Creators and guardians of breeds

Social and cultural factors, together with deliberate breeding decisions and management by livestock keeping communities, have been crucial in the creation of breeds. Many breeds are associated with a particular ethnic group or community and this is often reflected in their names (Köhler-Rollefson, 1997). Breeds named after ethnic groups are a vivid testimony of the human factor in the creation of these gene pools and the cultural link between individual ethnic or social groups and specific breeds (Köhler-Rollefson, 1993a, 1997, 2003; Rege, 2001). See Box 1 for examples.

By contrast, in Europe, traditional breeds tend to be named after the geographic locations in which they were developed. Examples from the United Kingdom include Lincoln Red, North Devon, Sussex and Hereford cattle; Cheviot, Exmoor Horn and Hampshire Down sheep; Berkshire and Tamworth pigs; and Clydesdale and Suffolk horses.

SOCIAL BREEDING MECHANISMS

Social breeding mechanisms ensure that livestock is distributed within the community and remains a long-term asset over generations; such mechanisms also allow limits to be placed on genetic exchange with the livestock kept by other social groups. For example, some livestock keeping communities prevent the sale of female stock to anyone outside

BOX 1

Livestock breeds named after ethnic groups

- Different groups of West African Fulani developed the White Fulani and Red Bororo cattle, and Peulh sheep and goats; Touareg developed Touareg sheep and goats.
- East African pastoralists created Somali and Red Maasai sheep.
- Borana pastoralists of East Africa bred Boran cattle, adapted to their three-day watering interval.
- Southern African small-scale farmers developed Mashona and Nguni cattle.
- The Rath Muslims of northwestern Rajasthan developed the Rathi dairy cattle breed.
- In the Himalayas, the Gaddi pastoralists rear the sheep and goat breeds named after them.
- In southern India, the Toda tribal community has collectively bred the Toda buffalo breed.
- The Navajo Churro sheep of the southwestern United States of America was bred by the Navajo Indians.

the community (Köhler-Rollefson, 1993a, Schäfer, 1998). Pastoralist societies, in particular, often regard livestock as heritage passed down by their ancestors, for which they act as temporary guardians and which they have to pass on to their children. Unwritten community rules, often in the form of taboos, could be so strict that non-compliance was subject to punishment.

Another set of social rules determines how animals are passed from one generation to the next, regulating the presentation of animals as gifts at life-cycle events, such as birth, circumcision and puberty, and as dowry or bride wealth at weddings. They also regulate what happens to a herd when the owner dies. Among the East African Gabra and Turkana, for example, camel herds are inherited by the son. Unmarried Turkana daughters receive an adult female camel. Pastoralists and other livestock keeping communities also have sharing arrangements that facilitate access to breeding animals, the distribution of livestock and their products. Sharing strengthens social relationships and reduces the risk of losing the whole herd if a disease or other calamity strikes. For the latter reasons, pastoralists may place some of their cattle in the herds of other herders far away from their own herd (Schwabe, 1978).

In many communities, the wealthier members have an obligation to share their livestock with their poorer relatives by giving long-term stock loans, which sometimes extend over generations. They may allow the placement of female animals in their herd so that these animals can be mated by a superior male. Other arrangements involve the loan of breeding males. Payments are often through the use of animal products and the sharing of offspring rather than money. Sharing brings prestige, helps build alliances and reduces risk of total herd loss. The set-up of sharing arrangements differs from society to society (Box 2).

BOX 2

Traditional livestock-sharing arrangements

- *Vaata* is a traditional system of sharing and building assets among the Adivasi, a tribal group in Andhra Pradesh, India. The owner gives a six-month-old goat to another community member under the following arrangement: if the first-born kid is a male, the kid is sold and the profit is shared between owner and recipient. Female offspring are shared by giving the first-born kid to the owner and the second born kid to the beneficiary. The mother goat remains the property of the original owner, but when the animal becomes sick both parties are responsible (ANTHRA and Girijana Deepika, 2003).
- In Lesotho and western Zambia, *mafisa* entails placement of a family's cow in a herd where there is a superior bull. The cow returns home with its improved progeny after several years; in the meantime the host family can use the milk it produces (Beerling, 1986).
- If a Somali camel-breeding family does not have a breeding male of their own, they borrow one from kin, hire one from others, or may drive their female camels as far as 200–500 km to have them served by a prominent sire (Hussein, 1993).

