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Conservation and management of animal genetic resources in agriculture: a challenge for German development cooperation

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Abstract
Although farm-animal biodiversity (FAB) played a role already in the Transfer-of-Technology phase of development cooperation and although the importance of local adaptation to the natural and economic environment is increasingly recognised, a generally accepted operational concept of FAB is still lacking. This is being sought through a recent GTZ project on agro-biodiversity. Necessary elements for a concept include avoiding concentration on few animal species, emphasising adaptation instead of phenotypes in breed definition, promoting site-specific selection in a wide variety of farming systems, supporting the development of breeding policies and strategies instead of breeding operations, and improving communication between farmers, development workers and scientists.

Key words: animal genetic resources, agro-biodiversity, development cooperation

Introduction

Development cooperation has come of age. This year, GTZ celebrated its 25th anniversary, and FAO already turned 54. It is not surprising that concepts and paradigms have changed over the years. Development efforts can be divided roughly into the following phases:

- **sectorial projects for Transfer of Technology** aiming at increasing production
- **integrated rural development**, aiming at developing all aspects of rural life
- **people-oriented development**, recognising the value of indigenous knowledge and aiming at greater ownership of project measures by local people, and
- **policy and political framework advice**, taking into account the importance of political and legal framework conditions for sustainable agriculture and food security.

Biodiversity - and particularly the conservation of animal genetic resources - became a major concern in development cooperation only fairly recently. In this paper, we will first discuss approaches to animal breeding during the above-mentioned phases of development cooperation. We will then outline our present ideas on conservation of animal genetic resources. Finally, we will look ahead to identify future challenges in this field .

Transfer of Technology (up to the early 1980s)

The main emphasis in this phase, which began to go out of favour in the early 1980s, was in increasing production. Projects and research were technical and sectorial, socio-economic

aspects were of little concern. It was widely believed that simply more meat and milk were needed and that, by introducing technologies from industrialised countries, more protein for poor and malnourished people could be made available. It was also believed that indigenous breeds in developing countries were unproductive and that farmers were ignorant and had to be educated. Therefore, the wholesale introduction of exotic "high-performing" breeds was attempted on state farms, and crossbreeding programmes were introduced to cater for private farmers. Some examples of this approach in German technical cooperation were the introduction of Braunvieh in Tunisia, Fleckvieh as dairy animals in Togo (Avetenou) or Schwarzbunte and Jersey in Savar, Bangladesh. Often, pregnant heifers were raised in Germany and then exported. As is now well known, the success of such ventures was only moderate. High-producing animals require reliable supplies of good-quality feed (often concentrates), reliable and affordable veterinary services, and good breeding infrastructure. In many countries, these are not available. Where the rearing of high-producing breeds was adopted, the already relatively rich farmers benefited more than did the poor farmers. Instead of enhancing food security for poor people, the socio-economic differences within the society became wider.

One trend in industrialised countries was successfully transferred to developing countries: the concentration on a very small number of animal species. Development efforts were centred on cattle, pigs, chickens and - already at a clear distance behind - sheep. This is also evident in the scientific literature: publications on the nutrition of these "big" farm animals can probably fill entire libraries, but when we received a request about a book on donkey nutrition and consulted one of the rare donkey specialists, he regretted that there was no such book available. Dealing with a wider variety of species was of little concern until it was slowly realised that the emphasis on high-producing breeds was a potential threat to biodiversity in livestock.

Of course, there were always a few scientists and development workers interested in "non-conventional" animals such as buffaloes, goats or camels. Some work supported by GTZ in this direction concerned camel husbandry in Tunisia (Burgemeister, 1975) and vicuna preservation in Peru in the 1970s (Hofmann *et al*., 1978), a compendium on rabbits in the 1980s (Schlohlaut, 1984) or, more recently, support to domesticating giant cane rats (Schrage & Yéwadan, 1995). However, these efforts concentrated on promoting a particular animal species, and insufficient attention was given to integrating the animals into the existing farming systems.

We had to learn that, with little or no veterinary care and with frequent feed shortages, indigenous breeds often outperform exotic breeds (e.g. Buck *et al*., 1982). It was then that animal adaptation to the environment began to attract increasing interest of researchers, and research and development activities started shifting towards characterising and promoting the use of indigenous breeds. Animals were increasingly regarded in a wider perspective of farming systems.

