# Commission on Livestock Development for Latin America and the Caribbean

**XVI CODEGALAC**

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## Animal Genetic Resources and their Contribution to Livestock Sustainability

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## I. CONTEXT

### I.1 SUMMARY

Food security is closely related to food and agricultural biodiversity, enabling people to acquire goods or services to meet their food and nutritional needs, either through direct use or economic transactions of these resources.

One of the cornerstones of biodiversity are animal genetic resources or animal genetic resources for food and agriculture, i.e., those animal species that are or could be used for food production and agriculture. The variety of animal genetic resources provides the capacity to adapt to and withstand the effects of climate change, emerging diseases, limited food and water supplies, and changing market demands.

At present, of the thousands of mammal and bird species, only 40 species are domestic and play an important role in meat, dairy and egg production. Some of these species are responsible for the vast majority of production, such as cattle, buffalo, goats and sheep. However, a 26 percent of the breeds for livestock production are endangered species, and 6 percent are already extinct. Adaptation strategies focused on animal genetic resources can influence a population through selective breeding of more resilient breeds or crossbreeding of high-temperature or disease-resistant breeds; or switching to other species when the above measures can no longer be applied.

In Latin America and the Caribbean, there are several cattle breeds classified as heat-resistant and adapted to dry conditions. The region is also home to South American camelids, such as the alpaca and the llama, which live in high Andean regions up to 5 000 meters above sea level. These species have the ability to grow in a wide variety of climates and in very scarce pasture conditions. These resources have traditionally been used for food, fibre and transport and have contributed to the cultural identity of the region; however, they are often inadequately managed and threatened. It is therefore imperative to intensify efforts to promote the sustainable use, development and conservation of these resources.

The main reasons for the decline in biodiversity in the region are the introduction of breeds (64 percent), indiscriminate breeding (29 percent), increased intensity of production systems (29 percent) and scarcity of land or productive environments (21 percent).

Through the Technical Secretariat of CODEGALAC, FAO offers support in mobilizing resources; facilitating technical support; collaborating in the formulation and adaptation of data sharing procedures; and technical advice in the analysis, identification and systematization of successful experiences related to the use and conservation of animal genetic resources.

## I.2 INTRODUCTION

The *State of Food Security and Nutrition in the World 2022*[1] report indicates that in 2021, 828 million people were suffering from hunger (almost 10 percent of the global population) and 2.3 billion from moderate or severe food insecurity. The Latin America and Caribbean (LAC) region was severely stricken: in 2020, 267 million people in the region were suffering from food insecurity, 60 million more than before COVID19.

In order to maintain food systems' sustainability, it is essential to recognize the role of biodiversity in food and agriculture, i.e. the genetic diversity present in forestry and aquaculture production systems and in the systems surrounding them. Food security is closely related to biodiversity within these systems, either through direct use of these resources or the economic transactions of the same, enabling people to buy goods or services to meet their food and nutritional needs. However, the *State of the World's Biodiversity for Food and Agriculture*[2] report of the year 2019, showed that many of the key components of biodiversity for food and agriculture at the genetic, species and ecosystem levels are declining. The factors behind this decline include climate change, overexploitation of crops and changes in land use, as well as demographic developments and market preferences.

One of the key pillars of biodiversity is animal genetic resources for food and agriculture, i.e. those animal species and their preserved genetic material that are or could be used for food production and agriculture.[3] Animal genetic resources include over 8 800 livestock breeds, but only a few, such as Holstein, for example, or Leghorn hens account for a huge proportion of the production volume, particularly commercial production systems, mainly due to the highly controlled production environments that demand relatively uniform products.[4] Low livestock diversity decreases the adaptive capacity and 'option value' related to the production systems resilient to climate change with detrimental effects on nutritional variety.

