Part 1

USING WWL-DAD:3

Kuri cattle in Chad are facing extinction due to uncontrolled zebu introgression

Demands for a diverse range of livestock products will increase rapidly in the next decades, primarily in the developing world. In order to meet the demands of a much larger and more affluent human population in this century, the use and development of a broad spectrum of locally adapted domestic animal breeds, in association with the intensification of animal agriculture in most available production environments is required.

Awareness of the roles and values of animal genetic resources and concern for their rapid loss must be translated into effective action at the local, national, regional and global levels. Development of FAO's Global Strategy for the Management of Farm Animal Genetic Resources is supported by the UN Secretariat's 181 members as offering a framework for planning and implementing necessary management action.

As an element of the Global Strategy for Farm Animal Genetic Resources, the World Watch List for Domestic Animal Diversity (WWL-DAD:3) provides inventories and descriptions of breeds at risk in order to identify and monitor conservation priorities. Part 1 of WWL-DAD:3 introduces the important issues relating to management and conservation of domestic animal genetic resources and outlines the struture of the list for better use.

1.1 THE PURPOSE OF WWL-DAD:3

The World Watch List for Domestic Animal Diversity (WWL-DAD) is the voice of the Global Early Warning System for Farm Animal Genetic Resources. Based on survey data, a system of monitoring has been put in place as part of FAO's Global Strategy for the Management of Farm Animal Genetic Resources. Analysis of this data, which has been collated in the Global Databank for Farm Animal Genetic Resources within the Domestic Animal Diversity Information System, enables the identification of domestic animal genetic resources at risk of loss and the monitoring over time of extinction rates.

The goal of WWL-DAD:3 is to communicate the state of these genetic resources and to further serve as a catalyst to stop and reverse the trend of erosion of genetic diversity. These farm animal resources and the genetic diversity they represent, have developed over 12 000 years of domestication as a result of selection by human communities and adaptation to new environments and environmental challenges. Because of their major contributions to food and agriculture production and their important role in sustainable production systems, a threat to domestic animal resources is a major threat to global food security.

Part 2 of WWL-DAD:3 includes information on 30 mammalian and avian species of domesticated animals, a list of which appears in Table 1.1.1.

Not to be overlooked are the wild relatives of domestic species and their current or future role as animal genetic resources important for food and agriculture production.

Part 3 of the WWL-DAD:3 is devoted to the wild relatives of domesticated species.

TABLE 1.1.1 SPECIES INCLUDED IN WWL-DAD:3

MAMMALIAN species	AVIAN species
Buffalo	Chicken
Cattle[1]	Duck
Yak	Turkey
Goat	Goose
Sheep	Muscovy Duck
Pig	Guinea fowl
Ass	Partridge
Horse	Pheasant
Bactrian Camel	Quail
Dromedary	Pigeon
Alpaca	Cassowary
Llama	Emu
Guanaco	Ñandu
Vicuña	Ostrich
Deer[2]	
Rabbit	

[1] *The term cattle is used in the broad sense to include Bos indicus, Bos taurus, Banteng, Mithan.*

[2] *The term deer is used in the broad sense to include all domesticated and semi-domesticated deer species.*

Part 4 introduces feral populations that have been derived from previously domesticated stock. Discussed in this section are the potential costs and benefits of feral animals, the impact of such animals on the environment, the use of management practices to limit harmful impacts and gain some economic and nutritional benefits and their value as sources of genetic diversity.

The WWL-DAD:

- Is a central communications tool for the Global Early Warning System for Farm Animal Genetic Resources.

- Will focus attention on the very large number of breed populations currently at high risk of loss.

- Provides risk status and extinction monitoring assessments as a tool for all those concerned with biodiversity and the production of food.

- Has been developed as an aid for use by country, regional and global NGOs and training and research institutions concerned with conserving threatened farm animal breeds and the sustainable utilization of animal genetic diversity.

- Identifies areas where action (conservation, sustainable use and research requirements) from governments and concerned institutions and organizations is needed.

- Facilitates education on and awareness of the status of domestic animal breeds and their conservation and sustainable use, thus leading to more effective management of these resources.

- Identifies those key country contacts and national co-ordinating institutions that are in the best position to assist with local information and advice on the status of animal breeds of all species used for food and agriculture and their conservation and sustainable use. These contacts are developing within-country networks responsible for providing quality data to upgrade and continually update the Global Databank for Farm Animal Genetic Resources, enabling it to assist country and regional decision-making and to develop as the ongoing global monitoring mechanism for domestic animal diversity.

- Contributes to better global communication and collaboration in conservation, encourages more efficient, effective and sustainable use of the remaining farm animal genetic resources and facilitates project development and international collaborative action.

- Brings to public attention the importance of the wild and feral relatives of domestic livestock. Wild and feral relatives are important for several reasons. Wild relatives may be domesticated in their own right and used to produce similar or new products in modified production systems, or possibly in new production environments. In the future, unique genes may be extracted from them and introgressed into domesticants to improve production, productivity, product quality and possibly adaptive fitness to particular production systems. Similarly, feral populations of domesticated livestock represent important sources of genetic diversity.

1.2 OPPORTUNITIES FOR ACTION

To assist the necessary country, regional and global conservation efforts governments and other relevant bodies should consider the following opportunities for using and contributing to the information presented in the WWL-DAD:3.

- Treat animal genetic resources and domestic animal diversity, including the wild relatives of domestic farm animals, as an essential component of global biodiversity, which requires good management both for its most effective short-term use, and to ensure its future availability.

- Take into account the many breeds classified as critical and endangered and extinction rates when formulating, adopting and implementing farm animal genetic resource management policies and strategies for their sustainable use and conservation. Also to be considered are the wild relatives of farm animals classified as endangered, vulnerable, rare, indeterminate or threatened. For further information refer to references outlined in the bibliography (section 1.12) and in particular to the set of FAO's Guidelines that can be found in the Reference Library of the FAO Domestic Animal Diversity Information System (DAD-IS) at URL: www.fao.org/dad-is/.

- Implement appropriate conservation measures to maintain breeds or populations of wild relatives of farm animals included in WWL-DAD:3, in co-operation with neighbouring countries sharing a similar goal. All breed populations should be regularly monitored, whether currently under threat or not. A current and reliable description of the status of each animal genetic resource is fundamental to good management and sustainable development.

- Undertake the preparation of comprehensive national Watch Lists for all farm animal species and their wild relatives using the recommended status categories (see section 1.6). Particular emphasis should be given to locally adapted breeds and wild relatives that have not yet been well described. DAD-IS offers a readily available means for collecting, validating and reporting data.

- Strengthen national programmes for surveying and monitoring farm animals. Particular emphasis should be given to breeds listed in WWL-DAD:3 as critical or endangered and wild relatives of farm animals at risk.

- Maintain country animal genetic resources inventories current through DAD-IS.

- Regularly report data to FAO on the state of national domestic breeds and their wild relatives, to contribute to benefit sharing amongst countries and to the development and maintenance of the Global Early Warning System for Farm Animal Genetic Resources.

- Identify incentives and possibilities encouraging the more effective development, use and maintenance of breeds under threat, and design, execute and maintain farm animal genetic development initiatives to ensure the conservation of diversity. Sustainable, well-managed utilization of a genetic resource (*in situ* conservation) is likely to be the most cost-effective means of also maintaining it for future use. For further information refer to references outlined in the bibliography (section 1.12) and in particular to FAO's Guidelines for the Development of National Farm Animal Genetic Resources Management Plans – Developing Breeding Strategies, that can be found in the Reference Library of DAD-IS at URL: www.fao.org/dad-is/.

- Support the development and maintenance of gene banks to ensure cryo-preservation of adequate samples of each animal genetic resource not currently being effectively maintained via *in situ* conservation activities. For further information refer to references outlined in the bibliography (section 1.12) and in particular to FAO's Guidelines for the Development of National Farm Animal Genetic Resources Management Plans – Management of Small Populations at Risk, that can be found in the Reference Library of DAD-IS at URL: www.fao.org/dad-is/.

- Participate in the first report on the State of the World's Animal Genetic Resources, to establish a sound basis for action at the country, regional and global levels, in relation to the resources themselves and the state of the art capacity to manage these resources' priority needs (see section 1.11).

1.3 THE STRUCTURE OF WWL-DAD:3

STRUCTURE OF PART 2

The information of greatest importance in WWL-DAD:3 includes the descriptive lists of the animal breeds currently recorded at risk and the resulting summary figures and charts presented by species for each region.This information is provided in Part 2 (see figures 2.2.2.1 to 2.2.7.2). Breeds are categorized in the lists as either CRITICAL, CRITICAL MAINTAINED, ENDANGERED or ENDANGERED MAINTAINED according to criteria described in section 1.6. Risk status was assessed only for breeds for which population information was available in the Global Databank for Farm Animal Genetic Resources, as of 30 November 1999.

Breeds are listed according to FAO's regional structure: Africa, Asia and the Pacific, Europe, Latin America and the Caribbean, Near East and North America.This regional categorization is based on climatic, agro-ecological and cultural considerations.

A section (sections 2.2.2 – 2.2.7) devoted to each region highlights the countries included and presents an outline of the region. Geography, demography, agro-ecology, and special factors affecting the development of breeds are described. Examples are included to illustrate the diversity and utility of breeds at the local level.

Within each region, breed descriptions are sorted alphabetically within mammalian and then within avian breeds, first by country, then by species, by risk status (see section 1.6) and finally by most common breed name. Breeds are referred to by using the name by which they are most commonly known within each country.

FAO REGION

BREED NAME

SPECIES *RISK STATUS*

Local names or synonyms (lang.):

Population data: (total population size • number of breeding females • number of breeding males • year of data collection)
Population trend: (increasing/stable/decreasing)
Range of uses: (listed by priority)

COUNTRY

A short paragraph details the origins, current location, phenotype (particularly any unusual visible traits), adaptability to local environmental pressures, population information and any *in situ* and *ex situ* conservation efforts that are operational. Basic information is given only for traits that differ from the most common situation for the species as a whole. For example, cattle breeds are presumed to be horned unless specifically listed as polled, coat type is described only if it is exceptional in some way, etc.

BREED INFORMATION

Basic descriptive information documented in the Global Databank for Farm Animal Genetic Resources, provided by countries from Breed Surveys for each species, is presented in the format outlined below. Additional data such as performance data, provided by some countries' Breed Surveys are not included in the WWL-DAD:3. However, this information is available in the Global Databank for Farm Animal Genetic Resources within DAD-IS. Country networks are encouraged to better characterize their animal genetic resources by including more complete and current data in the Global Databank for Farm Animal Genetic Resources. The language of the most common name is identified in Local names or synonyms (lang.). Language abbreviations can be found on page XIX.

EXTINCTION INFORMATION

Although it may not be possible to conserve every breed at risk, attention to breed extinction in the animal genetic resources management programme will serve to reduce the number of losses and, through proper recording, enable the analysis of extinction rates over time periods as an indicator of the effectiveness of the programme.

WWL-DAD:3 provides the first concerted effort by FAO to collate and summarize all of the available information on breed loss. A summary, incorporating a list of documented extinct breeds, is provided in Part 2.3. The Extinct Breeds List gives some indication of the number and types of breeds that are being lost. The breeds are listed by region, by country and by species (mammalian species followed by avian species). For each entry the origin of the breed is given followed, when available, by the reason for its extinction. For some breeds, confirmation of their extinction is still required from National Co-ordinators.

