralists although exports of Borana cattle genetic materials to developed countries such as USA and Australia has been growing. There is also no documentary evidence that pastoralists do share benefits from such exports. Thus, this paper addresses the following questions: what kinds of pastoralists, due to their involvement in conservation, deserve compensation and how much should be the level of compensation?

The empirical data analysed in this paper was collected from Borana pastoralists in Ethiopia. The magnitude of compensation payments is derived from the costs that pastoralists incur for maintaining only Borana cattle in their herds. These costs include costs for not keeping other breeds which are probably more economically attractive (opportunity costs), as well as transaction costs. Finally, several policy implications for community-based conservation of Borana cattle are derived.

Key words: animal genetic resources, Borana cattle, benefit sharing, costs of conservation, compensation payments

INTRODUCTION

Since traditional breeds contain the genetic potential for new breeds tolerant or resistant to biotic and abiotic stress factors, traditional[1] breeds will remain an essential aspect of sustainable animal production and food security for the growing world population. A loss in animal genetic diversity may weaken the chances of future generations to respond adequately to increasing food demand, to potential environmental changes, to diseases and to other challenges and catastrophes we cannot foresee. Confronted with these challenges, there is a growing need to carry out economic, social and institutional assessments of animal genetic resources (AnGRs) in order to establish conservation programmes that benefit livelihoods of the local communities (Anderson, 2003). The assessment of the monetary value and conservation costs of these resources and strategising of their management are still in their infancy, not only due to the lack of market structures but also defined property rights (Kamara, 2001; Scarpa et al., 2003). Incentives, if allocated properly to the farmers, could solve this problem and enable farmers to keep economical less-attractive cattle breeds without getting worse off. Thus, defining costs of conservation is crucial because the amount and need of possible compensation for farmers ought to be based on the costs farmers incur to maintain one breed or the other. Against this background, this paper examines the costs of conserving Borana cattle, in comparison to other prevalent breeds, and assesses the magnitudes of compensatory payments that would accrue to the pastoralists. Further, the characteristics of the farmers to be targeted for compensations are analysed. The paper uses two different approaches to assess the magnitudes of conservation costs: a direct approach and an indirect approach. The former is based on farmers' statements whereas the latter constitutes a gross margin analysis.

This paper is outlined as follows: the next section of this paper details the reasons for the shrinking number of Borana cattle, and the need to conserve this important resource and to compensate the conservation efforts of the pastoralists. Further, this section examines the kinds of strategies that can be employed to effectively conserve the Borana cattle. The second section explains the study area where the empirical data analysed in this paper was collected and analyses the Borana people and their Borana cattle. The third section gives an overview of the characteristics of the pastoralists who can be associated with conservation of Borana cattle and reviews their perceptions towards conservation and the specification of the property rights which would motivate their conservation efforts. In the fourth section, the magnitude of compensation is assessed through a direct approach and also from the calculation of production costs, transaction costs and gross margin analysis. The analysis of costs of conserving Borana cattle is made in

[1] The term 'traditional' breed is simultaneous to 'local' breed, 'indigenous' breed and 'old' breed

comparison to other prevalent breeds in the Borana zone. Finally, section five provides a number of conclusions and policy implications.

The need to conserve AnGRs and compensate farmers

Domestic farm animals are crucial for food and agriculture, having a share of 30% to 40% of the agricultural sector's global economic value. Around 2 billion people depend at least partly on farm animals for their livelihoods (FAO, 2000). According to FAO (2000), 16% of animal breeds used for agricultural production have been lost since the turn of the last century and further 30% are currently at risk of becoming extinct and the rate of extinction continues to accelerate. The depletion of a breed, even if the breed in question is not yet recognised as being endangered, provides justification for conservation efforts because its loss results in a worsening condition for the farmers. This worsening can be in the form of income reduction and food shortage but also traditional drawbacks. The Borana pastoralists' traditional rites, for example, all involve cattle. For the Borana pastoralists, keeping large cattle herds is a kind of prestige. Thus, in the survey region for this paper it was observed that a cattle corral is placed in front of the houses in order to be invisible for visitors, while a corral for the less important camels is set up in the backyard. Furthermore, keeping traditional cattle is not only important as a kind of insurance (as capital wealth accumulation) but also as source of money for urgent needs (e.g. farmers sell cattle for paying school fees or doctors' bills). Moreover, male cattle are needed for draft power, without which it is almost impossible for farmers to cultivate larger plots.

Another important reason for conservation of the local breeds is the multiple use of their various traits in uncertain situations, for instance, in case of climate change, catastrophes, loss of resistance due to changing environment, protection failures (Tsetse controlling) etc. Equally important is the fact that the preserved breeds might possess qualities that are not yet known but which could be of some use in the future. A proper conservation strategy must then be to conserve as many genetic traits as possible aiming to maximise the chance of making use of more qualities.

Domestic animal diversity is the result of the way in which communities of farmers and pastoralists manage their animal genetic resources in their respective habitats, according to their own preferences and needs. Breeds have thus developed over time in traditional societies without herd books and scientific interventions (Koehler-Rollefson, 2001). 190 million pastoralists throughout the world are stewarding breeds with some of the most valuable genes for specific ecosystems. The value of their stewardship is nowadays being recognised by private and public authorities. As soon as the benefits of an indigenous breed are globally recognised (as it happened with the Borana cattle), the ownership of the genetic resources and purity of this breed is coming

under increasing pressure from the expansion of industrialised animal production into developing countries. Provisions must be made to compensate pastoralists for the service they provide to humanity at large by husbanding breeds with traits that have disappeared from the genetic make-up of the high performance breeds. An international Treaty on Livestock keepers Rights is necessary to safeguard their rights and prevent further acceleration of the loss of indigenous breeds.

Based on the assumption that in the past century, international movements of breeds and genes were mainly from industrial to developing countries, the issue of having livestock keepers' rights only came up recently. Moreover, while documentation of the past and present movements of breeds is incomplete, such movements from South to North or South to South are clearly increasing. For plants and animals, there must be either a patent or similar regulations of their own ("sui generis"). Until now, livestock genetic diversity does not play a role in the existing conventions (German NGO Forum on Environment and Development, 2002). There is therefore a need to review the property rights assigned to the pastoralists in order to motivate them continue preserving the local breeds in their ecosystems. Such rights should include the rights for deriving benefits of conservation through establishment of compensatory mechanisms. It is in this regard that this paper assesses the level of compensation that would be accorded to the Ethiopian Borana pastoralists.

