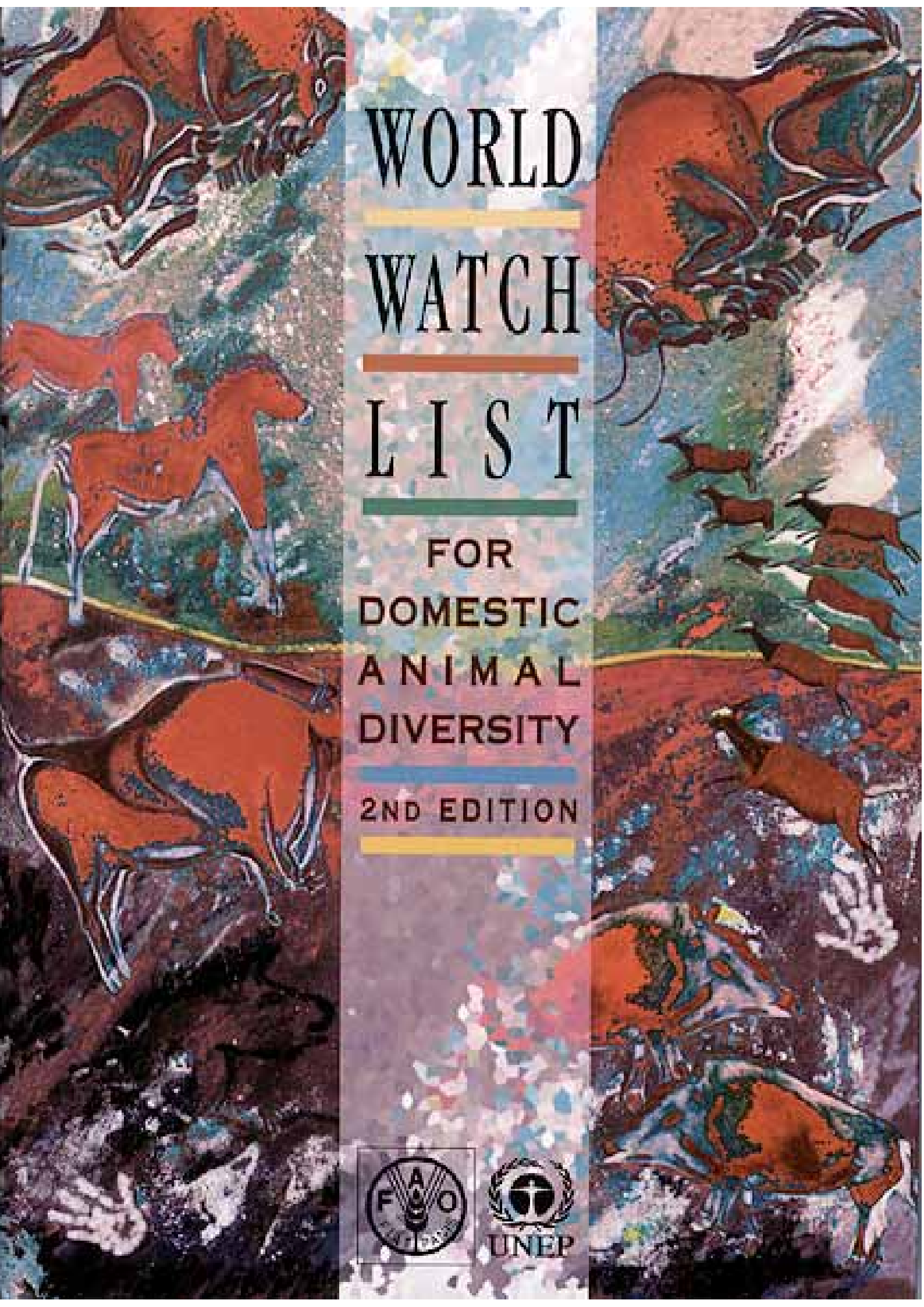

WORLD WATCH LIST

FOR DOMESTIC ANIMAL DIVERSITY

2ND EDITION

FAO
UNEP

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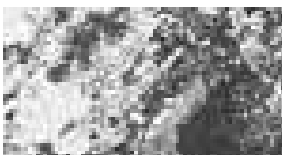
FOR DOMESTIC ANIMAL DIVERSITY

2nd EDITION

EDITED BY
BEATE D. SCHERF

FOOD AND AGRICULTURE
ORGANIZATION OF THE
UNITED NATIONS

ROME, September 1995



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The production of this second edition of the World Watch List for Domestic Animal Diversity has been based largely upon The Global Databank for Farm Animal Genetic Resources being developed and maintained by FAO. The extensive information in this Databank is predominantly from global breed surveys. The cooperation of individuals and organizations throughout the world providing better information is greatly appreciated. Particular gratification is extended to the country contacts in 181 countries, dependent territories and overseas departments who provided breed data through these global surveys. A listing of these appears in Annex 2.2 and 2.3.

The global surveys, The Global Databank and this WWL-DAD, form the key components of The Global Early Warning System for Animal Genetic Resources. This serves to underscore the important contributions of those providing breed data.

Substantial contributions were made by a range of people to complete this second edition of WWL-DAD; particularly Daniela Scicchigno in developing software for the improvement of FAO's Global Databank for Farm Animal Genetic Resources and assisting in preparing the manuscript; Sandro Sovani in validating and entering much of the recent data and in assisting with the manuscript; and Nicholas Rubery in designing the colour plates and providing technical assistance.

PREFACE

World food production and agriculture utilize only a few animal species, within which many breeds with unique characteristics exist. These genetic resources form the pool of domestic animal diversity available to meet the increasing massive global demand for food and agriculture. This component of biodiversity is essential for efficient and sustainable production of food from the great range of production environments in the world, and to satisfy the many different needs of human societies.

This biological diversity is being lost as human population and economic pressures accelerate the pace of change in traditional agricultural systems. As a result, more and more breeds of domestic animals are in danger of becoming extinct. Greater efforts in the conservation and sustainable use of these irreplaceable resources are required to prevent, stop and reverse this trend of erosion of diversity. Conservation is not simply preservation of those breeds currently not in use. It also encompasses the monitoring, characterization and well-managed development and utilization over time of the gene pool of each species.

Within its Global Programme for the Management of Farm Animal Genetic Resources FAO has established The Global Early Warning System for this sector of biological diversity. The basis of this system are databases for breed inventory and description, and for monitoring the preservation of animal genetic material. At this stage The Databank incorporates information on 3 882 breeds comprising twenty-eight species. This information has been used to prepare this second edition of the World Watch List for Domestic Animal Diversity (WWL-DAD:2).

Information on wild relatives of domestic animal genetic resources is also provided. The diversity represented in the wild relatives has the potential to make important contributions to food and agricultural production.

The WWL-DAD acts as the voice of the Global Early Warning System by providing inventory basic description information on domestic breeds at risk. The list will serve to monitor their stability and conservation needs overtime. Undoubtedly this list will be used in a range of ways by many governmental and non-governmental organizations at the local, national and international levels. Opportunities for action arising from this second edition of WWL-DAD are listed at the start of PART 1 (section 1.2).

WWL-DAD:2 contains not only information on a large number of species and breeds, but also provides additional information on breeds included in the first edition. WWL-DAD:2 provides further evidence that genetic

diversity is being eroded. More than 30% of all remaining animal genetic resources are now classified either on the critical, critical-maintained, endangered or endangered-maintained list. These lists are presented here based on criteria established by FAO.

FAO and UNEP consider the communication of this most up to date information on the state of global animal genetic resources as important. Eventually all 40+ animal species in use, involving some 4 000 to 5 000 breeds, will be included in FAO's Global Databank for Farm Animal Genetic Resources. Future editions of WWL-DAD will be extended to reflect this additional information.