STRUCTURE OF PART 3

Part 3 documents and describes the wild relatives of domestic livestock. Species are grouped taxonomically rather than geographically as they are in Part 2. Some species that are farmed also occur in the wild and others have just recently been bred in captivity. As a result, Parts 2 and 3 may contain some common information.

Part 3 records the geographical distribution of the wild relatives of domesticates, their current status in the wild, threats to survival and economic importance. Where appropriate, prospects for the use of their genetic attributes for the improvement of the productivity of their domestic counterparts are presented. Extensive ranching and intensive farming of some of these wild relatives are already being developed. Some speculations on potential value are made for other species that are not immediately related to domesticated animal species but which are, or could be, in the process of domestication for the benefit of humankind.

Past and present domestication achievements are discussed. The development of innovative husbandry techniques which may overcome the difficulties that have constrained the management, taming and breeding of non-social, territorial species are described.

STRUCTURE OF PART 4

Part 4 introduces the issue of feral populations associated with domestic animal diversity. In explaining that feral populations, by definition, are derived from previously domesticated stock, the section expands on the potential costs and benefits of feral animals. Species covered include goats and sheep, through cattle and buffaloes to horses.

Exploring issues related to the impact of feral organisms on the environment, the use of management practices, especially hunting, to limit harmful impacts and gain some economic and nutritional benefits is discussed. The value of the resource for genetic diversity and the means of assessing this potential are included.

More detailed documentation of these feral populations and their relationships to farm animal genetic resources will be provided as the Global Strategy for the Management of Farm Animal Genetic Resources is further developed.

1.4 DOMESTIC ANIMALS AND BIODIVERSITY

The animal species important today for food and agriculture production are a consequence of processes of domestication that have been continuing for almost 12 000 years. The domestication of animal species involves controlled breeding and husbandry. As human beings evolved and extended the area under their control, animals were domesticated and breeds developed to provide for human needs within these new environments.The purpose was to ensure the sustainability of human communities.The result was the development of genetically distinct breeds through the combined response of these animal populations to two interacting forces: selection pressures imposed by human communities, identifying and making greater use of preferred genetic types amongst the available animals over time; and the selection pressures imposed by the ruling environmental stress factors which operate through differential reproduction and survival of parent animals and their offspring to realize high adaptive fitness of the breed in the environment.

The evolutionary relationships between several of the domestic mammalian and avian species are summarized in Figures 1.4.1 and 1.4.2. Thirty avian and mammalian species of domestic livestock are included WWL-DAD:3, and future issues will incorporate additional species as the survey data becomes available. There are some 40+ species of domestic animals. Although small in number, their impact is substantial - they contribute directly and indirectly to some 30 – 40 percent of the total value of food and agriculture production. For most agro-ecosystems animals are one of the fundamental elements. Combining animal and plant species will commonly increase production and productivity of sustainable agriculture in most production environments.

Animal genetic diversity allows farmers to select stocks or develop new breeds in response to environmental change, threats of disease, new knowledge of human nutrition requirements, changing market conditions and societal needs, all of which are largely unpredictable. What is predictable is the future human demand for food. At the current rate of population growth, during the second decade of this century, it is predicted that the consumption of food and agriculture products will be equivalent to that in all of the last 10 000 years. This need will be felt most acutely in developing countries where 85 percent of the increased food demand is expected.

Given the above facts, domestic animal diversity is critical for food security. It is important not to permit the erosion of this diversity. WWL-DAD:3 provides an inventory and basic descriptive information on the domestic animal breeds that are at risk of extinction and those that are already extinct. The list will serve to monitor the stability of the remaining breeds and highlight conservation needs over time.

The domestication of animals over the past 12 000 years has been arguably one of humankind's greatest achievements. The following paragraphs give some indication of the major schools of thought on the domestication of the animal genetic resources outlined in WWL-DAD:3. Some indication of the genetic relationships within and between the families of domestic animals is also given. Please note that there may be some overlap with Part 3, which provides more details on the wild relatives of domesticants.

MAMMALIAN SPECIES

HORSE AND ASS

There are four main species in the family *Equidae,* which include horses and asses.

Equus caballus – the true horses of Europe and northern Asia
Equus heminus – the pseudo-asses of central and southern Asia
Equus asinus – the true asses of north and north-east Africa
Equus quagga, Equus greyvi, etc. – the quaggas of Africa south of the Sahara

Archaeological evidence for the domestication of the horse has been found in the Eurasian Steppes of the Ukraine dating to 4 000 BC where they were used for riding and as a source of meat. Other possible areas of horse domestication have been suggested and include China, Mesopotamia, Turkestan and the region north of the Persian mountains.

Two theories for the domestication of the donkey are debated. One theory contends that the donkey is descended from the Nubian wild ass. An alternative theory suggests the *Equus asinus africanus*, or the *Equus africanus somalicus* as the progenitor. The group of true asses includes eight subspecies of Asian wild ass that have not been domesticated.

PIG

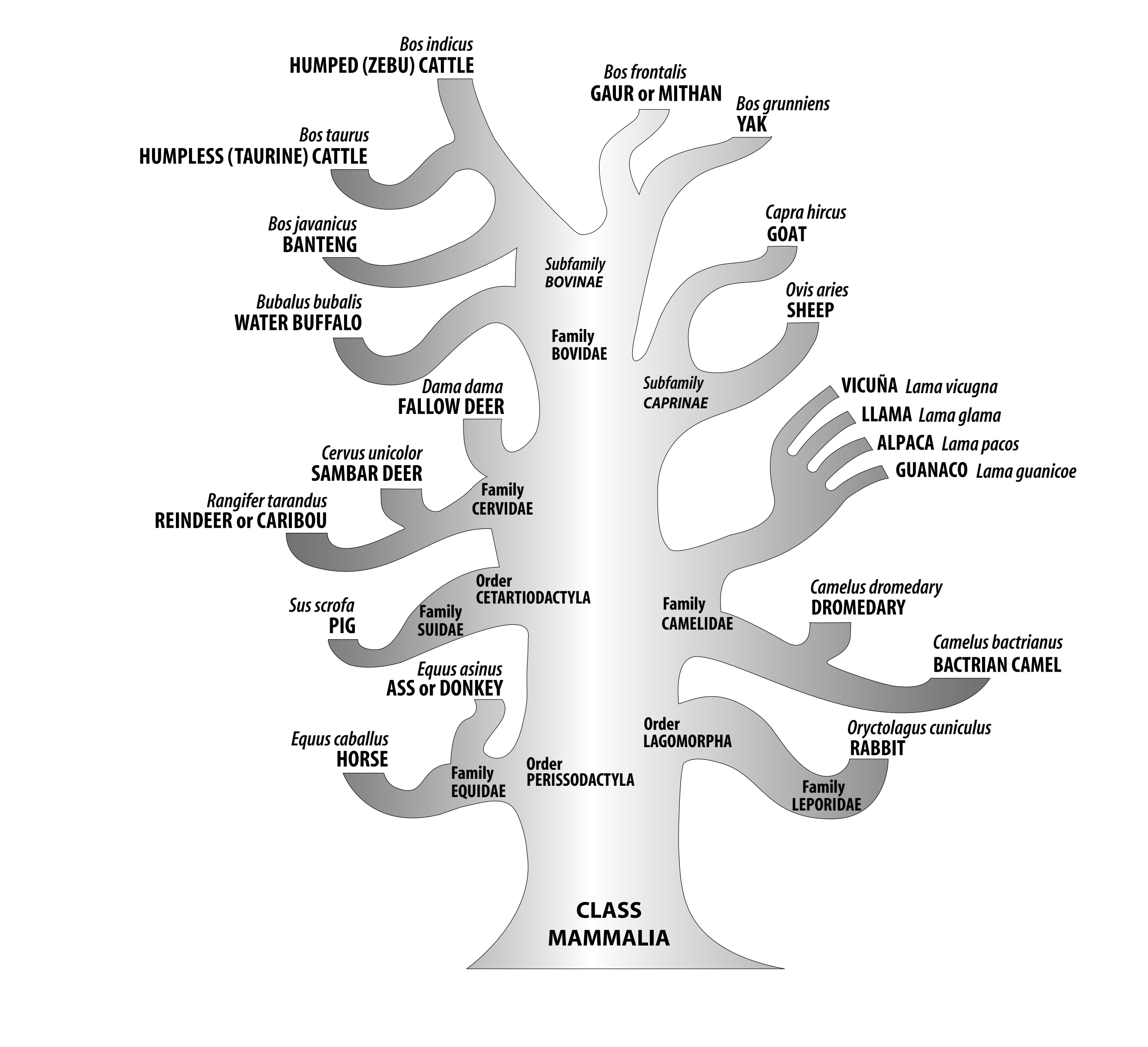
The ancestors of the domestic pig are found among the wild pigs of the species *Sus scrofa*. These wild relatives occur throughout Eurasia and in North Africa - in the countries through which the Atlas range runs, in the Sudan and, until the beginning of the 1900s, Egypt. *Sus scrofa* is divided into 25 subspecies.

The domestic pig is believed to have originated in several different regions. For example, Chinese breeds originated in east Asia, whereas European breeds are believed to have originated in south-west Asia. The Sulawesi Warty Pig (*Sus celebensis*) has been independently domesticated on the island of Sulawesi and elsewhere in Indonesia.

GOAT AND SHEEP

Goats (*Capra hircus*) and sheep (*Ovis aries*) were among the earliest livestock species to be domesticated. As ruminants, they provided humankind with a means of digesting, via fermentation, a substantial proportion of the fibrous material produced by grasslands, which single-stomach or monogastric species are less able to digest.

FIGURE 1.4.1. EVOLUTIONARY RELATIONSHIPS OF MAMMALIAN SPECIES USED FOR FOOD AND AGRICULTURE



These genera, *Capra* and *Ovis*, which form the subfamily *Caprinae,* have quite distinct evolutionary histories. The domestic breeds of goat are descended from the Bezoar of Pasang, *Capra aegagrus,* and may have been domesticated in Iran some time around 10 000 years ago. Genetic sequence analysis of mitochondrial cytochrome b genes suggests the presence of two distinct clades of goat in the Caucasus and a domestication event in the Fertile Crescent.

All domestic breeds of sheep are thought to have descended from the Mouflon (*Ovis musimon*), although the Urial (*Ovis orientalis*) may have contributed to European breeds. Blood protein analysis has suggested that the genetic variability is greater both within and between domesticated sheep than their wild relatives, probably a result of increased genetic drift following the processes of domestication.

CATTLE AND RELATED SPECIES

A further major group of mammals to be domesticated are the *Bovinae*. This family includes humped (*Bos indicus*) and humpless (*Bos taurus*) cattle, the Yak (*Bos grunniens*), the Mithan or Gaur (*Bos frontalis*), Banteng (*Bos javanicus*) and Buffalo (*Bubalus bubalis*). Both the Swamp and the Riverine Buffalo belong to *Bubalus bubalis* and, as members of the same species group, may be inter-bred. Buffalo production is on the increase because of the lifecycle efficiency of this species particularly under extensive tropical and sub-tropical farming systems. The unique genetics of the Yak enable human communities to live in otherwise inhospitable high altitude, alpine ecosystems, by supplying most of the communities' daily needs.

Genetic evidence suggests two independent domestication events for *Bos indicus* and *Bos taurus* cattle.

