

5. State of animal genetic resources and their conservation

Information about the status of animal genetic resources is summarised in a global database called DAD-IS, which is maintained by the Food and Agriculture Organisation, known as FAO, a specialized agency of the United Nations located in Rome. The DAD-IS database is freely available and provides information about more than 8800 breeds of 38 species of domesticated animals. Of these, 6,916 can be considered local, occurring only in a specific geographical area, and 1,081 can be regarded as transboundary or even cosmopolitan, occurring in different geographical locations. Transboundary breeds are further subdivided into regional and international. Examples of local breeds are, for example, breeds such as the Slovak spotted cattle or Improved Valachian sheep, and examples of transboundary breeds are, for example, the Holstein breed or the Merino sheep. Local breeds found in Africa, Asia, Europe and the Caucasus, Latin America and the Caribbean and the Near and Middle East account for around 60% of all breeds. International transboundary breeds of birds and mammals dominate in the Pacific and North America. Regional transboundary mammal breeds are relatively abundant in Europe and the Caucasus, in Africa and to a lesser extent in Asia.

The first complex report about the state of animal genetic resources was published by FAO in 2007, followed by a second one in 2015. Both of these reports are complex documents characterizing the status of diversity of individual breeds and populations, national capacities for the management of animal genetic resources, the development of methodologies and technological tools for their evaluation, as well as starting points for the development of new programmes and strategies for the sustainable conservation of animal genetic resources.

The conservation strategies for animal genetic resources are linked to another document called the Global Action Plan, which covers four strategic areas, namely description, monitoring of trends and associated risks, sustainable use and conservation of animal genetic resources, policies and regulations, and institutions and capacity building.

The DAD-IS database was started as a publicly available database in 1996 and is currently used to store information about national populations and species of animal genetic resources. This information is updated annually through a network of national coordinators or contact points. In Slovakia, the National Agricultural and Food Centre, Research Institute of Livestock Production Nitra is responsible for updating this information. However, this platform is also used to communicate and share data and knowledge between countries and local contact points.

However, in developing strategies for the sustainable conservation of animal genetic resources, it is important to say that these strategies are particularly relevant for populations that are at risk of diversity loss. So when and why does the loss of diversity endanger populations? One important aspect is the ratio between the real and effective number of individuals in a population. The effective number of individuals refers to the number of animals that are active in reproduction and thus can be the parents of the offspring that form the next generation. Suppose the effective number of individuals in a population is low. In that case, there is a high probability of a loss of diversity in the gene pool of the population because the number of parents and, in particular, the variability of the genetic information transmitted by them to their offspring is limited. However, many populations in different geographical regions are decreasing in size for many reasons. An example of this is, in the case of livestock, the changing

preferences of breeders or the consumer market. In such a case, the effective population size is consequently strongly influenced by the intensity of the population size decrease, and thus the higher the intensity, the higher the probability of diversity loss. However, the effective size is also directly related to the degree of relatedness of animals in the population. The smaller the effective size, the higher the probability that there will be an increase in the relatedness between individuals and, consequently, an increase in the inbreeding of individuals in subsequent generations. However, the diversity of animal genetic resources can also be endangered by other factors, such as natural disasters, changing climatic conditions or diseases that spread rapidly, which can significantly limit the effective population size.

Based on the degree to which animal genetic resources are endangered by the loss of diversity, we can classify them into several groups. In this context, the FAO distinguishes six groups: extinct, cryo-conserved, critical, endangered, vulnerable and populations/breeds or animal genetic resources not endangered by the loss of diversity. However, there is a further categorization by the European Federation for Animal Sciences (EAAP) into five groups, namely Critical, Endangered, Minimally Endangered, Potentially Endangered and Not Endangered. In the following slides, I will briefly characterize each group.

We can consider as extinct all species/breeds/animal genetic resources for which there are no living animals, i.e. males or females, and no genetic material from which to recover them. However, even if there is at least genetic material stored in a gene bank for a given breed, the FAO recommends that such breeds be categorized as cryo-conserved.

The second group is the critically endangered breeds. In such breeds, the number of dams does not exceed 100 and the number of sires does not exceed 5 individuals, corresponding to an inbreeding increase per generation of 3% or more. The level of genetic variability in the population is lower than in its ancestors. Regarding the number of animals, we can speak about two cases. In the first, the population size is less than or equal to 80 individuals, while the population trend is growing and the proportion of purebred dams is greater than 80%. In the second case, the population size is less than or equal to 120 animals, but the population growth trend is stable or decreasing and the proportion of purebred dams is equal to or less than 80%.