Possible conservation strategies

Conservation techniques can be divided in *in-situ*[2] and *ex-situ*. According to FAO, *ex-situ* techniques are further divided in cryo-conservation of genetic material[3] on the one hand and the maintenance of live animals outside their production system on the other hand. It is widely accepted that in the case of conserving AnGRs, *in-situ* conservation is most beneficial from many points of view (League for Pastoral Peoples, 2002). This is because *in-situ* conservation enables animals to adapt to changing environmental conditions and endemic diseases, and thus increases the probability that their genes might be valuable for utilization, in other countries and also in the future. The maintenance of live herds allows for selection and improvement of populations for future needs within the constraints of a changing environment. Furthermore *in-situ* conservation is most likely to benefit the farmers. In case of *ex-situ* conservation, a benefit flow from the involved institutions or the government to the farmers is difficult to achieve and farmers' rights would most likely be left unconsidered. A combination of *ex-situ* and *in-situ* is imaginable if the

[2] *In-situ* means the maintenance of a breed within its natural production system or habit; on-farm conservation is a subset of in-situ conservation

[3] Including haploid cells (semen, oocytes), diploid cells (in vivo and in vitro embryos, somatic cells) and DNA

costs for *in-situ* conservation exceed the benefits immensely. This strategy is conceivable when the same breed is found in different areas/countries. Then this breed can be conserved on-farm in the area where it gives the largest economic benefit, in other area(s) its semen can be used for cryogenic conservation. A possible *in-situ* strategy could be conservation in large herds on selected large-scale farms, private or civic. Those farms are designed for solely keeping indigenous breeds. However, keeping one breed on one large farm only can be risky in case of diseases or environmental hazards. The most promising strategy is therefore the on-farm conservation in habitual farm activities. On-farm conservation could take place in small-scale or large-scale but a sound management is vital. Incentives for keeping the local breeds must also be availed to the involved farmers. Such incentives would even make poor households have the opportunity to get additional income. In this respect, this paper is confined to on-farm conservation of cattle breeds and looks at what kinds of compensatory incentives could be provided to farmers for the maintenance of the Borana cattle in their farms.

THE STUDY AREA

The results of this study are derived from a survey carried out in October 2003 to January 2004 among 246 randomly sampled households in the Borana zone in Ethiopia. Four peasant associations (PAs) were chosen for conducting interviews: Didi Hara, Web, Wachile and Finchawa. Didi Hara is situated in Yabello district, Web and Wachile in Arero district and Finchawa in Bule Hora district. All the four districts are situated in the Borana plateau (zone) that is the southern-most part of Ethiopian lowlands, bordering northern Kenya. The distribution of the respondents among the three districts and four PAs is shown in Table 1.

Table 1: Distribution of interviews among districts and PAs (in number of persons)

		District			
		Yabello	Arero	Bule Hora	Total
PA	Didi Hara	100			100
	Web		97		97
	Wachile		27		27
	Finchawa			22	22
Total		100	124	22	246

Description of the climate and agro-ecological zones

The Borana zone or plateau occupies a total land area of about 95,000 square kilometres and its altitude range from 1,600 meters above sea level (asl) in the northeast to about 1,000 meters (asl)

in the extreme south (Kamara, 2000). The climate of the research area is semi-arid, with average annual rainfall ranging between 350 mm and 900 mm and a coefficient of rainfall variability between 21% and 68% (Kamara, 2001). The precipitation is bimodal with 60% of the annual rainfall occurring between March and May. Recurrent droughts[4] are integral to the pastoral systems, but the frequency of drought has increased from 20 to 5 years. The last drought occurred already 3 years after the previous.

The plateau is divided into four ecological zones based on soil types, natural vegetation, primary productivity, and duration of growing seasons. These divisions include the savanna in the north, which has potential for carrying high numbers of livestock, the bush land with high shrub cover in the central zone, the medium-potential grassland in the east, and the volcanic areas in the west (Kamara, 2000).

A particular feature is the supply of permanent water by the nine deep well complexes and dispersed springs. The pastures are dominated by savannah vegetation, with varying proportion of open grasslands, perennial herbaceous and woody vegetation.

The Borana people

The dominant clan in the Borana zone is the Borana - the eldest branch of the Oromo people and part of the Cushitic language family - followed by Somali and the Gari, and a smaller number of Gabra, Guji, Burgi and Konso. The social organisation of the Borana is based on the generation sets of the *gada* system. The *gada* system changes every eight years and to-date it has taken over the governance responsibility and provides a framework for socio-political stability (Homann et al., 2003b). Since 1975, various administrative reforms were carried out in Ethiopia in order to devolve political power to ethnically defined regional administrations, delegate rural development planning to the district level and strengthen their linkage with administration, extension and research at the community level. But it was only in 1992 when the new government established successfully a new administrative regime after years of military regimes and disagreements with the Borana clans. Since then the two systems, the *gada* system and the administration system based on peasant associations (PAs) [5]exists evenly in the Borana zone (Helland, 2000).

The most recent census estimates a total population of 480,000 and an annual population growth rate of 2.5-3 % in the Borana zone (Homann et al., 2003b). The population is unevenly

[4] Drought defined by Coppock (1994) as a period when two or more consecutive dry years occur in which the length of the growing period is less then 75% of the mean, and deficient rainfall has detrimental effects on the production system.

[5] The *PA*s were created under the Land Reform Proclamation Act (1975), as a means to organise the pastoralists in territorial units. Their importance increased when they obtained the responsibility of local administration, including tax collection, delivery of relief, extension and formal education.

distributed, with urban agglomerations at Negelle, Yabello and Moyale town and few pastoralists in open grazing areas that have no permanent encampments. An important link to urban markets is the tarmac road from Addis Ababa to Nairobi intersecting the area (Homann et al., 2003b). Over 90% of the pastoralists' cash income is derived from livestock sales as alternatives for income generation are very few mainly due to the lack of infrastructure.