As The Global Databank for Farm Animal Genetic Resources is expanded and updated, further issues of WWL-DAD will be produced, to record and monitor global animal diversity. In this process, FAO will continue to rely on receiving data and information from the networks of country contacts throughout the world. If you are able to assist with new information on one or more breeds this would be appreciated. Please respond using a copy of the pro-forma in Annex 2.1 (Part 2) of this publication, forwarding completed forms either to your country's National Coordinator, listed in Annex 2.3 or where governments have not yet been invited to identify a National Coordinating Institute for contact with FAO's Global Programme for the Management of Farm Animal Genetic Resources by forwarding completed forms direct to FAO.

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ACRONYMS & ABBREVIATIONS

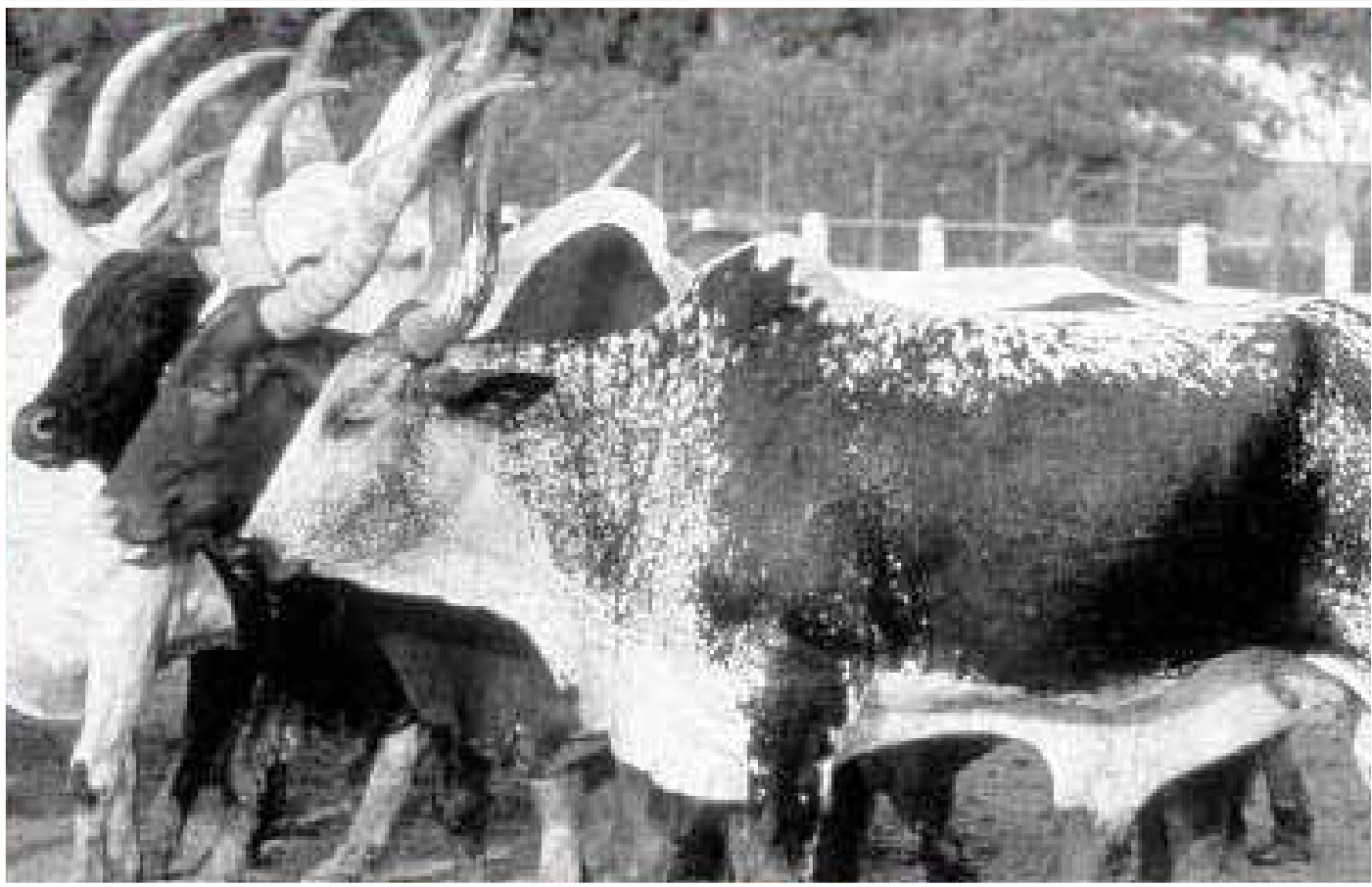
AnGR	Animal Genetic Resources
AGRI	Animal Genetic Resources Information Bulletin
AI	Artificial Insemination
ARS	Agricultural Research Service
CIS	Commonwealth of Independent States
CDAD	Centre for Domestic Animal Diversity
CENARGEN	National Genetic Resources and Biotechnology Programme
CGIAR	Consultative Group on International Agricultural Research
DAD	Domestic Animal Diversity
DAD-IS	Domestic Animal Diversity Information System
EAAP	European Association of Animal Production
FAO	Food and Agriculture Organization of the United Nations
GRIN	Germplasm Resources Information Network
IARC	International Agriculture Research Centres
ICA	Informal Country Contact - Avian Species
ICC	Informal Country Contact - Camel Species
ICM	Informal Country Contact - Mammalian Species
IICA	Inter-American Institute for Cooperation in Agriculture
ILCA	International Livestock Centre for Africa
ILRAD	International Laboratory for Animal Diseases
ILRI	International Livestock Research Institute
IPGRI	International Plant Genetic Resources Institute
NC	Country Official National Coordinator
NGO	Non–Governmental Organization
RENEGAL	Latin American and Caribbean Network for Animal Genetic Resources
UNEP	United Nations Environment Programme
USDA	United States Department of Agriculture
WWL-DAD:1	World Watch List for Domestic Animal Diversity: 1st edition
WWL-DAD:2	World Watch List for Domestic Animal Diversity: 2nd edition

RISK STATUS CATEGORIES:

C Critical	CM Critical-Maintained
D Endangered	DM Endangered-Maintained

Part 1

USING WWL-DAD:2



Zebu cattle in Chad

1.1 THE PURPOSE OF WWL-DAD:2

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 Program for the Management of Farm Animal Genetic Resources. Analysis of this data, which has been collated in The FAO Global Databank on Farm Animal Genetic Resources and is part of The Domestic Animal Diversity Information System, enables identification of domestic animal resources at risk of loss.

The goal of the WWL-DAD 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 domestic 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. 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 this second edition of the WWL-DAD includes information on 28 mammalian and avian species of domestic animals. A listing of species included 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 is devoted to the wild relatives of domestic species.

TABLE 1.1.1 SPECIES INCLUDED IN WWL-DAD:2

The MAMMALIAN species	The AVIAN species
Buffalo	Chicken
Cattle[1]	Domestic Duck
Yak	Turkey
Goat	Muscovy duck
Sheep	Domestic Goose
Pig	Guineafowl
Ass	Partridge
Horse	Pheasant
Dromedary	Quail
Bactrian Camel	Pigeon
Alpaca	
Llama	Cassowary
	Emu
Guanaco	Ñandu
Vicuña	Ostrich

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

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 a risk status assessment as a tool for all those concerned with biodiversity and the production of food.

■ Is also developed as an aid for use by country, regional and global NGOs concerned with conserving endangered farm animal breeds and with 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 of their conservation and sustainable use, thus leading to more effective management of these resources.

■ Identifies key country contacts and national coordinating institutes, which are in the best position to assist with local information and advise 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 upgrading and continually updating The Global Databank, enabling it to develop as the ongoing global monitoring mechanism for domestic animal diversity.

■ Contributes to better global communication and collaboration in conservation, encourage more efficient, effective and sustainable use of the remaining resources, and it will facilitate project development.