Mitochondrial DNA sequence analysis identifies two major genetic clades; one in which humpless, or taurine, sequences cluster and another in which humped, or zebu, sequences cluster. The two major clades diverged at least 200 000 years ago, a date inconsistent with a single domestication 10 000 years ago. This has been interpreted most simply as evidence for two separate domestication events at this time, the ancestral stock presumably being different subspecies of the local aurochs, *Bos primigenius*. Taurine cattle were domesticated in the Fertile Crescent region, whereas zebu cattle were domesticated independently in the Indus valley region.

The range of species in the family *Bovinae* makes a very large number of important contributions to food and agriculture, providing nearly 30% of the world's meat and over 87% of the world's milk production. *Bovinae* are also highly valued for provision of draught power (transport of families and goods and for cultivation for cropping) and manure for fuel and fertilizer. *Bovinae* in particular commonly serve as the family bank and hedge against drought.

RABBIT

Domesticated rabbits are descended from the wild rabbit (*Oryctolagus cuniculus*) of Southern Europe and possibly North Africa. *Oryctolagus cuniculus* was discovered by the Phoenicians when they reached the shores of Spain in 1 000 BC, and the Romans introduced it as a game species throughout their empire. Domestication was probably carried out by monks in the late Middle Ages, and by the sixteenth century several breeds were known. Whilst China and Italy are the main producers of rabbit meat, farming of the species is increasing in many countries because of its high production capacity.

DEER

The wild relatives of those species of the *Cervidae* family which have been domesticated or semi-domesticated in recent years are in most cases still present in the wild in considerable numbers. Presently, the main species under domestication are Red deer *(Cervus elaphus elaphus*), Sika deer (*C. nippon nippon*), Wapiti (*C. elaphus canadensis*), Sambar *(C. unicolor unicolor*), Hog deer (*Axis porcinus*), Fallow deer (*Dama dama*), Rusa or Javan deer (*C. timorensis russa*), Chital or Axis deer (*Axis axis*), Reindeer/Caribou (*Rangifer tarandus*), Musk deer (*Moschus moschiferus*), Pere David's deer (*Elaphurus davidianus*) and Moose / Elk (*Alces alces*).
Deer of various species have long been exploited by man as mobile sources of meat. In recent years there has been much interest in the domestication and farming of different species of deer under varying degrees of intensification.

CAMELIDAE

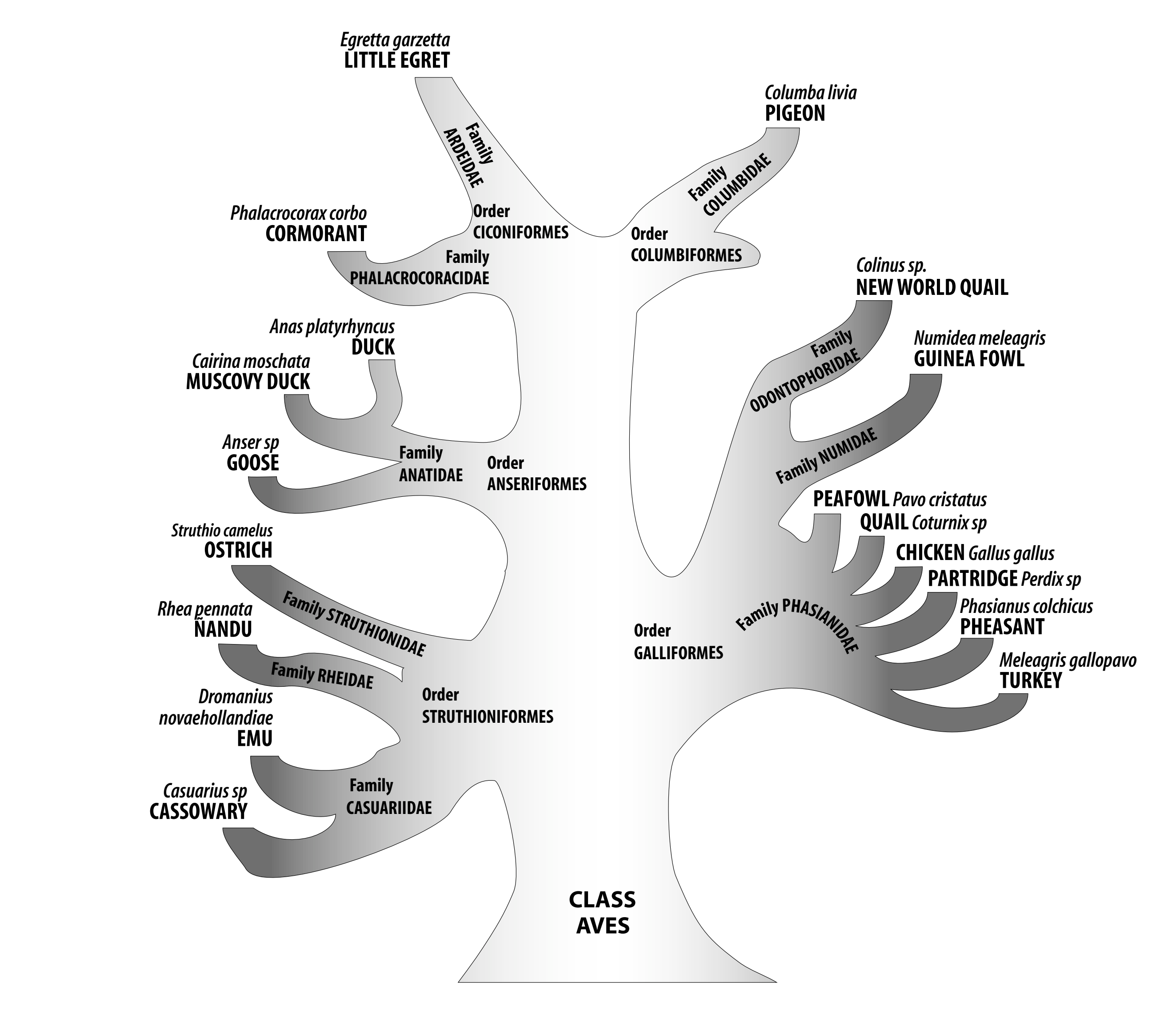
The early evolution of the family *Camelidae* occurred in North America over 40 million years ago. *Camelidae* descended from an animal the size of a rabbit. During one of the Ice Ages a solid bridge between Alaska and Siberia enabled the early migration of camels to Asia.

Camelids that migrated to South America became the ancestors of the Guanaco (*Lama guanicoe*) and Vicuña (*Vicugna vicugna*). Archaeological evidence indicates that Llama (*Lama glama*) and Alpaca (*Lama pacos*) were domesticated in the Andean Puna at elevations of 4 000 – 4 900 m asl, by 4 000 BC. There are different theories as to whether these New World camels should be classified as species or subspecies, and whether the Guanaco is the common ancestor of the Llama and Alpaca or the Alpaca is the result of crossing domestic Llama with the Vicuña. The Vicuña and the Guanaco are not domesticated, but species are hunted and used intensively for meat and wool.

Southern Arabia is the most probable area of domestication of the wild Dromedary Camel (*Camelus dromedary*) around 3 000 BC. The wild two-humped camel, the Bactrian Camel (*Camelus bactrianus*) is now found only in one small area in the Trans-Altai Gobi desert on the border of Mongolia, China and Russia. Many attempts have been made to introduce Dromedaries into areas beyond their original range, as far north as the Tuscany region in Italy but with lasting success only in the Canary Islands and Australia where the population is now feral.

Camelidae provide humankind with a range of products and services, from fine wool to meat, milk, blood and draught power. The ability of the *Camelidae* to go for long periods of time without water and live on thorny and high-fibre diets, tolerate high altitudes and extreme temperatures makes them one of the few animal families well adapted for food and agricultural production under harsh semi-desert environments.

FIGURE 1.4.2. EVOLUTIONARY RELATIONSHIPS OF AVIAN SPECIES USED FOR FOOD AND AGRICULTURE



AVIAN SPECIES

CHICKEN

The representatives of the most useful family of birds for humankind belong to the family *Phasianidae,* from the order *Galliformes*. The genus *Gallus* comprises four species of birds occurring naturally in different regions of Asia. It is believed that the wild form of the red jungle fowl (*Gallus gallus*) was the main ancestor of the domestic form. The three other species (*G. sonneratii* - grey jungle fowl, *G. lafayetii* - Ceylon jungle fowl and *G. varous* - green jungle fowl) may also have contributed to the gene pool, although this has not yet been established using molecular genetic techniques. The exact date of its domestication is unknown but there is some evidence to suggest that the first domestication occurred in Southeast Asia some time prior to 6 000 BC before introduction to China. The domestication of chickens in the Indus Valley (India) around 2 500 – 2 100 BC might have been independent, although it has been argued that their presence in this area may have been a result of diffusion from south-east Asia.

Chickens were formerly used primarily for cock-fighting or were assigned specific cultural or religious significance. However, they spread rapidly and became popular and highly appreciated as an important source of food. There is evidence that as early as the times of Plato and Aristotle specific chicken varieties were distinguishable.

DUCK

The duck is a member of the genus *Anas*, subfamily *Anatinae*, family *Anatidae*, order *Anseriformes*. It is thought that *Anseriformes* and *Galliformes* (chickens) had a common ancestor in the Cretaceous period. The oldest fossils of *Anatidae* have been found in archaeological remains from the upper Eocene, about 40 - 50 million years ago. It is generally agreed that all breeds of domestic duck were derived from the wild mallard (*Anas platyrhynchos*) and that there were two domestication events. The first is thought to have occurred in the Far East at least 3 000 years ago. The second domestication event took place in Europe during the Middle Ages.

TURKEY

The turkey belongs to the family *Phasianidae*, subfamily *Meleagridinae*. The natural habitats of birds belonging to the genus *Meleagris* were mixed forests, open woodlands and the savannahs of North and Central America. The earliest known fossils date to the Miocene period around 8 - 15 million years ago. It is believed that among the *Galliformes*, *Meleagris* is the closest relative to pheasants, from which it diverged around 11 million years ago. Domestic turkeys originated from the wild form *Meleagris gallopavo*. Although the exact place and date of domestication are not certain, it is believed that turkey domestication took place initially in Mexico. Archaeological remains dating to 200 BC - AD 700 found in the Puebla state region of Mexico, suggests this as the place of domestication. Early records from the Spanish Conquest period indicate that turkeys were being used at that time for meat.

MUSCOVY DUCK

The Muscovy duck belongs to the genus *Cairina*, family *Anatinae*. The domestic form was derived from the original dark Muscovy duck (*Cairina moschata*), the species common in Central and South America. Muscovy ducks were domesticated in pre-Columbian times in the Americas, but there is no evidence to indicate the precise time and location of this domestication. Domesticated Muscovy ducks, demonstrating different colour variants, were already present at the time of the Spanish Conquest. There is not a lot of information on the diffusion of Muscovy ducks, but it is believed that they were introduced to Europe after the Conquest.

GOOSE

The goose belongs to the genus *Anser*, subfamily *Anserinae*, family *Anatidae*. The genus *Anser* comprises 10 species. It is thought that there were several centres of goose domestication, one of which is believed to have been the Far East where the swan goose (*Anser cygnoides*) had been living with man in China and Southeast Asia from a very early date. The swan goose is the common ancestor of all Eastern goose breeds, the European domestic goose evolving from the greylag goose (*Anser anser*). It is possible that as early as before the great Mediterranean civilisations, Germanic tribes domesticated geese. There is also some evidence that the domestic goose was kept in Asia Minor about 4 000 BC. Domestic geese were very popular in the times of ancient Greece and Rome when they were regarded as a religious symbol as well as providing eggs, meat, down and feathers. A further domestication event occurred in Egypt where it is likely that both species, the greylag goose (*Anser anser*) and the Egyptian goose (*Alopochen aegyptiacus*) were present during the period of the Old Kingdom (around 2 500 BC). The domestication of the Egyptian goose was interrupted after the Persian Conquest in 525 - 524 BC.