Integrated rural development and farming systems (mid-1970s to early 1990s)

We also had to learn that higher production alone is not sufficient to solve development problems. If poverty is to be overcome, people need access to food, buying power and/or opportunities to produce the food for themselves. This lead to a re-orientation of development cooperation towards a more holistic approach of integrated rural development, with a clear

focus on goal-oriented planning and implementation of projects and programmes with traditional livestock keepers (landless livestock keepers, smallholder farmers and traditional pastoralists). Increasingly, we also realised the importance of the socio-economic setting for the welfare of smallholders and for their way of animal husbandry.

Integrated rural development became mainstream in the mid-1970s. This was an attempt to develop whole - what we now call "livelihood" - systems. Projects were multi-sectorial, animal breeding being only a subsector. Top-down integrated rural development projects turned out to be very complex, expensive and difficult to manage. Lasting successes are few. On the positive side, these projects yielded important insights into production and livelihood systems of local people. The scientific partner of the integrated rural development approach was Farming Systems Research (cf. Ruthenberg, 1980). When looking at animal husbandry from this perspective, it became clear that animals do more than grow, lay eggs or produce milk. They have other important functions in rural households, such as:

- investment and savings account, including risk reduction
- draught power and pack animal
- manure production
- cultural asset .

Livestock keepers often live in harsh and diverse environments, household resource endowment varies greatly, and cultural preferences also differ between countries and regions. The types of animals needed may be those that can go without water for several days, defend themselves against predators, walk long distances, withstand heat or cold stress and survive periods when feed is of low quality or scarce in quantity. Many livestock keepers manage a range of species, e.g., chickens for home consumption, sheep and goats for sale, and cattle, buffaloes or camels for milk, transport and for sale when a large amount of money is needed.

The best-suited breeds and livestock portfolios depend not only on natural conditions but also on farming systems. Natural conditions and farming systems can vary greatly even within a small region. The combination of animals species and breeds kept by smallholders and pastoralists varies accordingly. In other words, they maintain and need animal biodiversity, although the individual livestock farmer will do so only if it is to her or his economic advantage. What also became clear was that farmers are local experts. Within the limitations of their natural, social and economic environment, they act very rationally. The value of their indigenous knowledge and of local capacities is increasingly being recognised, as well as the importance of local capacities. This recognition, in the light of the often very limited success of complex projects, led to the search for ways to work with rather than for farmers (BMZ 1993).

People-oriented development (1990s)

Pioneered in the 1980s by non-governmental organisations (NGOs) and development-oriented research organisations, participatory development became increasingly fashionable also in bilateral and international development co-operation. Nowadays, there are few project proposals which do not include the participation of local people - at least verbally - as a major concern. Participatory development is closely related to the development of local institutions.

As we now know, institutional development is sensitive and cannot be achieved within a short period of time.

There are few, if any, participatory projects designed to support the maintenance of biodiversity in domestic animals. Moreover, few farmers maintain their indigenous breeds if other breeds with a proven on-the-spot record are economically more advantageous. However, because agro-ecological conditions and resource endowment of farms differ greatly even within a region, animal breeds and species suited for particular circumstances will differ accordingly. It is the diversity of farming systems that requires and, to some extent, also insures livestock biodiversity. Past experience has taught us that it is rarely possible to scale up widely from some small successful pilot schemes. Instead, in maintaining or enhancing with biodiversity, a wide scheme of seeking very site-specific technical or biological solutions is needed, What can be scaled up or "extended" from pilot schemes are methods and approaches to participatory research and development designed to support farmers in their efforts to achieve the biodiversity that they need. Experience has further shown that giving recognition to farmers' knowledge and incorporating it into projects and programmes improves ownership of project activities by local people, although it is clear that external knowledge can be advantageously incorporated. Recent experiences indicate the potentials of open projects which allow joint learning by farmers and project personnel, rather than implementing a pre-determined blueprint. The initial project idea can start with concerns around livestock but can lead into supporting activities in human health or cropping, or vice versa.

Some lesson learnt so far include the following:

- instant project success cannot be expected. Establishing a good working relationship between project staff and farmers is a sensitive process, and requires time;
- external, especially expatriate, advisers are expensive and can hardly be justified if project successes cannot have a wide impact. Therefore, collaboration with local organisations is necessary; NGOs and community-based organisations should play an important role in designing, planning and implementing development projects and programs;
- development agencies are experiencing substantial difficulties in adjusting their organisational structure and procedures to the new requirements of participatory approaches and in yielding power to local institutions. This is also true for administrations within developing countries, which need to be truly decentralised. Therefore, substantial advisory support in organisational change is needed;
- in regions with long experience of conventional development projects, local farmers and pastoralists also have difficulties in accepting new roles in terms of greater responsibilities (especially financial contributions), because the earlier projects often provided (non-sustainable) hand-outs;
- despite the great importance of institutional development and empowerment of people, efforts in this direction cannot stand alone; they need a clear and sound purpose such as better veterinary services, or concrete suggestions for better animal nutrition or appropriate breeding strategies;
- there is an increasing recognition of the importance of the political, legal and institutional framework for the appropriateness and success of development efforts, including those to preserve biodiversity.

