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# COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

## Item 3.1 of the Provisional Agenda

### INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON ANIMAL GENETIC RESOURCES FOR FOOD AND AGRICULTURE

#### Eleventh Session

19 - 21 May 2021

### DETAILED FAO PROGRESS REPORT ON THE IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION FOR ANIMAL GENETIC RESOURCES

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## I. INTRODUCTION

The Commission on Genetic Resources for Food and Agriculture (Commission), at its Seventeenth Regular Session,<sup>1</sup> requested FAO to continue technical and policy support for country implementation of the Global Plan of Action for Animal Genetic Resources<sup>2</sup> (Global Plan of Action).

The Global Plan of Action<sup>3</sup> refers to the essential role of FAO in supporting country-driven implementation efforts, in particular in the following areas: facilitating global and regional collaboration and networks; supporting the convening of intergovernmental meetings; maintaining and further developing DAD-IS;<sup>4</sup> developing communication products; providing technical guidelines and assistance; contributing to coordinated training programmes; promoting the transfer of technologies related to the sustainable use, development and conservation of animal genetic resources; and coordinating the preparation of global status and trends reports on animal genetic resources.<sup>5</sup>

The document *Review of Implementation of the Global Plan of Action for Animal Genetic Resources*<sup>6</sup> provides an overview of activities undertaken by FAO since the Tenth Session of the Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture (Working Group). This document provides a more detailed report. The activities are grouped according to their relevance to the four strategic priority areas of the Global Plan of Action.

## II. REPORTING AND AWARENESS-RAISING ON THE GLOBAL PLAN OF ACTION

FAO serves as the Global Focal Point among the network of regional and national focal points for the management of animal genetic resources for food and agriculture. To improve its outreach and communication, FAO completely redesigned its website<sup>7</sup> and launched the new version in early 2020. The website “Animal genetics”<sup>8</sup> (available in all official UN languages) provides information under the following headings: Background; Global policy; Breed database; Resources; Fora and Events.

FAO has continued to distribute printed versions of the Global Plan of Action and related products and guidelines and to prepare articles for the scientific press. Annex 4 provides a list of documents regarding the management of animal genetic resources for food and agriculture that have been prepared and published by FAO divisions and centres since the Tenth Session of the Working Group.

Links to these publications and important scientific articles on animal genetic resources for food and agriculture prepared by non-FAO authors have been made available on the website of the Domestic Animal Diversity Information System (DAD-IS)<sup>9</sup> as an awareness-raising and capacity building service to countries. These publications span across the four strategic priority areas.

FAO has expanded its use of social media for raising awareness of animal genetic resources for food and agriculture, particularly through the Twitter application. Starting in 2020, FAO has been posting to its “@FAOLivestock account news articles and a weekly quiz on animal breeds. The account has more than 18 500 followers.

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<sup>1</sup> CGRFA-17/19/Report, paragraph 86.

<sup>2</sup> [www.fao.org/docrep/010/a1404e/a1404e00.htm](http://www.fao.org/docrep/010/a1404e/a1404e00.htm)

<sup>3</sup> Global Plan of Action for Animal Genetic Resources, paragraph 58–61.

<sup>4</sup> <http://www.fao.org/dad-is>

<sup>5</sup> Global Plan of Action for Animal Genetic Resources, paragraph 22–23, Strategic Priority 14.

<sup>6</sup> CGRFA/WG-AnGR-11/21/2.

<sup>7</sup> <http://www.fao.org/animal-genetics>

<sup>8</sup> <http://www.fao.org/ag/angr.html>

<sup>9</sup> <http://www.fao.org/dad-is/publications/en>

### III. CAPACITY-BUILDING AND TECHNICAL SUPPORT TO THE IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION AT NATIONAL LEVEL

The following paragraphs provide a detailed description of FAO activities in each strategic priority area of the Global Plan of Action. Work continued despite the global COVID 19 pandemic.

#### A. Strategic Priority Area 1. Characterization, inventory and monitoring of trends and risks

##### *Institutional and technical support*

The Commission stressed the importance of DAD-IS as the international clearing-house mechanism for animal genetic resources for food and agriculture and requested FAO to support its further maintenance and development and to continue to collaborate with managers of national and regional systems and other stakeholders to develop and refine procedures for exchange of data.<sup>10</sup> The new version of DAD-IS has been under continual development since its launch in November 2017. FAO has implemented several pilot projects or made direct interventions to assist countries<sup>11</sup> in accessing existing data, estimating population sizes and entering data into DAD-IS. FAO has developed several tools to facilitate exchange of data with national databases and has tested the tools in cooperation with countries.<sup>12</sup>