The Borana cattle

Origin and Development

The Borana cattle are commonly found in Kenya and Ethiopia. They have their origin in Ethiopia and were initially introduced into Kenya by Oromo pastoralists migrating from the southern Ethiopia. There are three recognised types: the Orma Borana which is the smallest in size and is found in Ethiopia, and the unimproved Borana and the improved Borana which are found in Kenya. The improved Borana, which is also known as Kenyan Borana, originated from the unimproved types of Borana that were bought by European ranchers from the Borana lowlands to central Kenya in the early 20th century (Rege et al., 2001). To-date the improved Kenya Borana can be found in the highlands which are characterised by fertile pastures. Its breeding purpose was for beef production.

From the perspective of phenotypic selection, two sub types of the Borana cattle in the Borana zone can be distinguished, the traditional large-framed *Qorti* and the smaller *Ayuna.* Both sub types are the result of deliberate human selection along with adaptation to environmental changes. The *Qorti* has been known for its physiological adaptation to heat stress, drought tolerance and walkability, good mothering ability, docility and longevity. Information about the *Ayuna* is not yet documented, other than its partial origin from highland cattle (Haile Mariam et al., 1998). Under normal pastoral circumstances of the Borana rangelands the Borana pastoralists prefer the large-framed *Qorti* type, considered here as the true type of the Ethiopian Boran cattle.

The phenotype of *Qorti* was described by the community in the study area as being of tall height with comparatively long legs, broad back, long neck, pending dewlap, short horns, small hump and a short tail. The original and the most preferred coat colour for Boran cattle was light grey for the body and dark grey around the dewlap. *Qorti* is known for high fertility, good growth and its milk producing capacity under range conditions. However, compared to the other type, known as the *Ayuna*, *Qorti* was said to show lower tolerance to drought and ticks and that it adapts poorly to scarcity of forage resources.

In contrast, the *Ayuna* type was described as shorter in height, smaller in body size, but more sturdy to adapt to degraded rangeland conditions. It was judged as generally poorer than the *Qorti* in fertility, beef and milk production. The import of genes resources was apparent in the multiple

coat colours, and pastoralists mostly rejected the *Ayuna* of black coat colour for inducing low productivity. There is also a third category of animals that exhibited features intermediate between those of the *Qorti* and *Ayuna* (Homann et al., 2003a).Pastoralists like the Borana select animals for characteristics such as their ability to withstand periodic shortages of water and feed, their ability to digest low quality feed and their ability to walk long distances (Haile Mariam et al., 1998).

Distribution among sample farmers

Farmers in the study area were asked about the kinds of breeds they keep in their herds. In total, 85.7% of them stated that they keep pure Borana cattle. Only 8.2% stated that they keep Borana cattle as well as their crosses with other breeds. 5.3% of the interviewees keep solely Guji cattle and less than 1% stated to have solely Gari cattle. The number of farmers keeping Borana-crosses seems to be largely underestimated because farmers tended to hide the fact that their Borana cattle are crosses. The phenotypic makeup of the investigated cattle showed traces of crossbreeding and even the farmers agree that their cattle are in jeopardy due to mating with other local breeds. Table 2 details the breed distribution among the research PAs, showing the highest occurrence of Borana cattle in Didi Hara (96% of farmers), followed by Web (92.7%).

Table 2: Distribution of cattle breeds among PAs (given in % within each PA)

		PA				
		Didi Hara	Web	Wachile	Finchawa	Total
Breed	Borana	96.0%	92.7%	88.9%	4.5%	85.7%
	Borana crosses	4.0%	7.3%	3.7%	36.4%	8.2%
	Guji				59.1%	5.3%
	Gari			7.4%		0.8%

Herd size does not differ significantly among the four PAs under investigation. Taking the four PAs together, the mean among all 246 farmers is 18 cattle. In Didi Hara, farmers have 16 cattle in average, in Web 18 cattle, in Wachile 26 and in Finchawa 14 cattle. The largest cattle herd (148 head) was found in Wachile, the smallest with only 1 cattle in Didi Hara.

The number of tropical livestock units (TLUs)[6] is highest in Wachile with a mean of 27 units, the mean of TLUs in Web is 22, in Didi Hara 18 and it's lowest in Finchawa with a mean of 15 TLUs. The total mean of all four PAs is 21 units.

Reasons for the depletion of Borana genetic resources

There are various reasons for the genetic erosion of the Borana cattle. The most severe ones are ecological reasons such as bush encroachment and recurrent droughts, reasons related to the herd management, and civil reasons. Bush encroachment as well as population pressure lead to diminishing availability of good pasture and hence to a decline in the total number of cattle and particularly in Borana cattle. After frequent droughts, the loss of Borana cattle is often compensated by other breeds that are readily available or cheaper. These include the smaller Guji cattle or Small East African Zebus in general which are often bought for restocking whole Borana herds lost due to droughts. Occurrence of frequent droughts is also the reason why pastoralists do not anymore send large parts of the herd to the *forra*[7] areas and keep only those animals needed for immediate subsistence needs. There traditional grazing system founded on the use of *warra*[8] and *forra* is violated and these rapid shifts of *warra* animals to *forra* early on during a drought can increase the potential for crossbreeding among otherwise geographically isolated cattle populations (Coppock, 1994).

Crossbreeding is causing severe damage to the pureness of the Borana cattle blood, not only through the mentioned shift from *warra* to *forra* but also through conflicts between clans and ethnic groups as a result of raiding. Animals stolen from other tribes are subsequently reared for breeding purposes. The substitution of Borana with other breeds such as Guji or Gari, due to their preferable attributes (e.g. Guji more resistant in droughts, Gari cows have higher milk yield), contributes to crossbreeding as well. Due to an improvement in organised market days and access to markets, different breeds are available for buying and the pastoralists make their choices according to their preferences and market prices. Guji cattle are usually slightly cheaper than Borana cattle, and Gari cattle achieve the highest prices. The smaller Guji breed is preferred under drought conditions, presumably because with a smaller body size they have lower metabolic maintenance requirements which allow them to better survive such events (Alemayehu et al., 2002). The effect of crossbreeding on the cattle can be clearly seen at the herd composition. 50 years ago, the Borana herds were uniform in colour, size and horn shape (all were plain

[6] For the calculation of the sum of TLUs every single animal has to be converted into one TLU: 1 goat = 0.1 units, 1 sheep = 0.1 units, 1 camel = 1.7 units, 1 cattle = 1 unit

[7] *Forra* areas are grazing areas for bulls and non-lactating cows, and are open for all pastoralists (Kamara, 2000).