INDIGENOUS KNOWLEDGE ABOUT ANIMAL BREEDING AND BREEDS

With their long tradition of animal breeding and daily interaction with their herds, livestock-keeping communities have accumulated detailed knowledge of their animals, their needs and their surroundings. Pastoralists, especially, are privy to important information that eludes scientists: they know the qualities and the family history of animals in their herd; they have traditional systems of population classification and are aware of the existence of breeds that have not been documented (Galaty, 1989; Kaufmann, 1998; Rege, 2001; Ayantunde *at al*., 2007; Krätli, 2008). This knowledge is an extremely useful resource for breed documentation as well as breeding and conservation decisions (Perezgrovas *et al*., 1995).

Pastoralists classify animals first by status (sex and age; and whether pregnant, lactating, castrated, etc.), then by colour and pattern, and the shape of the horns or other special characteristics. Frequently, all animals in a herd are named; all female animals of the same lineage are often given the same name (Galaty, 1989). Knowledge of the individual animals and their genetic relationship with the others in the herd allows the herders to make considered breeding decisions and avoid inbreeding.

Despite the absence of written records, pastoralists often memorize the ancestry of their animals in great detail and over several generations. Such mental pedigree records are known from the East African Maasai (Galaty, 1989), the WoDaaBe in Niger (Krätli, 2007, 2008), the Nuer of southern Sudan (Schwabe, 1978) and the Bodi of Ethiopia (Fukui, 1988). The WoDaaBe also remember the age of a cow when it first calved, and the age at which a sire was first used for breeding. In the case of heifers given out in loan contracts, they know the age at which the animal was loaned, how many calves it had borne and whether they were male or female (Krätli, 2008).

Banni buffalo breeders maintain that they remember the ancestry of their animals for 107 years. Raika camel breeders claim that they know the pedigree of their camels for seven generations (Köhler-Rollefson, 1993b).

The concern of Arab Bedouin breeders for purity of their animals often bordered on

PHOTO CREDIT: SAVERIO KRÄTLI

WooDaaBe pastoralists herding Bororo cattle in Niger

fanaticism. They distinguished between pure-bred and ordinary camels and only recognized a she-camel as a thoroughbred if its female ancestors had been covered by a thoroughbred bull for at least four generations. Male thoroughbreds were recognized only in the ninth generation (Musil, 1928). The code of personal honour associated with horsemanship made it impossible for Bedouin owners to misrepresent the pedigree of their horses. The members of a Bedouin tribe who had lost pedigree horses in a raid were bound in honour to treat the enemy scouts as inviolable when they came to demand the breeding details of the captured animals (Chaudhuri, 1990).

Traditional mental record keeping of animals' pedigrees has parallels with herd-book societies. In fact, the Arab principles of careful parent selection and maintaining pure lines, which came to Britain with imported oriental horses in the seventeenth century, substantially influenced breed development in Europe, culminating in the foundation of herd books and breeding societies in the nineteenth century (Berge, 1959).

CLASSIFICATION OF BREEDS AND KNOWLEDGE ABOUT UNDOCUMENTED BREEDS

Local classification systems for livestock commonly differ from those used by modern science. Local classifications can be very detailed; for instance, Rendille and Gabbra pastoralists in Kenya differentiate their camel breeds into four types, each having different adaptation and performance characteristics (Hülsebusch and Kaufmann, 2002). In Nigeria, Hausa and Fulani distinguish at least 15 types of local chicken based on productivity, colouring, feathering, body size and conformation, and ideological association with certain spirits (Ibrahim and Abdu, 1996).

PHOTO CREDIT: ILSE KÖHLER-ROLLEFSON.