■ Brings to public attention the importance of the wild relatives of domestic livestock. These wild relatives are important for several reasons. They 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 future, unique genes may be extracted from them and introgressed into domesticants to improve production, productivity or sustainability and possibly to change product quality.

1.2 OPPORTUNITIES FOR ACTION

To assist the necessary country, regional and global conservation effort, governments and other relevant bodies should consider the following opportunities for using and contributing to the information in WWL-DAD:2.

1. 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.

2. Take into account the many breeds classified as critical and endangered when formulating, adopting and implementing 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 FAO's Guidelines for the Design of Management Action Plans for Animal Genetic Resources.

3. Implement appropriate conservation measures to maintain breeds, or populations of wild relatives of farm animals included in WWL-DAD:2, in cooperation 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.

4. Undertake the preparation of comprehensive national Watch Lists for farm animal species and their wild relatives using the recommended status categories (see section 1.6). Particular emphasis should be given to indigenous native breeds and wild relatives that are not yet well described. The FAO Domestic Animal Diversity Information System (DAD-IS) - the Global Surveys and Databanks, provide the means for collecting and reporting data.

5. Strengthen national programmes for surveying and monitoring farm animals. Particular emphasis should be given to: breeds listed in the WWL-DAD:2 as critical or endangered; and wild relatives of farm animals at risk.

6. Maintain national databases integrated with FAO's global Domestic Animal Diversity Information System (DAD-IS) with emphasis as listed in point 5 above.

7. Regularly provide data to FAO on the status of national domestic breeds and their wild relatives', to contribute to the maintenance of The Global Early Warning System for Animal Genetic Resources.

8. Identify incentives and possibilities encouraging the more effective development, use and maintenance of breeds under threat, and manage animal breeding 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 FAO's Guidelines for the Sustainable Development and Use of Farm Animal Genetic Resources.

9. Support the development and maintenance of genebanks to insure 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 FAO's Guidelines for the Management of Farm Animal Genetic Resources at Risk.

1.3 THE STRUCTURE OF WWL-DAD:2

STRUCTURE OF PART 2

The most important information provided are the descriptive lists of animal breeds currently at risk and the resulting summary tables presented by species and region. This information is provided in Part 2 (see Tables 2.1.1.1 to 2.1.1.4.). Breeds are categorized in the lists as either 'critical' or 'endangered' according to criteria described in section 1.6. Risk status was assessed only for breeds for which population information was available on FAO's Global Databank for Farm Animal Genetic Resources.

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

A chapter is devoted to each region, highlighting the countries included, and presenting an outline of the regions. Geography, demography, agro-ecology, and special factors affecting the development of breeds are also described. Examples are included to illustrate the diversity and utility of breeds at the local level.

Within each region, breed descriptions are sorted alphabetically, first by country, then by species group (see Table 1.3.1) and risk status (see section 1.6) and finally by breed name. Colour varieties especially of avian species, are listed under the breed name. Breeds are referred to using the name by which they are most commonly known. If a breed is found in more than one country, its description may be located under the country of origin (see section 2.4).

TABLE 1.3.1 ORDER OF SPECIES USED IN THE REGIONAL SECTIONS

1. The MAMMALIAN species	2. The AVIAN species
Ass	Cassowary
Buffalo	Chicken
The Camel species:	Domestic Duck
Alpaca	Domestic Goose
Bactrian Camel	Emu
Dromedary	Guineafowl
Guanaco	Muscovy Duck
Llama	Ñandu
Vicuña	Ostrich
Cattle[1]	Partridge
Goat	Pheasant
Horse	Pigeon
Pig	Quail
Sheep	Turkey
Yak	

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

BREED INFORMATION

Basic descriptive information from FAO's Global Databank for Farm Animal Genetic Resources, originally obtained from the Global Breeds Survey for each species and subsequently expanded by surveying literature, is presented in the format outlined below. For a number of breeds additional data, e.g. performance data, collected through the Breeds Survey is not included in the WWL-DAD:2. This information, is however, in The Databank and available on request (see Annex 2.1). Information which better characterizes each breed will continue to be added to The Global Databank.

FAO REGION

BREED NAME

COUNTRY

RISK STATUS

SPECIES

LOCAL NAMES OR SYNONYMS:

TOTAL POPULATION SIZE: • YEAR

POPULATION TREND - INCREASING / STABLE / DECREASING:

RANGE OF USES - LISTED BY PRIORITY:

A paragraph then details the origin, location and morphological description of the breed and lists any special features of the breed, when available. Some basic population data are also provided.

POPULATION SIZE

In the absence of survey population data, descriptive categories from Mason (1988) are utilized. Breeds that are described as RARE by Mason will be classified ENDANGERED in WWL-DAD:2 and breeds that are described as NEARLY EXTINCT will be classified CRITICAL. When population data collected through the Breeds Survey is used, the year of data collection is indicated.

MORPHOLOGICAL DESCRIPTION

Basic information is given only for traits that differ from the most common situation. For example, cattle breeds are horned unless specifically listed as polled, coat type is described only if it is exceptional in some way, e.g. curly. Weights and wither heights for the average adult animal are given when available, but are obviously NOT COMPARABLE among breeds which are maintained under different environment.

STRUCTURE OF PART 3

Part 3 documents the wild species which are related to domestic livestock. Species information is provided following zoological taxonomy rather than according geographical distribution utilized for Part 2. As there are some species farmed but which also occur in the wild and others which are just recently bred in captivity on farms, Part 2 and Part 3 may have parts in common.

Part 3 records the geographical distribution of the wild relatives, 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 are also made for other species that are not related to domestic animals 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.

