The current status of animal genetic resource diversity

The following analysis is based on FAO's Global Databank for Animal Genetic Resources for Food and Agriculture (the backbone of the DAD-IS[3] system), which is the most comprehensive global information source for livestock genetic diversity.

Assessing the status of animal genetic resources on a global scale presents some methodological difficulties. In the past, analysis of the Global Databank to identify breeds that are globally at risk was hampered by the structure of the system, which is based on breed populations at the national level. To address this problem, and to enable *The State of the World's Animal Genetic Resources for Food and Agriculture* to offer a more useful assessment, a new breed classification system was developed. Breeds are now classified as either local or transboundary, and further as regional or international transboundary (see Box 2).

A total 7 616 breeds are recorded in the Global Databank; 6 536 are local breeds and 1 080 are transboundary breeds. Among the transboundary breeds, 523 are regional transboundary breeds, and 557 are international transboundary breeds (Figure 4).

There are some regional differences in terms of the relative importance of the different breed categories (Figure 5). In most regions – Africa, Asia, Europe and the Caucasus, Latin America and the Caribbean, and the Near and Middle East – local breeds make up more than two-thirds of all breeds. Conversely, international transboundary avian and mammalian breeds dominate in the Southwest Pacific and North America. Regional transboundary mammalian breeds are relatively numerous in Europe and the Caucasus, Africa, and to lesser extent Asia, while it is only in Europe and the Caucasus that there are many regional transboundary avian breeds.

[3] http://www.fao.org/dad-is

Box 2
A new classification system for breed populations

Under the new system of breed classification developed for *The State of the World's Animal Genetic Resources for Food and Agriculture*, the primary distinction is between breeds that occur in only one country, which are referred to as "local" breeds, and those that occur in more than one country, which are referred to as "transboundary" breeds. Within the transboundary breed category, a further distinction is drawn between "regional" transboundary breeds – those that occur in more than one country within a single region, and "international" transboundary breeds – those that occur in more than one region. The decision as to which national-level breed populations should be considered as belonging to a transboundary breed was taken on the basis of expert judgment and reviewed by National Coordinators for the Management of Animal Genetic Resources from the relevant countries. Although some refinements are still required, the new classification has proved to be very useful as a framework for assessing breed diversity at global and regional levels.

FIGURE 4
Share of local and transboundary breeds in the world total

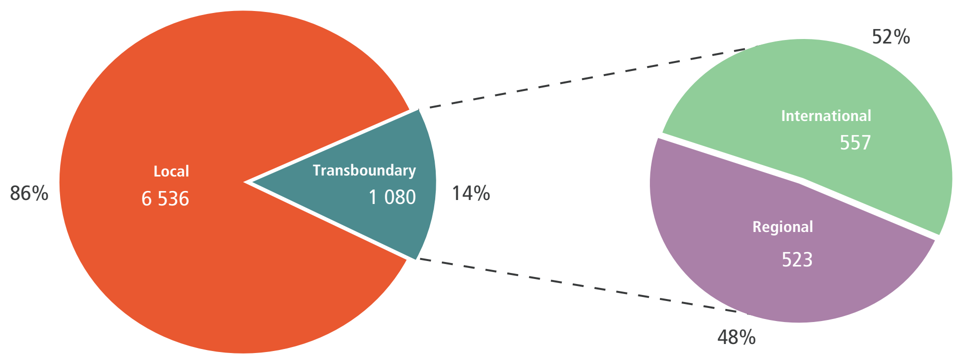
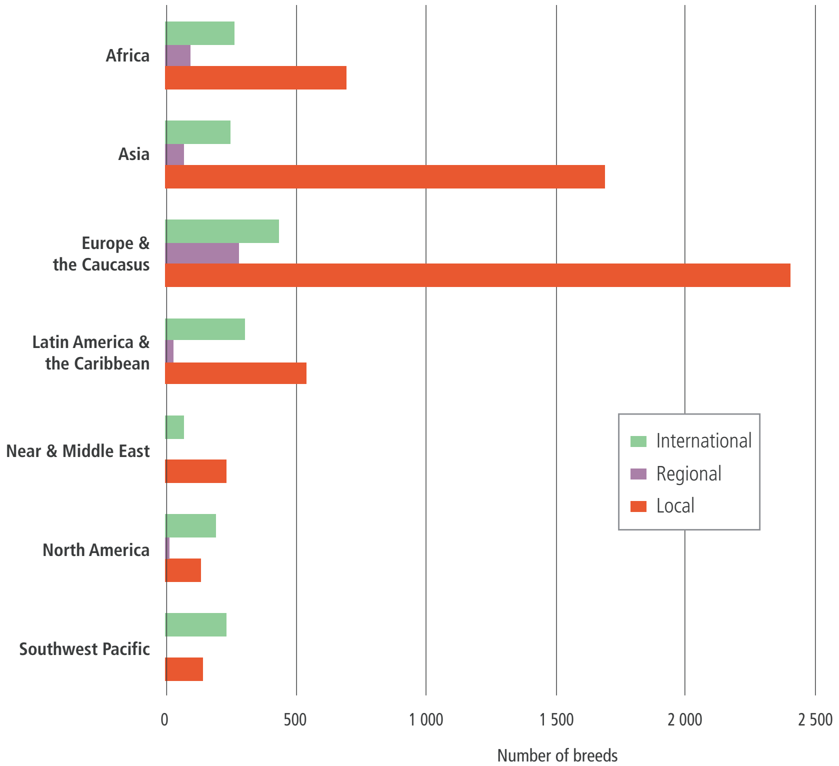