GUINEA FOWL

The helmeted guinea fowl (*Numida meleagris*) belongs to the family *Phasianidae* and the subfamily *Numidinae*. Found exclusively in Africa, there are nine regionally specific subspecies: West Africa *(N.m. galeata, N.m. sabyi)*; East Africa (*N.m. meleagris, N.m. somaliensis*); Central-Southern Africa *(N.m. reichenovi, N.m. mitrata, N.m. marungensis, N.m. papillosa,* and *N.m. coronata*). Although guinea fowl have been found depicted in an Egyptian mural dating to 2 400 BC, it is unclear whether they have been domesticated since that time. It is likely that there were several separate domestication centres in two regions: central-southern and West Africa, but the exact dates are unknown. There may have been more than one subspecies involved in the domestication process, however, it is supposed that *N.m. galeata* is the ancestral source of domestic birds. Since contact with man, guinea fowl have been bred for eggs and meat although no known breeds have been developed.

PHEASANT PARTRIDGE AND NEW WORLD QUAIL

There are a number of game birds bred in captivity on a very large scale for restocking wild populations, for sport shooting and as a speciality product for niche markets. The most common species used include the pheasant, the partridge and several species of quail. There are two species of pheasant from the genus *Phasianus*, subfamily *Phasianine*: the common pheasant (*Phasianus colchicus*) and the green (or Japan) pheasant (*Phasianus versicolor*). The common pheasant is widespread in the temperate regions of Eurasia and lives on open country, open woodland, grassy steppes or farmland. They have been known in Europe since the time of Jason and the Argonauts, about 1 300 BC. Pheasants, although kept in captivity for many centuries, have not yet been fully domesticated. *Phasianus* has been introduced to many regions of the world and has become one of the most popular game birds.

A similar role is played by members of another genus *Perdrix*. One, the grey partridge (*Perdrix perdrix*), living naturally on farmland, steppes and meadows, is widespread in Eurasia. Members of the New World quail family (*Odontophoridae*), such as the Bobwhite quail (*Colinus virginianus*), live in the neotropical and neoarctic regions of the Americas. Fossils of this family have been found dating to the lower Oligocene, around 37 million years ago. In spite of the similar nomenclature, quails from the New and Old Worlds should be clearly distinguished because they diverged some time around 35 - 63 million years ago.

PIGEON

Pigeons, together with doves, belong to the family *Columbidae* that has been divided into numerous genera. The genus *Columba* comprises 51 species found in all terrestrial habitats throughout the world except at the polar caps. Among these species, 34 are from the Old World and 17 from the New World. The two groups are not closely related. The earliest known pigeon fossils date to the Miocene (30 million years ago) but the family is thought to be older. Since ancient times (around 6 000 years ago) the presence of pigeons has been regarded as a symbol of longevity or fertility.

The rock pigeon (*Columba livia*) from Eurasia is believed to be the wild ancestor of all domestic pigeon breeds. It is believed that the pigeon was the first domesticated bird and that domestication occurred in the eastern Mediterranean region around 5 000 - 10 000 years ago. Nowadays, as a result of selective breeding practices, the number of domestic varieties exceeds 350. They differ in important traits such as body weight and shape, rate of sexual maturity, plumage colour, specific ornaments and singing, flying and homing ability.

CASSOWARY

Three species of birds belong to the tribe *Casuariini*, one of the two tribes of the *Casuariidae* family. Their natural habitat is the dense, humid forest of Papua New Guinea and north-eastern Australia. Cassowaries have been hunted in the wild for some time, mainly for meat. In Papua New Guinea they are often kept in captivity where domestication efforts are underway.

EMU

The emu (*Dromaius novaehollanidiae*) is the sole surviving species of the tribe *Dromaiini*, which, along with cassowaries, belongs to the family *Casuariidae*. Emus and cassowaries are thought to have had a common ancestor during the Pliocene (5 - 10 million years ago). Emus live in the open woodland and semi-desert regions of Australia and Tasmania. They are easy to keep and rear in captivity and have been bred on farms in western Australia since 1970 mainly for meat. Emus are gaining in popularity in anticipation of a market for their meat, feathers, oil and hide.

ÑANDU

The two species of ñandu, also known as rhea, belong to the family *Rheidae*, order *Rheiforms*. Ñandus are large, flightless birds related to ostriches, emus and cassowaries. Both of the ñandu species are confined to the South American continent: the common rhea (*Rhea americana*) inhabits open country from north-eastern Brazil to Argentina; Darwin's rhea (*Pterocnemia pennata*) is found in regions between Peru and Patagonia. They are hardy animals that can utilize marginal land. As a result, in the last few years they have become increasingly popular and commercial farming of the common rhea has commenced in North America primarily for meat, hide and oil products.

OSTRICH

Struthio camelus, the unique species of the *Struthionidae* family, was formerly widespread in the African savannah and bush. The ancestor of the ostrich probably emerged during the Cretaceous period (65 – 146 million years ago) while contemporary ostrich fossils have been found dating to the Miocene period (12 million years ago). In Mesopotamian and Egyptian art there is evidence that ostrich feathers have been used by humankind for at least 5 000 years. However, the most important domestication occurred in the latter half of the nineteenth century when ostrich feathers became fashionable. In 1833 the first ostrich farm was established in South Africa. The number of ostrich farms as well as the number of breeding birds has increased in the last few decades, not only in South Africa and the Near East but also in regions with quite different climates, such as North America and Europe where ostrich meat has become valuable.

CORMORANT

The cormorant family (*Phalacrocoracidae*) includes 38 species found all over the world. Fossils of a cormorant ancestor have been found in North America dating to around 60 million years ago. The use of cormorants for fishing was widespread in the Old World, and in China this custom dates to the end of the fourth century BC. It is continued today both in China and Japan with both bred and tamed birds which belong mainly to two species: great (*Phalacrocorax carbo*) and Japanese (*Phalacrocorax capillatus*) cormorants. The truly domesticated birds are often variable in colour.

LITTLE EGRET

Egrets belong to the family *Ardeidae* and, like the cormorants, belong to the order *Ciconiformes*. The genus *Egretta* consists of 13 species. One, the *Egretta garzetta* (little egret), has been domesticated and has been farmed in Pakistan since 1930 for its ornamental plumes. At the height of the ostrich feather trade it was also domesticated and farmed on a small scale in Tunisia.

PEAFOWL

There are two species of peafowl: Indian peafowl (*Pavo cristacus*) and green peafowl (*Pavo muticus*) which belong to the genus *Pavo* and the subfamily *Phasianinae*. They naturally inhabit the open forests of India. The domestic form is descended from the Indian peafowl. Present in Indian mythology, it has been known outside India since the time of Solomon (about 900 BC). Peafowl were originally kept for the beauty of the males who were regarded as a symbol of wealth and power. No varieties have been developed since domestication.

QUAIL

The quail belongs to the subfamily *Phasianinae*, in which the eight species of the genus *Coturnix* are included. Quails are found widespread throughout the Old World. Their natural habitats are fields, meadows, pastures and farmlands. The oldest indication of quails in human culture comes from a hieroglyph from the Old Kingdom of Egypt (about 2 500 BC). It was most probably a common quail (*Coturnix coturnix*) that is found in Europe and some parts of Asia and Africa. It is believed that all, or almost all, domestic quails were derived from the wild Japanese quail (*Coturnix japonica*) originating in the Far East where their domestication occurred in the eleventh or twelfth century. Japanese quails were kept and bred primarily for their song and it was not until the beginning of the twentieth century that quail eggs and meat became valuable. After the Second World War, the Japanese quail was introduced to North America, Europe and the Near East where it is now used both for eggs and meat as well as a laboratory animal.

1.5 THE WILD RELATIVES OF DOMESTIC ANIMALS

As many as 100 wild animal species a day may be facing extinction. The proportion of known threatened animal species varies on a country by country basis: according to the OECD (1999), in Japan eight percent of all known mammalian and avian species are threatened; and in the Czech Republic and Hungary almost 45 percent of all known mammalian and avian species are threatened.

Some of these vanishing wild species have the potential to contribute to humankind's food and agriculture by providing additional genetic diversity to that being maintained in the domestic breeds described in Part 2. For this reason, they are also of interest to food and agriculture for the sustainability of humankind, for which the Global Strategy for the Management of Farm Animal Genetic Resources is being developed. The imminent plight of both the domestic breed resources and of their wild relatives has not been widely recognised. Nevertheless, in 1980 a joint FAO/UNEP consultation on Animal Genetic Resources held in Rome *"urged all governments to give full consideration to ways and means of conserving viable populations of wild animal species, including avian, which are the ancestors or close relatives of domestic species".* To this end, the consultation recommended that FAO and UNEP *"expand their programmes in support of the establishment and improved management of national parks and reserves".* An outcome of the meeting was the development of a list, comprising more than 35 species of animals and birds, of the wild relatives of domestic species.

Developments are underway for the sustainable use and conservation of the genetic diversity associated both with domestic livestock and their immediate wild relatives. The botanical community has long recognised the importance of conservation and utilisation of wild plant genetic resources, but the conservation of wild animal genetic material lags far behind. The International Plant Genetic Resources Institute (IPGRI), co-ordinates the collection of wild specimens of plants, undertakes research and holds them in trust for farmers use. Research initiatives have led to improvements in crop yields and in disease and pest resistance. For animals, however, no such organisation exists. The International Livestock Research Institute (ILRI) has the system-wide mandate amongst the 14 International Agricultural Research Centres for certain domestic animal species and is developing a substantial animal genetic resources component in its research programme, with a second centre, The International Centre for Agricultural Research in the Dry Areas (ICARDA), now also contributing to this.

As yet, there have been very few examples of the systematic use of genetic material from wild relatives to improve modern domestic livestock. As such, the potential of these wild resources remains undervalued.

In a world where there are estimated to be a quarter of a million more mouths to feed each day, many changes in our food production systems will of necessity be made, even in the near future. For example, the majority of meat demanded by humankind is still produced from grazing and foraging animals. Against this background it has been shown that just 22 unimproved guinea pigs, fed largely on household scraps and kept in makeshift housing, can provide enough animal protein for a family of six for a year and that already improved guinea pigs, with increased weights from 0.5 kg to 1.8 kg, have been developed by selective breeding. It is a matter for speculation as to what might be the potential for meat production of some of the other highly fecund South American rodents once they attract the attention of animal breeders.

In October 1992 the FAO Projet de Developpement des Animaux Villageois de Ouagadougou in Burkina Faso organised a workshop on the development of the guinea fowl (*Numida meleagris*) as a semi-domestic producer of meat and eggs in the dry regions of West Africa. Considering that more than 73 million guinea fowl (55 million in Nigeria alone) are kept by village farmers in these dry countries, highlights the importance of this workshop. It is by drawing to the attention of agricultural extension officers and the farmers themselves those wild species that can thrive and produce in areas unsuitable for conventional domestic livestock that their intrinsic value will be realised and an incentive for their conservation provided. If there is not to be a disastrous collision between ever-increasing human numbers and the constraints of the earth's natural productivity, we can ill afford to ignore the genetic potential of the fast disappearing relatives of domestic livestock and the, as yet, largely unexploited wild animal resources.

