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Agrobiodiversity – animal genetic resources

At a time when a growing world population needs to be fed on limited resources in a changing climate, the conservation and sustainable use of agricultural biological diversity gains utmost importance. Agrobiodiversity plays a crucial role in food security and nutrition, as well as in the provision of environmental services and livelihoods. It is critical to the sustainability, resilience and adaptability of agricultural production systems. To promote awareness and share knowledge on conservation and the sustainable use of agrobiodiversity, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ), has published this series of agrobiodiversity factsheets.

The present factsheet gives attention to those agrobiodiversity issues that are related to animals. (Note: One of the other factsheets deals with plant genetic resources). It explains the importance of genetic diversity in livestock, describes present trends in the development of animal genetic resources, and gives a brief overview about relevant key events and institutions. It explains the value of local breeds, *in situ* and *ex situ* conservation of animal genetic resources as well as the special role of small-scale livestock keepers and pastoralists in the development, use and conservation of animal genetic resources. Finally, the paper presents key elements for promoting the conservation and sustainable use of livestock genetic resources.

Animals for food and agriculture and their genetic diversity

Domestication of animals began over 12,000 years ago. Only about 40 of the 50,000 known mammalian and avian species were selected as useful by different human cultures and domesticated. Today's livestock diversity is the result of thousands of years of human intervention. 14 species account for most of global livestock production, and five of them (cattle, sheep, goats, pigs and chickens – the so-called 'big five') show particularly large numbers. In the past century, research and breed improvement programmes have concentrated on the 'big five' and breeding for production. Locally adapted breeds of these species and of other, 'minor', species such as dromedaries and Bactrian camels, yaks, water and dairy buffaloes, as well as donkeys were regarded as less productive and less economic, and received little attention.

What is agrobiodiversity?

Agricultural biodiversity includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems: the variety and variability of animals, plants and micro-organisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem. Agrobiodiversity is the outcome of the interactions among genetic resources, the environment and the management systems and practices used by farmers and herders. It has developed over millennia, as a result of both natural selection and human interventions.

In contrast to plant genetic resources for food and agriculture, animal genetic resources for food and agriculture comprise fewer species, have lower reproduction rates, and longer generation intervals. The major centres of livestock domestication are less relevant than the crop centres of origin. Unlike the many crop wild relatives, there are only very few wild relatives of livestock, such as wild banteng, gaur, kouprey, wild yak, and wild water buffalo in Asia. Many livestock wild relatives are already extinct. The risk status of these wild relatives is categorized in the IUCN Red List of Threatened Species, while the



What is a breed?

There is no strict scientific definition of a breed – a breed is a breed if enough people say it is. Scientists usually define a breed as 'a group of animals with definable and identifiable external characteristics that distinguish it from other groups within the same species'.

According to the FAO a breed is 'either a sub-specific group of domestic livestock with definable and identifiable external characteristics that enable it to be separated by visual appraisal from other similarly defined groups within the same species, or a group for which geographical and/or cultural separation from phenotypically separate groups has led to acceptance of its separate identity.'

risk status of domestic animal breeds is classified in the FAO Domestic Animal Diversity Information System (DAD-IS).

The erosion of animal genetic resources is much more serious than in crops, given the fact that the gene pool is much smaller. In September 2015, DAD-IS compiled data on 38 livestock species (21 mammalian and 17 avian). In total, 8,812 breeds were registered (6,242 mammalian and 2,570 avian) which consisted of 7,754 local, 513 regional transboundary and 545 international transboundary breeds. 7 % of these breeds are already extinct, and 26 % are at risk of extinction (the FAO defines this as breeds with fewer than 1000 breeding females, or 20 or fewer breeding males). However, many breeds (31 %) have an unknown status, indicating insufficient monitoring and reporting.

Why are animal genetic resources important?

