CHAPTER 6
PRESERVING AND DEVELOPING UNIQUE ANIMAL GENETIC RESOURCES FOR

HOW COMMUNITIES MANAGE LOCAL ANIMAL GENETIC RESOURCES

The thirteen case studies cover five climatic zones; seven out of the nine ruminant production systems are wholly or partially mobile (transhumant); i. e. where people with their animals move between two distinct seasonal pasture areas, usually at considerable distance or altitude from each other. The Nepali buffalo, Somba cattle, Basotho ponies, swine and poultry are associated with sedentary agricultural, or agropastoral systems. Livestock breeds in traditional systems are very often multipurpose rather than specialized. Large ruminants provide milk, meat, draught, transport, dung (which may be used as fuel), hides and in some cases (camelids, yaks) fibres.

MOBILE, EXTENSIVE PRODUCTION SYSTEMS

Few, if any, extensive livestock production takes place on land of good agricultural potential nowadays. The case studies are all in areas where the climate, the soils or both are not conducive to crop production and stock-rearing is the most obvious way to gain a living. Mobile herding requires detailed knowledge of the terrain and considerable stock management skills; it also requires recognition (official or traditional) of grazing rights and migration routes as well as cooperation among herder groups.

Farmers will select and keep animals that provide products best meeting their needs so that the production potential of the animals is maximized under the given circumstances. In the areas of the case studies, the climatic and environmental conditions are harsh and feed is scarce and of low quality, but the animals raised in these areas are physiologically adapted to such conditions. With appropriate management, based on local knowledge transmitted from generation to generation, they can live and produce in harmony with people and the environment.

Neuquén goats are reared, under cold, semi-arid conditions, in a traditional transhumance system, although families are now settled while herds continue to migrate on their transhumance circuit. Land development and forestry now hamper transit routes and resting sites. Border closure has limited their migration range and trading possibilities. Bhutanese yaks are raised at very high altitudes where other livestock do not thrive. They follow traditional transhumance, but they have also had their range limited by border closure. Bolivian camelids are raised in a high altitude, cold semi-arid zone where they have advantages over exotic species and are managed in a transhumant system. Sheep in the Central Peruvian Andes are raised in a high mountain ecosystem of very humid, tropical, sub-alpine plains and rainy tundra-tropical alpine zones. Tajik zebu are found in semi-arid areas of Central Asia and may be in sedentary systems or move to summer pastures; when Tajikistan was in the USSR livestock were collectivized; decollectivization has upset livestock production systems

which are still in the process of stabilization. Navajo-churro sheep are being revived as a breed after near extinction and management systems may be evolving, but their owners mainly keep to traditional mobile methods which suit harsh, semi-arid conditions. Karakul sheep are kept in transhumant systems under desert to semi-desert conditions; the slaughter of many lambs immediately after birth for high-value pelts reduces the overall nutritional needs of the flock and help survival on very sparse pastures; decollectivization has again disrupted livestock services and infrastructure.

In most of the extensive systems herd size is relatively large; mating may be poorly controlled as in the case of yaks in Bhutan and zebus in Tajikistan, or controlled to various degrees as in the cases of Peruvian sheep, goats and camelids.

SEDENTARY PRODUCTION SYSTEMS

Livestock are a component of many sedentary farming systems; often a very important one. In smallholder subsistence farming, where much of the crops are consumed domestically, livestock often provide the main cash income as well as being a means of commercializing crop residues and any available grazing, while also serving as savings. In subsistence, low external input systems use hardy local breeds. Where farming intensifies and free grazing becomes scarce, stall-feeding may be necessary; in that case higher yielding breeds may become attractive, especially for cattle where there is a good demand for fresh milk – as in the Nepal study.

Basotho ponies are raised on grass, in cool, subtropical mountain conditions. Buffaloes in the Hills of Nepal are stall-fed in subtropical hills within cropping systems and utilize large quantities of crop residues. Schwäbisch Hällisches Landschwein are raised under European commercial conditions. Somba cattle are kept under lowland tropical conditions, with a severe trypanosomiasis challenge, in an agropastoral system. Indigenous chickens in Laos are scavengers, kept in small family flocks, within a tropical crop-based farming system. Co ducks are raised within tropical crop production systems and are particularly successful as gleaners and scavengers in rice-based, lowland systems where they may be kept in large flocks. Somba cattle are kept in herds of up to ten; mating is uncontrolled.