The wild ancestral species included in Part 3 comprise those considered to be the free-living counterparts of the world's major domestic livestock species - cattle, sheep, goats, horses, asses, pigs, camelids and the avian species. Along with these long domesticated animals are a number of other taxa which are at present undergoing varying degrees of the domestication process. These taxa include species of deer, musk oxen, African and Asian elephants, bear, rodents and rabbits. The wild relatives of domestic chickens, ducks and geese are considered as are the emerging domesticants such as ostrich, emu and rhea (ñandu). Civet cats, valued for the production of musk, are also included because development of improved management procedures may eventually lead to their domestication. The imminent domestication of several reptile groups, important for meat and skin, is also discussed. Because of the contributions made to food and agricultural production by these wild, and sometimes emerging domestic species, they must not be overlooked in the global management of biodiversity.

1.6 CRITERIA FOR DETERMINING BREEDS AT RISK

DOMESTIC ANIMALS

In the analysis of the Global Databank for Farm Animal Genetic Resources, breeds are classified into one of seven categories:

- extinct
- critical
- critical-maintained
- endangered
- endangered-maintained
- not at risk
- unknown

This categorization is based on overall population size, number of breeding females, the number of breeding males, the percentage of females bred to males of the same breed and the trend in population size. Further consideration is given to whether active conservation programmes are in place for critical or endangered populations. When relevant information on conservation management of breeds at risk is not available a conservative approach is taken and the breed is categorised in the higher risk category of critical or endangered.

A further consideration in categorization is whether active conservation programmes are in place for critical or endangered populations.

When relevant information is not available a conservative approach is taken and the breed is categorised in the higher risk category.

The general guidelines used to determine the risk status involves the following iterative process:

EXTINCT
A breed is categorized as extinct if:
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.

CRITICAL
A breed is categorized as critical if:
The total number of breeding females is less than or equal to 100 or the total number of breeding males is less than or equal to five;

OR

The overall population size is less than or equal to 120 and decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

ENDANGERED
A breed is categorized as endangered if:
The total number of breeding females is greater than 100

and less than or equal to 1 000 or the total number of breeding males is less than or equal to 20 and greater than five;

OR

The overall population size is greater than 80 and less than 100 and increasing and the percentage of females being bred to males of the same breed is above 80 percent;

OR

The overall population size is greater than 1 000 and less than or equal to 1 200 decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

Breeds may be further categorized as CRITICAL-MAINTAINED or ENDANGERED-MAINTAINED. These categories identify critical or endangered populations for which active conservation programmes are in place or populations are maintained by commercial companies or research institutions.

NOT AT RISK

A breed is categorized as not at risk if none of the above definitions apply and:

The total number of breeding females and males are greater than 1 000 and 20, respectively;

OR

If the population size is greater than 1 200 and the overall population size is increasing.

These definitions are currently used by FAO but are not final and will be further developed. As they are, they enable all countries to participate in the evaluation of information in the Global Databank for Farm Animal Genetic Resources. However, some countries may wish to use a more refined or conservative system.

Whilst a small number of countries have themselves declared particular breeds to be not at risk or unknown where they believe those breeds to be also represented in one or more other countries; this refinement was not included in the analysis on which this edition of WWL-DAD is based, for the information could not be properly recorded in the current version of the Global Databank for Farm Animal Genetic Resources. The risk status categorization of breeds documented in Part 2 refers only to the status of the breed population in that country and should not be interpreted as reflecting the global picture. However, the further development of the Global Early Warning System for Farm Animal Genetic Resources and of DAD-IS will enable all countries to evaluate the status of their breeds that occur in other countries and will provide for the calculation of the global risk status of all breeds.

WILD RELATIVES

The wild relatives documented in Part 3 are categorized by the IUCN threatened species categories which differ slightly from the FAO definitions of risk for domestic animals outlined above.

Species identified as threatened by IUCN are assigned a category indicating the degree of threat (for more details see reference in bibliography Part 3). These categories have been used for Part 3 of this text only, where they are generally more relevant. Definitions are as follows:

EXTINCT (EX)

Species not definitely located in the wild during the last 50 years.

ENDANGERED (E)

Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included are taxa whose numbers have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction. Also included are taxa that may be extinct but have definitely been seen in the wild in the past 50 years.

VULNERABLE (V)

Taxa believed likely to move into the endangered category in the near future if the causal factors continue operating. Included are taxa of which most of all the populations are decreasing because of over-exploitation, extensive destruction of habitat or other environmental disturbance; taxa with populations that have seriously been depleted and whose ultimate security has not yet been assured; and taxa with populations that are still abundant but are under threat from severe adverse factors throughout their range.

RARE (R)

Taxa with small world populations that are not at present endangered or vulnerable, but are at risk.

INDETERMINATE (I)

Taxa known to be endangered, vulnerable, or rare but where there is not enough information to say which of the three categories is appropriate.

INSUFFICIENTLY KNOWN (K)

Taxa that are suspected, but not definitely known, to belong to any of the above categories because of lack of information.

THREATENED (T)

Threatened is a general term to denote species that are endangered, vulnerable, rare, indeterminate, or insufficiently known and should not be confused with the use of the same term by the United States Office of Endangered Species.

COMMERCIALLY THREATENED (CT)

Taxa not currently threatened with extinction, but most or all of whose populations are threatened as a sustainable commercial resource, or will become so, unless their exploitation is regulated. This category applies only to taxa whose populations are assumed to be relatively large.

1.7 INFORMATION GATHERING

The information used to compile WWL-DAD:3 was derived from an analysis of the country survey data in the Global Databank for Farm Animal Genetic Resources. These data were compiled from the following sources:

BREEDS SURVEYS

In 1991 a breed survey focusing on the major domestic livestock species (ass, buffalo, cattle, goat, horse, pig and sheep) was initiated in all non-European countries. The primary aims of the survey were to identify and obtain basic descriptions of all breeds and varieties within each country and to identify breeds at risk of extinction.

Brief two-page questionnaires were completed enabling the collation of basic morphological descriptions, population size and production performance data. These questionnaires form a subset of the questionnaires that are directly accessible by National Co-ordinators, through DAD-IS, either on-line (URL:http://www.fao.org/dad-is) or via the DAD-IS CD-ROM (see also Table 1.7.1). The focus of the initial survey was to gather basic breed identification data and information on population size.

The National Co-ordinator for each country:

- arranged for the completion/update of one questionnaire for each breed/breed variety in the country or region, and

- remains responsible for validating and updating the country's data stored in the Global Databank for Farm Animal Genetic Resources.

In Europe, the need for animal genetic resources conservation efforts was recognised in the late 1960s. The first concerted action was initiated in the 1980s when The European Association for Animal Production (EAAP) initiated three successive breed surveys (1982, 1985 and 1988) on European cattle, sheep, goat and pig breeds, with the participation of 22, 17 and 12 countries respectively. In 1986, the Department of Animal Breeding at Hannover Veterinary University was entrusted by EAAP with the task of creating the European data bank for animal genetic resources. By 1994 all of the data contained in the EAAP-AGDB (EAAP-Animal Genetic Data Bank) on both non-European and European breeds, was transferred to the Global Databank for Farm Animal Genetic Resources. The EAAP-AGDB can be found at URL: http://www.tiho.hannover.de/einricht/zucht/eaap/index.htm.

Towards the end of 1993 global surveys were initiated for domestic avian species and the *Camelidae*. Two-page questionnaires were developed for use with the avian species survey to provide for avian-specific characteristics. Provision was also made for some added avian species that have only recently been bred in captivity by farmers. Contacts were asked to complete a questionnaire for each breed in their country, including varieties, strains and lines for research or other purposes, all of which must be regarded as animal genetic resources.

All of the information stored in the Global Databank for Farm Animal Genetic Resources is reviewed and verified before being made publicly accessible. When breed questionnaires are provided by National Co-ordinators to FAO a validation process is initiated. The data are critically examined in detail and, where necessary, correspondence is initiated between the National Co-ordinators and FAO in order to clarify points or questions raised by the provided data. Only when these queries are resolved is data released for general access through the Global Databank for Farm Animal Genetic Resources of DAD-IS. Once in the Global Databank for Farm Animal Genetic Resources a permanent record of sovereign animal genetic resources for the country is in place. This information is continually updated and developed by the respective National Co-ordinator. No sequential data such as population information has been or will be deleted or overwritten. This ensures the maintenance of valuable time-trend information that can be analysed at any point to assist management decision-making. For further verification of the stored information, all country contacts were requested, in early 1999, to check the validity of the data and to update the information where necessary. Tables 1.7.1 and 1.7.2 provide overviews of the type of information recorded in the Global Databank for Farm Animal Genetic Resources.

By April 1996, all of the information stored in the Global Databank for Farm Animal Genetic Resources was available for viewing on DAD-IS. In September 1998, the second stage of DAD-IS was released with additional functions, which included the initiation of an interactive service, allowing National Co-ordinators and Informal Contacts with special access rights to correct and update the information on the breeds in their own countries. The development of DAD-IS is ongoing. The third stage of development will train and include functionality to assist countries prepare for the first report on the State of the World's Animal Genetic Resources.

MASON'S WORLD DICTIONARY OF LIVESTOCK BREEDS

Mason's World Dictionary of Livestock Breeds (1988) was used as an initial information source for the development of the Global Databank for Farm Animal Genetic Resources. For seven species (ass, buffalo, cattle, goat, horse, pig and sheep) it lists the breeds and breed varieties that Mason identified worldwide. For each entry the following are provided: the breed name, synonymous names, location and sometimes the origin, physical appearance, main uses and risk status. FAO uses the term breed differently to Mason, to also include breed varieties. Almost all breeds described by Mason were originally entered in the Global Databank for Farm Animal Genetic Resources. Those described as feral or wild were also included, while those referring to an unstable cross between breeds or to a group or collection of breeds were not. The information originally obtained from Mason was updated and validated by National Co-ordinators and Informal Contacts operating directly with FAO.