Livestock contributes 40 % of the global value of agricultural output and provides approximately 26 % of human global protein consumption and 13 % of total calories. Nearly 1 billion of the rural poor hold livestock. The value of animal genetic resources for humankind are manifold as they provide different productive, cultural and ecological services. Livestock contributes to food production (meat, milk and eggs), livelihoods and economic output. It provides fibres, hides and skins, transport and agricultural draught power, fertilizer and fuel, as well as income, savings and insurance. Livestock plays ecological roles and has impacts, both positive and negative, on the functioning of the ecosystems in which it is kept – methane production, carbon sequestration, regulation of water cycling, maintenance of soil fertility, and provision of wildlife habitats.

Genetic improvement of livestock populations is dependent on the existence of genetic variation, between breeds and among animals within breeds. The degree of diversity of animal genetic resources is directly related to the capacity of livestock populations to adapt to future changes in environmental and market conditions. Livestock keepers need a broad gene pool to draw upon if they are to improve the characteristics of their animals under changing conditions. Therefore, genetic diversity is the basis for future development.

Ecosystem services and livestock breeds

Breed roles in ecosystem services relate to the ability of indigenous breeds to provide ecosystem services in harsh, remote and/or fragile environments. However, the extent to which these ecosystem services are actually delivered depends on a range of institutional factors and management practices. Actions that shift pastoralism from a sustainable to an unsustainable land use option, such as the conversion of pastoral lands to sedentary agriculture or the replacement of traditional livestock breeds with exotic stock, can cause the degradation of ecosystem services. For example, degradation of vegetative cover can undermine water-cycling, leading to both increased flooding and increased drought threatening both development and biodiversity objectives. For further information, see Hoffmann et al., 2014: Ecosystem services provided by livestock species and breeds, with special consideration to the contributions of small-scale livestock keepers and pastoralists, and FAO, 2014: The nature of ecosystem services provided by livestock species and breeds.

Present trends

Growing populations and incomes, along with urbanisation and changing food preferences, have been rapidly increasing the demand for livestock products, while globalization is boosting trade in livestock inputs and products. Humankind's ability to influence production environments and to move genetic material around the world has increased, see also the



Photos: © Christine Martins

GIZ factsheet (in the present text, GIZ factsheets, hyperlinked, are marked with ▸):

▸ *GIZ, 2006: Gene flow: Farm animals travel the world*

The livestock sector has undergone tremendous changes. Increasing polarisation has occurred across different regions. Development has differed drastically in developed and developing countries, in urban and rural areas, in high-intensity industrial and low-intensity systems, in large-scale and smallholder production systems, in sedentary and pastoralist systems, as well as in monogastric (pigs, chickens) and ruminant (cattle, sheep, goats) production systems. The world's livestock production is increasingly based on a limited number of breeds, and genetic diversity within these breeds is in decline.

There are shifts from subsistence-level livestock keeping to market-oriented production and shifts towards sedentarization and disintegration of pastoralism. Niche markets and specialty markets for high-value livestock products from local breeds have emerged. The livestock sector is entering into greater and more direct competition for scarce land, water and other natural resources. The shrinking of common-property resources due to population pressure and the expansion of cultivation and nature reserves, as well as land-grabbing, particularly affects pastoralists and small-holder livestock producers.

Feed requirements of different livestock types (ruminants and non-ruminants) and species, as well as availability and type of feed resources, determine to a large degree the scope for expansion and intensification of production. Development of intensive, near-landless systems for poultry, pig and milk production has gone much further than for beef and small ruminants. The growth in demand for livestock products in the poultry, pork and dairy sectors has been especially huge in countries with a large population and high economic growth rates (e.g. China, Brazil and, partly, India).

In highly industrialized pork and chicken production systems, hybrid breeds are used. Hybrid animals are the result of cross-breeding. These animals acquire better productivity characteristics than non-hybrids, but cannot be reproduced in a stable manner. Farmers and breeders always need to buy new chicks and piglets from the company controlling the parent and grandparent lines. Increasingly, intellectual property issues are of concern in animal genetic resource management. The majority of patent activity focuses on dominant breeds and does not involve genetic material from rarer breeds from specific countries or the use of traditional knowledge (see WIPO, 2014: Patent landscape report on animal genetic resources).