UTILIZATION OF LIVESTOCK AND LIVESTOCK PRODUCTS

The ways in which traditional producers use livestock and livestock products vary considerable but are usually geared to obtaining subsistence and as good an income as possible. In most systems dairy products are mainly consumed domestically while stock, eggs and fibres will be sold to obtain necessities and supplement income. In many cases livestock are savings and in some cases have social significance.

The study on Neuquén goats states that, "levels of on-farm consumption should be determined" and does are milked and goats sheared. Sale of kids is obviously important. Cereals are no longer grown; grain is bought, presumably from income from livestock. The yak rearing system in Bhutan uses much of its production for domestic consumption, but trades yak products with lower areas and hires yaks for transport; most of its cereals will have to be bought. Bolivian camelids are raised at very high altitudes where few crops are grown; stock on the hoof and dried meat are sold and camelids are important for sacrifices. The paper on sheep in Peru does not mention crops, but it is obvious that the various groups and communities are commercial producers of sheep and sheep products and also use them as collateral for loans. Tajik zebus are

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PHOTO 1. A typical yak herd in Laya

reared in a system which is still readjusting after decollectivization and marketing of livestock products has been disrupted. The paper on Navajo-churro sheep does not describe the system, but implies that marketing of craft products and meat is one aim; the sheep also have sacrificial importance. Karakul sheep are raised for pelts in an area where crop production is impossible; pelts are commercialized and the other sheep products are either used domestically or traded; decollectivization and changes in fashion have caused problems in pelt marketing.

Basotho ponies are used as transport within various farming systems but are becoming important for trekking, which should raise income. Buffaloes in the Nepal Hills are kept within crop-based systems for milk, much of which is used domestically, but there are collection and marketing systems, and dung and cull stock are by-products; the exotic buffaloes are mainly kept by richer households. Lao chickens are mainly used for domestic consumption but surplus birds are sold; they are also kept for sport. Somba cattle are kept within a crop-based farming system; they are kept for prestige and sacrificial purposes and as savings; small-stock and poultry are important for capital building and domestic use. Co duck rearing is very well integrated with crop production, especially in lowland areas where rice is grown year round; they are mainly kept for sale of eggs or ducks.

HOW ANIMAL GENETIC RESOURCES INTERACT WITH THEIR ENVIRONMENT

The breeds have, in most cases, developed through the ages along with the production system or, as in the Americas, date from distant importations. Several studies mention the nefarious effect of "improved" breeds on the hardiness and sustainability of local livestock in extensive or low input systems despite it being known for a very long time (except by development projects) that "high yielding" stock are only productive under high levels of nutrition, management and sometimes housing. The Tajikistan and Uzbekistan studies mention the effects of introduction of exotic stock during the Soviet era when many external inputs were used. Once these countries became independent, the subsidies and technical support were no longer available and marketing systems collapsed. Livestock numbers fell drastically and exotic breeds were no longer profitable – farmers and herders are now moving back to traditional breeds.

LOCAL KNOWLEDGE AND GOOD PRACTICES

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PHOTO 2. Basotho ponies in their environment

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PHOTO 3. Goat herders migrating with their animals from summer to winter pasture in Northern Neuquén province (Argentina)

Passing on knowledge is essential to generate new ideas and solutions so that farmers can develop and conserve their animal genetic resources and improve their livelihoods. This can be achieved by connecting farmers with others who have similar problems. With government support, networks can be developed to exchange information, techniques, methodologies and experience. Potential tools of communication could be newsletters and, where financially and technically viable, national or regional workshops organized and virtual interaction enhanced.

Several authors consider training and coaching as a crucial part of a coordinated livestock improvement strategy, especially on the sustainable utilization of local animal genetic resources. The development objectives of such a strategy should take into account all stress elements present in the production environment, while the linkages between livestock, forests, grazing resources and wildlife conservation should be highlighted. Farmer field schools could be a possible way to teach farmers about their production environment and the interaction between its various components since they allow farmers to learn by doing, by being involved in experimentation, discussion and decision-making. This strengthens their role in the researcher-extensionist-farmer chain and also improves the sense of ownership of rural communities in technological packages and new knowledge and skills.

In most systems, transfer of traditional knowledge and expertise has been handed down through hands-on experience within families; in mobile systems this requires, in addition to stock-rearing and breeding skills, intimate knowledge of migration routes, the pastoral resources along these and the grazing and water rights of the groups involved. In many studies this is still ongoing, but the Neuquén goat study indicates that sedentarization of families and increased scholarization is hampering knowledge transfer. The Tajikistan and Uzbekistan studies show how collectivization destroyed traditional knowledge. The skills of Somba cattle raisers are diminishing as they hire out their livestock. Training, which is mentioned in most studies, is better suited to informing farmers of technical innovations and modern techniques than for passing on folk knowledge.