FAO supported countries with regard to inventory and monitoring of their breeds with activities based on three pillars: (i) development of additional training material as requested by the Commission; (ii) provision of simplified procedures and direct support to upload cryoconservation data; and (iii) financial and technical support to countries to address the lack of breed-level population data. More detailed information on the recent development of DAD-IS and related activities is presented in the documents *Status of the development of the Domestic Animal Diversity Information System*<sup>13</sup> and *Detailed analysis of the factors influencing the reporting of information in the Domestic Animal Diversity Information System*.<sup>14</sup>

In 2009, the Commission requested FAO to make status and trends reports on animal genetic resources available to the Commission at each of its regular sessions.<sup>15</sup> FAO has prepared a report of this kind for each subsequent session. The document *Status and trends of animal genetic resources – 2020*,<sup>16</sup> has been made available for review by the Working Group. The status and trends report is based on information entered into DAD-IS by National Coordinators for the Management of Animal Genetic Resources (NC-AnGR) as of February 2021. Currently, 178 countries have a nominated NC-AnGR.

The Commission, at its Seventeenth Session, requested FAO to continue developing and updating guidelines to facilitate the application of new scientific discoveries related to the identification, characterization and conservation of animal genetic resources.<sup>17</sup> The documents *Review of the work on biotechnologies for the sustainable use and conservation of genetic resources for food and agriculture*<sup>18</sup> and *Recent developments in biotechnologies relevant to the characterization, sustainable*

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<sup>10</sup> CGRFA-17/19/Report, paragraph 86.

<sup>11</sup> Argentina, Algeria, China, Colombia, Ecuador, Panama, Libya, Mauritania, Mongolia, Morocco, Tunisia, Vietnam.

<sup>12</sup> Brazil, Canada, United States of America.

<sup>13</sup> CGRFA/WG-AnGR-11/21/5.

<sup>14</sup> CGRFA/WG-AnGR-11/21/Inf.7.

<sup>15</sup> CGRFA-12/09/Report, paragraph 39.

<sup>16</sup> CGRFA/WG-AnGR-11/21/Inf.6.

<sup>17</sup> CGRFA-17/19/Report, paragraph 84.

<sup>18</sup> CGRFA/WG-AnGR-11/21/9.

*use and conservation of genetic resources for food and agriculture*<sup>19</sup> provide an overview of recent relevant scientific discoveries. In response to the Commission's request, FAO has prepared the documents *Genomic characterization of animal genetic resources for food and agriculture*<sup>20</sup> and *Genomic characterization of animal genetic resources – Draft updated technical guidelines*.<sup>21</sup> The latter guidelines supersede the *FAO guidelines on molecular genomic characterization of animal genetic resources*.<sup>22</sup>

FAO has supported characterization of local populations through a national Technical Cooperation Projects (TCP) in Mongolia (TCP/MON/3707) entitled, "Support the assessment of animal genetic resources".

The Joint FAO/International Atomic Energy Agency (IAEA) Centre of Nuclear Techniques in Food and Agriculture (CJN) provided technical support to 30 countries<sup>23</sup> on phenotypic and molecular characterization of indigenous livestock breeds. CJN continued to maintain and enrich the Global Genetic Repository of Livestock at its Animal Production and Health Laboratory (CJN-APHL). The purpose of the repository is to help preserve genomic DNA from animal genetic resources from around the world and promote collaborative research in developing countries. At present, the repository maintains about 13 000 DNA samples belonging to more than 180 breeds of various livestock species including cattle, sheep, goats, buffaloes, pigs, alpacas, chickens and guinea fowl.

#### *Research and capacity-building*

To facilitate global analysis of breed diversity through molecular genetic characterization, FAO has continued its partnership with the International Society for Animal Genetics (ISAG),<sup>24</sup> through the ISAG/FAO Advisory Group on Animal Genetic Diversity. Members of the Advisory Group served as editors of the document *Genomic characterization of animal genetic resources – Draft updated technical guidelines*.<sup>25</sup>

Since the Tenth Session of the Working Group, CJN has supported the characterization of 60 breeds/populations of cattle, sheep, goats and guinea fowl across 13 countries.<sup>26</sup> Ten national IAEA TCPs and one regional TCP included components on? characterization of animal genetic resources for food and agriculture. The countries and projects were the following:

- (i) Burkina Faso (BKF5021) "Improving local poultry production through incorporation of nutraceuticals in feeds and genetic characterization";
- (ii) Togo (TOG5001) "Improving and promoting bovine milk production through artificial insemination";
- (iii) Papua New Guinea (PAP5003) "Enhancing genetic characterization and improving productivity of cattle by enhanced reproduction and better feeding - Phase-II";
- (iv) Cameroon (CMR5024) "Improving goat and sheep productivity in rural areas using nuclear-derived techniques for genetic marker identification, reproduction harnessing and feed analysis";

<sup>19</sup> CGRFA/WG-AnGR-11/21/Inf.12.

<sup>20</sup> CGRFA/WG-AnGR-11/21/4.

<sup>21</sup> CGRFA/WG-AnGR-11/21/Inf.5.