It is estimated that world demand for milk will increase 46 percent and for meat 76 percent by the year 2050. This increased demand and the effects of the pandemic make it necessary to reconsider priorities and approaches.[5] Countries in the region will have to ensure that future investments and policy decisions affecting the livestock sector are an opportunity to drive the transformation of these systems to make them more efficient, inclusive, resilient and sustainable. That is, to ensure food security and nutrition for all people, without

[1] FAO.2022. Available at https://www.fao.org/3/cc0639es/online/cc0639es.html

[2] FAO. 2019. The State of the World’s Biodiversity for Food and Agriculture. Available at fao.org/3/CA3129EN/CA3129EN.pdf

[3] FAO. 2007a. The State of the World’s Animal Genetic Resources for Food and Agriculture. B. Richkowsky y D. Pilling, eds. Roma. Available at http://www.fao.org/3/a-a1260e.pdf.

[4] FAO. 2017. Climate-smart agriculture sourcebook. Available at www.fao.org/ climate-smart-agriculture-sourcebook/en/

[5] FAO. 2015. Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture. Summary. Available at https://www.fao.org/3/i5077s/i5077s.pdf

jeopardizing the economic, social and environmental foundations that make it possible to provide food and nutrition security for future generations.

These challenges fall within FAO's mandate and substantially contribute to the four improvements of the strategic framework: better production, better nutrition, better environment and better lives[6].

### I.3 CURRENT STATE

In 2007, with the adoption of the Global Plan of Action for Animal Genetic Resources[7] (GPA), the international community recognized the vital importance of the world's livestock biodiversity for agriculture, rural development and food and nutrition security. The GPA is overseen by the Commission on Genetic Resources for Food and Agriculture[8], which is responsible for ensuring the sustainable use and conservation of biodiversity for food and agriculture. The Commission has published two reports on the state of animal genetic resources, the first in 2007 and the second in 2015. A third report is currently being prepared.

According to the *Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture* (second SoW-AnGR)[9], 40 of the 17 thousand species of mammals and birds, are domestic species. However, according to data reported in 2018, only eight of these species contributed 97 percent of meat production; four (cattle, buffalo, goat, and sheep) contributed 100 percent of milk production and only one species contributed 93 percent of egg production[10]. In addition, it is estimated that 26 percent of the breeds used in animal husbandry are endangered species and 6 percent are already extinct. These numbers may vary because information on the status of 55 percent of the breeds is not available.

## II. CHALLENGES AND OPPORTUNITIES

### II.1 Animal genetic resources and their role in adaptation to climate change

The loss of animal genetic resources is caused by factors that transcend the boundaries of countries and regions. One of the causal factors is climate change. This phenomenon disrupts agricultural cycles, increases extreme weather events and weakens ecosystems, causing effects that can be devastating for agricultural systems and wild food sources. Heat stress influences the physiological and immune responses of livestock[11], and ranching is directly exposed to it, prompting farmers to change breeds or species, or to migrate to other production areas. Moreover, lower forage quality can increase methane emissions and alter the incidence, spread and predictability of diseases.

For this reason, it is important to maintain the diversity of animal genetic resources, in order to provide alternatives for adaptation according to a site-specific strategy.  Hence the importance of mapping the characterization of breeds and production environments in order to pay attention to relevant characteristics for their successful climate adaptation.

According to the classification of the second SoW-AnGR, in terms of adaptation, native breeds refer to a subgroup of locally adapted breeds, that is, breeds that have existed in the country long enough (approximately

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[6] FAO's Strategic Framework 2022-2031 aims to support the 2030 Agenda with a transformation towards more efficient, inclusive, resilient and sustainable agri-food systems, for better production, better nutrition, better environment and better lives leaving no one behind. Available at: https://www.fao.org/strategic-framework/es

[7] FAO. Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration. Available at https://www.fao.org/3/a1404s/a1404s.pdf

[8] https://www.fao.org/cgrfa/meetings/commission/es/

[9] FAO. 2015. The Second Report on the state of the World's Animal Genetic Resources for Food and Agriculture. B.D. Scherf y D. Pilling, eds. FAO Commission on Genetic Resources for Food and Agriculture Assessments. Roma. Available at https://www.fao.org/3/i4787e/i4787e.pdf

[10] Global status of genetic resources for food and agriculture: challenges and research needs. 2020. Pilling, D.; B´elanger, J.; Diulgheroff, S.; Koskela, J., Leroy; Graham, Mair., and Hoffmann, I. Genetic Resources (2020), 1 (1) 4–16. Available at https://www.genresj.org/index.php/grj/article/view/genresj.2020.1.4-16

[11] Heat affects production and fertility, increases water requirements, reduces appetite and increases mortality. For example, in poultry production, it affects fat deposition and meat quality and lowers immunity, and in dairy cattle it reduces milk production.