Horse breeding is central to the culture of the inhabitants of the steppe in Turkmenistan

The information that pastoralists and smallholder farmers have on the history of their animals can point to breeds and strains that would otherwise escape the attention of scientists, who often find it difficult to determine whether animals belong to different breeds or represent ecotypes within a single breed. For example:

- The Malvi camel breed of Madhya Pradesh, India, was discovered based on information provided by Raika camel pastoralists (Köhler-Rollefson and Rathore, 1996).
- The Banni buffalo from Kutch in Gujarat, India, is in the process of being officially recognized as a separate breed – the first new breed to be acknowledged since official Indian breed classification was established in colonial times. While scientists presumed it was the same as the Murrah buffalo, ethno-historical information provided by Banni pastoralists clearly shows that the breed came from Sindh in Pakistan and has evolved independently of the Murrah buffalo (Sahjeevan, 2008).
- In Patagonia, Argentina, artisans pointed scientists to a sheep with a special type of wool. These sheep are locally known as Linca or Pampa, depending on the area where they are kept. They have existed in the region since the late seventeenth century and were bred by local communities long before the introduction of the Merino (Cardinaletti *et al*., 2008).

TRADITIONAL BREEDING INSTITUTIONS

Official breeding societies maintain breeds through a formal system of recording sires and progenies. Traditional societies have also developed breeding institutions that facilitate access to male breeding animals and aim to ensure the quality of their herds and flocks. Such breeding institutions are frequently anchored at village level and supported by respected community members. In West Africa and India, it was often pastoralists that supplied working animals to farmers and had extensive knowledge of line-breeding. Traditional breeding institutions from various parts of India are described in Box 3.

BREEDING GOALS AND OBJECTIVES

The breeding goals of livestock breeding communities are multifaceted and comprise many criteria beyond high production of milk and meat. Given that they often have to cope with poor quality feed or seasonal feed shortages, high disease pressures, poor infrastructure and high costs for veterinary care and other inputs, pastoralists especially are usually more concerned with adaptive traits than with productive traits (Steglich and Peters, 2003).

Breeding goals are also guided by aesthetic preferences, religious requirements and behavioural characteristics, such as compliant nature, good mothering instincts, herdability, ability to walk long distances and loyalty to the owner (Köhler-Rollefson, 2000a).

Pastoralists do not have the concept of an "ideal animal" such as exists in formal breeding societies (Adams and Kaufmann, 2003). Instead, they seek to maintain an optimal herd composed of different lineages representing certain functional traits (Krätli, 2008). Pastoralists structure their herds into matrilineal lineages to ensure the transmission of functionality across generations. Functionality includes feeding competence, minimum-stress interaction with other herd members and the herder (ibid.) and production traits (Hülsebusch and Kaufmann, 2002).

BOX 3

Traditional breeding institutions in India

- In Rajasthan, village-based breeding institutions include maintaining a communally owned bull and/or male buffalo. A survey conducted in 2000 in 50 villages revealed that this institution continued to exist, in parallel to the government system of providing artificial insemination from exotic breeds. In most of the villages, community members jointly selected the animal, with each household contributing to the purchase costs. Some villages went to great lengths to obtain bulls and buffaloes of superior genotypes, sending out scouting committees to distant villages that had a reputation for such animals. Each household shared the expense of the community bull's upkeep and its keeper's salary (Anderson and Centonze, 2006).
- The famous Ongole breed from Ongole Taluka in Andhra Pradesh, developed through the practice of the "Brahmini" bull. When a well-to-do man died, his family dedicated a good stud bull to the local deity. A special committee of experts was given the task of searching for a superior bull, which became the property of the community (Nath, 1992).
- Around 80 percent of Kankrej cows are in the hands of the Rebaris and Bharwads, two tribes in northwestern India. Each breeder has a thorn paddock near his house, where cattle are kept at night. Breeders take great care in selecting and caring for male calves retained for breeding (Joshi and Phillips, 1982).
- In Gujarat, Gir cattle are bred largely by professional breeding groups such as Rabaris, Bharwads, Maldharis, Ahirs and Charans. These groups lead a nomadic life, moving their cattle from place to place in search of grazing (Joshi and Phillips, 1982).
- The Hallikar breed of southern Karnataka is bred by both professional breeders and cultivators. Each village has a few families who have been breeding the Hallikar for generations. These families maintain their own stud bulls and charge a small fee for service. It is said that certain families have become famous beyond their community and that cows may be taken up to 160 km to the bulls kept by such families (ibid.).