HOW COMMUNITIES COPE WITH THREATS TO THEIR LOCAL ANIMAL GENETIC

RESOURCES

Some of the major threats mentioned in the studies are summarized below. Some are internal problems of the systems, but others, notably land tenure and grazing rights, are often external and pastoral communities have little control over them.

Breeding problems. Poorly controlled mating is mentioned in several studies; in the mixed farming systems families often have only a few animals so these may be herded communally or, especially in the non-cropping season, allowed to graze at will. Communal watering points are another meeting place of herds. Pastoral families generally have larger numbers of livestock and take care in herding them; the pastoral studies frequently mention care taken in controlling mating, although the broken and mountainous nature of the yak pastures in Bhutan make supervision difficult. Access to good genitors is mentioned in several studies. This is a serious problem for traditional breeds; pastoralists exchange stock to avoid inbreeding, but in most studies there is little mention of really active selection. The problem is particularly serious with traditional breeds raised under harsh conditions on unsupplemented grazing and often with a severe disease and parasite challenge; stock selected on stations and government farms are notoriously unsuited in such cases. The Peruvian study shows how this problem can be tackled if pastoralists collaborate. Crossbreeding with introduced breeds is a threat in some cases; in the harsher environments it may be a slight threat, but it is more serious elsewhere. In the studies the presence of exotic stock in marginal areas of subsistence stock-rearing is usually due to misguided attempts by development agencies who assume that exotic breeds are superior to native ones, even under smallholder or pastoral conditions.

Problems of access to pastoral resources. The maintenance of traditional breeds depends largely on the sustainability of the system in which they are kept. Access or land tenure problems are common in the studies involving ruminants. They are especially dangerous for mobile systems which depend on year-round access to grazing land and water as well as to traditional migration routes between seasonal pastures. Legislation on pastoral land tenure or grazing rights may be unclear and is often at odds with the traditional perceived rights to grazing resources and to passage. Clearing of grazing land for crops, or change of land use to forestry, usually without the pastoralists' consent, not only causes loss of grazing area, but fragments grazing lands and causes problems of access to migration routes and water. In many cases the land so "developed" is very marginal for agriculture and crop production proves unsustainable; mining is another potent source of destruction of grazing resources, including water supplies. In sedentary, smallholder, mixed farming systems population pressure is, as in the Nepal example, so high that there is little natural grazing or browse left. This leads to livestock being kept at the homestead and stall-fed. Because of the labour and costs of stall-feeding, it is likely that farmers will change their breeds to those more responsive to their degree of intensification. This leads to the loss of the original, hardy, free-range stock. Local disputes may be resolved by discussion and negotiation, but most of these problems are outside the competence of the herding or farming communities and require to be addressed through policy decisions at regional or national level.

Mismanagement of pastoral resources. Many of the studies mention pasture degradation due to poor management and overstocking. The only serious attempts to tackle the problem are described in the Peruvian study where herders manage their pastures cooperatively. Under the conditions of the studies mismanagement is often due to lack of clear title to grazing rights which discourages pastoralists from investing in management and development of infrastructure. Pastoral populations are often poor and tend to maximise herd numbers in the hope of increasing output as well as accumulating capital; where access to grazing is open or communal there is little incentive to limit herd size since others will increase their holdings to exploit or overexploit the available herbage. Mobile systems with seasonal grazing of pastures are generally much less damaging

to pastoral resources (provided that others do not exploit them in the off season) than are sedentary systems. It follows that attempts to improve or rehabilitate grazing lands will be futile until these underlying problems of tenure and responsibility are resolved. The same applies to proposals to give herders training in better management.

Political change. Several studies mention the effects of political changes on the maintenance of genetic resources. Closure to livestock movement, and sometimes trade, of the borders between Bhutan and China and between Argentina and Chile have restricted access to traditional sources of genitors. Decollectivization in Central Asian states, as exemplified by the Tajik and Uzbek studies, led to the collapse of management, breeding systems as well as veterinary services and organized marketing.