40 years) to have developed characteristics that allow them to survive one or more production systems or environments in the country.

Adaptation strategies focused on animal genetic resources can influence a population through selective breeding of more resilient breeds or crossbreeding with high-temperature or disease-resistant breeds; or changing species when the above measures can no longer be implemented.[12] In general, the response to climate change consists mostly of changes in production systems and management of animal genetic resources; in cases of increased demand for adapted breeds, this is met by local breeds rather than transboundary breeds. In some regions, cattle have been replaced by camelids or small ruminants in an attempt to adapt to drought conditions. In Ethiopia, for example, the cattle population declined by 50-70 percent, while the dromedary population grew by as much as 200 percent in 2015.

Climate change may also act as an enhancer of gene flow, i.e., the movement and exchange of breeding animals and germplasm. This likely includes increased flow from the South as a result of demand for animals that are well adapted to extreme climatic conditions or climate-related diseases, although this has not been reported on a significant scale yet. Loss of populations as a result of epidemics or other disasters may also prompt these gene flows.

The most important impact of gene flows is their contribution to the erosion of animal genetic resources due to indiscriminate crossbreeding between imported and native breeds. This can be avoided with good planning, and in some cases, gene flow can even increase the range of breeds available to farmers. In other cases, outward gene flow can help encourage the breeding of locally adapted livestock to meet external demand.

The Domestic Animal Diversity Information System (DAD-IS)[13], created in 1996 as a mechanism to register the world's cattle breeds, includes the description of important breeds' adaptation traits. In LAC, of the 44 registered cattle breeds, 12 are classified as heat-resistant breeds and eight as dry environment-resistant breeds. A special case in LAC is the presence of South American camelids: the alpaca and llama inhabit high Andean regions up to 5 000 meters above sea level and are capable of growing in a wide variety of climates and in very scarce pasture conditions. There are eight alpaca and six llama breeds worldwide, with no differences in the levels of adaptability between breeds.[14]

## II.2 Animal genetic resources and their contribution to climate change mitigation

Animal husbandry systems use a significant amount of water resources and contribute to changes in land use in some areas. This is especially true when forests are encroached upon to produce food and pasture for livestock, resulting in deforestation, habitat fragmentation and biodiversity loss. In addition, animal husbandry systems are also responsible for greenhouse gas (GHG) emissions, mainly due to enteric fermentation and manure, but they are also present in the upstream stages of production of feed and other inputs, as well as in the downstream stages of transport, refrigeration, storage and processing of livestock products.[15]

Livestock systems issue three main GHGs: methane ($CH_4$), nitrous oxide ($N_2O$) and carbon dioxide ($CO_2$). Methane is especially important because of its high power as a GHG, although it lasts for a short period of time. Reducing methane emissions can therefore generate rapid results in combating global warming.

[12] FAO. 2022. The Role of Genetic Resources for Food and Agriculture in Adaptation to and Mitigation of Climate Change. Available at https://www.fao.org/3/cb9570en/cb9570en.pdf

[13] For more information see https://www.fao.org/dad-is/es/

[14] For information on other species, see the Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture. Available at https://www.fao.org/3/i4787e/i4787e.pdf

[15] COAG:LI/2022/8 (https://www.fao.org/3/ni075es/ni075es.pdf)

Livestock systems have great potential to reduce emissions, as well as to capture CO2 and produce renewable energy. Through improving sustainable production and animal health, this contributes to reducing GHG emissions in the livestock sector while enhancing sinks in pastures, taking into account different systems and national circumstances. It has been estimated that more efficient husbandry practices could reduce GHG emissions by 20-30 percent (2,5 GT of $CO_2$ eq).[16]