Different age- and sex groups within a livestock keeping society may have different breeding preferences. Among the Maasai of East Africa, the young men (*moran*) prefer sturdy and hardy animals that can walk long distances and withstand food and water shortage. The elder men (*landis*) who remain at home give preference to larger-framed and higher-producing animals. Women, who have to do a lot of the work involved in caring for the livestock, favour animals that are docile, easy to milk, have good mothering instincts and provide surplus milk that can be used for home consumption or sold in the market (Laswai *et al.*, 2004).

BOX 4

Examples of selection criteria

- Beauty traits (colour patterns and horn length and shape) are major selection criteria for Ankole breeders in East Africa. Fertility and milk yield are prioritized in cows, while disease resistance and sire fertility are prioritize in bulls (Ndumu *et al.*, 2006).
- In interviews with various categories of livestock keepers in a tsetse-affected zone in Burkina Faso, it was discovered that all livestock keepers prefer cattle that are not selective in the type of grass or the quality of water they consume (Tano *et al.*, 2003). In bulls, traction ability, large body size, high fertility, disease resistance and rapid weight gain are favoured. For cows, reproductive performance, milk yield and body size are important criteria, but this varies across the production systems. Pastoralists value milk yield highly. Mixed crop–livestock farmers are more interested in animal traction, less interested in meat and milk off-take, and therefore are less concerned about low reproductive performance. For pastoralists, low reproductive performance is of great concern because of its impact on herd size and productive capacity, and milk and beef production often ranked highly. As in the case of bulls, large frame size in cows was preferred because it increases the market value of the animals (ibid.).
- Raika shepherds in India select their sheep according to a set criteria called "*Naguna*": wool production, milk production, good pedigree (true to the breed), mothering abilities, height, good walking ability, fast growth rate, drought and famine resistance, beauty, high birth weight, and ability to endure and withstand pain (Köhler-Rollefson and LIFE-Network, 2007).
- Rural women in southwestern areas of the Islamic Republic of Iran select hatching eggs that are of medium size and weight, and laid by hens with good body formation, weight, feathers, colour, laying and growth rate, as well as good broodiness. Eggs laid in the morning are preferred. The women continue to prefer traditional breeds, although the Ministry of Rural Development has distributed many highly productive laying breeds throughout rural areas (Shahvali *et al*., 2000).
- Among goat herders in Patagonia, hair type and coat colour are the two most commonly mentioned criteria for selecting Neuquén Criollo goats for breeding (Lanari *et al*., 2005).
- Agropastoralists in Usi, Peru, use different selection criteria for llamas and alpacas. For llamas, size and strength are important, while for alpacas fibre is the main criterion (McCorkle, 1983).

Selection criteria, therefore, vary between societies, within societies, and between different species and breeds, between male and female animals, and perhaps even between types within a breed. Several examples of selection criteria are described in Box 4.

BREEDING MANAGEMENT

Breeding management includes the practices and institutions that livestock keepers use to implement their decisions as to which animals are allowed to reproduce and which are not. It consists of selecting breeding animals, mating control, the removal of unwanted animals from the herd through culling or sale, and the decision as to how many males are needed to cover all females (e.g. Hülsebusch and Kaufmann, 2002).

Selection of breeding animals

In traditional breeding, selecting male animals is more practical than selecting females, as one male can sire many offspring, while the number of offspring a female can produce is far more limited. Furthermore, given small herd sizes and the need to obtain milk from all females in a herd, it is often not feasible to mate only the superior female animals (Mathias-Mundy and McCorkle, 1989).

Selection can focus on individual animals or on families. In Kenya, Rendille pastoralists select camels by family. For them, the quality of the characteristics of the ancestors and the "breeding line" of a potential new sire are more important than the characteristics of the individual. Conversely, Somali, and to a lesser degree also Gabbra, consider the young sire's own characteristics and give less importance to those of his ancestors. Family selection offers better prospects for success in breeding for characteristics with low heritability, such as disease resistance or adaptation to drought, while individual selection has advantages when breeding for good milk production and growth which have slightly higher heritability values (Hülsebusch and Kaufmann, 2002).