Though there is an increasing trend towards intensification and industrialization, extensive grazing still occupies vast areas of land. Many traditional livestock breeds continue to be kept by poor rural people, in more or less traditional production systems. Even where large-scale production has taken off, it often coexists with more traditional production in rural areas as well as with small-scale production of various types in urban and peri-urban zones. Given the experience of developed countries, the spread of highly intensified livestock production into the developing world has raised concerns about the fate of the locally adapted breeds, particularly in those regions such as East and Southeast Asia that have been most affected by the rapid expansion of large-scale, highly intensified pig and poultry production.

Threats to livestock genetic diversity in developing countries

- Information on the state of local livestock breeds far from complete
- Indiscriminate cross-breeding
- Weak programmes, policies and institutions for the management of livestock genetic resources
- Economic problems and market-related threats
- Factors that undermine sustainability of smallholder and pastoralist production systems
- Degradation of (or lack of access to) natural resources, disease epidemics, and climate change

Drivers of change in animal genetic resources over the last ten years:

- Changing demand for livestock products (quantity and quality)
- Economic, livelihood or lifestyle factors affecting the popularity of livestock keeping
- Changes in international trade in animal products
- Policy factors

Source: FAO, 2014: The second report on the state of the world's animal genetic resources – state of development and overview.

Even though there is a global trend of industrialized pig production using hybrid breeds, in rural areas all over the world smallholders continue to keep traditional breeds. Indigenous pig breeds are assumed to be 'low producers', although many of them have never been documented and characterized. Their advantages over hybrid pigs is in terms of ability to use a variety of feed, to forage for themselves and to cope with disease pressures.

Photos, l.t.r.: © Ute Grabowsky/photothek.net; © Christine Martins

'Livestock revolution' and 'livestock's long shadow'

Already in 1999, the changes in the livestock sector were described with the term 'livestock revolution' to highlight the accelerated growth in demand for livestock products in parts of the developing world. This was tied to human population growth, rising incomes, continuing urbanisation and changing food preferences. In contrast to the earlier Green Revolution which was supply-driven, the livestock revolution is demand-driven. The changes in the production, processing, retailing and consumption of livestock products had massive structural, financial, social and environmental implications (Sumberg and Thompson, 2013).

The 2006 study 'Livestock's Long Shadow' (FAO, 2006) shows the livestock sector's significant contributions to the most serious environmental problems, such as land degradation, climate change, air pollution, water shortage, water pollution, and loss of biodiversity. Environmental problems are associated with both production systems: low-intensity production (primarily as a result of land degradation) and high-intensity industrial production (mainly because of pollution, greenhouse gas emissions and environmental damage associated with the production of feed crops).

Global governance of animal genetic resources for food and agriculture

FAO's Commission on Genetic Resources for Food and Agriculture (CGRFA) established in 1997 the Intergovernmental Technical Working Group on Animal Genetic Resources. In its 2007 report on 'The State of the World's Animal Genetic Resources for Food and Agriculture' (SoW-AnGRFA), the working group expressed its concern about the urgent need to sustainably manage animal genetic resources. In the same year, the FAO Conference adopted the 'Global Plan of Action for Animal Genetic Resources' and the 'Interlaken Declaration'. The second SoW-AnGRFA is due to be published in November 2015.

There is no internationally agreed-upon convention or treaty for the conservation of animal genetic resources, such as there is for plants (the International Treaty on Plant Genetic Resources for Food and Agriculture, ITPGRFA). Important steps and key events concerning animal genetic resources for food and agriculture are listed in the timeline below.