1.4 DOMESTIC ANIMALS AND BIODIVERSITY

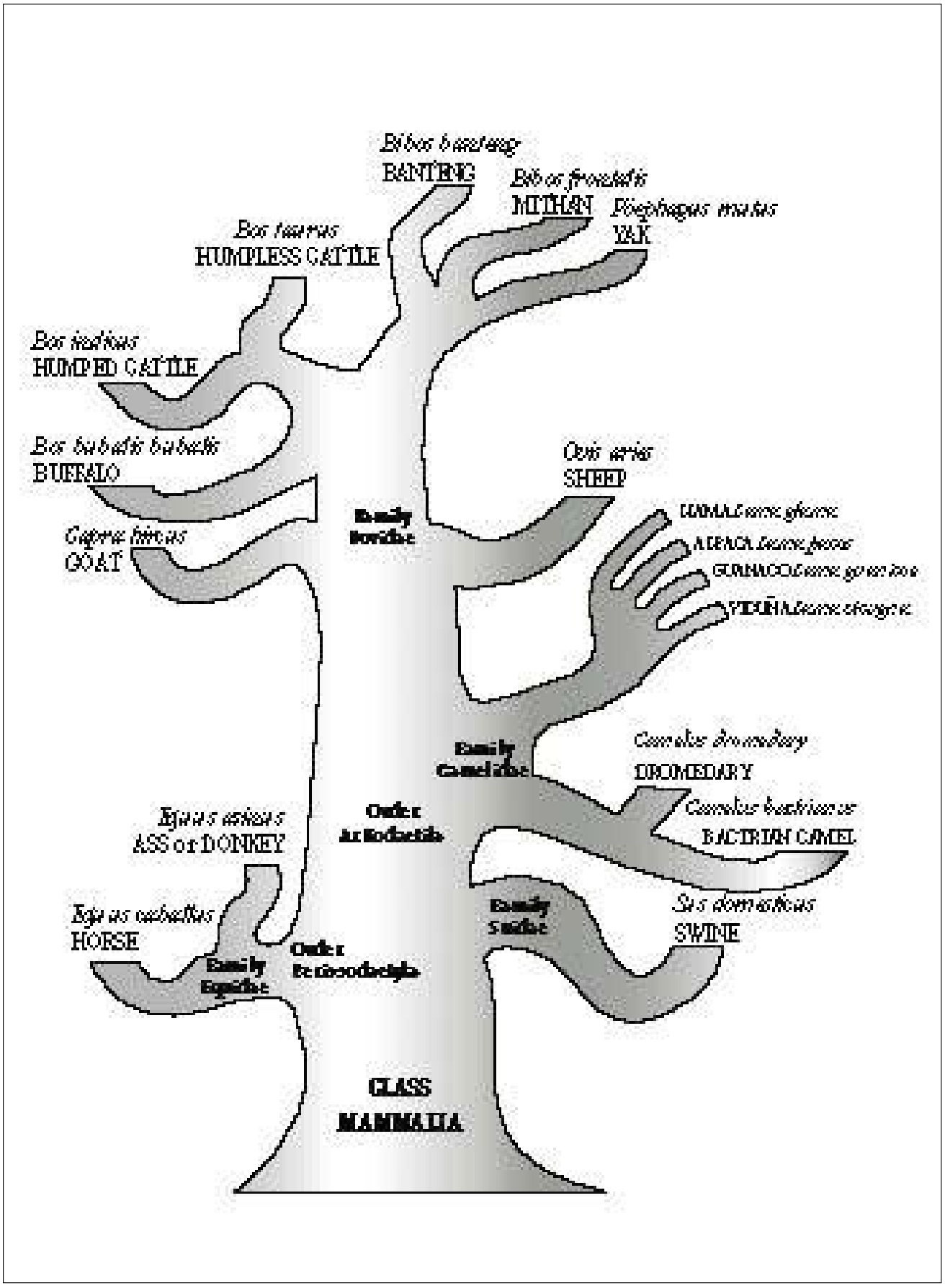
The animal species important for food and agriculture production result from the process of domestication. This process began some 12 000 years ago with wild progenitor species, and continues even today. Evolutionary relationships between several domestic mammalian species are summarized in Figure 1.4.1. Domestication of animal species involves controlled breeding for the purpose of economic benefit to a human community. As human beings evolved and extended the area under their control, animals were developed to provide for human needs within these new environments. Genetically distinct breeds developed through interaction of human selection and adaptation to environmental situations.

Twenty-eight species of domestic livestock are included WWL-DAD:2, 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 some 30 to 40% of the total value of food and agriculture production. For most agro-ecosystems, animals are one of the fundamental elements. Incorporating animal with 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 changes in the environment, 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 the next century, consumption of food and agriculture products will be equivalent to that in the last 10 000 years (HAMMOND and LEITCH, 1995). This need will be most acutely felt in developing countries where 85% of the increased food demand is expected.

Given the above facts, domestic animal diversity, is critical for food security. It is important to stop and reverse the erosion of this diversity. WWL-DAD:2 provides an inventory and basic descriptive information on domestic breeds at risk. The list will serve to monitor their stability and highlight conservation needs over time.

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



HORSE AND ASS

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

- *Equus caballus* – the true horses in Europe and northern Asia
- *Equus heminus* – the pseudo asses in Central and southern Asia
- *Equus asinus* – the true asses in North and Northeast Africa
- *Equus quagga*, *Equus greyvi*, etc. – the quaggas in Africa, south of the Sahara

There are two theories as to the origin of the domestic donkey, viz. it is descended from the Nubian wild ass, *Equus asinus africanus*, or, alternatively, *Equus africanus somalicus* was the progenitor. The group of true asses also includes eight subspecies of Asian wild ass which are not domesticated. Part 3 of this WWL-DAD incorporates further information on these wild relatives.

PIG

The ancestors of the domesticated pig are to be found among the wild pigs of the species *Sus scrofa*. These wild relatives are found throughout Eurasia and in North Africa, in the countries through which the Atlas range is found, and in Sudan and, until the beginning of the present century, in Egypt. *Sus scrofa* is further divided in 25 subspecies (MASON, 1984).

The domesticated pig is believed to originate from several separate locations in different regions. The Chinese and European breeds differ in origin. The former originating in east Asia. The 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 (genus *capra*) and sheep (genus *ovis*) were among the earliest livestock species to be domesticated. As early 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.

The ruminants assist our modern communities by digesting much of the large amount of fibrous material unsuitable for human consumption, crop

residues and by-products from human food production.
These genera, *Capra* and *Ovis* which form the sub-family *Caprinae* have quite distinct evolutionary histories. All domestic breeds of sheep are thought to have descended from the mouflon, (*Ovis musimon*), although the Urial (*Ovis orientalis*), may have contributed to the European breeds of sheep, whereas all domestic breeds of goat have descended from the bezoar of Pasang, Capra aegagrus.

CATTLE AND RELATED SPECIES

A further major group of mammals to be domesticated (after the *Caprinae*) were the large *Bovinae.* This family includes the humped (*Bos indicus*) and humpless (*Bos taurus*) cattle, the yak (Pöephagus grunniens), the mithan (*Bibos frontalis*),the banteng (*Bibos banteng*), and the buffalo (*Bos bubalus bubalis*), to mention a few. Both the swamp and the riverine buffalo belong to Bos bubalus bubalis, and as members of the same species group, may be inter-bred.

The range of species in the family *Bovinae* makes a very large number of important contributions to food and agriculture, providing nearly 30% of world meat, over 87% of world 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. Wild relatives of the *Bovinae* species are included in Part 3 of this WWL-DAD.

CAMEL

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 which migrated to South America became the ancestors of the guanaco and vicuña. Archaeological evidence indicates that llamas and alpacas were domesticated in the Andean puna at elevations of 4 000 - 4 900 m above sea-level, 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 camel, believed to have occurred around 3 000 BC. The wild two-humped camel (Bactrian Camel) 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 without water and live on thorny and high-fibre diets, stand 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.

CHICKEN

The domestic fowl usually regarded as a domesticated form of *Gallus gallus* is thought to be descended from one or more of 4 species of jungle fowl *Gallus* spp. inhabiting South-eastern Asia. Although the date of its domestication is unknown, it was recorded in India as early as 3 200 BC and in China it was known as a domesticated bird by 1 400 BC.

DUCK

All breeds of domestic duck are descended from the Mallard *Anas platyrhynchos*, which is thought to have been first domesticated in China or South-eastern Asia at a very early date. The amount of variability in the domestic duck is very small compared with that found in the domestic fowl.

GOOSE

The European goose is believed to have been domesticated in south-east Asia around 5 000 BC and may be the oldest domestic poultry species. It is generally agreed that the European goose is descended from the Greylag Goose *Anser anser* and the Chinese goose from the Swan Goose *Anser cygnoides*.

In ancient Egypt, the Egyptian (or Nile) Goose *Alopochen aegyptiacus* was the main domestic bird. Domestication took place early - in the Old Kingdom, which ended in 2 300 BC, the Egyptian Goose was very common. There are very few records of the domesticated bird outside Egypt. After the Persian conquest of Egypt in 525 - 524 BC the species ceased to be a domestic animal.

TURKEY

The Mexican subspecies of the wild turkey *Meleagris gallopavo* is considered to be the ancestor of today's domestic turkey. Domestication probably occurred near Oaxaco in Mexico. The date of domestication is uncertain, although it may have occurred about the same time as the Neolithic age in Europe.

MUSCOVY DUCK

The muscovy duck was domesticated in pre-Columbian times in the New World. The wild muscovy duck *Cairina moschata* is a tree-nesting bird found in the tropics that apparently avoids human habitation. It's name may have come from the Muisca Indians of central Colombia. Apart from the establishment of 3 varieties differing in colour, there has been no selection amongst the domesticants of this species.

