

## **THE ROLE OF ANIMAL GENETIC RESOURCES IN THE SUSTAINABLE LIVESTOCK TRANSFORMATION**

**P. Boettcher, R. Baumung, G. Leroy and B. Besbes**

Food and Agriculture Organization of the United Nations, Rome, 00153 Italy

### **SUMMARY**

The world's food systems must become more sustainable and equitable. The livestock sector must evolve and continue to deliver its benefits to humankind while competing for natural resources and maintaining resilience to changes in climate and other outside forces. The genetic diversity of livestock is a global public good that will underlie this transformation and demands collaborative stewardship. The FAO provides a forum for its member countries to discuss and agree upon priorities and actions for the proper management of animal genetic resources. It also facilitates the sharing of knowledge among countries and monitors the degree and impact of measures undertaken to safeguard and sustainably utilize livestock genetic diversity. Activities are guided by the Global Plan of Action for Animal Genetic Resources.

### **INTRODUCTION**

Sufficient, nutritious and safe food is a need and right for everyone. Fortunately, due to advances in technology, improved agriculture and food policy, increases in income and greater international cooperation, among other factors, the proportion of undernourished people has continually declined across the recent decades. Proportions of incomes spent on food have also decreased steadily. Food systems are not perfect, however. Hundreds of millions of people still go hungry on a regular basis, while many others suffer from other dietary imbalances, including obesity. Many production systems have questionable sustainability from environmental, economic and/or social perspectives. The global COVID-19 pandemic revealed the fragility of many of the world's food systems. In 2021, the UN convened the Food Systems Summit as the climax of a comprehensive consultative process. Summit participants concluded that although current systems already produce billions of tons of food while considering the conservation of biodiversity and ecosystems, "business as usual" is not sufficient, and that a transformation of global food systems is needed. This process must consider "People, Planet and Prosperity" and align with the UN Sustainable Development Goals (SDG). FAO, a specialized agency of the UN, leads international efforts to defeat hunger and improve nutrition and food security, and will have a key role in this transition. Its current Strategic Framework aims to support its member countries in achieving the "Four Betters": better production, better nutrition, a better environment, and a better life, while leaving no one behind.

### **THE SUSTAINABLE LIVESTOCK TRANSFORMATION**

Livestock production is an exemplary case. The sector makes a vital contribution to global food security and nutrition, livelihoods, and ecosystem services. It contributes to all of the SDGs (FAO 2018). At the same time, the sector utilizes vast amounts of natural resources, faces continual threats from epidemic, transboundary and zoonotic diseases, and both contributes to and is affected by climate change. Trade-offs abound, and disparities between regions and economies are commonplace. To provide just a few examples, animal source foods are a nutrient-dense source of protein, energy and many micronutrients, but are characterized by both under- and over-consumption. Ruminants can convert human-inedible plant matter into valuable foods, but they emit greenhouse gases in the process. Human-edible feeds improve efficiency of livestock diets, but compete with humans and require land for production. Wide differences exist in access to, and application of, technologies to help enhance productivity. In the future, livestock production will

continue to play an important role in the diets and livelihoods of billions of people and to the economies of all countries. However, like food systems in general, evolution and transformation of the sector are required to ensure it achieves its goals in a sustainable manner, while addressing all of the many trade-offs.

### **LIVESTOCK GENETIC DIVERSITY**

Within the livestock sector, wise management of animal genetic resources (AnGR) will be an essential part of this transformation. “Transformation” is just another way to say “change”. The genetic diversity within and across breeds allows populations to adapt to changes in their production environment and breeders to improve the ability of their animals to achieve productivity objectives. This diversity will be critical in the future. The sustainable transformation will demand increased efficiency of resource utilization. This implies effective use of AnGR around the world and implementation of genetic improvement programmes. Climate challenges may lead to more movement of diverse genetic material across borders. This will depend upon increased knowledge on the characteristics of different AnGR, to properly match breeds with environments, both for productivity and welfare of animals and the sustainability of the natural biodiversity of the production environment. Greater equity in access to technology and the capacity to use it will also be critical. Conservation programmes must be strengthened to ensure diversity is maintained.

Although individual animals and breeds are private or “club” goods, the collection of genetic diversity is considered a global public good. Alas, recent assessments have determined that this diversity has been decreasing over time (FAO 2015). This suggests a need for global collaboration on its management, and as a UN agency, FAO has a natural role to play. FAO has a history of supporting countries on matters regarding AnGR since the 1960s. This work was formalized in the 1990s, when the Commission on Genetic Resources on Genetic Resources for Food and Agriculture (CGRFA) established its Intergovernmental Technical Working Group on AnGR (ITWG). The CGRFA and ITWG provide a forum for countries to discuss key issues regarding livestock genetic diversity and to advise FAO (and themselves) about steps to be taken to improve its use and conservation.

### **THE GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES**

Under the umbrella of the CGRFA and ITWG, FAO member countries developed the Global Plan of Action for Animal Genetic Resources (GPA; FAO 2007). The GPA is a policy document that includes 23 *Strategic Priorities* (SP), under four *Strategic Priority Areas* (SPA; described below) and provides the framework for sustainable management of AnGR. The SP address the most important actions to ensure sustainable use and conservation of AnGR that when implemented would ensure a substantial contribution of livestock genetic diversity. Table 1 provides an example of the actions under SP4 on breed development.

Although the GPA was adopted in 2007, it was prepared with a forward vision and remains fully valid today and highly relevant. In 2017, FAO members reaffirmed their commitment to its continued implementation. As sustainability was a key theme in its preparation, the priorities and actions of the GPA are highly appropriate for the evolution associated with the transformation of the livestock sector.