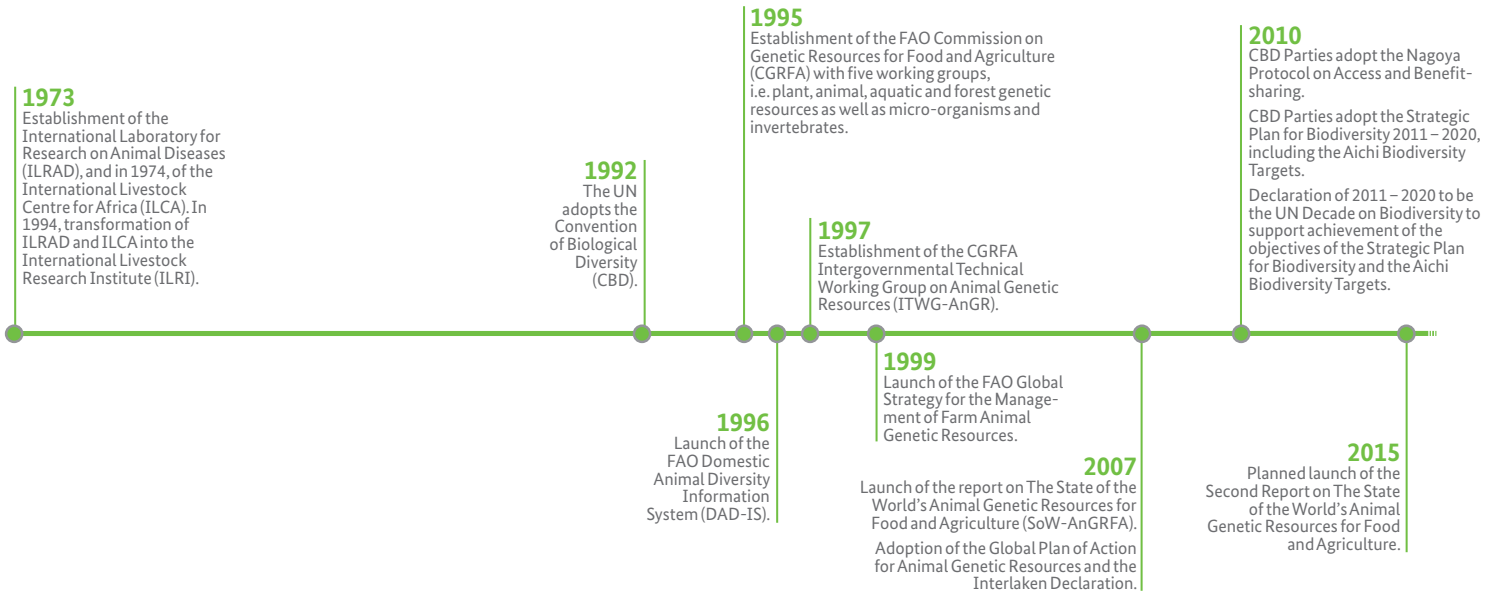
Animal genetic resources in the Aichi Targets

Aichi Target No. 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.

- Target element 2: The genetic diversity of farmed and domesticated animals is maintained.
- Target element 5: Strategies have been developed and implemented for minimizing genetic erosion and safeguarding genetic diversity.

All FAO member states are required to develop national strategies and action plans (NSAPs) for animal genetic resources. National, regional, and global focal points for planning and implementing these in the livestock sector have been appointed. The International Livestock Research Institute (ILRI) works as the main global research organisation for animal genetic resources. It has been developing the Domestic

Timeline of key international events in animal genetic resources



Animal Genetic Resources Information System (DAGRIS) as a web-based electronic source of information on selected indigenous farm animal genetic resources. The FAO-run Domestic Animal Diversity Information System (DAD-IS) has already been mentioned.

The value of local breeds

Many harsh production environments, such as those characterized by extreme temperatures, lack of good-quality feed resources, high elevations, rough terrain or high disease pressures, can only be utilized effectively by breeds that have particular characteristics enabling them to cope with these challenges. Traditional breeds, suited to local conditions, survive times of drought and distress better than exotic pure breeds or their cross breeds and, therefore, frequently offer poor farmers better protection against hunger. Locally adapted breeds tend to be more commonly found in marginal areas with stressful environments and high poverty rates. Globally, 51 % of all sheep, 44 % of goats, 38 % of cattle, 21 % of pigs and 27 % of chickens occur in systems where predominantly locally adapted breeds can thrive.