[8] *Warra* grazing areas are designed for lactating cows, and for sick and weak animals that can return to the encampment every day for monitoring and milking (Kamara, 2000).

white/grey, big sized and with short horns) but nowadays they differ a lot[9]. All kinds of colours (black, brown, reddish with spots patchy) can be found now and the body size of the animals has gradually decreased. The survival of Borana cattle is also threatened by competition for grazing resources with other animal species. Rivalry for scarce pasture and water exists between cattle and different domestic animal species. Cattle in general are in danger of being replaced with camels and goats. Cattle belong to the grazers whereas goats and camels are browsers and consequently better suited for some areas where the bush encroachment heavily took place. Moreover, under drought condition, grazers are more affected than browsers (Reda, 2001).

The selling of male Borana bulls at the market for export to other regions/countries also contributes to dwindling number of Borana cattle. In economically hard times many males are sold and no proper Borana bulls for mating remains in the herd. Pure Borana bulls fetch high prices at the market and are hence likely to be sold, particularly in harsh times.

THE CHARACTERISTICS, PERCEPTIONS FOR CONSERVATION AND PROPERTY RIGHTS OF BORANA PASTORALISTS

Household characteristics

The most common production system among farmers in the Borana zone is agro-pastoralism. 81.3% of the interviewed farmers stated that they depend fully on both livestock and crop production for their livelihoods. 17.1% of them are solely pastoralists, i.e. their livelihood depend almost solely on livestock production (with some crop production for subsistence use), while 1.6% of the interviewees do mainly crop production for a living and keep few animals for subsistence use.

The average total household size is 6, with in average 3 children under 15 years. The total level of education in years were calculated by taking the sum of the years that each household member went or go to school or higher institutions of learning. The average number of schooling years is 4.2. 86.6% of the interviewed head of households are illiterate, 9.8% can write and read (i.e. went to primary school at least for one year), 0.8% completed primary school (8^{th} grade) and 2.8% went to secondary school. Considering ethnic affiliation, 90% of the interviewed farmers belong to the Borana tribe, 9% to the Guji tribe and the remaining few farmers are Gabra people. Most farmers (83%) are part of the traditional religion called *Wakefata*, 8% are Muslims and the remaining 9% are either Protestants or Catholics.

[9] According to an interview with Kalicha Kanchora, aba ola (village chief)

Farmers' attitudes towards conservation of Borana cattle

One reason for dwindling global AnGRs is the trend for increased intensification and industrialisation of production systems based on uniform genetic resources. To meet the growing demand for animal products high yielding "exotic" [10] breeds are increasingly imported and are interbred with local breeds, replacing the local breeds in some regions. This is not the case in the Ethiopian Borana zone where the replacement of the Borana is more due to other local breeds or other species such as goats and camels. Farmers were asked several questions about their attitude towards keeping exotic breeds, crossbreeding of exotic with Borana breeds, crossbreeding of local cattle with Borana and about their awareness of a decrease in Borana cattle and pasture. It came to light, that to 78% of all interviewed farmers in Ethiopia view crossbreeding with other local breeds as very important, whereas only 15% consider exotic breeds as important for crossbreeding with Borana. Keeping "pure" exotic breeds in the herd is preferable to only 15% of the Borana pastoralists. In contrast, 96% of the farmers view keeping Borana cattle in the herd as vital. For 37% of the interviewees it is evident that the Borana breed is facing decreasing numbers and 59% agreed that it is increasingly becoming harder to find pure Borana cattle on the local markets. Furthermore, a study conducted by Homann et al. (2003b) justified these results as it revealed that the Borana pastoralists feared that the *Qorti* was in danger of gradually disappearing from the Borana rangelands.

The Borana pastoralists' rights

The Borana pastoralists are not able to exclude[11] others from using their genetic resource of the Borana cattle. The keeping of the Borana cattle by neighbouring tribes can hardly be monitored or prevented. This is often done without purpose though common grazing areas and uncontrolled mating. Another example is the hostile taking over of the resource by other tribes or communities as it happened in Ethiopia during the civil wars between the Guji and the Borana tribes. Guji people stole large amounts of cattle herds and hence introduced and interbred the Borana cattle with their traditional Guji cattle. Taking possession of a resource violently is certainly against the rules of property rights and needs punishment. What could be better monitored, with respect to the right of exclusion, is prevention of export of Borana genetic material into other countries and

[10] Exotic breeds are high potential breeds that are imported from other countries, not only from neighbouring countries but also from North America or Europe

[11] The right to exclusion states that others can use a resource only with the consent of the person A. If person A does not agree, it is wrong for other to use it.

particularly if it is done illegally and thus not traceable[12]. Due to the recognised excellent characteristics, the improved type of Borana has been exported to Western countries and to other African countries (e.g. Zambia, Somalia, Uganda, and South Africa). In Australia, for instance, the first calves were imported from Ethiopia by a consortium of Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Australian cattle breeders in 1990, after extensive quarantine testing. There were also exports into the USA; researchers from US Meat and Animal Research Centre (MARC) have introduced the Borana breed into USA and crossbred it with Angus cattle (Boran cattle breeders society, 2004). Once being introduced into Australia or the USA, selection and crossbreeding with high-yielding breeds took place and new well performing crossbreeds have emerged. As the Borana cattle are partly the result of hundred thousands of years of the Borana pastoralist's traditional knowledge, the Western countries owe these pastoralists compensation for not choosing to keep crossbreeds and exotic cattle in their ecosystems. This flow of conservation benefits from African countries to Australia and USA happened without considerations of costs of conservation of the pastoralists. The communities keeping Borana have never benefited from all advantages derived from their Borana cattle due to denial of the right to compensation[13]by those who benefit from their conservation efforts. Moreover, improved Boran and other crossbreeds are being introduced by governments in their ecosystems, further denying them the benefits they ought to derive from pure Boran breeds. For a proper application of the right to compensation it is inevitable to know the exact amount of compensation and who exactly needs to be compensated for what. As already mentioned, this question is tackled in this study.