Markets. Many studies mention marketing problems. Pastoralists and many farmers are in relatively isolated areas and only sell sporadically and in small quantities so they can be at the mercy of middlemen where there are no established and regulated markets in their neighbourhood. Traditional producers increasingly face problems of quality and quality control. Urban populations now prefer young and tender meat which is difficult to produce off poor, unsupplemented pasture. Traditional meat and dairy products, however flavoursome, do not always meet modern standards of hygiene and small rural producers are often unable to provide certification of acceptable quality. Changes in fashions may affect breeds producing fibre and pelts; wool markets worldwide have been poor for years; cashmere prices fluctuate with fashion changes; the catastrophic fall in the market for Karakul pelts in the early nineteen-nineties, while partly due to decollectivization, was also strongly influenced by a campaign against fur-wearing in western countries. A serious potential threat to the marketing of produce from traditional breeds (and therefore to their survival) is the increasing opening of markets to imports of poultry, meat and dairy products as more and more countries join the World Trade Organization. In many cases, especially for large coastal conurbations, it will be cheaper and easier to import from countries which are large-scale, modern producers than to collect scattered supplies of varying quality from distant inland pastures with mediocre transport infrastructure.

Threats due to changing life-styles As more pastoral people have access to education there may be an increasing migration to urban employment with its access to other facilities and diversions. There is also a trend towards settling herding families so that they can have access to education and other social services; this is desirable, where practical, so long as the herds continue to migrate.

LONG-TERM SOLUTIONS AND SUSTAINABILITY OF STRATEGIES

Livestock keepers, and especially transhumant, mobile pastoralists, are often marginalized by policies arising from their own governments. These policies, in which

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PHOTO 4. Q'ara male llama raised in a Centro de Machaje of Chiluma, Turco region (Bolivia)

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PHOTO 5. Basotho pony and his owner

they still have no say, are often developed without acknowledging their way of life or their contribution to the country's economy. Policies favouring exotic livestock breeds; those supporting foreign industrial investments such as mining; and changing land tenure for the regeneration of forests or wildlife conservation, severely threaten the sustainability of the farming systems described. As demonstrated by the Drivers of Change framework, policy changes can have far-reaching impacts such as the permanent loss of livestock diversity and local knowledge, social disruption, health problems and economic losses.

MAINTENANCE OF LOCAL BREEDS

Livestock keepers in marginal areas raise livestock mainly to provide food for their families; to raise cash for other expenses, including education and purchase of cereals and other foods; to provide transport and traction and to serve as savings. Secondary products such as dung, hides and wool are used to meet other needs – fuel for cooking or clothing. Should there be a surplus of any of these products, then farmers will generally sell them to supplement their income and, whenever possible, to increase their economic returns through other farming alternatives. Their breeds are generally multi-purpose. Farmers select and keep animals that provide products best meeting their needs so that the production potential of the animals is maximized under local conditions. In the areas of the case studies, the climatic and environmental conditions are harsh and feed is scarce and of low quality. However, the animals raised in these areas are physiologically adapted to such conditions and, with appropriate management, based on local knowledge transmitted from generation to generation, can live and produce in harmony with people and the environment. It follows that national policies must emphasize the use of traditional local breeds in marginal areas and prescribe the use of introduced exotic stock in development projects in other areas. In order to preserve and maintain these traditional breeds assistance should be provided in training herders and farmers in breed improvement, as well as devising ways to provide hardy genitors for pastoral conditions.

LAND TENURE AND LANDSCAPE MANAGEMENT

Extensive grasslands have a great value, beyond providing livelihoods for those who graze them and the meat and livestock products which they yield.

- They are major sites for wildlife and for the *in situ* conservation of plant and animal resources.
- They contain a wide range of pastoral plants, most not yet cultivated, as well as the relatives of cultivated pasture plants: these are of interest since new fodders and cultivars may be needed as global warming progresses.
- They contain many plants of economic importance including plants of interest to traditional and conventional medicine; flavourings and aromatics which are harvested from the wild but which are increasingly being cultivated.
- Grasslands are, in many cases, important for recreation, sport and tourism.
- Because of their vast extent they are important catchment areas, so proper management of the pastoral vegetation is necessary to ensure maximum retention of precipitation. The grasslands of the Hindu-Kush-Himalaya, along with the contiguous Tibet-Qinghai Plateau are extremely important in this respect since many of the rivers on which Asia depends have their origin there (including the Yellow River, Salween, Indus - including the Punjab rivers, Ganges, Brahmaputra and the Syr Daya).