TABLE 1.7.1 SUMMARY OF INFORMATION RECORDED FOR MAMMALIAN SPECIES IN THE GLOBAL DATABANK FOR FARM ANIMAL GENETIC RESOURCES

■ GENERAL INFORMATION

Species
Breed name (most common name and other local names)
Distribution

■ POPULATION DATA

Basic Population Information:
Year of data collection
Total population size (range or exact figure)
Reliability of population data
Population trend (increasing, stable, decreasing)
Population figures based on (census/survey at species/breed level or estimate)

Advanced Population Information:
Number of breeding females and males
Percentage of females bred to males of the same breed and percentage of males used for breeding.
Number of females registered in herd book/register
Artificial Insemination usage and storage of semen and embryos
Number of herds and average herd size

■ MAIN USES

Listed in order of importance

■ ORIGIN AND DEVELOPMENT

Current domestication status (domestic/wild/feral)
Taxonomic classification (breed/variety/strain/line)
Origin (description and year)
Import
Year of herd book establishment
Organization monitoring breed (address)

■ MORPHOLOGY

Adult height and weight
Number and shape/size of horns
Colour
Specific visible traits
Hair and/or wool type

■ SPECIAL QUALITIES

Specific quality of products
Specific health characteristics
Adaptability to specific environment
Special reproductive characteristics
Other special qualities

■ MANAGEMENT CONDITIONS

Management system
Mobility
Feeding of adults
Housing period
Specific management conditions

■ *IN SITU* CONSERVATION

Description of *in situ* conservation programmes

■ *EX SITU* CONSERVATION

Semen stored and number of sires represented
Embryos stored and number of dams and sires represented in embryos
Description of *ex situ* conservation programmes

■ PERFORMANCE

Birth weight
Age at sexual maturity
Average age of breeding males
Age at first parturition and parturition interval
Length of productive life
Milk yield and lactation length (mammals)
Milk fat
Lean meat
Daily gain
Carcass Weight
Dressing percentage
Management conditions under which performance was measured

TABLE 1.7.2 SUMMARY OF INFORMATION RECORDED FOR AVIAN SPECIES IN THE GLOBAL DATABANK FOR FARM ANIMAL GENETIC RESOURCES

■ GENERAL INFORMATION

Species
Breed name (most common name and other local names)
Distribution

■ POPULATION DATA

Basic Population Information:
Year of data collection
Total population size (range or exact figure)
Reliability of population data
Population trend (increasing, stable, decreasing)
Population figures based on (census/survey at species/breed level or estimate)

Advanced Population Information:
Number of breeding females and males
Percentage of females bred to males of the same breed and percentage of males used for breeding.
Number of females registered in herd book/register
Artificial Insemination usage and storage of semen and embryos
Number of herds and average herd size

■ MAIN USES

Listed in order of importance

■ ORIGIN AND DEVELOPMENT

Current domestication status (domestic/wild/feral)
Taxonomic classification (breed/variety/strain/line)
Origin (description and year)
Import
Year of herd book establishment
Organization monitoring breed (address)

■ MORPHOLOGY

Adult live weight
Patterns within feathers
Plumage pattern
Skin colour
Shank and foot colour
Comb type
Egg shell colour
Specific visible traits

■ SPECIAL QUALITIES

Specific quality of products
Specific health characteristics
Adaptability to specific environment
Special reproductive characteristics
Other special qualities

■ MANAGEMENT CONDITIONS

Management system
Mobility
Feeding of adults
Housing period
Specific management conditions

■ *IN SITU* CONSERVATION

Description of *in situ* conservation programmes

■ *EX SITU* CONSERVATION

Semen stored and number of sires represented
Description of *ex situ* conservation programmes

■ PERFORMANCE

Age at sexual maturity
Age at first egg and clutch interval
Length of productive life
Number of eggs per year
Daily gain
Carcass Weight
Dressing percentage
Management conditions under which performance was measured

In 1999, data on extinct breeds was extracted from Mason's World Dictionary of Livestock Breeds, Types and Varieties (1996) and entered into the Global Databank for Farm Animal Genetic Resources. National Co-ordinators and Informal Contacts were contacted and requested to confirm the loss of these breeds and to provide additional information on other extinct breeds that are not documented in Mason (see Part 2.3 for further information on extinct breeds).

PUBLISHED LITERATURE

A literature search was carried out for all breeds to collate initial information on population size and basic phenotypic performance. Several of the FAO Animal Production and Health series publications also provided substantial initial data, particularly volumes 46 and 65 published in 1984 and 1989. These publications describe the animal genetic resources of China and the former Union of Soviet Socialist Republics. Population data for breeds in developing countries are scarce. More direct reporting of this data is required. An improved recording and updating effort is needed within many countries to obtain the necessary survey data.

THE GLOBAL IMAGE DATABANK FOR FARM ANIMAL GENETIC RESOURCES

FAO receives many requests, particularly from the media, countries and other stakeholders interested in particular breeds, for quality images of animal genetic resources. To provide a reliable and efficient global service, FAO is developing a high quality image database to complement and link directly with the Global Databank for Farm Animal Genetic Resources. Survey country contacts and species experts throughout the world are invited to provide images (good quality slides, photo prints including high resolution virtual images) showing the breeds in various aspects within their primary production environment, together with brief informative descriptions of the images and identification of the photographer.

1.8 RESPONSIBILITY FOR QUALITY OF DATA

Under the Convention on Biological Diversity (CBD) (see also URL: http://www.biodiv.org/), implemented as international law in 1993, each country has sovereignty over all genetic resources occurring within its jurisdiction. Thus, each country must be responsible for validating and maintaining current data describing the status and characteristics of their resources and for reporting on this internationally.

The breed survey questionnaires are completed by country contacts, co-ordinated by the country-identified National Co-ordinators for the Management of Animal Genetic Resources. These individuals and the National Co-ordinating Institutions may be located in governments, research institutes, universities or NGOs having an effective link with governments. National Focal Points for the Management of Animal Genetic Resources also have primary technical responsibility for the country for collating and validating data maintained in the Global Databank for Farm Animal Genetic Resources. All countries deciding to participate in the first report on the State of the World's Animal Genetic Resources will need to have identified with FAO their National Focal Point for the Management of Animal Genetic Resources.

Some countries provide more detailed and better quality information than do others. In many cases further efforts have been made to validate and augment the original information supplied. Often this has not been possible as either the information requested is unavailable or the National Co-ordinator is not in a position to provide it.

PLEASE HELP

If you, the reader, are aware of, and are in a position to furnish further information on the breeds listed, or on other breeds that are not listed, current or extinct, please contact your National Co-ordinator – see Annex 2.2 for names and addresses of current National Co-ordinators for the Management of Animal Genetic Resources. Continuously updated National Co-ordinator information for your country can be found in the communication module of DAD-IS (**URL: http://www.fao.org/dad-is/**).

1.9 DEFINITION OF TERMS

AGROBIODIVERSITY or AGRICULTURAL BIOLOGICAL DIVERSITY: that component of biodiversity that contributes to food and agriculture production. The term agrobiodiversity encompasses within-species, species and ecosystem diversity.

ANIMAL GENETIC RESOURCES DATABANK: a databank that contains inventories of farm animal genetic resources and their immediate wild relatives, including any information that helps to characterize these resources.

ANIMAL GENOME (GENE) BANK: a planned and managed repository containing animal genetic resources. Repositories include the environment in which the genetic resource has developed, or is now normally found (*in situ*) or facilities elsewhere (*ex situ* – in vivo or in vitro). For in vitro, ex situ genome bank facilities, germplasm is stored in the form of one or more of the following: semen, ova, embryos and tissue samples.

BIODIVERSITY or BIOLOGICAL DIVERSITY: 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 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 similar groups has led to acceptance of its separate identity. Note: Breeds have been developed according to geographic and cultural differences, and to meet human food and agricultural requirements. In this sense, breed is not a technical term. The differences, both visual and otherwise, between breeds account for much of the diversity associated with each domestic animal species. Breed is often accepted as a cultural rather than a technical term.

CHARACTERIZATION OF ANIMAL GENETIC RESOURCES: all activities associated with the description of animal genetic resources aimed at better knowledge of these resources and their state. Characterization by a country of its animal genetic resources will incorporate development of necessary descriptors for use, identification of the country's sovereign animal genetic resources; 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 animal genetic resources at risk.

CRITICAL: a breed is categorized as critical if: The total number of breeding females is less than or equal to 100 or the total number of breeding males is less than or equal to five; **or** The overall population size is less than or equal to 120 and decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

CRITICAL-MAINTAINED: are those critical populations for which active conservation programmes are in place or populations are maintained by commercial companies or research institutions.

DOMESTIC ANIMAL DIVERSITY (DAD): the spectrum of genetic differences within each breed, and across all breeds within each domestic animal species, together with the species differences; all of which are available for the sustainable intensification of food and agriculture production.

ENDANGERED: a breed is categorized as endangered if: The total number of breeding females is greater than 100 and less than or equal to 1 000 or the total number of breeding males is less than or equal to 20 and greater than five; **OR** The overall population size is greater than 80 and less than 100 and increasing and the percentage of females being bred to males of the same breed is above 80 percent; **OR** The overall population size is greater than 1 000 and less than or equal to 1 200 decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

ENDANGERED -MAINTAINED: are those endangered populations for which active conservation programmes are in place or populations are maintained by commercial companies or research institutions.

EX SITU CONSERVATION OF FARM ANIMAL GENETIC DIVERSITY: all conservation of genetic material in vivo, but out of the environment in which it developed, and in vitro including, inter alia, the cryoconservation of semen, oocytes, embryos, cells or tissues. Note that ex situ conservation and ex situ preservation are considered here to be synonymous.

EXTINCT: a breed is categorized as extinct if: 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 (AnGR): 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, and any conserved genetic material.

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.

LINE: similar to a strain but refers to commercial line breeding, which is the breeding of birds that have outstanding performance characteristics within closed populations.

MANAGEMENT OF FARM ANIMAL GENETIC RESOURCES: the sum total of technical, policy, and logistical operations involved in understanding (characterization), using and developing (utilization), maintaining (conservation), accessing, and sharing the benefits of animal genetic resources.

NOT AT RISK: a breed is categorized as Not at Risk if none of the above definitions apply and: The total number of breeding females and males are greater than 1 000 and 20, respectively; **OR** If the population size is greater than 1 200 and the overall population size is increasing.

PRODUCTION ENVIRONMENT: all input–output relationships, over time, at a particular location. The relationships will include biological, climatic, economic, social, cultural and political factors, which combine to determine the productive potential of a particular livestock enterprise.

- HIGH-INPUT PRODUCTION ENVIRONMENT: a production environment where all rate-limiting inputs to animal production can be managed to ensure high levels of survival, reproduction and output. Output and production risks are constrained primarily by managerial decisions.

- MEDIUM-INPUT PRODUCTION ENVIRONMENT: a production environment where management of the available resources has the scope to overcome the negative effects of the environment on animal production, although it is common for one or more factors to limit output, survival or reproduction in a serious fashion.

- LOW-INPUT PRODUCTION ENVIRONMENT: a production environment where one or more rate-limiting inputs impose continuous or variable severe pressure on livestock, resulting in low survival, reproductive rate or output. Output and production risks are exposed to major influences which may go beyond human management capacity.

POPULATION: a generic term but when used in a genetic sense it defines an interbreeding group, and may refer to all the animals within a breed, variety or strain. The genetics of the population is concerned with the genetic constitution of the sum total of individuals it comprises, and with the transmission from generation to generation of the large number of genes and the alternative forms of these genes carried by each animal.

STRAIN: a group of birds within a variety named after their breeder and which has been developed with the aim to improve some special morphological or performance characteristics.

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 AnGRs 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 AnGRs and the sustainable intensification of the production systems themselves. The wise use of AnGRs is possible without depleting domestic animal diversity. Development of AnGRs 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.

VARIETY: a subdivision within a breed, characterised largely by distinctive colour of plumage or markings.

1.10 CONSERVING DOMESTIC ANIMAL GENETIC RESOURCES

Estimates of the number of species of living organisms on earth range from two million to 100 million with a best estimate of somewhere near 10 million. Less than 0.5 percent of these species are known to be birds and mammals. Within this small slice of biological diversity there are some 40+ domestic livestock species. Only 14 percent of these species contribute to 82 percent of the world's food and agriculture production. Over the last 12 000 years these 14 species have been domesticated and have evolved into separate and genetically unique breeds adapted to their local environments and community requirements. There are some 6 000 to 7 000 domestic breeds remaining. These breeds and the species they represent, together with the 80+ species of wild relatives, comprise the world's animal genetic resources important for food and agriculture.

WHAT IS DOMESTIC ANIMAL DIVERSITY?

Domestic animal diversity has evolved over millions of years through the processes of natural selection forming and stabilizing each of the species used in food and agriculture. Over the more recent millennia the interaction between environmental and human selection has led to the development of genetically distinct breeds. Domestic animal diversity is the spectrum of genetic differences within and across all breeds and species utilised in agriculture.