Despite lack of benefits sharing, the communities keeping Borana suffer from lack of markets to sell their animals for direct export use. Only local markets are accessible but their inefficient and weak system hinders the pastoralists to fetch higher prices for their animals. The link of lowland livestock (where the pure Borana originated from) markets with the highlands is very poor or even completely absent (Reda, 2001). It is envisaged that fair and equitable sharing of benefits derived from the Borana cattle breed is a basis for encouraging pastoralists to maintain their conservation efforts. Government and private authorities need therefore to established ways of compensation and benefit sharing in order to enhance conservation of the Borana cattle.

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[12] According to Teka et al. (1999) the in-official export from Ethiopia to Kenya plays an important role with 35-50,000 heads of cattle smuggled in 1998.

[13] The right to compensation states that if a person A uses the resource of person B and A is causing damage to B, B has the right to compensation.

THE COSTS OF CONSERVING BORANA AND COMPENSATION

Before deciding on a conservation strategy, the questions as to which AnGRs should be conserved and what kinds of costs will be incurred need to be clarified, bearing in mind the extreme competition for scarce financial resources for development measures directed towards alleviation of poverty and eradication of hunger. The costs incurred for conservation of AnGRs fall into three categories: direct costs, indirect costs and opportunity costs (Mburu et al., 2003). Direct costs are incurred when households have to employ labour and have to invest for the implementation and monitoring of a system (barns, semen, etc.). Indirect costs include to a great extent transaction costs. Opportunity costs reflect the foregone benefits for the farmer and for the country by maintaining the diversity of AnGRs on-farm. With regard to this study, opportunity costs are equal to the income loss due to maintaining the Borana breed (that is desired to be conserved) instead of another available or recommended breed. This income loss can be due to lower food production, higher production costs or lower market prices when selling the animals.

Direct cost and compensation calculation

Farmers were confronted with the hypothetical scenario of replacing their cattle with pure Borana cattle. Hypothetically, they had to give up their animal and in return obtain the same amount of cattle, but solely pure Borana. The assumption was made that no costs accrue to the farmer for this exchange. Bidding pricing was used to make the monetary value more realistic because when asked for willingness to accept (compensation) rather than for willingness to pay, respondents tend to act more unrealistic and inconsistent.

The interviewees then gave the perceived amount of money they would need for keeping solely the pure Borana cattle year by year, no crossbreds and no other local breeds. The required money was given in terms of animal per year. This is the amount of required compensation per animal for the farmer and can also be regarded as opportunity cost for not keeping the other, probably more economically attractive breeds. The farmer has to be compensated for this opportunity cost. The magnitude of opportunity costs is referred to as the conservation cost because the production costs (variable costs) are considered to be equal for all breeds that can feasibly be kept in the Borana plateau. The fixed costs for the traditional cattle herding are negligibly low.

229 of the 246 (93%) interviewed farmers had an opinion of whether to require compensation or not. 80% of those 227 farmers (181 farmers) stated that they did not need any compensation at all for maintaining the Borana cattle. The remaining 20% (46 farmers) approved requirement of compensation. The amount of compensation solicited from the farmers ranges between 8 and 120 Euros for each animal per year, with a mean of 36.4 Euros. The costs were fitted into five

categories plus the category "no compensation needed". The distribution of the categories among the four study PAs is detailed in Table 3.

Table 3: Required compensation for conserving Borana (in % of PA members)

		PA			
		Didi Hara	Web	Wachile	Finchawa
Required compensation in categories	No compensation	97.8%	74.5%	22.2%	100%
	1-15 Euros		3.3%	14.8%	
	16-50 Euros		18.9%	55.6%	
	51-100 Euros	1.1%	2.2%	7.4%	
	101-200 Euros	1.1%	1.1%		

It can be noticed that all farmers (100 %) in Finchawa do not require any compensation at all. Similarly, the percentage of farmers not needing any compensation is very high in Didi Hara (97,8%) and Web (74.5%). However, in Wachile majority of pastoralists needed compensation (only 22.2% would reject compensation). If compensation is asked for, then it is most frequently within the category of 16-50 Euros per animal per year (=69.6% of all farmers who require compensation, yet alone 55.6% of farmers situated in Wachile). 15.2% (7 out of 46 farmers) of those needing compensation would ask for 1-15 Euros per animal per year, 10.9% (5 out of 46) would be willing to conserve Borana at a charge of 51-100 Euros per animal.

Gross margin analysis

The previous approach does not bear in mind the transaction costs of cattle production arising from their management. Transaction costs can occur in several ways but gathering information for selling cattle products and live animals were found to be the most significant category of transaction costs incurred by the pastoralists.

The total costs ($Costs_{tot}$) reflect the expenditures that each farmer has to bear for each adult animal every year, including production costs ($Costs_{prod}$) of keeping cattle and transaction costs ($Costs_{tran}$) for marketing them and seeking for information related to cattle management.

$$Costs_{tot} = Costs_{tran} + Costs_{prod} \quad (1)$$

Calculation of transaction costs

Interviews with focus groups and elderly brought into light that at least one member of a household goes to a market once a week. A big market is usually once a week and in more remote

areas there is more or less a market opportunity once a week. Not only pastoralists who intend to sell products or animals visit the market regularly but also those who do not sell anything but who want to seek for information on marketing, management issues, etc. Hence, information gathering costs during market days and costs for marketing cattle are similar in this case and cannot be separated. The term transaction costs used in the subsequent analysis is hence referring to the combination of marketing and information costs.