FIGURE 5
Regional distribution of international and regional transboundary and local breeds



Note that extinct breeds are excluded from these figures.

For most species, the Europe and the Caucasus region has a far higher share of the world's total number of breeds than it has of the world's total animal population. This is partly because in this region many breeds are recognized as separate entities even when they are closely related genetically. It also reflects the advanced state of breed inventory and characterization in this region. In many regions, work in these fields is restricted by a lack of technical resources and trained personnel.

FIGURE 6
Proportion of the world's breeds by risk status category

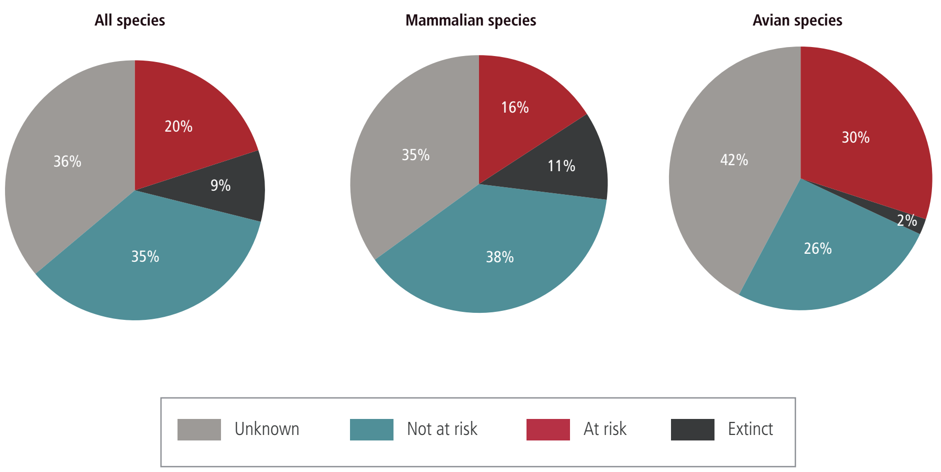
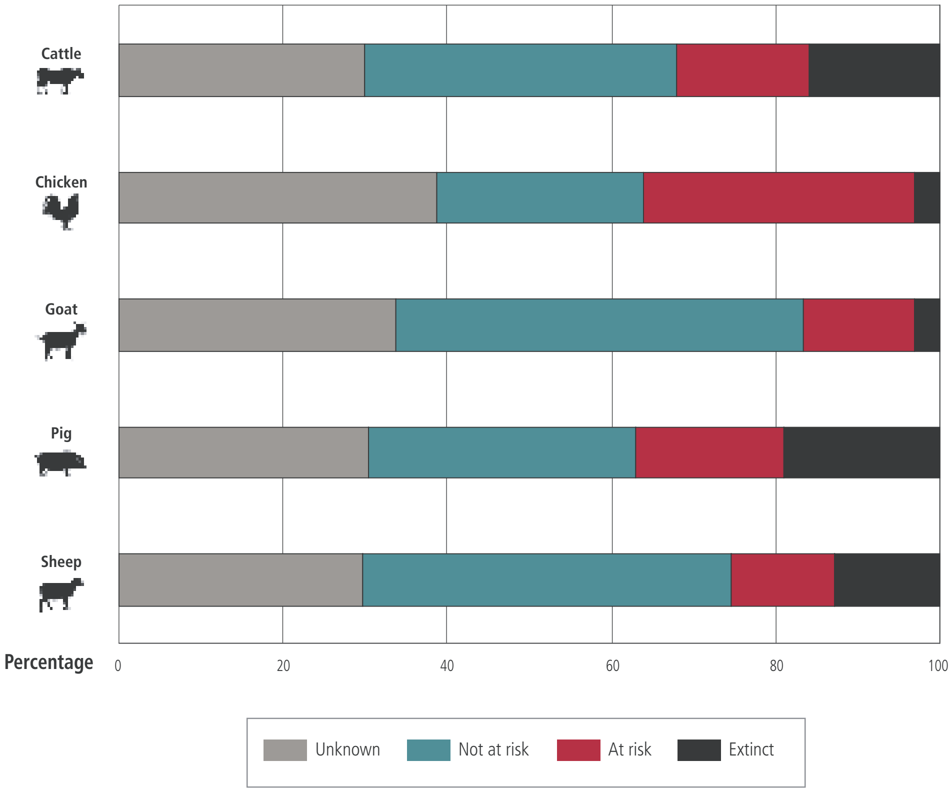