The overall management of extensive grazing lands should be done within a wide framework on a very large, landscape scale so that it is effective in dealing with the whole range of pastoral resources and products, covers the migration territories of transhumant groups as well as conserving wildlife and catchments. In traditional areas pastoralists are often in small, often poorly organized groups. Better planning and management is only likely to succeed if the pastoral population is assisted to organize itself into large groups which can enter into dialogue with one another and with the authorities, not only to participate but to play a leading role in the planning and management processes. The

general public benefits from the proper management of catchments, landscapes for wildlife, tourism, conservation of biodiversity, recreation and hunting, but the management costs fall on the pastoralists – be they traditional or commercial. In many areas commercial stock-rearing off extensive grassland is in economic difficulties and the people of traditional systems are mostly poor to very poor. How can those who manage grasslands be encouraged to do so for the general good and how can they be recompensed for adjusting management to even more environmentally friendly ways?

MARKET OPPORTUNITIES

Most farmers will find it worthwhile to invest in the improvement and conservation of their local livestock breeds if new market opportunities arise. Identification of new markets and marketing strategies are particularly important to provide them with the necessary incentive to continue raising their indigenous breeds rather than changing to a greater input with high production breeds. Another reason for promoting the improvement and conservation of local livestock is to preserve the characteristics of their products. For activities, such as weaving, it is important that the quality of the wool sold on the market is stable. Through cross-breeding it would be possible to improve the fineness of the wool of local sheep breeds. However, the consumer, i.e. the weaver, would not be able to process this wool, which would, objectively be of a higher quality. In areas where tourism is developing rapidly, alternative income-generating activities such as handicrafts and ecotourism could be further explored.

GIVING FARMING COMMUNITIES THE OPPORTUNITY TO DECIDE ABOUT THEIR FUTURE

Governments should seek to involve indigenous and local communities more actively, and to apply their knowledge and technologies when developing national livestock programmes for the improvement, sustainable use and conservation of domestic animal diversity. More specifically, many authors mentioned that governments need to include the participation of indigenous and local communities when developing policies for the specifically, many authors mentioned that governments need to include the participation of indigenous and local communities when developing policies for the conservation and sustainable use of animal genetic resources, the access to these resources, the sharing of benefits and the designation and management of protected areas. The experience and knowledge of these farming communities, and their respect towards their animals and the environment, are essential to developing sound policies. A first step to facilitate the participation of these communities in policy development is to translate livestock breeding policy and guidelines into understandable documents for farmers.

AWARENESS RAISING AND CAPACITY BUILDING

Passing on lessons is considered essential to generate new ideas and solutions so that farmers can develop and conserve their animal genetic resources and ultimately improve their livelihoods. This can be achieved by connecting farmers with others who have similar problems. With government support, networks can be developed to exchange information, techniques, methodologies and experience. Potential tools of communication could be newsletters and, if financially and technically viable, national or regional workshops organized and virtual interaction enhanced.

As part of a coordinated livestock improvement strategy, various authors feel that training and coaching are crucial, especially to increase farmers' knowledge about the sustainable utilization of local animal genetic resources. The development objectives of such a strategy should take into account all stress elements present in the production environment and the linkages between livestock, forests, grazing lands and wildlife conservation should be highlighted. Farmer field schools could be a possible way to teach farmers about their production environment and the interaction between its various components. Field schools offer farmers an opportunity to learn by doing, by being involved in experimentation, discussion and decision-making. This strengthens their role in the researcher-extensionist-farmer chain and also improves the sense of ownership of rural communities in

technological packages and new knowledge and skills.

CONSERVATION

A precondition for *in situ* conservation of local animal genetic resources is for farmers to be convinced about the potential of their animals and the need for their products and services. Farmers will not conserve a breed without targeted incentives. In developed countries this incentive might be sentimental (conserve the breed because of its beauty, its uniqueness), but this is hardly the case for farmers in developing countries who often strive for improvement and conservation at the same time. Farmers significantly contribute to the conservation of domestic animal diversity through the use and further development of their local breeds.

Several authors pointed out that strategies such as cryopreservation and associated reproductive technologies are necessary for the conservation of genetic livestock material. The costs of these types of technologies depend on local circumstances, availability of technology, labour and local facilities. Therefore, it is important for decision-makers to reconsider the balance between objectives, costs and technical and practical feasibility in conservation programmes (Hiemstra *et al.*, 2005.)

REFERENCE

Hiemstra, S.J., van der Lende, T. & Woelders, H. 2005. *The potential of cryopreservation and reproductive technologies for animal genetic resources conservation strategies*. The role of biotechnology – Villa Gualino, Turin, Italy, 5–7 March 2005.