In fertile, favourable environments, there is a high probability of finding exotic, international transboundary breeds. The share accounted for by crossbreeds depends largely on the level of intensification. Local breeds are generally not used in intensive and large-scale systems, as their low output of marketable products makes keeping them unviable economically (Hoffmann et al., 2014).

Under climate change, the importance of well-adapted animals is likely to increase in those production systems where extensive use of external inputs is rarely possible. The genetic diversity of the world's livestock provides a range of options that are likely to be valuable in climate change adaptation, including resistance and tolerance to specific diseases, adaptation to poor-quality diets or to feeding in harsh conditions, and tolerance of climatic extremes.

Many countries face the challenge of managing their animal genetic resources across a range of very different production systems. There has so far been insufficient research on the genetic performance of local livestock breeds. Often, governments promote cross-breeding and replacement of indigenous with exotic breeds and insufficiently consider the locally available genetic resources. Different production systems require different livestock-support strategies and different types of animal genetic resources – they cannot be managed with a 'one size fits all' approach.

- *GIZ, 2005: Indigenous knowledge of animal breeding and breeds*
- *GIZ, 2006: Landraces – Allies in the fight against animal epidemics*
- *GIZ, 2008: Conserving local livestock breeds – Political strategies and legal regulations*

In situ and *ex situ* conservation

There are two possibilities for conserving animal genetic resources: *in situ* conservation, which is conservation on-farm by farmers; and *ex situ* conservation, which is conservation action away from the habitat and production systems where the resource developed – this can be either by the maintenance of live animals (*in vivo*) or by cryoconservation, the deep-freezing of genetic material in gene banks (*in vitro*). *In situ* conservation also includes steps taken to ensure the sustainable management of ecosystems used for agriculture and food production. Generally, *in situ* conservation is preferred because the genetic diversity of animals can evolve with the environment.

Cryoconservation of animal genetic resources can be used with mammals, but not with birds. There are three main methods for storing animal genetic material *in vitro* in gene banks. Semen is the most common material conserved. Its collection and use is rather low cost and it requires only moderate technical capacity. Storing embryos is an option for more special situations; it involves greater costs and technical capacity. The third option is storing somatic cells. This method is applied against the extinction of livestock breeds. The utilization is difficult and expensive. See also FAO, 2013: *In vivo* conservation of animal genetic resources, and FAO, 2012: Cryoconservation of animal genetic resources.

Gene banking can play an important role in national programmes for animal genetic resource management. However, many breeds or animal populations with specific characteristics are not well characterized and their genetic basis is not well known. There are so far only a few breeds which have been re-established from cryoconserved material. Livestock genetic resources do not have a global breed repository such as the Global Seed Vault and no global safeguard organisation such as the Global Crop Diversity Trust.

- *GIZ, 2006: Deep-frozen? Alive and kicking? Different approaches to the conservation of farm animal diversity*

Different production systems require different animal genetic resources.

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The Nguni cattle of South Africa are an example of ex situ in vivo conservation of a local breed: almost extinct, they were conserved on government farms, outside their natural habitat, and once their numbers had been increased by breeding, they were made available for commercial production.

Conservers of animal genetic resources

CGRFA and FAO have continuously stressed the important role of small-scale livestock keepers and pastoralists in the development, use and conservation of animal genetic resources (see FAO, 2009: Livestock keepers – Guardians of biodiversity). Breed diversity is especially high in peripheral and remote areas, notably drylands. Since their livestock is exposed to natural selection, smallholder livestock farmers and pastoralists play a crucial role in the development of adaptation and fitness traits.

The use of multi-species and multi-breed herds and flocks is one strategy that many traditional livestock farmers use to buffer against economic and climatic adversities. Different breeds and species make different contributions to livelihoods. Generally, the more complex, diverse and risk-prone peasant livelihood systems are, the more they need animal genetic resources that are flexible, resistant and diverse in order to perform the required functions.