Although there is political will among countries, there is still a long way to go. For example, in 2020, only 36 percent of the Nationally Determined Contributions (NDCs) mentioned specific mitigation and adaptation commitments in the livestock sector. Some African and LAC countries noted as a major obstacle to integrating the livestock sector into climate action, the limited capacity to quantify collateral climate and GHG emission benefits, especially measurement, reporting and verification and the improved transparency framework.[17]

Most measures presented in the NDCs for the livestock sector are traditional measures: 20 percent slurry management, 16 percent feed management and 10 percent silvipasture. Reduction of enteric methane and management practices for climate-smart production, genetic improvement of livestock and agriculture, and *in situ and ex situ* genetic conservation are also mentioned.[18]

In the context of productivity improvements to reduce emission rates, it is argued that well-planned breeding programs and animal genetic conservation can ensure that farmers have access to the best animals for each environment.[19, 20]

### II.3 Global Plan of Action

The objective of the Global Plan of Action is to implement measures to reverse the current trends of erosion and underutilization of animal genetic resources, facilitate access to them and ensure fair and equitable benefits sharing. It is structured around 23 strategic priorities at national, regional and international levels and grouped into four priority areas: (i) characterization, inventory and monitoring; (ii) sustainable use and development; (iii) *in situ* and *ex situ* conservation; and (iv) policies, institutions and capacity building.

Governments are responsible for implementing the Plan and designate a national focal point (a reference agency, usually the Ministry of Livestock or Agriculture or an agricultural research institute) and a coordinator. These coordinators are essential to facilitate the preparation of national reports and the implementation of the Commission's action plans and decisions. At present, LAC has an active Regional Coordinator who holds regular meetings, but there are only 14 national coordinators working regularly. The rest are not appointed (9) or are not active (10). All of the national focal points in LAC are members of the national public sector (Ministries of Livestock or Agriculture or research institutes). So far, there are no representatives from the academia in the region, as in other regions.

To implement the plan, the coordinators receive the following support from FAO:

- Technical information: guidelines and other publications, information system (DAD-IS), the Animal Genetic Resources journal and Global Status Reports among others.
- Information networks (DAD-Net): one global and seven subregional networks.
- Project financing strategy.

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[16]FAO. 2018. Livestock Solutions for Climate Change. Available at https://www.fao.org/3/I8098ES/i8098es.pdf

[17] COAG:LI/2022/4 (https://www.fao.org/3/ni006es/ni006es.pdf)

[18] *In situ* conservation refers to the support for a continuous animal husbandry in the past or current production system. *Ex situ* conservation refers to animal husbandry in conditions other than their normal management conditions (e.g., in zoos or government farms) or outside the areas in which they are normally found. For more details see section D of the *Second Report on the State of the World's Animal Genetic Resources for Food and Agriculture.*

[19] FAO. 2018. Livestock Solutions to Climate Change. Available at https://www.fao.org/3/i8098es/I8098ES.pdf

[20] For more references on other measures for climate change adaptation and mitigation through livestock, see *Addressing Climate Change through Livestock.* FAO, 2013. Available at https://www.fao.org/3/i3437s/i3437s.pdf

- Intergovernmental discussion and decision-making processes: the Commission on Genetic Resources for Food and Agriculture (CGRFA) and the Intergovernmental Technical Working Group on Animal Genetic Resources (ITWG).
- Regional collaboration: through Regional Focal Points.

The second SoW-AnGR was prepared using information compiled from 129 national reports, 15 reports from international organizations and four reports from regional focal points and networks dedicated to animal genetic resources. It also benefited from the contribution of 150 authors and reviewers, as well as data from FAO's DAD-IS. This report served as an update of the first report on the state of the world's animal genetic resources for food and agriculture, published in 2007 and its main emphasis was to highlight the progress made since the preparation of the previous report.

There is still much to be done to improve the management of animal genetic resources for food and agriculture. Although there was an improvement in terms of GPA implementation, there is great variability among subregions and countries. Some countries reached high levels of implementation in all areas, while others remain at low levels of implementation in all or most priority areas. The priority with the lowest implementation is the state of *ex situ* conservation programmes. On the other hand, of the 33 countries in the region, only 15 submitted information on progress in 2019.