The GPA stipulates that the main responsibility for its implementation rests with national governments, but it also specifies that FAO has an essential role in supporting these country-driven efforts, as well as monitoring their progress and impact. In particular, FAO is key actor in coordinating international cooperation. FAO also promotes the importance of AnGR and their diversity and leads efforts in information sharing. With the contribution of international scientific experts, technical support to countries is provided

by implementing and backstopping projects, organizing and participating in capacity building activities, developing international technical standards and protocols, and producing technical guidelines. The following paragraphs provide examples of current activities to support the integration of AnGR into the sustainable livestock transformation, organized according to the SPAs of the GPA.

**Table 1. The actions associated with Strategic Priority 4 of the Global Plan of Action on Animal Genetic Resources**

<b>Strategic Priority</b>	<b>Actions</b>
Establish national species and breed development strategies and programmes	Develop long-term planning and strategic breeding programmes Assess breed development programmes and revise, as appropriate, with the aim to meet foreseeable economic and social needs and market demands Establish and develop organizational structures of breeding programmes Incorporate consideration of the impacts of selection on genetic diversity Establish or strengthen recording schemes to monitor changes in non-production traits and adjust breeding goals accordingly Encourage the development of backup collections of frozen semen and embryos from current breeding schemes to ensure genetic variability Provide information to farmers and livestock keepers to assist in facilitating access to animal genetic resources

**SPA1. Characterization, inventory and monitoring of trends and associated risks.** Information about any entity is requisite for its proper management. A major role of FAO is curation and maintenance of the Domestic Animal Diversity Information System (DAD-IS), the web interface for the Global Database of Livestock Breeds. DAD-IS contains information on nearly 9,000 breeds from 37 livestock species plus managed bees. Among the data are inventories population sizes of breeds and material in gene banks, which are key indicators for risk of extinction. These data are used to indirectly monitor the impact of the GPA and inform official Indicators of the SDGs. Alas, these data are lacking for about half of the breeds, so FAO is currently developing low-cost methods to estimate population sizes. To complement census population size as a risk indicator, FAO is working with experts to facilitate the use of effective population size as an indicator of risk in DAD-IS. Developments in genomics have decreased costs substantially, making this possibility feasible. This effort corresponds to the recent release of guidelines on genomic characterization (Ajmone *et al.* 2023) and the recognition in the Kunming-Montreal Global Biodiversity Framework of the key importance of within-population genetic diversity. FAO has recently expanded DAD-IS to include data for populations of bees that are managed for food and agricultural purposes.

**SPA2. Sustainable use and development.** The profitable maintenance of breeds *in situ* is the optimal way to maintain livestock genetic diversity, as it ensures not only the survival of the breed, but the continued delivery of ecosystem services by the breed and its traditional production system. FAO is undertaking a study to collect best practices for establishing and operating breeding programmes on the community level and upscaling them to greater dimensions. Promotion of agroecosystems approaches in the management of AnGR is SP5 of the GPA. FAO has developed the Tool for Agroecology Performance Evaluation (TAPE) and is building capacity in its utilisation. TAPE can be used for self-diagnosis of existing production systems and for gathering of evidence on how agroecology can contribute to sustainability. The overwhelming majority of genetics-related technical cooperation projects of FAO and its joint centre with the International Atomic Agency address sustainable use. These projects support countries in the adoption of new technologies and practices to improve the management of livestock genetic diversity.

**SPA3. Conservation.** FAO has recently released guideline on cryoconservation of AnGR (Boes *et al.* 2023), which informs countries about recent innovations in animal gene banking. Major innovations include not only new methods for collection and cryopreservation of genetic material, but also in the application of genomics for management of collections. The guide also promotes a more active engagement with stakeholders in developing the gene banking strategy and in stimulating the wider use of gene banks in the active management populations *in situ*, rather than primarily as a safeguard against breed extinction. A series of webinars was implemented to build capacity on the content of the guidelines.

**SPA4. Policies, institutions and capacity-building.** Policy support is a key role of FAO. For livestock, FAO support to countries ranges from developing comprehensive Livestock Master Plans, to national strategy and action plans for all AnGR, to targeted conservation programmes for single breeds.

Previous global assessments on animal resources (e.g. FAO 2015) identified lack of technical capacity in developing countries as one of the factors hindering the sustainable use and conservation of AnGR. FAO both builds capacity directly and helps coordinate cooperation between countries. FAO has widely adopted the web-conferencing practices utilised as a necessity during the pandemic. More than a dozen webinars were presented in 2022 and more are planned for the future. Live or recorded presentations are also given in events of other organizations. However, many types of capacity building are difficult to do effectively online. In 2024 and 2025, FAO will benefit from support from the government of Germany to organize regional in-person training events on topics to be determined in direct consultation with the beneficiary regions.

In-person events also provide more visibility and opportunities for networking than can be offered by the virtual world. Therefore, from 25 to 27 September 2023, FAO will be hosting the first-ever Global Conference on the Sustainable Livestock Transformation. The conference will be held in Rome and will include scientific sessions on the contributions of livestock, including AnGR, to the Four Betters, as well as a high-level session for ministers of agriculture and livestock. Participants will be nominated by national governments, but the Conference will be webcasted to make sure that anyone who is interested can follow.

## CONCLUSIONS

By improving the management of AnGR, countries will take an important step in the sustainable transformation of the livestock sector and contribute to better production, better nutrition, a better environment, and a better life for both human kind and their animals. FAO is looking forward to cooperating with all stakeholders in these efforts.

## REFERENCES

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