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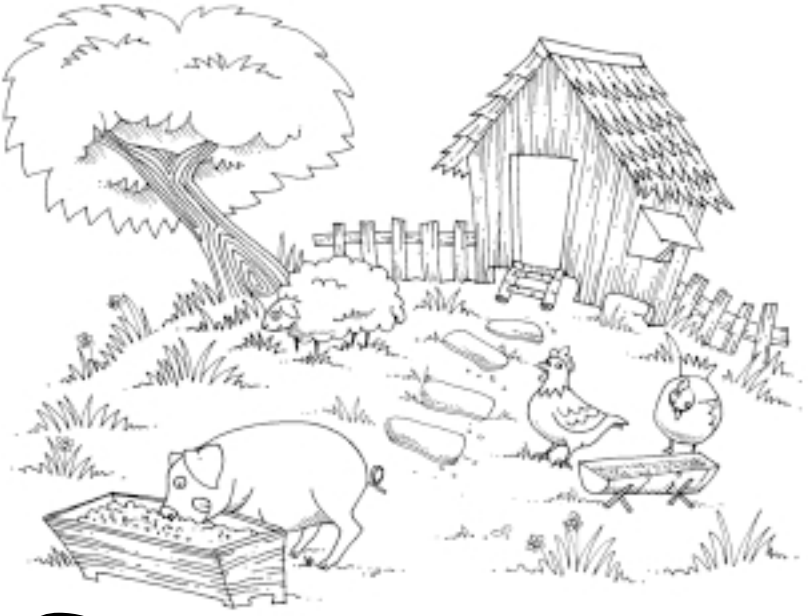
Diversity of Animals Adapted to Smallholder Systems



Generally, animal keepers can follow two alternative strategies: **adapt the environment to the need of the animals or keep animals adapted to the respective environment.** The first strategy is used in industrial animal production such as chicken batteries or large-scale pig fattening. Here, animals are divided into production animals and breeding stock. To take advantage of the economy of scale, production animals need to be uniform. For the specialized breeding stock, some diversity is desirable as breeding progress depends on selection, but industrialized animal production and efforts to maintain or enhance biodiversity remain antagonists.

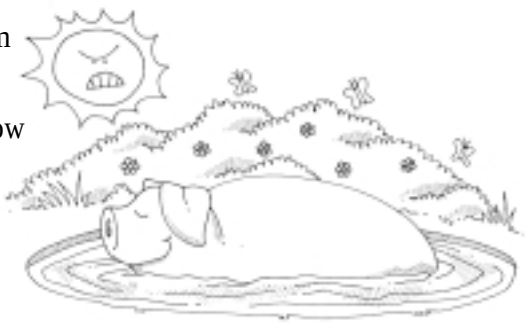
Smallholders and pastoralists follow the "keep animals adapted to the environment" approach. Environment in this sense is not restricted to natural conditions, but also includes the production systems. The physical environment greatly differs between locations, just as production systems differ according to available resources and economic conditions. Because of this, smallholders and pastoralists need different animal species and diverse types.

The common indicator for farm animal diversity is the number of breeds. However, smallholders and pastoralists do not need breeds but animals with certain characteristics. A discussion of these is the focus of this paper.

Adaptation to the Physical Environment

Smallholders and pastoralists and their animals often live in harsh environments. It can be hot and dry, hot and humid, or high and cold. Water and feed can be scarce, feed can be of low quality, and disease pressure high. Adaptation to these factors is largely based on genetics, but animals can “learn” to live under such stressful conditions. To delineate genetic and acquired behavioral adaptation is often difficult, if not impossible.

Adaptation to High Ambient Temperature



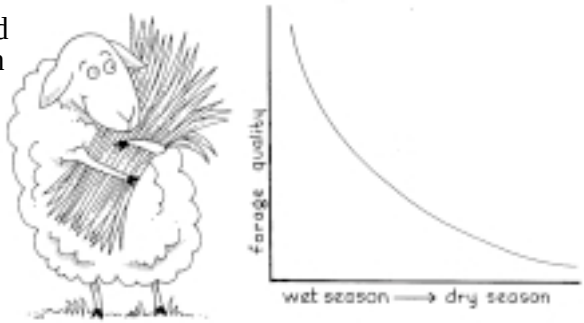
The great majority of domestic animals are warm blooded, and have to maintain the body temperature within a narrow range. In hot countries, they face the problem of how to get rid of their heat, produced by the physiological processes. In addition, sunshine warms up animals. Animals can avoid

sunshine, drink lots of water, wallow in ponds, block incoming radiation by a reflective (white) skin, insulate their skin with wool or pant to keep a cool head.