The transaction costs for each household were calculated as follows: first, from key informant interviews it was taken that one person of the household goes to the market once a week, i.e. 52 times a year. The average time spend on the market was determined to be 5 hours. The time for walking to and from the market is calculated as follows (it is taken that a farmer covers a distance of 6 km per hour when heading to the market and back):

$$hrs_{walk} = \frac{dis\tan ce(km)}{6(km/h)} * 2 \qquad (2)$$

Only the distance to the nearest market is regarded in the calculation of transaction costs. However, this is an underestimation as some farmers stated that they had to track their animals for 150 km and more to a livestock market in order to fetch better prices. The total transaction costs per household are then calculated by taking the total time (walking time plus 5hrs on the market) and multiplying it by the wage rate per hour (w). w constitutes the expected wage rate (as stated by farmer) in Euros per hour when working at the farm or hiring out work (see also Mburu et al., 2003).

$$Costs_{tran} = (hrs_{mar} + 5hrs) * w \qquad (3)$$

Finally, the transaction costs are calculated per animal by dividing $Costs_{tran}$ by the number of adult cattle of each household.

Production costs

The production costs comprise the costs for herding, costs for supplementation, and costs for veterinarian service. Table 4 illustrates how the production costs are composed and which breed is the most cost-efficient.

Table 4: Different costs and revenue for each breed (all in Euros per adult animal per year)

		Breed				
		Borana	Non-Borana[14]	Borana crosses	Guji	Gari
Transaction costs	Mean	2.72	4.25	4.39	4.85	0.42
	Minimum	0.18	0.27	0.50	1.15	0.27
	Maximum	25.47	26.90	26.90	11.99	0.57
Production costs	Mean	3.10	4.57	4.53	5.24	1.85
	Minimum	0.30	0.60	0.60	1.00	1.00
	Maximum	36.10	24.20	24.20	16.50	2.70
Revenue	Mean	9.35	18.45	16.52	21.86	19.34
	Minimum	0.00	0.00	0.00	0.00	9.00
	Maximum	103.80	137.10	35.50	137.10	29.70
Total costs	Mean	5.82	8.82	8.92	10.09	2.27
	Minimum	0.60	1.29	2.33	4.06	1.29
	Maximum	42.80	35.80	35.80	19.29	3.24
Gross margins	Mean	3.53	9.63	7.60	11.77	17.07
	Minimum	-26.82	-25.14	-25.14	-19.29	7.76
	Maximum	99.23	125.91	32.75	125.91	26.76

It is evident that the costs for producing Borana cattle are less than for producing Guji or Borana crosses but in return the revenues are quite low compared to those derived from the other breeds. The revenue is highest for the Gari cattle (19.34 Euros per Gari per year). The results of the gross margin analysis will be discussed in the subsequent chapter.

Results of the analysis

When calculating the gross margins[15] (see Table 4), it comes to light that the farmer will be worse-off when replacing any of his breeds by pure Borana, i.e. its gross margin is lower than of all other breeds. Hence, replacing the Borana cattle with every other breed results in a benefit or accordingly keeping Borana instead of another breed implies a cost to the farmer. This cost has to be compensated for. Replacing Guji by Borana, for instance, the participating farmers has a cost of 8.24 Euros per replaced animal (=11.77-3.53). Assuming that it is desirable to replace Non-Borana by Borana, 6.10 Euros has to be paid for each animal (=9.63-3.53). The difference of the

[14] Keeping non-Borana cattle implies keeping either of the three: Borana crosses, Guji or Gari.
[15] Gross margin = revenue – variable costs

gross margins between Borana and Gari cattle is the largest, i.e. it is most costly to replace Gari by Borana (13.54 Euros per animal). The substitution of Borana crosses by Borana requires 4.07 Euros as compensation payment per year to the farmer in order not to be left worse-off.

Table 5 outlines the results of the direct cost analysis. As mentioned before, pastoralists were directly asked for the amount of money they would ask for the conservation of Borana cattle per year (and hence a one-off replacement of their breeds). The results reveal similar results to the gross margin calculation. Again, owners of Gari cattle would be the most expensive group to target. They would need 50 Euros in average per year for the conservation of one Borana cattle. Every farmer who currently possesses Guji cattle rejects any compensation payments for keeping Borana instead of Guji. This group of farmers are thus the cheapest group for targeting. The inferior productivity of Guji, compared to the Borana breed, was often mentioned as the reason why farmers would be "happy" to replace their entire Guji herd with Borana animals at no charge.

Table 5: Comparison of means of compensation costs for different breeds (in Euros per adult animal per year)

	Breed			
	Non-Borana	Borana crosses	Guji	Gari
Compensation	15.65	21.39	0.00	50.00

When asking farmers about their willingness to accept compensation (Table 6), farmers in Didi Hara requires in average 2.21 Euros for each Borana cattle that they maintain on-farm. Pastoralists in Wachile would ask for the highest compensation if it comes to a conservation effort, namely for 26.89 Euros per Borana animal to be maintained. Those figures are irrespective of the breed which the farmers keep and which would then be substituted with Borana but the figures can be of use for deciding which PA is most cost-efficient for conservation efforts, as will be described in the following chapter.

Table 6: Required compensation among study PAs

	PA			
	Didi Hara	Web	Wachile	Finchawa
Mean	2.21	8.73	26.89	0.00
Minimum	0.00	0.00	0.00	0.00
Maximum	110.00	120.00	65.00	0.00

Conservation targets

The broad scope of farm animal genetic resources conservation requires effective priority setting and a sound ranking of different conservation opportunities. The subsequent table (Table 7) facilitates the decision-making of where and how to conserve the Borana breed and helps to define the targets for least cost conservation programmes. It is expected that those location (PAs) would be the one to target where the majority of farmers have a positive attitude towards the importance of the Borana cattle but a negative opinion about crossbreeding. According to Table 7 the most important PA to be targeted for conservation of Borana is Didi Hara, where 41% of the pastoralists are aware of the dwindling numbers of Borana cattle and only 67% in favour of crossbreeding practices (compared to 96% in Finchawa). Furthermore, it would be wise to target those PAs where the pastoralists stated not to require any compensation at all. This is unexceptional in Finchawa where all pastoralists prefer Borana cattle over the prevalent Guji cattle. In Didi Hara, the average amount of required compensation as calculated from the gross margins equals 0.41 Euros per animal per year. The most expensive PAs for maintaining the Borana is Wachile because replacing the prevalent productive Gari breed is costly (9.22 Euros per animal). According to the pastoralists' perception in Wachile, the payment has to be even higher in order to agree on conserving Borana. They ask for 26.89 Euros for each Borana that they keep on-farm for one year.