K Tempelman

PHOTO 6. Alpaca herd in the Central Andes of Peru.

G L O S S A R Y

Adaptation: a genetically determined characteristic that enhances an organism's ability to cope with its environment.

Adaptation traits: complex of traits related to reproduction and survival of the individual in a particular production environment. Adaptation traits contribute to individual fitness and to the evolution of animal genetic resources. By definition, these traits are also important for the ability of the animal genetic resource to be sustained in the production environment.

Adaptive fitness: a genetically determined complex of characteristics that enhance a breed's ability to reproduce and survive in a particular production environment.

Agricultural biological diversity or agrobiodiversity: that component of biodiversity that contributes to food and agriculture production. The term agricultural biodiversity encompasses within-species, species and ecosystem diversity.

Agro-ecological zone: an area of agricultural land, generally smaller than a region but considerably larger than a farm, with a definable combination of climate, relief, altitude, edaphic conditions and natural vegetation.

Animal gene-bank: the physical location where collections of genetic material in the form of semen, ova, embryos and/or tissue samples are stored.

Biological diversity or biodiversity: the variety of life in all its forms, levels and combinations, encompassing genetic diversity, species diversity and ecosystem diversity.

Breed: either a subspecific group of 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 geographic and/or cultural separation from phenotypically similar groups has led to acceptance of its separate identity.

Breed at risk: a breed that may become extinct if the factors causing its decline in numbers are not eliminated or mitigated. Breeds may be in danger of becoming extinct for a variety of reasons. Risk of extinction may result from, inter alia: low population size; direct and indirect impacts of policy at the farm, country or international level; lack of proper breed organization; or lack of adaptation to market demands. Breeds are categorized as to their risk status on the basis of, inter alia, the actual numbers of male and/or female breeding individuals and the percentage of purebred females.

Characterization of animal genetic resources: all activities associated with the description of animal genetic resources (AnGR) aimed at better knowledge of these resources and their state. Characterization by a country of its AnGR will incorporate development of necessary descriptors for use and identification of the country's sovereign AnGR; and baseline and advanced surveying of these populations, including their enumeration and visual description, their comparative genetic description in one or more production environments, their valuation, and ongoing monitoring of those AnGR at risk.

Community-based management of AnGR: decisions on breeding policies based on a participatory approach by the communities (see Management of farm animal genetic resources).

Conservation of farm animal genetic resources: refers to all human activities including strategies, plans, policies and actions undertaken to ensure that the diversity of farm AnGR is being maintained to contribute to food and agricultural production and productivity, now and in the future.

Cross-breeding: mating between animals of different breeds.

Cryopreservation: the preservation of germplasm resources in a dormant state by storage at ultra-low temperatures, often in liquid nitrogen.

Domestic animal diversity: the spectrum of genetic differences within each breed, and across all breeds within each domestic animal species, together with the species differences of interest for food and agriculture production.

Ecotourism: travel undertaken to witness the unique natural or ecological quality of particular sites or regions, including the provision of services to facilitate such travel.

Ethnoveterinary medicine: deals with the folk beliefs, knowledge, skills, methods and practices pertaining to the health care of animals.

Exotic breed: exotic breeds are maintained in a different area from the one in which they were developed. Exotic breeds comprise both recently introduced breeds and continually imported breeds.

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***Ex situ* conservation of farm animal genetic diversity:** all conservation of genetic material within living animals, but outside the environment in which it developed *(ex situ in vivo)*, or external to the living animal in an artificial environment, usually under cryogenic conditions, including, inter alia, the cryoconservation of semen, oocytes, embryos, cells or tissues *(ex situ in vitro)*. Note that *ex situ* conservation and *ex situ* preservation are considered here to be synonymous.

Extinct breed: when it is no longer possible to recreate the breed population. This situation becomes absolute when there are no breeding males or breeding females remaining. In reality, extinction may be realized well before the loss of the last animal, gamete or embryo.

Farm animal genetic resources: those animal species that are used, or may be used, for the production of food and agriculture, and the populations within each of them. These populations within each species can be classified as wild and feral populations, landraces and primary populations, standardized breeds, selected lines, varieties, strains and any conserved genetic material, and are all currently categorized as breeds.