GUINEAFOWL

Guineafowl, a subspecies of the wild Guineafowl *Numida meleagris,* are widespread in Africa. An East African subspecies group (*N.m. meleagris* and *N.m. somaliensis*) and a Central-Southern African subspecies group (*N.m. reichenowi, N.m. mitrata*, N.m. *manurgensis*, *N.m. papillosa* and *N.m. cororata*) can be distinguished. No known breeds have been developed.

PEAFOWL

The domesticated peafowl descended from the Peafowl *Pavo cristatus* inhabiting parts of India, Assam and Ceylon. Although the bird was known in ancient Egypt, it was probably not widely known in Europe until the time of Alexander the Great. No varieties have been developed through domestication. The Green Peafowl *P. muticus,* has also been domesticated, but further information is lacking.

OSTRICH

The 4 subspecies of the Ostrich appear to have been at least partially domesticated at some time. The most important domestication occurred in the latter half of the 19th century, when ostrich feathers became fashionable.

LITTLE EGRET

At the height of the ostrich feather trade, the little Egret *Egretta garzetta* was domesticated and farmed on a small scale in what is now Pakistan and in Tunisia. Like the ostrich, it was valued for its plumes.

CASSOWARY

In Papua Guinea attempts are underway to domesticate the Cassowary. This avian species belongs to the *Casuariidae*, one of the 6 families forming the order *Struthioniformes* of which three species are clearly recognizable: emu, cassowary and ostrich.

EMU

The Emu is the sole surviving member of the *Dromaiidae* (*Stuthioniformes*). Attempts to farm Emus intensively in Western Australia have not yet met with success. However, emus are gaining in popularity in anticipation of a market for their meat, feathers, oil and hide.

CORMORANT

The customs of using Cormorants *Phalacrocorax corbo* for fishing, dates back to the Sung dynasty (960-1298 AD) in China and to the 6th century AD in Japan. In China the birds are bred by specialized breeders; while in Japan, birds are captured from the wild and tamed. The truly domesticated birds are sometimes variable in colour.

PHEASANT AND QUAIL

Many enterprises breed game birds on a very large scale for restocking wild populations and as a speciality product for niche markets. The most common birds include the Pheasant *Phasianus colchicus*, the Partridge *Perdix*, the rock partridges *Alectoris*, the Bobwhite Quail, *Colinus virginianus* and several

species of the quail *Coturnix* spp..
The family *Phasianidae* consists of the subfamilies:

- *Phasianinae* (pheasants and peafowls)
- *Perdicinae* (Old World quail)
- *Odontophorinae* (New World quail)

The New World Quail subfamily comprises fourteen genera.
Coturnix quail were domesticated in the Orient and not in the Near East as was earlier believed. The first written records of domesticated quail date from 12th century in Japan. These birds were either domesticated in Japan itself or brought there from China across the Korean Bridge. No breed of quail is domesticated in the sense that domestic fowl have been developed. Quail are still essentially 'wild' in their morphology and behaviour. Although selective breeding programmes in many industrialized countries continue to produce new egg-laying or meat-producing strains of quail more suited for the market, this development remains relatively minor compared with that of the chicken.

PIGEON

The family *Columbiformidae* has been divided into numerous genera. The subfamily *Columbinae* includes the more typical pigeons and doves, in addition to many other forms. All domestic breeds of pigeons and the wild and feral populations are classified as *Columbia livia*. The wild ancestor is believed to be the rock pigeon or rock dove of Europe and Asia. Domestic forms of the rock pigeon are found worldwide except at the polar caps.

For a more detailed treatment of animal domestication and evolution of the above species the reader is referred to Mason (1984), Epstein (1971) and Payne (1990).

1.5 THE WILD RELATIVES OF DOMESTIC ANIMALS

By the end of this century no fewer than 100 wild animal species a day may be facing extinction. The proportion of known animal species in this predicament, on a country by country basis, varies between 0% for Sao Tome and Principe to 52% for France (OECD, 1989). Some of these vanishing wild species have the potential to contribute to humankind's food and agriculture by providing additional diversity to that being maintained in domestic breeds described in Part 2. For this reason, their consideration is included in FAO's Global Programme for the Management of Farm Animal Genetic Resources. 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 meeting 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 meeting 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 which are the wild relatives of domestic species.

Developments are underway for the conservation of the genetic diversity associated both with domestic livestock and their immediate wild relatives. The Convention on Biological Diversity which became international law in December 1993 specifically provides for agriculture and the sustainable use of biodiversity. FAO has been given a mandate by its member governments to design and implement a programme for the management of global animal genetic resources and the conservation of domestic animal diversity, including the wild relatives. In this context, 'conservation' means the total sum of all the operations involved in the management of animal genetic resources so that these resources are best used and developed to meet immediate and short-term requirements for food and agriculture, and that the diversity they harbour will remain available to meet possible longer term needs.

The botanical community has long recognised the importance of the preservation 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) which is substantially assisted by a number of other international agricultural research centres, coordinates the collection of wild specimens and undertakes research on these. Research initiatives have led to improvements in crop yields and in disease and pest resistance. For animals, however, no such organisation

exists at present, although IPGRI is now responsible, within the International Agriculture Research Centres (IARC) system, for policy matters relating to all genetic resources used for food and agriculture. Furthermore, another IARC, the International Livestock Research Institute (ILRI), formed early this year (1995), by combining the International Livestock Centre for Africa (ILCA) with the International Laboratory for Animal Diseases (ILRAD), will include a substantial animal genetic resources component in its research programme. ILRI has also been given a system-wide mandate for certain domestic species. 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 animals grazing and foraging. But the calculation that it takes 3 kg of grain to produce 0.5 kg of feed-lot beef, 1.8 kg for 0.5 kg of pork and a little over 0.7 kg of grain to produce 0.5 kg of farmed fish, is indeed significant. With world grain production falling since 1984 (BROWN et al., 1993), the growth in meat production by conventional livestock has slowed. Between 1950 and 1987 world meat production increased almost fourfold, raising the amount available per person from about 18 kg to just over 32 kg. Since 1987, however, it has not increased at all. Underlying this overall stagnation, there is said to be a marked decline in the production of beef and mutton, which may reflect the inability of the world's overgrazed grasslands to support any more cattle and sheep (BROWN et al., 1993). 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 then 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 the animal breeders.

In October 1992, FAO's 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 guineafowl (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 which 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. Civet cats, valued for production of musk, are also included because development of improved management procedures will lead to the eventual 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 domesticant species, they must not be overlooked in the global management of biodiversity.

1.6 CRITERIA FOR DETERMINING BREEDS AT RISK

In the analysis of The Global Databank, breeds are classified into one of seven categories: EXTINCT, CRITICAL, ENDANGERED, CRITICAL-MAINTAINED, ENDANGERED-MAINTAINED, NOT AT RISK and UNKNOWN. The categorization is based on overall population size, number of breeding females and the trend in population size, i.e. whether the population size is increasing, decreasing or stable. If categorization of a particular breed is borderline, further consideration is given to factors such as the number of animals actively used in AI (Artificial Insemination), the amount of semen and number of embryos stored, and the number of herds or flocks.

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

The general guidelines used to determine the risk status were as follows:

EXTINCT

A breed is categorized as extinct if:
It is no longer possible to easily recreate the breed population. This situation

becomes absolute when there are both no breeding males (semen) and breeding females (oocytes), nor embryos 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 100 or the total number of breeding males is less than or equal to 5;

OR

The overall population size is close to, but slightly above 100 and decreasing and the percentage of females being bred pure is below 80 percent.

ENDANGERED

A breed is categorized as endangered if:
The total number of breeding females is between 100 and 1 000 or the total number of breeding males is less than or equal to 20 and greater than 5;

OR

The overall population size is close to, but slightly below 100 and increasing and the percentage of females being bred pure is above 80 percent;

OR

The overall population size is close to, but slightly above 1 000 and decreasing and the percentage of females being bred pure 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 institutes.