FIGURE 7
Breed risk status in the major livestock species



Breed risk status

A total of 1 491 breeds (20 percent) are classified as being "at risk"[4]. The true figure will be even higher, as population data are unavailable for 36 percent of breeds. Figure 6 summarizes the proportion of breeds falling into each risk status category.

The regions with the highest proportion of their breeds classified as at risk are Europe and the Caucasus (28 percent of mammalian breeds and 49 percent of avian breeds) and North America (20 percent of mammalian breeds and 79 percent of avian breeds). These two regions have highly specialized livestock industries, in which production is dominated by a small number of breeds. In absolute terms, Europe and the Caucasus has by far the highest number of at-risk breeds. Despite the apparent dominance of these two regions, problems elsewhere may be obscured by the large number of breeds with unknown risk status. In Latin America and the Caribbean, for example, 68 percent and 81 percent of mammalian and avian breeds, respectively, are classified as being of unknown risk status. The figures for Africa are 59 percent for mammals and 60 percent for birds. This lack of data is a serious constraint to effective prioritization and planning of breed conservation measures. The problem is particularly significant in some species – 72 percent of rabbit breeds, 66 percent of deer breeds, 59 percent of ass breeds and 58 percent of dromedary breeds lack population data. There is an urgent need for improved surveying and subsequently reporting of breed population size and structure, and of other breed-related information.

A comparison at species level reveals that horses (23 percent), followed by rabbits (20 percent), pigs (18 percent) and cattle (16 percent), are the mammalian species that have the highest proportions of at-risk breeds. Among widely kept avian species, 34 percent of turkey breeds, 33 percent of chicken breeds, 31 percent of goose breeds and 24 percent of duck breeds are classified as at risk. Figure 7 summarizes breed risk status for the five most internationally important livestock species.

Cattle are the species with the highest number of breeds reported as extinct (209). Large numbers of extinct pig, sheep and horse breeds are also reported. This is probably not a complete picture of breed extinctions, as it is likely that numerous breeds have been lost without being documented.

[4] A breed is categorized as at risk if the total number of breeding females is less than or equal to 1 000 or the total number of breeding males is less than or equal to 20, or if the overall population size is greater than 1 000 and less than or equal to 1 200 and decreasing and the percentage of females being bred to males of the same breed is below 80 percent.

Trends in genetic erosion

Trends in genetic erosion can be identified by comparing the current risk status of a set of breeds with their status in the past. The most straightforward assessment can be achieved by comparing the figures for local breeds. An analysis of trends in the risk status of these breeds over the period between 1999 and 2006 presents a mixed picture. Some breeds became more secure – 60 breeds that were classified as at risk in 1999 were classified as not at risk in 2006. However, almost as many (a total of 59) moved into the at-risk category over the same period. Even more worryingly, despite increasing awareness and action, breeds continue to be lost. Sixty-two extinctions were recorded between December 1999 and January 2006 – amounting to the loss of almost one breed per month.