An effective way of reducing the heat load is reducing heat production. Unfortunately, growth, giving milk and producing eggs generate a lot of heat. Therefore, animals which do not grow so fast, give less milk or lay fewer eggs, produce less heat and have an advantage in a hot climate. Furthermore, animals with a genetic potential for high production have a high "basic metabolism", which is defined as “physiological turnover at rest, at a feeding level where animals neither gain nor lose weight.” Local animals with a lower genetic capacity for production also tend to have a lower “basic metabolism”, need less energy and feed to stay alive and therefore can cope better with heat stress. High production animals have higher maintenance requirements and therefore produce more heat than the animals adapted to a hot environment. It is not only because they are bigger, but also because they produce more heat per kilogram of live weight. The major source of heat in animal is food - intake and digestion. A reduction of food intake, hence heat produced during digestion, is therefore an efficient way to reduce heat stress. This leads to low milk output, fewer eggs and slower growth.

Adaptation to Low Feed Quality

Having lower energy requirements is also an advantage if feed quality is low. When high quality feed is available, the modern breeds produce more than the local breeds. However, high-producing dairy cows lose weight when they are fed poor quality grass or straw, whereas adapted, local animals still grow, give some milk and reproduce. There is some



evidence that local cattle recycle nutrients internally more efficiently than do modern breeds. In pigs, indigenous breeds can utilize fibrous material such as grass much better than do modern high production breeds.

In many areas, forage quality varies greatly between seasons. In the early wet season, forage quality is high and declines as grasses mature. During the dry season, forage quality may be so low that maintenance requirements can no longer be met, and animals have to mobile their body reserves and lose weight. Furthermore, forage can run short towards the end of the dry season. Some animal breeds can reduce their basic metabolism during periods of weight loss, which makes the limited feed go further. When good quality forage is available again, lean animals grow faster than fat animals, and in comparison to animals which are supplemented during the dry season, non-supplemented animals make up much of the difference in weight during the favorable season. This compensatory growth is an adaptation to changing forage quality.

Adaptation to Low and Erratic Water Supply

In drylands, water points can be far apart - at times 50 km or more. Livestock which needs little water and does not have to go back to a water point every day can access larger areas of pastures and thus get more feed. It is well known that camels can go without drinking for up to a week, even in the dry season. There are, however, also donkey, goat, sheep and cattle breeds that can get along without drinking for several days. These animals

can take in large amounts of water quickly, but their overall water intake is lower than that of animals which are watered daily. Reduced water intake reduces feed intake and metabolic rate and therefore livestock can survive longer during a drought, when feed is very scarce.

Disease Resistance

Climate influences strongly the prevalence of parasites and disease and indigenous animals have developed resistance against and tolerance to them. Disease resistance also depends on the animals' condition, and weak animals are more prone to disease, whereas animals in good conditions can cope more easily with stress.

Genetic diversity in livestock is important with respect to disease, as disease-causing organisms continue to evolve. If a new strain of a disease or a new disease occurs in a country, animals with a narrow genetic base are either all affected or none. With genetically diverse livestock, the chances that some animals are not affected, when others die, increase.

Some examples:
Indigenous livestock is less affected by ticks and worms than imported ones. In *tse-tse* areas in Africa, indigenous cattle have developed some tolerance to the disease, whereas imported livestock die, if not treated with chemicals. In west Africa, local cattle, sheep and goats have developed resistance to heart water, a deadly disease for imported animals or crossbreds.

In general, good adaptation to harsh environments and high production are mutually exclusive. Even with selection within indigenous breeds for higher production, there is not much scope because this leads to animals which produce more heat, need more water and better feed and are probably less

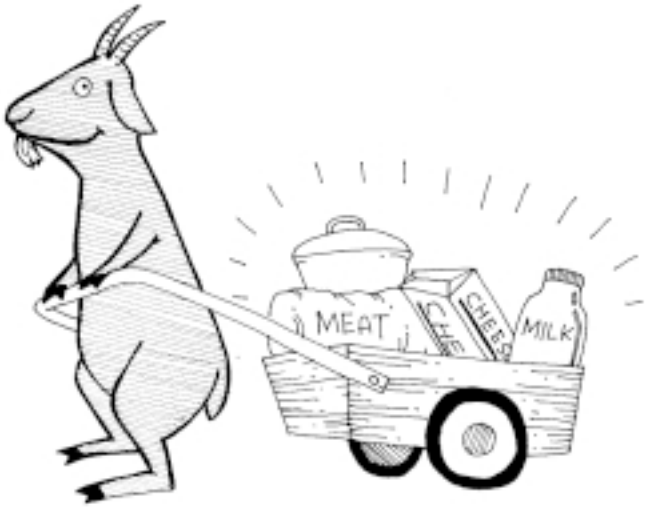
resistant to disease and parasites. This should be taken into account, when designing strategies for livestock development and conservation of farm animal genetic resources.