- *GIZ, 2010: Livestock as Integral Part of the Rural Economy*

Invisible guardians – women managing livestock diversity

Feminization of agriculture as a result of outward-migration of men to urban areas turns women into important livestock keepers. They play a major role in managing animal genetic resources and thereby conserving them. Rural women tend to have an affinity and preference for indigenous rather than improved breeds because they are easier to manage and disease resistant and therefore do not increase their workload. For further information, see FAO, 2012: Invisible guardians – women managing livestock diversity and

- *GIZ, 2013: Gender and Livestock Production*
- *GIZ, 2013: Gender and Rural Development – Aspects, Approaches and Good Practices*

Smallholder livestock farmers

Despite of the global trend towards high-intensity livestock production, smallholder livestock production plays an important role in food and nutrition security as well as poverty alleviation in developing countries. According to FAO data, smallholders produce between half and three quarters of total livestock production in Africa and Asia.

Smallholders make efficient use of scarce natural resources and seek to optimize the returns from (heterogeneous) family labour. Two challenges for rural smallholders are risk management and vulnerability. In response to these, smallholders have developed multiple strategies for risk management (*ex ante*, e.g. by diversification into livestock) and coping with shocks (*ex post*, e.g. by reducing variability in food consumption). Livestock offer many advantages to smallholders as they are generally more adaptable to environmental shocks than crops are; animals are mobile, which increases their survivability; they do not have a specific harvest season as most crops have; and may also be able to digest a wide variety of feedstuffs, thereby having the capacity to survive dramatic reductions in specific feed resources. Native animal breeds are adapted to local environmental risks and use available natural resources efficiently.

Pastoralists

There are world-wide about 190 million households making their living from nomadic or semi-nomadic livestock keeping. Such pastoralist communities create value in arid and semi-arid as well as remote highland regions where pastoralism is often the only sustainable form of agriculture possible – their mobile herding strategies enable them to produce food in areas too dry for cropping. Pastoralism is increasingly recognised and valued as a rational production system that is environmentally well-adapted to difficult and variable climatic conditions of arid and semi-arid regions. However, in most parts of the world, pastoralist systems are facing a crisis due to a decline in common-property resources, and unsupportive polices (e.g. driving sedentarization, restricting transboundary movements) as well as neglect by governments leading to disintegration and marginalization of pastoralist communities.

Mobile and flexible, pastoralists have created numerous breeds of cattle and camels, sheep and goats. These animal breeds

have evolved over centuries within specific ecological and social systems, without herdbooks and breeders associations. Subject to strong natural selection pressure, they hold many traits that enable them to optimally use their environment, including tolerance of climatic extremes (such as hot temperatures), adaptation to poor-quality diets or to feeding in harsh conditions, and resistance to and tolerance of specific diseases. Representing the collective heritage of the communities they are associated with, these breeds cannot be conserved separately from their production systems: they will survive only as long as the knowledge systems in which they are embedded also survive.

Pastoralist production systems are important because they are a rich reservoir of adaptive genes. They counterbalance the ever-narrowing genetic base of high-performance animal breeds. See also CBD, 2010: Pastoralism, nature conservation and development – a good practice guide, and

- *GIZ, 2011: Agrobiodiversity in drylands*
- *GIZ, 2013: Pastorale Nutztierhaltung als integraler Bestandteil marginaler Standorte*

Livestock keepers' rights

'Livestock keepers' rights' is a concept developed by civil society during the 'Interlaken process' (around 2007) and is advocated for by a group of non-government organizations, livestock keepers, pastoralist associations and scientists who support community-based conservation of local breeds. The concept was originally developed in accordance to the 'Farmers' Rights' which are described in the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA). Started as an effort to achieve formal recognition for livestock keepers around the world as creators and custodians of animal genetic resources, the concept has since been expanded and now includes rights to grazing, water, markets, training and capacity-building, and participation in research design and policy-making, as well as rights to the genetic resources of their animals. In contrast to 'Farmers' Rights', livestock keepers' rights also include strengthening small-scale livestock keepers and supporting them to make a living in their traditional agro-ecosystems (see LIFE, 2010: Declaration on livestock keepers' rights; and Köhler-Rollefson et al., 2010: Livestock keepers' rights: the state of discussion).