How the payments can be done and organizational aspect

The total costs of conservation programs not only include the costs occurring for compensate farmers but also the subsequent implementation costs and then various ex-post costs, such as monitoring costs etc. The implementation costs only have to be borne once but the ex-post costs will constitute a permanent asset, as long as the time horizon[16] for the conservation program is

[16] Very little research has been done so far concerning the question of how long a breed has to be maintained and further research is essential.

agreed on. The implementation costs include, for instance, the selection of participating farmers and distributing and replacing Borana cattle. Further monitoring is crucial for taking care that participating farmers follow some rules, such as no uncontrolled mating or selling of the whole Borana herd.

Obtaining funds for conservation of animal genetic resources is a difficult hurdle. When tackling the question of who will pay for the conservation, lessons can be learnt from the conservation of plant genetic resources. In the case of compensation payments for medicine plants the concepts upfront payments and royalties of have evolved lately. Upfront payments are always a sensitive issue because no third party is eager to accept them without being certain of a possible benefit. Royalties on the other hand seems to be a promising mechanism, paid by those who make use of the Borana genetic resources outside the Ethiopian production system, i.e. the importing countries.

Table 7: Summary of the four research PAs and their suitability to be targeted for the conservation of Borana cattle

PA	% of Borana cattle among HH	% of Borana crosses among HH	Threat to Borana cattle*	Intensity of threat (+++ = highest intensity)	Awareness of threat to Borana	Importance of crossbreeding Borana	Willingness to conserve Borana without costs	Costs for conserving one Borana cattle for one year[17]	Costs for replacing one non-Borana by one Borana cattle[18]
Didi Hara	96%	4%	Dilution with Guji blood	+ +	41%	67%	97.8%	2.21 Euros	0.41 Euros
			Dilution with Gari blood	+					
			Replacement with grazers	+ +					
			Reduction due to lack of pasture	+ + +					
Web	92.7%	7.3%	Dilution with Guji blood	+	39%	83%	74.5%	8.73 Euros	6.69 Euros
			Dilution with Gari blood	++					
			Replacement with grazers	+ +					
			Reduction due to lack of pasture	+ + +					
Wachile	88.9%	3.7%	Dilution with Guji blood	+	22%	85%	22.2%	26.89 Euros	9.22 Euros
			Dilution with Gari blood	+ + +					
			Replacement with grazers	+ + +					
			Reduction due to lack of pasture	+ + +					
Finchawa	4.5%	36.4%	Dilution with Guji blood	+ + +	27%	96%	100%	0 Euros	6.44 Euros
			Dilution with Gari blood	+					
			Replacement with grazers	+					
			Reduction due to lack of pasture	+ + +					

*only threats that can be influenced (no droughts, etc.)

[17] Results from direct WTA approach
[18] Results from gross margin analysis

CONCLUSIONS AND POLICY IMPLICATIONS

Conserving AnGRs is not a goal in itself, but a means to maintain the potential of drawing benefits from the conserved resources now and in the future. Therefore, to make a judgment as to the appropriate level of investment in conservation, the utility of AnGRs has to be valued and considered in light of the cost of their conservation. It is important that not only the costs and efficiency decide over a conservation program but also the farmers' willingness to conserve the targeted breeds. This study has shown that not all areas or regions in Borana Zone can be targeted for conservation of Borana and only pastoralists with certain favourable characteristics and perceptions can be included in conservation initiatives. For instance, that targeting pastoralists in Finchawa for conservation purposes would be very cost-efficient because they prefer Borana cattle over their traditional Guji cattle and thus would be willing to maintain Borana cattle without costs. However, one should be cautions with such a strategy as sooner or later it would result in the extinction of the Guji cattle. The analysis of the willingness to accept compensation revealed that pastoralist who predominantly keep Guji cattle are most eager to conserve Borana cattle at no charge, followed by farmers with Borana-crossbreeds who requires 21.39 Euros per year and farmers with Gari cattle (50 Euros per year per maintained Borana cattle).

Conserving Borana cattle in an area where the productive Gari breed is commonly kept would be very important (due to lacking awareness towards the threat to Borana and great importance of crossbreeding) but also very cost-intensive.

Knowing exactly how much money the conservation of one Borana cattle requires, in terms of gross margins and in terms of farmers' willingness to accept compensation, government and private parties can launch conservation programs that finally contribute to benefit sharing among pastoralists and those who commercialised the Borana (e.g. Western countries). The average amount of compensation that is needed for the substitution of one non-Borana cattle with one Borana equals 6.10 Euros per animal. With respect to the different breeds that have to be replaced for conserving the Borana, the cost ranges between 4.07 Euros for replacing one Borana-crossbred, 8.24 Euros for replacing one Guji and 13.54 Euros for replacing one Gari cattle.

Transaction costs and production costs are both higher for non-Borana breeds than for Borana cattle but in return the revenues from Borana cattle are quite low compared to those derived from the other breeds. The revenue is highest for the Gari cattle (19.34 Euros per animal per year), compared to 9.35 for each Borana cattle per year. Furthermore the study shows that the transaction costs for gathering information and marketing cattle products are in general quite high for the pastoralist in the Borana zone, no matter which breed (transaction costs are almost half of the total costs).

REFERENCES

ALEMAYEHU, N. GEBRU, G. AND DRUCKER, A. 2002. REASONS FOR THE LOSS OF ANIMAL GENETIC RESOURCES (ANGR) AND THE IMPORTANCE OF IK IN ANGR MANAGEMENT. ILRI, ADDIS ABABA, ETHIOPIA.

ANDERSON, S. 2003. ANIMAL GENETIC RESOURCES AND SUSTAINABLE LIVELIHOODS. IN: ECOLOGICAL ECONOMICS, VOL. 45, ISSUE 3, JULY 2003, PP. 331-339, ELSEVIER SCIENCE LTD.

BORAN CATTLE BREEDERS SOCIETY. 2004. WWW.BORANKENYA.ORG.

BROMLEY, D.W. 1992. THE COMMONS, PROPERTY, AND COMMON-PROPERTY REGIMES. IN BROMLEY, D.W. (ED.). MAKING THE COMMONS WORK: THEORY, PRACTICE, AND POLICY. ICS PRESS, SAN FRANCISCO, USA.