NOT AT RISK

A breed is categorized as not as risk if:
The total number of breeding females and males are greater than 1 000 and 20, respectively;

OR

If the population size approaches 1 000 and the percentage of females being bred pure is close to 100 percent, and the overall population size is increasing.

1.7 HOW THE INFORMATION HAS BEEN OBTAINED

The information used to compile WWL-DAD:2 results from analysis of survey data from FAO's Global Databank for Farm Animal Genetic Resources. This data has been compiled from the following sources:

(I) FAO GLOBAL BREEDS SURVEY

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 on all breeds and varieties within each country, and to identify breeds at risk of extinction.

The basic breed survey is not yet complete for several countries. To solicit information brief two-page questionnaires (see Annex 2.1) are used requesting basic morphological descriptions, population size and production performance data. The focus of the initial survey is to obtain data on population size.

The National Coordinator for each country is then requested to:

a. arrange for the completion of one questionnaire for each breed or breed variety, in the country or region, and
b. be responsible for validating and updating the country's data stored in The Global Databank.

When the completed breed questionnaires are received at FAO, Rome, they are critically examined in detail and correspondence initiated with the National Coordinator regarding points or questions raised by the information provided. Only when these queries have been resolved are data entered into The Global Databank. Once on The Global Databank a permanent record is established for the country, to be expanded over time without original population data being deleted or overwritten. Table 1.1 provides an overview of the information in The FAO Global Databank for Farm Animal Genetic Resources.

Towards the end of 1993 global surveys were initiated for domestic avian species and camelidae. Because of their differences to mammals a specific brief two-page questionnaire (see Annex 2.1) was developed for surveying avian species. Avian species that are used on farms and bred in captivity were included even though some of the species started to be bred only recently. Contacts were asked to complete questionnaires for each breed, variety, strain or line raised in their country. The validation process is similar

to that previously described for mammals. Table 1.2 provides an overview of the information on avian species stored in FAO's Global Databank for Farm Animal Genetic Resources. Existing descriptive information on these resources in scientific literature has not yet been extracted and entered on to The Global Databank.

(II) MASON (1988)

Mason's dictionary (1988) was used originally as the primary information source for The Global Databank. It lists the breeds and breed varieties which Mason had been able to identify worldwide for seven species (ass, buffalo, cattle, goat, horse, pig and sheep). Provided for each entry are the breed name and location , and/or the origin, physical appearance, main uses and synonyms for the breed. In the WWL-DAD the term 'breed' also covers populations described as 'breed varieties' by Mason. Almost all breeds described by Mason have been entered in The Global Databank. Those described as 'feral' or 'wild' were included, while those referring to an unstable cross between breeds or to a group or collection of breeds were not. For WWL-DAD:2 this information originally obtained from Mason (1988) has now been updated and validated by country contacts and National Coordinators operating directly with FAO.

(III) SCIENTIFIC LITERATURE AND FAO REPORTS

A literature search was carried out to obtain initial information on population size and basic phenotypic performance on all breeds. Several of the FAO Animal Production and Health series publications provided useful data, particularly volumes 46 and 65 (FAO, 1984 and 1989) which describe the animal genetic resources of China and the former Union of Soviet Socialist Republics (see 2.4 Bibliography). Population data for breeds in developing countries were scarce. More direct reporting of this by country is required. An improved recording and updating effort is needed within many countries to obtain the necessary survey data.

(IV) IMAGE DATABANK

FAO receives many requests for quality images of animal genetic resources. To provide a reliable and efficient global service, FAO is now 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 were invited to provide images (good quality slides or photo prints) showing the breeds preferably in their primary production environment.

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

1. GENERAL INFORMATION
   - Species (alpaca, ass, bactrian camel, buffalo, cattle, dromedary ,goat, guanaco , horse, llama, pig, sheep, vicuña, yak)
   - Breed or breed variety
   - Geographical location
   - Name (in English or if not available most common name),
   - local names and synonyms (as described by Mason, 1988)
   - Information source

2. BREED ORIGIN AND DEVELOPMENT
   - Origin
   - Wild or primitive breed
   - Recent immigrations to the breed (either from other breeds within or outside the country)
   - Population size (actual or approximate) and structure
   - Trend in number of females (increasing, stable or decreasing)
   - Risk status (extinct, critical, endangered, critical or endangered maintained, not at risk, unknown)
   - Artificial insemination usage, and storage of semen and embryos

3. BREED DESCRIPTION
   - Coat colour
   - Number and description of horns (for bovids and caprines)
   - Hair and/or wool type
   - Adult size and weight
   - Genetic characteristics, e.g. mendelian, documented chromosomal aberrations

4. BREED USES AND SPECIAL QUALITIES
   - Main uses
   - Special qualities (claimed/demonstrated), e.g. disease resistance, adaptability to environmental stressors

5. MANAGEMENT CONDITIONS
   - Type of management, housing period, feeding

6. PERFORMANCE TRAIT INFORMATION

7. ADDITIONAL INFORMATION
   - Estimates of genetic distances from other breeds
   - Analysis of genetic material (DNA or allozyme data)
   - Description of conservation programmes in operation

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

1. GENERAL INFORMATION

Species (cassowary, chicken, domestic duck, domestic goose, emu, guineafowl, muscovy duck, ñandu, ostrich, partridge, pheasant, pigeon, quail, others)

Breed, variety, line or strain
Country (and region in country)
Name (in English or if not available most common name), local names and synonyms

Classification of stock: indigenous, middle-level, fancy, feral, industrial or laboratory stock

2. POPULATION DATA

Population size and structure (actual or estimated range)
Trend in number of females (increasing, stable or decreasing)
Risk status (extinct, critical, endangered, critical or endangered maintained, not at risk, unknown)
Origin of population
Source of population data

3. DESCRIPTION OF THE BREED (and proportion of breed expressing each characteristic)

Plumage pattern
Pattern within feather
Skin colour
Shank and foot colour
Comb type
Egg shell colour
Any other specific visible traits

4. USES, MANAGEMENT CONDITIONS AND PERFORMANCE

Main uses
Management conditions under which flock is usually kept
Age of maturity for each sex
Live body weight (at maturity) for each sex
Average number of eggs laid per year
Special qualities, e.g. disease resistance, adaptability to environmental stressors

5. PERSON OR ORGANIZATION PROVIDING INFORMATION

1.8 RESPONSIBILITY FOR QUALITY OF DATA

Under the Convention on Biological Diversity each country has sovereignty over its genetic resources. Thus each country must be responsible for validating and maintaining current data describing the status and characteristics of these resources.

The FAO Global Breed Survey questionnaires are completed by country contacts. These individuals may be located in governments, research institutes, universities or NGOs. Some countries have now formally identified National Coordinating Institutes and National Coordinators for the Global Programme for Management of Farm Animal Genetic Resources. These focal points also have primary responsibility for collating and validating data maintained on FAO's Global Databank. Because FAO is establishing National Focal Points on a sequential basis by region, many countries have not yet been invited by FAO to nominate a National Focal Point. In these situations informal contacts have assisted FAO to commence the databank for their country.

Some contacts provide more detailed and better quality information than others. In many cases further efforts have been made to validate and augment the original information supplied. Often this is not possible as either the information requested is unavailable or the contact is not in a position to provide it. This lack of validated data may be reflected in a number of entries in the WWL-DAD:2.

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 not listed, please forward your data using the pro-forma provided (Annex 2.1). If your country has already nominated a National technical Focal Point for FAO's Global Programme it will help if you forward the completed forms through your National Coordinator (see Annex 2.2 and 2.3 for contact names and addresses).

1.9 DEFINITION OF TERMS

Breed, variety, strain, line and population are terms that are frequently used in the WWL-DAD. Working definitions are required for each.

A BREED is either a homogenous, 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, it is a homogenous group for which geographical separation from phenotypically similar groups has led to general acceptance of its separate identity (TURTON, 1974).