Biocultural community protocols

Pastoral communities and other indigenous peoples and local communities are often struggling to defend their rights over land and other resources they have traditionally used and over traditional knowledge they have developed over generations. Their role in the management of biological diversity, not only its livestock breeds but also its contribution to general ecosystem management, are often neither documented nor rewarded. This can be done by biocultural community protocols. This approach evolved about ten years ago, starting with civil sector organizations in South Africa and India. It implements the CBD and its Nagoya Protocol on Access and Benefit-sharing.

Biocultural community protocols provide a mechanism through which communities can assert their rights. These protocols make the linkages visible between breeds and the communities that have developed them and lay some claim to their animal genetic resources. See also IIED, 2012: Biodiversity and culture: exploring community protocols, rights and consent, www.community-protocols.org and

- *GIZ, 2011: Biocultural community protocols*

Outlook

The conservation and sustainable use of animal genetic resources for food and agriculture are important for assuring rural livelihoods, food and nutrition security, and cultural and ecosystem services – especially when considering the present trend of intensification and the narrowing of the genetic basis of livestock production. For different environments and production systems, specific livestock support strategies need to be developed. Imported high-performance breeds are often only suitable for specialised facilities and, in this case, no or little benefit arises to the poor rural population. However, in the long term, modern, intensive production will increasingly replace traditional, extensive production in places wherever this is possible.

Women make up the majority of poor livestock keepers, representing two-thirds of the estimated 600 million poor livestock keepers in the world. Women as the main keepers of locally adapted livestock breeds play a major role in managing animal genetic resources. As women are severely disadvantaged with respect to land ownership, locally adapted breeds that can access and utilize common-property resources represent an enormous asset.

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Key elements for promoting the conservation and sustainable use of livestock genetic resources include:

- Avoiding one-sided subsidies for imported breeds
- Increasing support in low-potential areas (extension, research, funds, secured access to land and water)
- Supporting local breeding and marketing organisations
- Improving breed management, pasture management and stocking rates
- Improving livestock productivity (more focus on quality instead of on quantity)
- Rising awareness on ecological services provided by smallholder livestock keepers and pastoralists.

Important links

- Commission on Genetic Resources for Food and Agriculture: www.fao.org/nr/cgrfa
- Community protocols: www.community-protocols.org
- FAO Pastoralist Knowledge Hub: www.fao.org/pastoralist-knowledge-hub/en
- International Livestock Research Institute (ILRI): www.ilri.org
- League for Pastoral Peoples: www.pastoralpeoples.org
- Sector Project Sustainable Agriculture (NAREN): www.giz.de/sustainable-agriculture

Further information

- FAO, 2007: The State of the World's Animal Genetic Resources for Food and Agriculture. www.fao.org/docrep/010/a1250e/a1250e00.htm
- FAO, 2007: Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration. www.fao.org/3/a-a1404e.pdf
- FAO, 2012: Livestock sector development for poverty reduction: an economic and policy perspective – Livestock's many virtues. www.fao.org/docrep/015/i2744e/i2744e00.pdf
- Heinrich Böll Foundation and Friends of the Earth Europe, 2014: Meat Atlas – Facts and figures about the animals we eat. www.boell.de/sites/default/files/meat_atlas2014_kommentierbar.pdf
- Koehler-Rollefson, Ilse, and Hartmut Meyer, 2014: Access and Benefit-Sharing of Animal Genetic Resources – Using the Nagoya Protocol as a Framework for the Conservation and Sustainable Use of Locally Adapted Livestock Breeds. www.fao.org/ag/againfo/programmes/en/genetics/documents/ITWG_AnGR_8/side-event/01_Invitation-ABS_for_AnGR_GIZ_LPP.pdf
- The LIFE Network, 2010: Local Livestock for Empowerment. www.pastoralpeoples.org/docs/lifebrochure_web.pdf

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