These lessons are oriented more to process than to topic, and are therefore applicable not only to livestock projects but to development project and programmes in general.

Policy framework-centred approach (present ....)

In recent years, more emphasis is being placed on supporting the creation of an enabling political and legal environment for development. Concepts such as "good governance" have gained in importance. Support includes advice on setting up legal frameworks, such as reforms in rights to land and other resources, and advice on formulating regional or national policies. This also includes provision of support to developing countries during international negotiations of protocols and international conventions, such as the convention to combat desertification or the convention on biological diversity, the so-called Rio follow-up meetings or, in the near future, the negotiations on the mandate and regulations within the framework of the World Trade Organization (WTO). Here, we have to aim at including our concern about livestock biodiversity into such negotiations, into the process of reforming resource-use rights, and in connection with other policy issues.

Giving policy advice and support during international negotiations is a sensitive process, and requires considerable diplomatic skills. Nevertheless, we are carefully optimistic that the policy framework-centred approaches in development collaboration will have a positive impact.

Our present concept

The discussion on biodiversity was given a major boost with the convention on biodiversity (Secretariat of the Convention on Biological Diversity, 1998) agreed during the Rio conference in 1992. Despite valuable contributions by experts and projects within development cooperation, an operational and generally accepted concept of agro-biodiversity is still lacking. Therefore, a sector project for supporting agro-biodiversity has recently been launched within the GTZ, with the aim of developing an operational concept of agro-biodiversity in both plants and animals. Use of the term "agro-biodiversity" means that we have to emphasise utilitarian aspects of biodiversity, although we do not negate an important cultural dimension.

In the public discussion on genetic diversity, animals have been given much less attention that plants. This is also because animals are more complicated than plants. Whereas plant genetic diversity can be conserved to some extent *ex situ* in gene banks, where small seed samples can be stored for years, animals can presently be conserved only *in vivo.* Another difference is with respect to intellectual property rights, which thus far are less critical in farm animals than in plants. Medicinal plants from the Amazona region have been patented in the USA, but we are not aware that the same has happened to exotic farm animals.

In the case of livestock, the first step in preserving biodiversity is good documentation. We draw attention here to books such as those published by the National Academy of Science in the USA and to work by ILCA (now ILRI) and other international and national R&D organisations in characterising breeds and productivity on station and under field conditions over the last 20 years. FAO is in the process of developing a "Global Strategy for the

Management of Farm Animal Resources", which should be able to provide a good overview of the current status of livestock species and breeds.

Our present view is that livestock biodiversity has to be managed on three levels:

- on species level
- on breed level
- within breeds.

On the species level, we have to get away from exclusive focus on the "big" species. Although livestock keepers generally know how they can manage their local species, interest shown by research scientists can enhance the self-respect of local knowledge holders and can influence policy advice to improve the framework conditions for maintaining and improving indigenous breeds and species. Good scientific research into less-known species and local breeds can also help to avoid expensive and not very promising projects not only by government agencies but also by well-meaning NGOs.

In industrialised countries, breeds are defined by breeding associations and herd books. Where herd books do not exist, breeds have been defined as

> "either a sub-group of domestic animals with ... identifiable external characteristics ... to be separated by visual appraisal from other groups of the same species ... or a group for which geographically and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity" (FAO, 1999).

We know that external characteristics are important for the cultural dimension - in Europe, what would be the Alps without Braunvieh? - but we think that physiological and behavioural characteristics are at least of similar importance when we look at disease pressure, or at variable forage quality and quantity.