Selection processes, directed by both humans and the environment, together with the random sampling processes causing genetic populations to drift over generations, have accelerated the development of the diversity within species leading to the creation of distinct genetic differences amongst breeds. Thus breeds, as well as species, have become important in the sustainability of production environments and the human communities that depend on agricultural ecosystems. Research to date suggests that about 50 percent of the genetic variation in each domestic animal species is breed level variation. Compared to domestic species, in the wild, relatively less diversity is observed within species.

WHAT IS THE ROLE OF ANIMAL PRODUCTION IN AGRICULTURE?

Animal production currently contributes between 30 and 40 percent of the total global economic value of food and agriculture with some 1.96 billion people depending at least in part directly upon farm animal species for their livelihood. Whilst its direct contribution to the value of food production is around 19 percent, animal production makes a range of further critical contributions.

Animal production provides a large component of the essential fertilizer for much of the world's developing agriculture. Without these organic nutrients much of the soil would not remain productive. Animal manure also serves as the primary source of fuel for cooking and heating in many communities. In addition animals provide much of the draught power used to cultivate, irrigate and harvest crops, together with much of the transport in the world today. Animal products are also used as fibre for clothing and hides and leather meet a variety of material needs. Animal products are also used in medicines and in some communities have great cultural significance. Additionally, animal production serves to contribute to employment of villagers throughout the year. Furthermore, in much of the developing world domestic animals serve as an important cash reserve, a natural bank making important contributions to poor farmers' ability to manage risk. Finally, having a broad range of animal species is essential for the many mixed farming systems that are almost always more sustainable than monoculture in major agricultural production environments.

WHY CONSERVE DOMESTIC ANIMAL DIVERSITY?

The conservation of domestic animal diversity is essential to meet future needs. The earth comprises a vast range of environments in which the production of food and agriculture must be practised. These environments are not static but are dynamic and may change through seasons, years and decades. In order to cope with an unpredictable future, genetic reserves capable of readily responding to directional forces imposed by a broad spectrum of environments must be maintained. Maintaining genetic diversity is an insurance package against future adverse conditions. Due to diversity among environments, nutritional standards and challenges from infectious agents, a large number of breeds are required. These act as storehouses of genetic variation which forms the basis for selection and may be drawn upon in times of biological stress such as famine, drought or disease epidemics. The wide range of challenges faced by animals requires the use of a wide range of breeds and species, each specifically adapted to a different set of conditions.

Maintaining diversity also provides stability within a production environment. If more than one breed or species is kept, given the failure of one to produce under certain conditions, others can be drawn upon. By maintaining more breeds and species, farmers are thus spreading risk.

In addition, with increasing global human population pressures, the quantity of food and other products must increase. Indeed, it is predicted that more than a doubling of meat and milk production will be required over the next 20 years. Furthermore, the range and quality of food and agricultural products sought by communities is affected by cultural differences and variations in purchasing powers. The increasing demand for a broad range of products, both locally and globally, requires a dynamic, adaptable, adjustable livestock system.

Changes in the production of food and agriculture influence local ecosystems. The different requirements of the domestic animal species and indeed of the breeds of each species, and the differences in behaviour and in product outputs have differential effects on, and interactions with, the respective production environments. Sustainability in these different environments will require different genetic types.

Furthermore, genetic diversity, particularly that within wild species, represents a storehouse of untested and unchallenged potential. Wild species may contain valuable but, as yet, unknown resources that could be useful and indeed essential for the future.

Not only should diversity be maintained for practical purposes, but also for cultural reasons. A community's domestic animals can enhance the environment as a living system, thus also enhancing the human inhabitants' quality of life. Domestic animal diversity that has evolved over more than 12 000 years is an integral component of our heritage, to be nurtured for future generations.

IS DOMESTIC ANIMAL DIVERSITY REPLACEABLE?

Domestic animal diversity cannot be replaced. As much as novel biotechnologies may attempt to improve breeds, it is not possible to replace lost diversity particularly over the time horizon now required to meet the human induced imperative. In practice, loss of diversity is forever.

Recent achievements in biotechnology have been enormous and the rapid increase in scientific knowledge acts to strengthen and accelerate these advances. Biotechnology offers the opportunity to better characterize, utilize, conserve and access animal genetic resources for food and agriculture production. However, there is neither an existing nor will there likely be a future biotechnology with the capacity to recreate and equal the naturally occurring diversity in the world today. Providing the inherent diversity associated with the farm animal species is conserved as a store of genetic potential, changes and improvements to existing breeds will continue to occur naturally over time, in response to the various dynamic environments, humankind's changing needs and through genetic drift.

To date, only a small number of engineered genes have proven useful for the improvement of plant production. Some transgenic cultivars of major food crops incorporating resistance to stress factors such as temperature, pests and herbicides, and with the potential to produce added food supplements have been successfully produced. The use and distribution of such plants is increasing rapidly. Animals, however, are more complex and costly than plants. All animals contain about 80 000 genes all of which interact in a complex system with each other. Unique combinations of genes are responsible for the adaptive fitness of a breed necessary for production in a particular environment. Transgenic alterations to individual genes are now becoming possible. In the near future these will likely begin to supplement classical selective breeding practices offering added opportunities to realize food security. The potential risks in doing this will need to be assessed on a case-by-case basis against the benefits of achieving more rapid genetic improvement in food and agriculture production.

The management costs required to maintain the existing pool of animal genetic diversity, in such a way as to protect and prepare for a range of indeterminate, unforeseeable future uses are, however, negligible compared to the massive costs involved in biotechnology development. Additionally, although biotechnology can contribute to agricultural improvement and aid conservation efforts, in no way does it have the capacity to regenerate diversity if it is lost. For developing countries the practice of good management of their treasure chests of genetic potential remains the most viable option, and is essential to ensure the future sustainability of animal production for agriculture.

ARE THE HIGHEST PRODUCERS UNIVERSALLY THE BEST?

Marked differences between production systems, such as product needs and prices, disease occurrence, spread and control methods and climatic differences will often require, for each environment, the use of quite different genetic resources to realize sustained production of food and agriculture. The food and agriculture requirements of developed and developing world consumers are largely incomparable.

In the developed world, just as Formula 1 racing cars require a high quantity of specialized inputs to perform on specific tracks, so too do the small number of highly geared breeds that have been refined over the last four or five decades to satisfy the immediate needs of developed world consumers. Currently some 400 of these finely tuned breeds, produced mainly for meat, milk and eggs, are being intensively developed, mostly in high input systems.

However, in the developing world, the majority of the world's people and agriculture continue to utilize low to medium input production systems. In such agro-ecosystems emphasis on further refining and fine tuning locally adapted indigenous breeds will result in more sustainable outcomes than utilising high producing breeds that have been improved in developed world environments. The adaptive fitness of genetic resources to their local production environments is an important consideration for sustainable intensification of these lower input, generally high stress production systems.

In developing countries, locally adapted indigenous breeds or landraces commonly demonstrate low absolute production figures, although productivity is commonly high when the level of input and the necessary long production cycle are taken into account. Indigenous breeds have evolved to survive and reproduce in their local environments. Often, developing country production environments include combinations of intense stressors. Unless these can be rapidly overcome, then the use and further development of locally adapted breeds should be favoured. Indigenous breeds are an important asset to countries for many reasons, but particularly because, over time, they have developed unique combinations of adaptive traits to best respond to the pressures of the local environment. These adaptive traits include:

- tolerance / resistance to various diseases
- tolerance to fluctuations in availability and quality of feed resources and water supply
- tolerance to extreme temperatures, humidity and other climatic factors
- adaptation to low capacity management conditions
- ability to survive, produce and reproduce for long periods of time

WHAT IS CONSERVATION?

Conservation is the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations.

The 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 animal genetic resources is maintained to contribute to food and agricultural production and productivity, now and in the future. Having ratified the Convention on Biological Diversity, it is the sovereign prerogative of countries to establish their national conservation strategy for animal genetic resources at risk.

The requirements for effective management of conservation needs at the country level encompass for each species:

- The identification and listing of breeds;

- Their description and characterization, in order to understand their unique qualities and potential contributions, and to identify those breeds that have the greatest potential to contribute to necessary variety in the future;

- Monitoring the population statistics for each breed and regularly reporting to the world those breed populations currently at risk of extinction;

- Facilitating the current use of as many breeds as possible – the wise use of a breed is likely to be the most cost-effective way of conserving its gene pool for the future;

- Storing adequate samples of as many of the unique breeds as possible, in the form of live animals if feasible, preferably supplemented by managed banks of frozen semen, ova and embryos, to enable the future regeneration of a lost population of animals;

- Implementing education and training programmes in conservation genetics and effective field techniques;

- Maximizing involvement of all stakeholders that are necessary to make the programme a success; and

- Assisting with the development of the necessary national and international policy and legal instruments.

Conservation is often seen as simply preserving or storing samples of semen and/or embryos. This alone will not provide effective national and regional programmes for maintaining and making the best use of animal genetic diversity.

WHAT IS *IN SITU* CONSERVATION?

The *in situ* conservation of farm animal genetic diversity incorporates all measures that aim 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. For wild relatives, *in situ* conservation, generally called *in situ* preservation, is the maintenance of live populations of animals in their adaptive environment or as close to it as practically possible.

WHAT IS *EX SITU* CONSERVATION?

In the context of the conservation of domestic animal diversity, *ex situ* conservation means storage. *Ex situ* conservation of farm animal genetic diversity is all conservation of genetic material *in vivo*, but out of the environment in which it developed, and *in vitro* including, *inter alia*, the cryo-conservation of semen, oocytes, embryos, cells or tissues. Note that *ex situ* conservation and *ex situ* preservation are considered here to be synonymous. Long-term storage of animal germplasm using cryo-conservation is possible for many, but not all, of the important animal livestock species.

Growing recognition of the roles and values of animal genetic resources over the past couple of decades has led to the initiation of conservation efforts. Many countries have attempted, or are attempting, to conserve some of their most important breeds using both *in situ* and *ex situ* conservation measures. Nevertheless, conservation efforts for animal genetic resources lag far behind conservation efforts for plant genetic resources.

IS THERE ONLY ONE RECIPE FOR CONSERVATION?

Whilst the basic operations of identification and characterization of genetic resources are universally required and an information system and management entity essential for the facilitation and co-ordination of the conservation effort, a variety of activities and technologies is needed in order to include all the processes required to best conserve a particular breed. Factors such as the breed's current use, the climatic, social and political stability of the area in which it is located, the number of animals in the existing breed population and the extent and type of performance recording and cross-breeding employed should all be considered. National policies and local attitudes, culture, and of course, available finance are also important factors. The conservation means is also dependent upon the species involved, the financial and human resource capacity, the establishment of policy concerning incentives for conserving breeds at risk and availability of reliable long-term cryo-preservation storage. Regional back-up conservation facilities are being demonstrated by some countries as very cost-effective.

HOW CAN EFFECTIVE MANAGEMENT OF DOMESTIC ANIMAL DIVERSITY BE IMPLEMENTED?

With the knowledge that 32 percent of the recorded animal genetic resources globally are at high risk of loss, and with so little known about most of the breeds involved, it would be unwise to suggest that the scarce available finances should be spent on a small number of breed rescue projects. The emphasis must be on implementing a sound global management infrastructure that overcomes the erosion of animal genetic resources and ensures their better development and sustainable use. In situations where animal genetic resources are not of current use by farmers, then a management programme which also provides for a breed conservation strategy will be crucial to success.