In terms of the state of animal genetic resources, Latin America has numerous animal species with unique genetic traits that are adapted to the region's diverse environments.  These resources have been traditionally used for food, fibre and transport and have contributed to the cultural identity of the region. The second SoW-AnGR reports that the region has 36 percent of the world's cattle breeds, 31 percent of the world's sheep breeds, 43 percent of the world's goat breeds, 45 percent of the world's camelid breeds, and 23 percent of the world's swine breeds. Alpacas and llamas have the highest proportion of animals in out-of-risk status and one of the lowest proportions in unknown risk status. There are 423 avian and 1 684 mammal breed. Of these, 152 avian and 445 mammalian breed are local. In both cases, there is more than 80 percent of breeds of unknown status (one of the highest figures worldwide). The percentage of breeds under unknown risk status increased, although this could be due to greater notification of the same.

The main causes of genetic erosion in the region are the introduction of breeds (64 percent), indiscriminate crossbreeding (29 percent), intensification of production systems (29 percent) and lack of land or productive environments (21 percent).

Although there are many experiences of sustainable use in LAC, only Brazil and Mexico have formal and officially approved national strategies and action plans for animal genetic resources. Some countries are preparing or planning such strategies in the short or medium term, while for other countries it is not a priority. Eighty-three percent of the countries in the region have *in situ* conservation programmes and 72 percent have ex situ in vivo conservation programmes; in addition, 61 percent of the countries have ex situ in vitro conservation programmes. Despite this, in terms of national germplasm banks, the region is ranked fourth worldwide. There are also many south-south and inter-regional cooperation projects, such as the 'Alelo Recursos Genéticos'[21] portal, which is being developed by EMBRAPA in Brazil together with the United States and Canada, which stores information from the semen, embryo and DNA banks of the three countries.

In terms of national policies, there is a lack of legislation regarding access and distribution of benefits derived from the use of animal genetic resources. The region ranks sixth worldwide in the implementation of laws and policies for management and access to animal genetic resources, and fifth in the generation of knowledge and

[21] Embrapa. Alelo Recursos Genéticos. Available at https://www.embrapa.br/alelo

education and awareness activities on the importance of these resources. A favourable point is that it ranks third in the participation of producers and researchers in the implementation of the Plan of Action.

## III. RECOMMENDATIONS

The variety of animal genetic resources provides the capacity to adapt to and withstand the effects of climate change, emerging diseases, limited food and water supplies, and changing market demands. However, these resources are often inadequately managed and at risk. Thus, it is critical to intensify efforts to promote the sustainable use, development and conservation of these resources.

It is therefore essential to have a jointly developed strategy to improve the knowledge, sustainable use, development and conservation of the diversity of animal genetic resources. In this sense, the Technical Secretariat of CODEGALAC proposes to focus on the following actions:

- Compile relevant data and information on the livestock sector and the situation of animal genetic resources at the local, national and regional levels, in order to have empirical evidence for decision-making based on objective evidence to favour more innovative, sustainable and low-emission livestock breeding.
- Prioritize the process of preparing and drafting the third report on the state of the world's animal genetic resources for food and agriculture.
- Update national data in DAD-IS, including information on *in situ* and *ex situ* animal genetic resources, and provide information on breed classifications, to ensure that decisions on the implementation of the Global Plan of Action for Animal Genetic Resources and the achievement of the SDGs are based on the latest information.
- Request LAC countries to appoint or update their national focal points.

FAO, through the Technical Secretariat of CODEGALAC, offers assistance to the countries for the implementation of the aforementioned actions by:

- Supporting the mobilisation of resources to enable the implementation of strategies and programmes for the conservation and use of animal genetic resources and the elaboration of the third report.
- Providing technical support to countries to estimate the size of breed populations.
- Maintaining and developing the DAD-IS and working with national database managers in the formulation and adaptation of data exchange procedures.
- Providing technical advice for the analysis, identification and systematisation of successful experiences related to the use and conservation of animal genetic resources.