The category of endangered breeds refers to breeds with a number of dams more than 100 and less than or equal to 1000. The number of sires ranges from 5 to 20. This number of sires and dams corresponds to an inbreeding increase per generation ranging from 1 to 3%. In the case of the number of individuals, as in the previous category, we can speak about two cases. In the first, the total population size is greater than 80 and less than 800 individuals and the population size is increasing, with the number of purebred dams greater than 80%. In the second case, the total number of animals in the population ranges from 120 to 1200, the size is stable or decreasing, and the proportion of purebred dams is equal to or less than 80%.

We can speak about vulnerable breeds or populations if the number of dams is between 1000 and 2000 and the number of sires is between 20 and 35, which corresponds to an increase in inbreeding per generation of 0.5 to 1%. The total population size ranges from 800 to 1600 with an increasing proportion of dams or from 1200 to 2400 with a decreasing proportion of dams.

We also know breeds with uncertain status, where the breed does not belong to any of the previous categories or subcategories. Even if the information on such a breed is not entirely accurate, there is sufficient evidence to claim that it exceeds the limits for the category of

vulnerable breeds. However, in the case of such breeds, it is strongly recommended that a careful survey of their populations be carried out to perform more accurate monitoring. In the case of populations with unknown status, it is more than appropriate to assess the populations and place them in one of the above categories so that they can be managed in the future using breeding programmes and strategies.

This slide shows graphically the current endangered status of the local breeds whose data are recorded in the DAD-IS database. The data are divided into seven geographic regions: Africa, Asia, Europe and the Caucasus, Latin America and the Caribbean, the Near and Middle East, North America and the Southwest Pacific. The table shows that countries from Europe and the Caucasus region provide the most information about breeds. Particularly alarming is the number of breeds considered extinct in this region, with the statistics showing up to 448 breeds. In addition, up to 534 breeds are critically endangered, and 678 breeds are considered endangered. However, for many breeds, more detailed information is not available. All this points to the fact that the decline in diversity is not a local or national problem but a global one that needs to be addressed and to avoid wasting valuable animal genetic resources.

This slide also shows for comparison the endangered status of transboundary breeds based on their geographic locations of occurrence. In the case of the Europe and Caucasus region, the statistics show that 5 breeds can be considered extinct, 65 critically endangered, 158 endangered, 71 vulnerable, and 229 not endangered by loss of diversity. However, up to 176 breeds have unknown endangered status. Similar trends can be observed in other geographic areas. The number of critical and endangered breeds is highest in the Europe and Caucasus region, but this region is under more precise monitoring compared to other regions, e.g. the Near and Middle East, which has the highest proportion of breeds with unknown status.

The following table and graph summarize the information about breeds of mammals bred in Slovakia which are registered in the DAD-IS database. As can be seen from the pie chart, most of the breeds fall into the category of international transboundary breeds. For example, there are Slovak Sport Pony, Slovak Warmblood horse, Zobor Rabbit and Improved Valachian sheep from the local breeds.

In the case of birds, the situation is similar, i.e. breeds kept in Slovakia are mainly international transboundary breeds. However, in this case, local breeds predominate over regional transboundary breeds.

The following four slides show, for comparison, the statistics for the numbers of mammal and bird breeds recorded in the DAD-IS database in the Czech Republic and Poland. As can be seen from the graph, in the case of the Czech Republic, there is equally higher number of mammal breeds that are considered international transboundary, but the number of local and regional transboundary breeds is more balanced than in the case of Slovakia.

In the case of birds, most breeds in the Czech Republic are classified as local breeds.

The situation in Poland is different compared to the Czech Republic and Slovakia. In Poland, most mammal breeds are classified as local breeds. In this case, regional transboundary breeds have the lowest proportion.

In the case of birds, the situation is similar. In this case, all breeds are registered as local in the DAD-IS database. In addition to these statistics, the database also provides many other statistics

related to the endangered status of breeds by loss of diversity, both for geographical regions and subsequently also for individual countries.

I want to thank you for your attention. If you have any questions, please contact me at the my email address on the slide. For more presentations, please scan the barcode of the ISAAGREED project on the slide.