Thus, 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, but certainly the differences, both visual and otherwise, between breeds account for much of the diversity associated with each domestic animal species. Breed is accepted as a cultural rather than a technical term, i.e. to emphasize ownership.

For these reasons,
EACH DOMESTIC FARM ANIMAL POPULATION WHICH A COUNTRY CLAIMS TO BE UNIQUE, WILL BE ENTERED IN FAO'S GLOBAL DATABANK FOR FARM ANIMAL GENETIC RESOURCES.

For the global surveying the term breeds also includes strains, varieties and research lines.

For some of the data provided the old original type of breeds continue to be combined with highly improved or modern types. It may be preferable to identify these as two separate breeds. Of course this decision is one for the country which, under the Convention on Biological Diversity, has sovereignty over its genetic resources.

POPULATION is 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 (about 100 000) and the alternative forms of these genes carried by each animal.

1.10 CONSERVING DOMESTIC ANIMAL GENETIC RESOURCES

Estimates of the species of living organisms on earth range from 2 million to 100 million with a best estimate of somewhere near 10 million of which less than 0.5% are birds and mammals. Within this small slice of biodiversity there are some 40+ species of domestic livestock. These species have been domesticated by humans over the last 12 000 years or so and are economically important for the contribution they make to food and agriculture production. In the process of domestication, separate and genetically unique breeds have developed to suit the local climate and community requirements. There are some 4 000 to 5 000 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 (DAD)?

The spectrum of genetic differences within each breed, and across all breeds within each domestic animal species, provides the variation or diversity for the species. This diversity has developed during millions of years of evolution, forming and stabilizing each species. Over the more recent millennia the interaction of environmental and human selection has lead to genetically distinct breeds.

These selection processes, both environmental and human directed, have resulted in much of the diversity formed from genetic differences between breeds. Thus breeds, and not species, are of crucial importance. This is somewhat different from the wild animal situation, where due to the untempered effect of environmental selection, relatively less diversity is observed within a species.

Because of the symbiosis between plants and animals important for production of food and agriculture domestic animal diversity is a key component of agro-biodiversity.

WHAT PLACE ANIMAL PRODUCTION?

Animal production contributes between 30 and 40 percent of the total global value of food and agriculture. Whilst its direct contribution to the value of food production is around 19 percent, animal production makes a range of further critical contributions to human existence. It provides a large component of the essential fertilizer to much of the world's developing agriculture, without which much of the soil would not remain productive. Animals, not machines, provide much of the draught used to cultivate crops, together with much of the transport in the world today. Animal products are

used in medicines and other special treatments and for cultural events in some communities. In much of the developing world domestic animals serve as an important cash reserve, a natural bank. Finally, a range of animal species form essential components in the many mixed farming systems. These mixed farms will almost always be more sustainable than monoculture in the major agricultural production environments. In many respects domestic animal and plant production are both equally critical to world food and agriculture.

WHY IS DAD NEEDED?

The earth comprises a vast range of environments in which the production of food and agriculture must be practised to provide for our many daily needs. These environments change over the seasons, the years and the decades. With increasing population pressures, the quantity of food and other products must increase. Indeed, a doubling of production is required over the next 20 years. Furthermore, the range and quality of food and agricultural products sought by communities is affected by variations in their purchasing powers. Predictions are that global food production from animal products will increase more rapidly than from plants in most developing countries with increasing affluence.

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

A community's domestic animals, particularly on the outskirts of cities and towns, can enhance the environment as a living system, thus also enhancing the human inhabitants' quality of life.

Finally, the domestic animal diversity which has evolved over more than 12 000 years is also an integral component of our heritage, to be nurtured for future generations.

CAN DAD BE REPLACED?

No! To date only a very small number of engineered mutations have proved useful for improving plant production. Animals are more complex and costly organisms. Each animal carries about 100 000 genes in its blueprint and these interact with each other and with the environment during the animal's production life cycle. Unique combinations of genes are responsible for the adaption necessary for production under diverse

environments. Further changes to these diverse 'genetic packages' will continue to occur in the many different environments, and in humankind's requirements.

These changes take place over relatively short periods of time – years and decades rather than millennia. The technology to achieve artificially the vast array of changes in genetic make-up which could be supplied by currently existing and readily available genetic resources does not exist now and may well not exist a century from now.

The management costs required to maintain this existing pool of diversity, particularly in such a way that it covers a range of possible future uses, are negligible compared with the massive costs that would be involved in an attempt to custom-make a breed artificially to suit a specific change or combination of changes in the environment and to be sustainable, even if the latter were technically feasible.

ARE THE HIGHEST PRODUCERS NECESSARILY THE BEST, UNIVERSALLY?

Just as Formula-1 racing cars require a high quantity of specialized inputs to perform on special tracks, so do that 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. However, the majority of people and agriculture are in the developing world, much of which will continue to utilize low to medium input production systems for the years and decades to come. In many of these production environments emphasis on further refining the indigenous breeds which have been adapted to these local environments over the past centuries, is likely to produce more sustainable outcomes.

WHAT IS CONSERVATION?

Conservation in general 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. Thus conservation is positive, embracing preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment (IUCN-UNEP-WWF and FAO-UNESCO, 1980).

Conservation of genetic resources for domestic animal species is the sum total of operations involved in the management of the pool of genetic diversity to ensure that it is maintained over time. The imperatives for effective management of conservation, at the global level and for each species, encompass:

- The identification and listing of all breeds;

- Their description and characterization, in order to understand their unique qualities and potential contributions, and to understand which breeds have the potential to make the greatest variety of future contributions;

- 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 well-managed 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 breeds as possible, generally in the form 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;

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

- To maximize involvement by the large number of stakeholders that are necessary to make the programme a success.

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

WHAT IS IN-SITU CONSERVATION?

Primarily the active breeding of animal populations for food production and agriculture, such that diversity is both best utilized in the short term and maintained for the longer term. Operations pertaining to in-situ conservation include performance recording schemes, and development (breeding) programmes. In-situ conservation also includes ecosystem management and use for the sustainable production of food and agriculture. 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 conservation of domestic animal diversity, ex-situ conservation means storage. It involves the preservation as live animals of a sample of a breed in a situation removed from its normal production environment or habitat, and/or the collection and cryo-preservation of resources in the form of semen, ova, embryos or tissues, which can be used to regenerate animals.

Other methods of genetic manipulation, such as the use of various recombinant DNA techniques, may represent useful means of studying or improving breeds, but do not constitute ex-situ conservation, and may not serve conservation objectives. At present the technical capacity to regenerate whole organisms from isolated DNA does not exist.

IS THERE ONE RECIPE FOR ALL CONSERVATION ?

No! Whilst the basic operations of identification and characterization of genetic resources are universally required and an information system and management entity will be essential to facilitate and coordinate the global effort, a varied mix of field activities and technologies will be used to cover the remaining processes required to best conserve a particular breed. These will depend upon factors such as the breed's current use, the climatic and social 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. Also important are: national policies and local attitudes, culture, and of course, available finances.

IS EFFECTIVE MANAGEMENT OF DAD FEASIBLE?

With the projection that nearly 30% of the possibly 4 500 breeds are at high risk of loss, and with so little known about most, scarce finances cannot be spent on a small number of breed rescue projects. Emphasis must be on implementing a sound global management infrastructure which overcomes the erosion of animal genetic resources (AnGR) and ensures their better development and sustainable use. In situations where AnGR are not of interest for current use by farmers, then a management program which relies on breed preservation will be required.

Because countries possess different subsets of AnGR and, as recognized by the Convention on Biological Diversity, have sovereignty over them, effective conservation programs by nations must provide the foundation for a successful global program of management. National strategies for management of AnGR need involve all stakeholders from farmers to government policy makers. Broader participation means broader responsibility for successful management of AnGR.