Farming system: a contiguous population of farms that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. Farming systems include all activities, both agricultural (cropping, pasture, livestock; any horticultural, silvicultural and aquacultural elements; providing also for processing and marketing of commodities) and non-agricultural, under the control of farm household units. Generally, consideration of farming systems should account for all inputs and outputs of each element of the system.
Farm categories *(by size)*
Subsistence: less than 50 percent of production is marketed.
Smallholder: small family farms with more than 50 percent of production marketed.
Small-scale-commercial: medium family farms with more than 50 percent of production marketed.
Large-scale-commercial: large farms or companies with all production marketed.

Feed conversion ratio (FCR): In animal husbandry, feed conversion ratio (FCR), or feed conversion rate, is a measure of an animal's efficiency in converting feed mass into increased body mass. Specifically FCR is the mass of the food eaten divided by the body mass gain, all over a specified period of time. FCR is dimensionless, i.e. there are no measurement units associated with FCR. Animals like ducks have a low FCR and are therefore considered efficient users of feed.

Feed supplement: prepared animal feed that supplements the basic farm-produced feed with organic or inorganic substances.

Food security: exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.

Gene pool: the sum of all genetic information in a breeding population at a given time.

Genotype: the genetic constitution of an organism.

Inbreeding: mating between animals with one or more ancestors in common and with a higher degree of relationship than the average of the population.

***In situ* conservation of farm animal genetic diversity:** all measures to maintain live animal breeding populations, including those involved in active breeding programmes in the agro-ecosystem where they either developed or are now normally found, together with husbandry activities that are undertaken to ensure the continued contribution of these resources to sustainable food and agricultural production, now and in the future.

Knowledge
Local knowledge: a collection of ideas and assumptions that are used to guide, control and explain actions within a specific setting, based on particular value systems (religious and mythical beliefs) and epistemology.
Traditional knowledge: that which is comprised of proven ancient, original and distinctive customs, conventions and routines. It also embodies a static view of culture having its origin in ancient history.
The difference between traditional knowledge (TK) and local knowledge (LK) is that the first is static, while the second is dynamic in nature. This means that LK continually changes and is reinterpreted and modelled by contemporary daily experiences and activities.
Indigenous knowledge: that which tends to emphasize the

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knowledge internal to a particular setting differing from LK, which focuses on the locality in which the knowledge is used and embraces exogenous knowledge that entered the local community over time.

Livelihood: a combination of the resources used and the activities undertaken in order to live. The resources might consist of individual skills and abilities (human capital), land, savings and equipment (natural, financial and physical capital, respectively) and formal support groups or informal networks that assist in the activities being undertaken (social capital).

Management of farm animal genetic resources: encompasses all technical, policy, and logistical operations involved in understanding (characterization), using and developing (utilization), maintaining (conservation), accessing and sharing the benefits of animal genetic resources.

Mixed farming system: a farming system conducted by households or by enterprises where crop cultivation and livestock rearing together form integrated components of a single farming system. They include the livestock systems of landless smallholders that rely on the crop cultivation of neighbouring farms.

Monitoring of AnGR: collection of information to assess the population size and structure, as the basis for an early warning system to prevent disappearance or extinction.

Phenotype: the visible appearance of an animal (with respect to one or more traits) that reflects the reaction of a given genotype within a given environment.

Population: a defined group of interbreeding organisms.

Poverty: a pronounced deprivation of well-being related to lack of material income or consumption, low levels of education and health, vulnerability and exposure to risk, voicelessness and powerlessness.

Selection: a system for either isolating or identifying specific genotypes in a population, resulting in a choice of which animals will be used for reproduction.

Shifting cultivation: a method of cultivation in which several crop years are followed by several fallow years with the land not under management during the fallow. The shifting cultivation may involve shifts around a permanent homestead or village site, or the entire living area may shift location to fields in a totally different area.

Species: a class of individuals capable of interbreeding and producing fertile offspring, but which is reproductively isolated from other such groups having many characteristics in common. In the hierarchy of biological classification species is the category below genus; species is the basic unit of biological classification.

Sustainable development: the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially responsible.

Utilization of farm animal genetic resources: the use and development of animal genetic resources for the production of food and agriculture. The use in production systems of AnGR that already possess high levels of adaptive fitness to the environments concerned, and the deployment of sound genetic principles, will facilitate sustainable development of the AnGR and the sustainable intensification of the production systems themselves. The wise use of AnGR is possible without depleting domestic animal diversity. Development of AnGR includes a broad mix of ongoing activities that must be well planned and executed for success, and compounded over time, hence with high value. It requires careful definition of breeding objectives, and the planning, establishment and maintenance of effective and efficient animal recording and breeding strategies.