Risk status figures based on population data may not reveal the full extent of genetic erosion. Within-breed diversity is also important. A weakness of the current monitoring of breed status, and one that is difficult to overcome, is that it gives little indication of the extent of genetic dilution caused by indiscriminate cross-breeding[5] – a problem that is considered by many experts to be a major threat to genetic diversity. Risk status figures also fail to show the inbreeding that may occur, even within breeds that have large total populations, as a result of the use of a limited number of breeding animals. Neither do the figures allow an assessment of the extent to which subpopulations within breeds are genetically isolated from each other – an important consideration for management decisions.

Uses and values of animal genetic resources

In many countries, the livestock sector makes a significant contribution to national economic output. On average, this contribution is highest (between 4 and 5 percent of regional gross domestic product) in the Near and Middle East, Asia and Africa. Although the overall figures are relatively modest, it is important to note that livestock production contributes 30 percent of agricultural gross domestic production in developing countries, with a projected increase to 39 percent by 2030. Moreover, in some of the world's poorest countries, the contribution is far above the regional averages. Another significant development in recent years has been the emergence of new net exporters of milk, meat and eggs among developing countries. Production and trade figures at the national or international levels do not, however, reveal the full socio-economic significance of the livestock sector. The fact that livestock contribute to the livelihoods of very large numbers of people – many of them among the world's poor – has to be taken into consideration. From another perspective, the vast areas of land used for livestock production indicate the potential environmental and social impacts of developments in the sector. Livestock keeping is an integral element of ecosystems and productive landscapes throughout the world.

Another important consideration is that while the value of marketed food, fibre, hide and skin products is relatively well recorded, there is a danger that the many non-marketed outputs and less easily quantified benefits provided by livestock are undervalued. This is particularly the case for the smallholder production systems of the developing world. Many farmers rely on animals to provide inputs to crop production (draught power and manure). Where modern financial institutions are inaccessible, keeping animals that can be sold in times of need provides many households with the equivalent of savings and insurance services. Livestock and their products also fulfil a wide variety of social and cultural functions – they are important elements of many religious festivals, weddings, funerals and other social gatherings, and contribute to sporting and leisure activities. In many livestock-keeping societies, exchange of animals also helps to reinforce social relationships and networks that can be drawn upon in times of need. Livestock also provides key agro-ecosystem functions, such as nutrient cycling, seed dispersal and habitat maintenance.

In more affluent societies, livestock functions tend to be less varied. Nevertheless, some cultural functions remain important – including in sports and leisure (mainly horses) and in the supply of culturally significant food products. New roles are also emerging (often for traditional breeds) in tourism and in landscape management.

Although these many functions can be outlined in broad terms, there is a large knowledge gap with regard to the current roles of specific breeds, and whether they have characteristics that make them especially suited to particular purposes or production conditions. There is a need for more complete data to be collected and made available.

Multiple roles and multiple combinations of roles require diversity within the livestock population – including both specialized and multipurpose breeds. However, decision-making in the field of animal genetic resources management is often characterized by a lack of attention to multiple functions. In these circumstances, it is likely that the value of local multipurpose breeds is underestimated, and that only some elements of livestock's overall contribution to human well-being are taken into consideration.

Animal genetic resources and resistance to disease

Among the most potentially valuable characteristics of specific livestock breeds is resistance or tolerance to disease. The sustainability of key disease control strategies, including the use of drugs and the control of disease vectors such as ticks and tsetse flies, is uncertain. Problems include the environmental and food safety impacts of chemical treatments, affordability and accessibility to poorer livestock keepers, and the evolution of drug resistance. Managing genetic diversity to enhance the resistance or tolerance found in livestock populations offers an

[5] Indiscriminate cross-breeding refers to a spectrum of actions ranging from upgrading or cross-breeding to complete replacement of a local breed with imported animal genetic resources in an unplanned manner and without adequate assessment of the performance of the respective breeds under relevant production conditions.