Some societies base selection on offspring testing. Camel breeders, including the Somali and the Indian Raika, mate new or young male animals with a limited number of females in order to scrutinize the quality of the offspring. Only if the first crop conforms to their expectations will they use the male animal more widely (Elmi, 1989).

PHOTO CREDIT: ILSE KÖHLER-ROLLEFSON

The Raika pastoralists are the custodians of the dromedary in Rajasthan, India

Mating control

Mating control is practised by pastoralists and smallholder farmers all over the world. Mating control can be temporary or long-term. The latter includes castration and the removal of potential breeders through culling or sale.

Some societies use very rigid mating control to obtain a specific bull/cow ratio and ensure selection for particular qualities. In the Marwar region of Rajasthan, communities enforced castration of all male animals not approved for reproduction. Male calves of the Nagauri cattle breed were castrated at the age of six months, with only one bull left for every 80 cows (Joshi and Phillips, 1982). It is reported that during a five-year period in the early twentieth century, herders in Nigeria castrated more than two-hundred thousand goats that did not have the red skin characteristic of the Red Sokoto breed, which is highly valued for the production of Morocco leather (Blench, 1999).

Methods for temporary mating control include fencing, the use of devices to hinder mating, and manipulative practices such as tying the penis to the side of the animal. Castration is widely practised among traditional livestock keepers, independently of veterinarians and government programmes. Animals with unwanted characteristics are removed by being sold or culled. The removal of both males and females is reported (e.g. Laswai *et al.*, 2004). If unwanted animals are left in the herd and allowed to breed, herd composition will come to resemble that of a wild population, as the examples of several cattle breeds in southern India show (Vivekanandan and Paulraj, 2002).

EXPERIMENTING WITH BREEDS

Pastoralists and smallholder farmers experiment with breeds and are often keen to introduce new blood into their herds. The Maasai, for example, deliberately introduce new germplasm into their herds by means of exchanges within the community and by experimenting with improved breeds such as Boran and Mpwapwa cattle. However, it has been observed that these improved genotypes suffer from high mortality rates; they are not able to trek very long distances or cope with prolonged intervals between drinking (Laswai *et al.*, 2004).

Keteku cattle kept by Fulani pastoralists in Nigeria are a stabilized cross of Savannah Shorthorn (Muturu) and White Fulani (Bunaji), with some input from N'Dama Longhorn (Rege *et al.*, 1994; Felius, 1995). The Bunaji has relatively high milk production for a savannah breed, while the N'Dama is trypanotolerant and adapted to rainforests. The resulting Keteku cattle can thrive under a wider range of drought and disease challenge (Martin *et al.*, 2001).

In the Gambia, cattle owners depend on the functional traits of the N'Dama and appreciate it as a multipurpose animal that is well integrated into their production system. Nevertheless, where the local agro-environment is favourable, they conduct experiments with crossing it with the higher potential, but trypanosensitive, Gobra (Steglich, 2006).

Pastoralists in Tibet have experimented with different ways of producing a species cross between cattle and yaks. The herders regard the offspring of cows crossed with yak bulls as less suitable for their harsh conditions than offspring stemming from cattle bulls mated to yak cows (Wu Ning, 1997; 1998).

PHOTO CREDIT: ANDREAS WILKES

The yak is important to the livelihoods of the inhabitants of the Tibetan plateau in China

Most breeding programmes aimed at improving the productivity of indigenous chickens have used cross-breeding. This approach has provided significantly higher productivity, but has resulted in a loss or dilution of the indigenous birds' morphological characters and instinct for broodiness. For example, the Sonali breed, developed in Bangladesh as a high-yielding breed for use in under semi-scavenging conditions, lost popularity among smallholders when they discovered that they had no success in reproducing it. Similarly in India, when villagers received cross-bred hens from a research institute, they expressed concerns about the dilution of morphological characters (Besbes, 2008).

PHOTO CREDIT: ELLEN GEERLINGS

Indigenous chickens are important in the rural economy of Cambodia