FAO is the sole intergovernmental organization with a broad international mandate for improving agriculture and food production for current and future populations - with particular emphasis on developing countries. Given the global nature of AnGR, few institutions have the capacity to coordinate the geographic, species, technical and intergovernmental issues which are necessarily involved in developing a successful global program of management for the farm AnGR. FAO is meeting the global challenge of effective conservation and sustainable use of AnGR head-on by committing to assist countries design comprehensive national strategies for the management of their AnGR; and to coordinate policy development and management at the regional and global levels.

FAO GLOBAL PROGRAMME FOR MANAGEMENT OF FARM ANIMAL GENETIC RESOURCES

From its earliest days FAO has provided much of the initiative in conserving animal genetic resources with a range of studies and publications. Based on the Expert Consultation in 1992 which reaffirmed FAO's global leadership role in management of animal genetic resources, an expanded Global Programme for the Management of Farm AnGR (hereafter referred to as The Programme) was recommended. The United Nations Conference on Environment and Development (the 'Earth Summit'), and Convention on Biodiversity and Agenda 21 emanating from it, have provided additional impetus and a mechanism for formally identifying domestic animal diversity as a genuine and important component of global biodiversity.

Specifically, the goal of The Programme is to overcome the erosion of AnGR and to ensure better development and use of these resources globally. The strategy for such an undertaking of necessity involves 4 components:

1. an intergovernmental support mechanism for enabling direct government involvement and ensuring continuity of policy advice,
2. a technical programme of interdependent activities,
3. a geographically distributed and country-based global structure,supported by regional and national focal points (Figure 1.10.1), to assist and coordinate national actions, and
4. a panel of experts to guide The Programme and maximize its cost-effectiveness.

At the heart of The Programme are several integrally related activities: monitoring and description of the remaining AnGR; characterization at the molecular level to establish breed level genetic diversity and maximize cost-effectiveness of management; a computer-based global system serving as the information axis for The Programme; in-situ and ex-situ conservation strategies designed to make best-use of and to maintain unique AnGR;

training in all aspects of conservation genetics and procedures, and communicating to the world community the importance of AnGR. Long term vision for The Programme is provided by the Global Action Plan developed by integrating all national action strategies; and development of the necessary international instruments by the intergovernmental Commission on Genetic Resources for Food and Agriculture.

A GLOBAL MANAGEMENT ENTITY

To ensure realization of the successful management of AnGR, FAO is establishing a management entity - the Centre for Domestic Animal Diversity - CDAD. CDAD's mission is to establish and maintain The Global Programme for the management of unique animal genetic resources and the conservation of diversity in each domestic animal species of interest to food and agriculture. To accomplish this mission, CDAD has been mandated to:

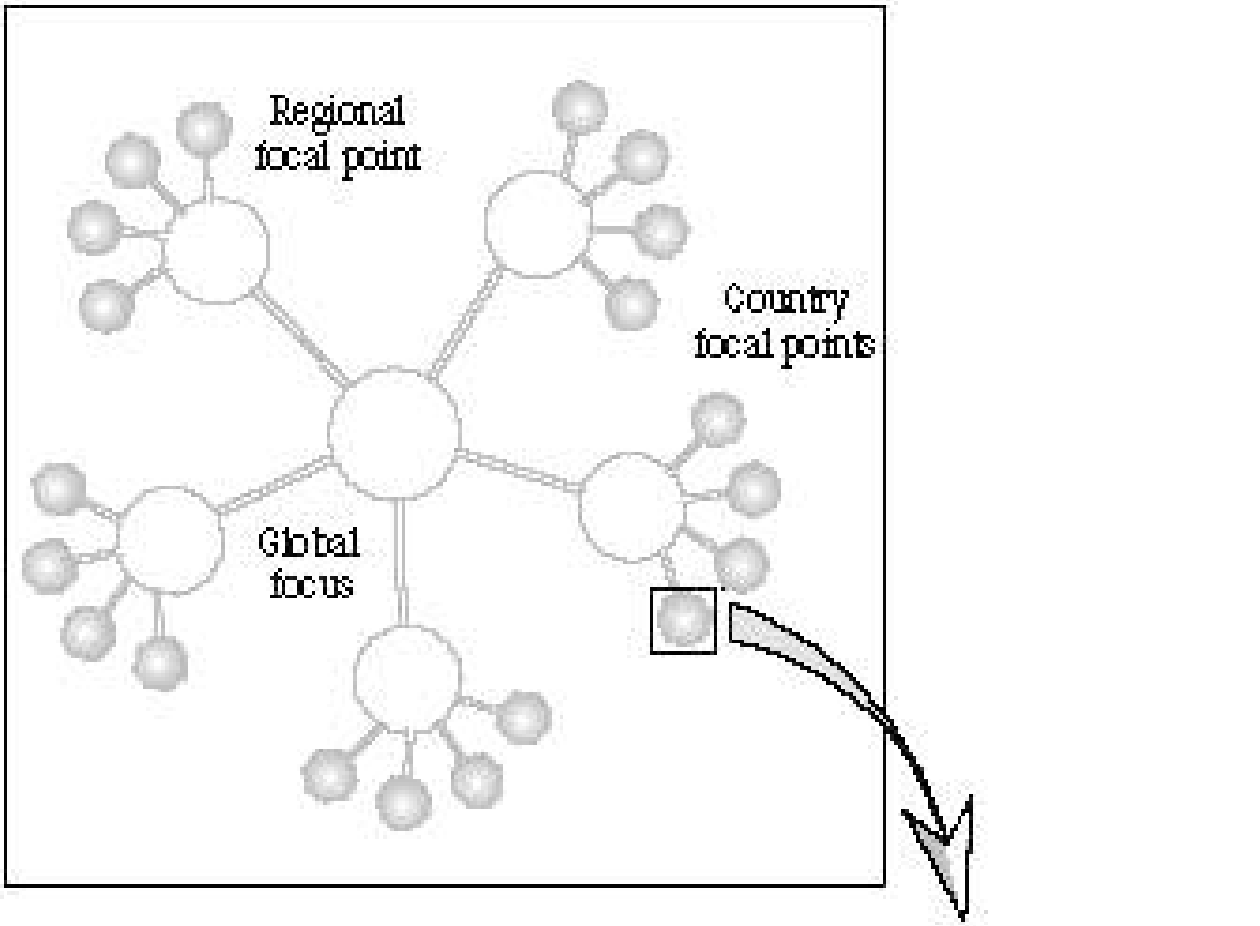
- assist countries to develop and implement effective management strategies;
- develop uniform basic procedures, guidelines and protocols;
- maintain The Global Early Warning System for Farm AnGR;
- bolster capacity building and upgrade training;
- increase awareness and communicate the issues globally;
- serve as the secretariat for the global intergovernmental mechanism for AnGR.
- coordinate activities regionally and globally.

CONSERVATION INITIATIVES

FAO has accepted responsibility to assist countries in the development of an effective global program of management for farm AnGR. However, FAO is not the only organization making substantial contributions to effective management of AnGR. During recent years there have 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: the formation in India of a national animal genetic resources network; Brazil commencing a national genetic resources and biotechnology programme (CENARGEN); the national germplasm evaluation programme set up in the United States of America; the fact that the European Community now has a genetic resources

focus and that the European Association of Animal Production has a standing committee on animal genetic resources and has taken a range of other initiatives; the coordination of a Pan-African programme in animal genetic resources through the International Livestock Research Institute (ILRI) and the Institutes responsibility for the CGIARs system-wide animal genetic resources initiative; the initiation of a Latin American and Caribbean 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 Cooperation in Agriculture (IICA); and maintenance by the Nordic governments of joint standing committees on genetic resources.

FIGURE 1.10.1 STRUCTURE FOR FAO'S GLOBAL PROGRAMME FOR THE MANAGEMENT OF FARM ANIMAL GENETIC RESOURCES



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