We should look beyond the phenology and should fit animals to the production system and environment, not vice versa. As environments and resource endowments are very diverse, a range of species is needed, not only a few specialised breeds within a species. Adaptation to the environment is already an element in the FAO breed description, but needs to be given more emphasis. FAO classifies the status of breeds as follows:

- extinct breeds, i.e. it is no longer possible to re-create a breed population
- critical breeds, in which the number of breeding females is less than 100 and the number of breeding males less than 5, pure-bred females are below 80% of the population and decreasing in numbers
- endangered breeds, in which breeding females number between 100 and 1000, and breeding males 20 or slightly above and are decreasing in numbers
- critically-maintained and endangered maintained breeds, i.e. breeds with the above numbers but being supported by an active public conservation programme
- breeds not at risk, with breeding females numbering more than 1000 and breeding males more than 20 or close to these figures, and increasing.

The numbers given above may have some meaning for slowly reproducing livestock, such as cattle, buffaloes or camels - at least as long as natural service is used. The genetic make-up and the relationship between individuals becomes more critical with faster-reproducing species such as pigs or chickens, or when artificial insemination or even embryo transplants are used on a wide scale.

We think that breeding practices should also be included in the definition. For example, it has been estimated that, if present selection intensity and breeding practices continue within the Holstein-Friesian cattle population in the USA (several million individuals), the number of genotypes within that population will be 66, or genetically similar to a population of 66 animals not closely related (de Haan *et al.,* 1997). Will this be soon a breed at risk?

Animal breeds are not static; environmental factors can exert some selection pressure, even if animals are allowed to breed freely. Moreover, most smallholders and pastoralists select their breeding males. If animal breeds are conserved on station or *ex situ0,* the environment usually differs from that outside the station: tsetse flies are often controlled more effectively on station, where feed supplements are more readily available, etc. As animals are generally selected, it can well be that, after some generations, animals on station are substantially heavier than those in the field. A ewe weighing 60 or 70 kg is a type of animal that is quite different from one weighing 35 or 40 kg, and it may no longer be able to cope with harsh conditions outside the station. We therefore think that, wherever possible, breeds should be conserved *in situ,* as there is then a better chance that a genetic make-up will be maintained that is adapted to the prevailing agro-ecological conditions. This does not mean, however, that selection for better performance under field conditions should be not be supported.

We are also aware of the influence on genetic diversity exerted by changes in economic conditions. It is hard to explain to pastoralists that they should stay with their small breeds, when meat prices are high and feed grain is cheap and a more intensive way of production with larger-framed animals is more profitable. In such cases, feed grain subsidies would have to be abolished and drought subsidies critically reviewed.

We must, however, also admit that we still have to invest much more in developing clear and operational concepts for our livestock-related development programmes.

Future challenges

The first challenge will be to develop an operational concept of farm-animal biodiversity and its incorporation into development cooperation. We have a fair knowledge of the biological advantages of animal biodiversity, and the FAO provides a good base for developing a concept. But we need to stress more strongly the importance of physiological characteristics of animals, and get away from the emphasis on phenotypes. Furthermore, the different functions of animals in different livestock-keeping systems need to be better taken into account in animal breeding. It will be by encouraging local people to keep the breeds most suitable for their very specific agro-ecological conditions, in many different environments, that livestock biodiversity will be best maintained.

In the past, conventional projects often concentrated on breeding operations and - if all went well - on breeding plans. We need to address first and foremost the questions of breeding policies and breeding strategies. This will demand, among other things, a critical but open

review of crossbreeding and of subsidies for artificial insemination. Furthermore, we need to improve methodologies for economic assessment of the costs and benefits of raising indigenous breeds, and of the costs and risks of losing them. We need to support the development of an enabling environment for realising breeding policies and strategies which take into account not only an improvement in productivity but also the maintenance of biodiversity already in the short term.

We need a realistic assessment of the potentials and limitations of "little-known animals" (BOSTID, 1991). This should include an assessment of only locally important or partly domesticated species, such as iguanas in Central America. We also have to admit that not all dreams can come true and especially not as soon as tomorrow. The process of domesticating wild animals, even where this is biologically feasible, is a long one and it will take some time before there are sufficient numbers to have a large impact in animal husbandry. Direct support for research is beyond the means of our project. Together with the scientific community, however, it may be possible to influence the research calls of, for example, the EU or research partnerships supported from other funds to support the necessary studies.

Finally, we need better communication between scientists, government agencies, development organisations, livestock breeders' associations and livestock keepers about principles, policies and practices for enhancing livestock biodiversity. This may include support for sessions on these topics during national and international meetings, initiating workshops on biodiversity at international, national or sub-national level, and supporting related publications for different readerships and in different languages. Although this meeting in Berlin is bringing together only scientists, consultants and some development practitioners, we think that it is making a good contribution to improving communication on the significance of livestock biodiversity.

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