Countries possess different subsets of animal genetic resources and, as recognized by the Convention on Biological Diversity, they have sovereignty over them. Therefore effective programmes of sustainable use and conservation by individual nations must provide the foundation for successful regional and global programmes of management. National strategies for the management of animal genetic resources should involve all stakeholders, from farmers to government policy makers. Broader participation means better management of animal genetic resources.

FAO has the international mandate for improving agriculture and food production for current and future world populations - with particular emphasis on developing countries. To this end, FAO is meeting the global challenge of effective conservation and sustainable use of animal genetic resources by assisting countries in the design of comprehensive national strategies for the management of their animal genetic resources and by co-ordinating policy development and management at the regional and global levels.

1.11 THE GLOBAL STRATEGY FOR MANAGEMENT OF FARM ANIMAL GENETIC RESOURCES

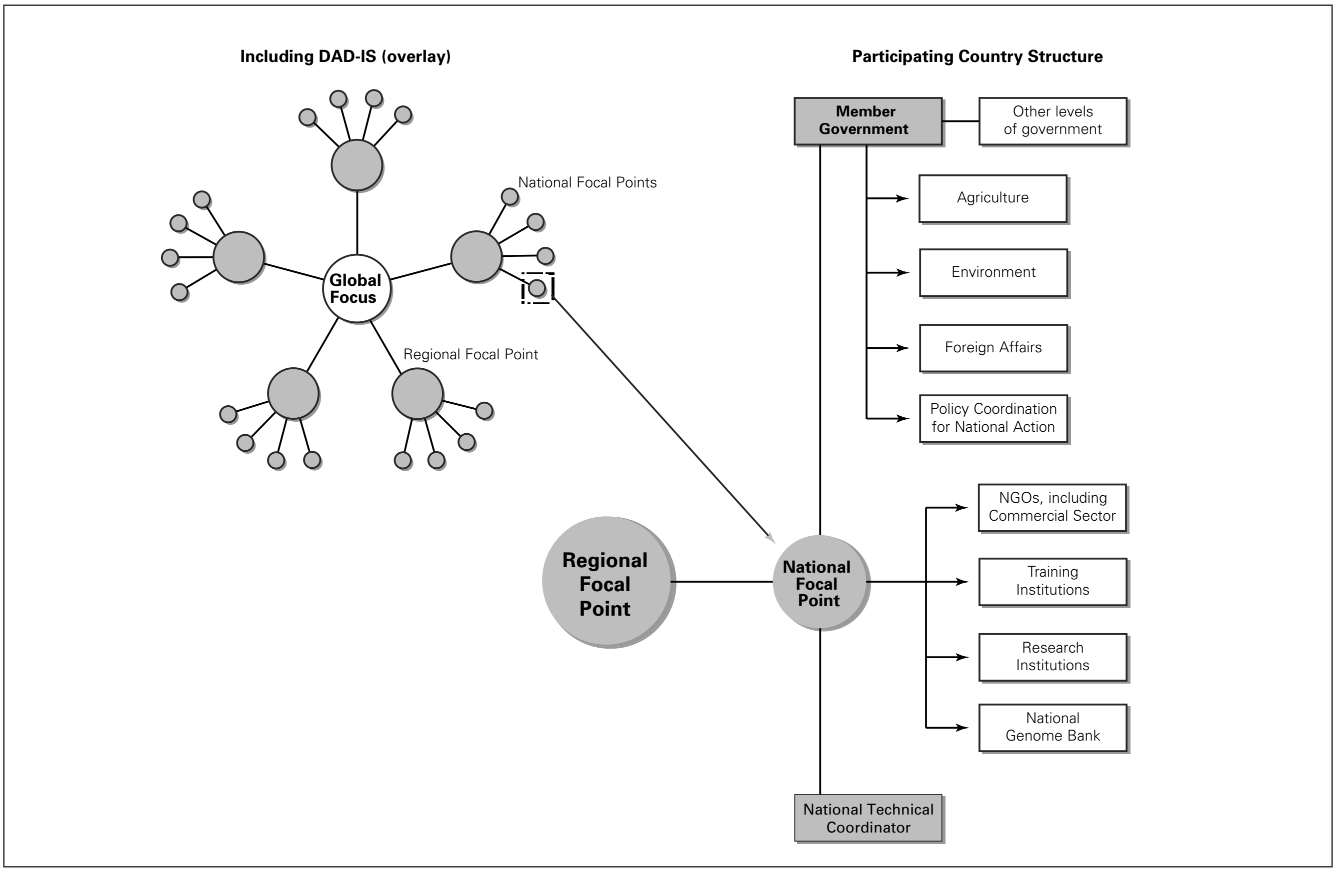
In 1992, the United Nations Conference on Environment and Development (The Earth Summit), the Convention on Biological Diversity and Agenda 21 formally identified domestic animal diversity as a genuine and important component of global biodiversity. Based on an expert consultation in 1992, an expanded priority programme of work associated with shaping and developing a Global Strategy for the Management of Farm Animal Genetic Resources (hereafter referred to as the Global Strategy) was recommended by FAO. The Global Strategy is now operational.

The goal of the Global Strategy is to overcome the erosion of animal genetic resources and to ensure the global better development and use of these resources. The Global Strategy provides a framework to assist countries, regions and other stakeholders plan, implement and maintain management programmes. The Global Strategy involves four fundamental components:

- an intergovernmental support mechanism for enabling direct government involvement and ensuring continuity of policy advice;
- a technical programme of interdependent activities to better characterize, use, develop and conserve those irreplaceable resource;
- a geographically distributed and country-based structure, supported by regional and global focal points (Figure 1.11.1), to assist national actions; and
- a reporting component to aid action planning and to monitor and evaluate progress.

At the core of the Global Strategy are several integrally related activities: the monitoring and describing of existing animal genetic resources; breed characterization at the molecular level to assess between breed diversity in order to maximize cost-effectiveness of management; a computer-based system serving as the information axis for country use(see also URL: http://www.fao.org/dad-is/); *in situ* and *ex situ* conservation strategies designed to make best use of and to maintain unique animal genetic resources; training in all aspects of sustainable intensification and conservation procedures; and communicating to the community the importance of animal genetic resources. Review of progress and long term vision for the Global Strategy is provided through the FAO's Commission on Genetic Resources for Food and Agriculture and its Intergovernmental Technical Working Group on Animal Genetic Resources.

FIGURE 1.11.1 STRUCTURE OF THE GLOBAL STRATEGY FOR MANAGEMENT OF FARM ANIMAL GENETIC RESOURCES



UNDERSTANDING THE STATE OF THE WORLD'S ANIMAL GENETIC RESOURCES

Recognising the need for increasing national and regional capacity to use, develop and conserve animal genetic resources, plus the ability to report on status and trends of the animal genetic resources and programmes supporting their management, the Intergovernmental Technical Working Group on Animal Genetic Resources (ITWG-AnGR) of FAO's Commission on Genetic Resources for Food and Agriculture (URL: http://www.fao.org/WAICENT/FAOINFO/AGRICULT/cgrfa/default.htm) recommended at its first meeting, September 1998, that FAO co-ordinate the development, over 2000 – 2005, of a country-driven Report on the State of the World's Animal Genetic Resources (SoW-AnGR). Subsequently, this recommendation was endorsed by the Commission and the ITWG-AnGR subsequently finalized the Guidelines for Development of Country Reports.

The SoW-AnGR will underpin the further development of the Global Strategy. The objective of the SoW-AnGR is to develop national capacities and international co-operation to achieve the sustainable intensification of livestock production systems through the wise use and development of farm animal genetic resources whilst taking into consideration the constraints and opportunities created by growing demands on the livestock sector and by changing climate and technologies.

The first SoW-AnGR Report will provide a foundation for setting country, regional and global priorities and programmes and for developing co-operation and assistance in maintaining and enhancing the contribution of animal genetic resources to food and agriculture. The outcomes sought by the SoW-AnGR Process include:

- Assessing national and regional capacity to manage animal genetic resources, and facilitating priority-setting inter alia for training and technology transfer and other forms of capacity-building.

- Increasing awareness of the many roles and values of animal genetic resources in order to promote action aimed at the better use, development and conservation of these essential resources.

- Promoting informed planning and collaboration among governments, non-governmental organizations and experts involved in the management of animal genetic resources.

- Providing the Commission on Genetic Resources for Food and Agriculture with comprehensive data and information on the state of animal genetic resources, as a basis for policy and management development in this sector, identifying gaps and opportunities and thereby providing a foundation for establishing priorities for country, regional and global action.

- Improving understanding of the status of breeds and of wild relatives of domesticated animals that are at risk, thus providing a foundation for an Early Warning System for animal genetic resources.

The SoW–AnGR process will not be limited to collecting information and reporting. During this process, follow-up activities and high-priority country projects will be identified and launched using information from the SoW-AnGR Strategic Priority Actions Report reflecting an array of longer-term outcomes sought which should include the essential elements of: institution and capacity building; characterization, sustainable use and development; and conservation

The governing bodies of FAO have strongly emphasized that the process for developing the first Report on SoW-AnGR must be country-driven, ensuring that national and regional capacities, issues, priorities and needs are reliably identified. The process will be co-ordinated by the SoW-AnGR Global Focal Point at FAO and guided by the ITWG-AnGR. For further information on progress and involvement, contact your National Co-ordinator and refer to the DAD-IS Stage 3 SoW-AnGR module at URL: http://fao.org/dad-is/.

FURTHER INITIATIVES

FAO is responsible for assisting countries in the development of an effective global programme of management for farm animal genetic resources. However, FAO is not the only organization making substantial contributions to effective management of these resources. In recent years there has been a range of other international, regional and national discussions on domestic animal genetic resources, and some national and regional bodies and programmes have been initiated.

Some examples of these initiatives are: in India the formation of a national animal genetic resources bureau and network; in Brazil the initiation of a national genetic resources and biotechnology programme (CENARGEN); in the United States of America the establishment of the national germplasm evaluation programme; in the European Community the focus on genetic resources and the establishment of a standing committee on animal genetic resources by the European Association of Animal Production (EAAP) resulting in the implementation of a range of other initiatives; the co-ordination of a Pan-African programme in animal genetic resources through the International Livestock Research Institute (ILRI) which is responsible for the CGIARs system-wide animal genetic resources initiative; in Latin American and the Caribbean the initiation of a network for animal genetic resources (REGENAL) and of an Inter-American System for the Sustainable Use and Conservation of Genetic Resources by the Inter-American Institute for Co-operation in Agriculture (IICA); the maintenance by the Nordic governments of joint standing committees on genetic resources and the Nordic Genebank; and the beginning of Regional Focal Points for animal genetic resources in Asia, Europe, Latin America and the Caribbean, the Near East and the Southern African Development Community (SADC), to assist countries.

1.12 BIBLIOGRAPHY

This section provides a collection of references relating to the management of animal genetic resources. Only some of the many available journal articles have been included in the bibliography. Please see also section 3.17, which provides a range of references for wild relatives of animal genetic resources and also the bibliography at the end of Part 4. If you are aware of any further significant publications, please inform FAO by using the Pro Forma provided in Annex 2.1. Note that the following abbreviations are used to denote the languages of some publications: **Ar** = Arabic, **C** = Chinese, **E** = English, **F** = French, **G** = German, **I** = Italian, **S** = Spanish, **Sl**= Slovene.

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