Adaptation to Smallholder and Pastoral Systems

In "modern" animal production, livestock is kept for meat, milk, eggs, wool or hides. This is also important in smallholder and pastoral animal husbandry, but animals here serve also other important functions.

All animals can be a form of investment and saving. Cattle, donkeys, camels, horses and buffaloes are used for draft and as beasts of burden; manure is used as fertilizer, for fuel and even building material; and many animals have cultural significance.

Smallholders and pastoralists also differ from "modern" animal production with respect to forage management. In modern systems, the requirements of animals are calculated, rations are formulated, and, if necessary, feed can be bought and imported. In contrast to that, smallholders and pastoralists have to optimize the use of the existing, limited forage. The different approaches also favor different genotypes.



The way animals are kept also influence the desired types. On extensive pastures in drylands, animals should be able to walk long distances. When they are herded, it is advantageous if they have a drive to stay together. When goats are kept in enclosures, it is of advantage if they are short legged and cannot jump the fence.

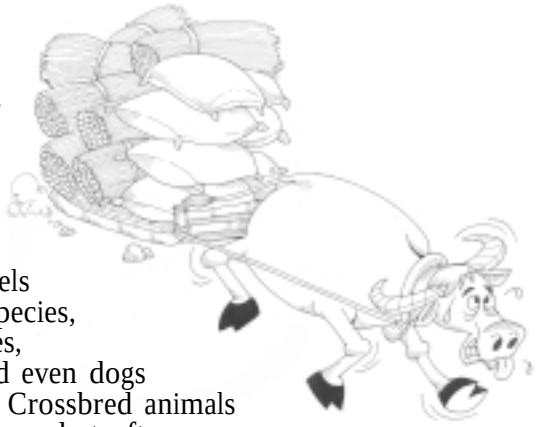
Within smallholder and pastoral systems, purposes or functions of animals strongly influence the type of animals and animal species used.

Multi-Purpose Livestock

Practically all domestic animals can be used for meat though culture and religion can limit its use. The types of animals used depend strongly on economics, especially on price ratios of liveweight to feed. As meat is comparatively cheap in most smallholder and pastoral areas, animals there have to do with natural forages and crop residues, and the uses of these forages for meat production have to be optimized. The types of animals required are those which grow reasonably well under these conditions.

For milk production, cattle, goats, buffaloes and camels are commonly used. The type of animals depends strongly on the access to markets. In mountainous areas, it makes little sense to keep high-producing dairy cows if roads are blocked by snow in winter and if the present dairy production is sufficient for household use. If the available forage on a farm is not sufficient for a cow, switching to smaller species, such as dairy goats, can be a viable option.

For producing manure, the animals need to stay alive, and available forage, including that of low quality, should be intensively used. Low maintenance requirements are an advantage.



Draft animals and beasts of burden are often used only for parts of the year. For the rest of the year, animals have to survive in reasonable conditions, without too much cost. Cattle, buffaloes, donkeys, horses and camels are the most important species, but there are other species, including sheep, goats and even dogs which locally carry loads. Crossbred animals might be bigger and stronger, but often additional draft power is not needed and therefore, the indigenous animals are usually preferred.

In the absence of banking services, animals are efficient "saving accounts". Often several species are combined: e.g., chicken as small change, sheep and goats for recurrent expenditures, such as school uniforms, and cattle for bigger expenditures. Animals kept as saving accounts require minimal care and therefore should not require expensive feed, should be docile and resistant to diseases. These characteristics are in favor of indigenous breeds.

Animals kept because of their cultural importance differ according to area and culture. We have to accept that in many areas, horses are regarded as more valuable than donkeys, even though donkeys require minimal care and are extremely useful. Animals may also be kept for other functions, e.g,. as "watch-dogs" (not only dogs, but also donkeys which can protect small ruminants against predators, or geese which are good "alarms").

Animals are usually kept for several purposes and therefore the type of animals actually kept is often a compromise. The importance of different functions varies over time. The conservation of farm animal genetic resources in smallholder and pastoral systems must, therefore, be dynamic and adaptive and not static.

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Sourcebook produced by **CIP-UPWARD**, in partnership with **GTZ** GmbH, **IDRC** of Canada, **IPGRI** and **SEARICE**.