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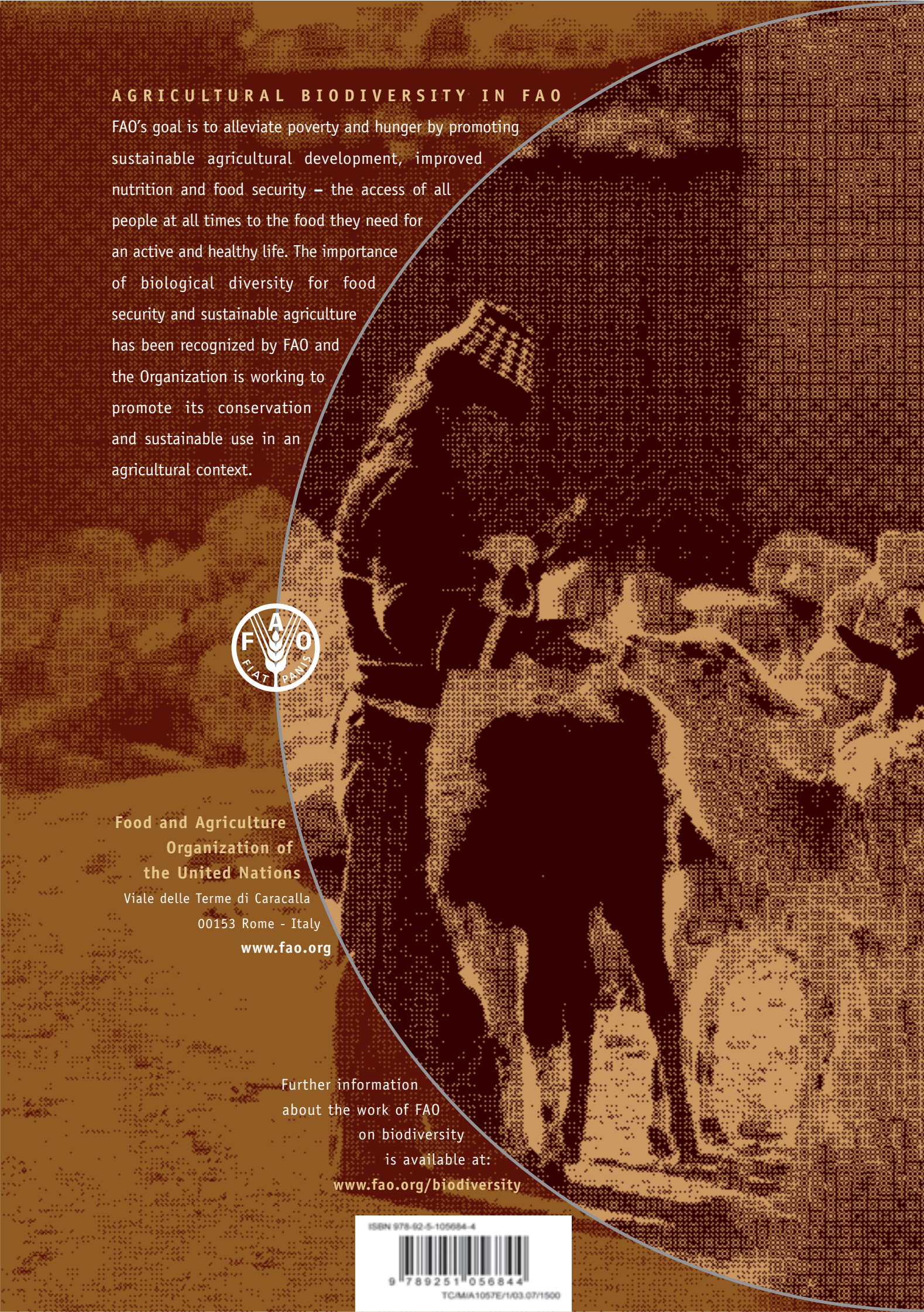

AGRICULTURAL BIODIVERSITY IN FAO

FAO's goal is to alleviate poverty and hunger by promoting sustainable agricultural development, improved nutrition and food security – the access of all people at all times to the food they need for an active and healthy life. The importance of biological diversity for food security and sustainable agriculture has been recognized by FAO and the Organization is working to promote its conservation and sustainable use in an agricultural context.

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Further information about the work of FAO on biodiversity is available at:

www.fao.org/biodiversity

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