COPPOCK, D.L. 1994. THE BORANA PLATEAU OF SOUTHERN ETHIOPIA: SYNTHESIS OF PASTORAL RESEARCH, DEVELOPMENT AND CHANGE, 1980-1991. ILCA, ADDIS ABABA, ETHIOPIA.

HAILE MARIAM, M., MAMFORS, B., AND PHILIPSSON.J. 1998. BORAN-INDIGENOUS AFRICAN CATTLE WITH POTENTIAL. CURRENT NO.17/18.

HELLAND, J., 2000. INSTITUTIONAL EROSION IN THE DRYLANDS: THE CASE OF THE BORANA PASTORALISTS. IN: MANGER, L. AND AHMED, A.G. (EDS.). PASTORALISTS AND ENVIRONMENT. OSSREA, ADDIS ABABA, ETHIOPIA.

HOMANN, S., RISCHKOWSKY B., J. STEINBACH AND AYALEW W. 2003A. DISTURBED TRADITIONAL RESOURCE MANAGEMENT AFFECTS THE PRESERVATION OF THE BORAN CATTLE IN THEIR ORIGINAL HABITAT. PAPER PRESENTED AT THE 8TH EJAP CONFERENCE, ADDIS ABABA, ETHIOPIA.

HOMANN, S., DALLE, G. AND RISCHKOWSKY, B. 2003B. POTENTIALS AND CONSTRAINTS OF INDIGENOUS KNOWLEDGE FOR SUSTAINABLE RANGE AND WATER DEVELOPMENT IN PASTORAL LAND USE SYSTEMS OF AFRICA: A CASE STUDY IN THE BORANA LOWLANDS OF SOUTHERN ETHIOPIA. UNPUBLISHED REPORT.

FAO. 2000. ONE THIRD OF FARM ANIMAL BREEDS FACE EXTINCTION. NEWS 2000. FOOD AND AGRICULTURE ORGANISATION OF THE UNITED NATIONS, ROME, ITALY. HTTP://WWW.FAO.ORG (STATUS: MARCH 2004).

KAMARA, A.B. 2000. ETHIOPIAN CASE STUDY. IN: MCCARTHY, N., SWALLOW, B., KIRK, M. AND HAZELL, P. (EDS.). PROPERTY RIGHTS, RISK, AND LIVESTOCK DEVELOPMENT IN AFRICA. PP. 396-426. IFPRI, WASHINGTON D.C., USA, ILRI, NAIROBI, KENYA.

KAMARA, A.B. 2001. PROPERTY RIGHTS, RISK AND LIVESTOCK DEVELOPMENT IN SOUTHERN ETHIOPIA. SOCIO-ECONOMIC STUDIES ON RURAL DEVELOPMENT 123. WISSENSCHAFTSVERLAG VAUK, KIEL, GERMANY.

KOEHLER-ROLLEFSON, I., 2000. MANAGEMENT OF ANIMAL GENETIC RESOURCES DIVERSITY AT COMMUNITY LEVEL. MANAGING AGROBIODIVERSITY IN RURAL AREAS. GTZ, ESCHBORN, GERMANY.

KOEHLER-ROLLEFSON, I. 2002. WHY WE NEED LIVESTOCK KEEPERS' RIGHTS TO SAVE LIVESTOCK GENETIC DIVERSITY. IN: LIVESTOCK DIVERSITY: KEEPERS' RIGHTS SHARED BENEFITS AND PRO-POOR POLICIES. PP. 37-41, GERMAN NGO FORUM ON ENVIRONMENT AND DEVELOPMENT, BONN, GERMANY.

LEAGUE FOR PASTORAL PEOPLES. 2002. SECURING TOMORROW'S FOOD: PROMOTING THE SUSTAINABLE USE OF FARM ANIMAL GENETIC RESOURCES. LEAGUE FOR PASTORAL PEOPLES, OBER-RAMSTADT, GERMANY.

MBURU J., BIRNER R. AND ZELLER M., 2003. RELATIVE IMPORTANCE AND DETERMINANTS OF LANDOWNERS' TRANSACTION COSTS IN COLLABORATIVE WILDLIFE MANAGEMENT IN KENYA: AN EMPIRICAL ANALYSIS. IN: ECOLOGICAL ECONOMICS: TRANSDISCIPLINARY JOURNAL OF THE INTERNATIONAL SOCIETY FOR ECOLOGICAL ECONOMICS, 45, VOL 1, PP. 59-73, ELSEVIER SCIENCE LTD.

REDA, A. 2001. SURVEY ON THE BORANA CATTLE BREED STATUS TO INITIATE COMMUNITY BASED CONSERVATION PRACTICES. BORANA LOWLAND PASTORAL DEVELOPMENT PROGRAM/GTZ, NEGELLE, ETHIOPIA.

REGE, J.E.O., KAHI, A., OKOMO-ADHIAMBO, M., MWACHARO, J. AND HANOTTE, O. 2001. ZEBU CATTLE OF KENYA: USES, PERFORMANCE, FARMER PREFERENCES AND MEASURES OF GENETIC DIVERSITY. ANIMAL GENETIC RESOURCES RESEARCH 1, ILRI, NAIROBI, KENYA.

SCARPA, R., DRUCKER, A., ANDERSON, S., FERRAES-EHUAN, N., GOMEZ, V., RISOPATRON, C.R. AND RUBIO-LEONEL, O. 2003. VALUING GENETIC RESOURCES IN PEASANT ECONOMIES: THE CASE

OF 'HAIRLESS' CREOLE PIGS IN YUCATAN. IN: ECOLOGICAL ECONOMICS, VOL. 45, ISSUE 3, JULY 2003, PP. 331-339, ELSEVIER SCIENCE LTD.

TEKA, T., AZEZE, A. & GEBREMARIAM, A. 1999. CROSS BORDER LIVESTOCK TRADE AND FOOD SECURITY IN THE SOUTHERN AND SOUTH-EASTERN ETHIOPIA BORDERLANDS. OSSREA DEVELOPMENT RESEARCH REPORT SERIES 1, ADDIS ABABA, ETHIOPIA.