<sup>22</sup> <http://www.fao.org/3/i2413e/i2413e00.htm>

<sup>23</sup> Argentina, Bangladesh, Bolivia, Brazil, Burkina Faso, Cambodia, Cameroon, China, Costa Rica, Cuba, Dominican Republic, El Salvador, Eritrea, India, Iraq, Kenya, Mexico, Mongolia, Nigeria, Papua New Guinea, Paraguay, Peru, Senegal, Serbia, South Africa, Sri Lanka, Togo, Tunisia, Uruguay, Venezuela.

<sup>24</sup> <http://www.isag.us>.

<sup>25</sup> CGRFA/WG-AnGR-11/21/Inf.5.

<sup>26</sup> Bulgaria, Burkina Faso, Cambodia, Indonesia, Lesotho, Mozambique, Papua New Guinea, Pakistan, Peru, Sri Lanka, Togo.

- (v) Eritrea (ERI5010) “Increasing small scale dairy production through improved feeding, cattle management and higher conception rates, thereby improving rural livelihood and contributing to food security”;
- (vi) Nigeria (NIR5041) “Improving livestock productivity through enhanced nutrition and reproduction using nuclear and molecular techniques”;
- (vii) Mongolia (MON5025) “Improving breed characterization of cashmere goats to facilitate the establishment of strategic breeding programmes”;
- (viii) Paraguay (PAE5011) “Improving the conservation of germplasm of high performance livestock and native cattle”;
- (ix) Senegal (SEN5042) “Using nuclear and related techniques in improving the productivity of domestic ruminants”;
- (x) Cambodia (KAM5003) “Supporting sustainable livestock production”;
- (xi) Latin America and the Caribbean<sup>27</sup> (RLA5071) “Decreasing the parasite infestation rate of sheep”.

To help address the issue of limited availability of genomic tools and resources for characterization of certain livestock species, the CJN-APHL initiated the development of DNA microarrays for camelid species in collaboration with the University of Veterinary Medicine in Vienna and the International Camel Genome Consortium. A multi-species camelid DNA chip containing around 200 000 single nucleotide polymorphic (SNP) markers was successfully developed, which includes at least 60 000 SNPs from each of dromedary, Bactrian and new world camelid species. The chip is currently under validation and field testing before distribution to stakeholders across Africa, Asia and Latin America.

During the reporting period, CJN-APHL staff trained 14 fellows in molecular genetic and genomic characterization. The trainees came from eleven countries<sup>28</sup> and the fellowships ranged from one to three months in length. CJN also implemented three regional training courses and four national training courses between 2018 and 2020. Details can be found in Annex 3.

## **B. Strategic Priority Area 2. Sustainable use and development**

### *Institutional and technical support*

At its Seventeenth Session, the Commission endorsed the *Guidelines on Developing Sustainable Value Chains for Small-scale Livestock Producers*<sup>29</sup> and requested FAO to publish and distribute them widely. The guidelines have been published in both electronic<sup>30</sup> and hard-copy formats. Distribution of hard copies has been delayed by the COVID-19 pandemic. The Government of China is supporting the translation of the guidelines into Chinese.

In addition to enhancing the inventory and monitoring the diversity of managed honey bees of relevance for food and agriculture by further developing DAD-IS, FAO also undertook activities to improve their sustainable use and development. In collaboration with the Istituto Zooprofilattico Sperimentale del Lazio e della Toscana “M. Aleandri”, Apimondia (the International Federation of Beekeepers' Associations) and the Chinese Academy of Agricultural Sciences, FAO is developing general guidelines on good beekeeping practices, and a practical manual for beekeepers on techniques and procedures for a sustainable production in rural areas of Africa. The documents include some sections on breeding and genetics but mainly address other topics related to sustainable beekeeping.

<sup>27</sup> Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Paraguay, Peru, Uruguay.

<sup>28</sup> Bulgaria, Burkina Faso, Cambodia, Indonesia, Lesotho, Mozambique, Papua New Guinea, Pakistan, Peru, Sri Lanka, Togo.

<sup>29</sup> CGRFA-17/19/11.2/Inf.5.

<sup>30</sup> <http://www.fao.org/3/ca5717en/CA5717EN.pdf>

In response to the need for technical assistance to ensure the better use and development of animal genetic resources for food and agriculture, FAO continued to provide assistance in these fields, both directly and through cooperation with other organizations. Particular topics receiving emphasis in FAO's technical support and capacity building included adaptation and mitigation of climate change, animal identification, establishing breeding strategies and programmes, application of biotechnologies, agroecology and development of livestock market chains for smallholders.

Animal identification, recording and traceability systems can play multiple roles in improving the sustainable management of animal genetic resources for food and agriculture.<sup>31</sup> In recent years, FAO has implemented TCPs to provide technical and financial assistance to several countries to support the development of such systems. Three such projects were under implementation since the last session of the Working Group. In the Latin America and the Caribbean region, FAO has supported Suriname (TCP/SUR/3701) in the development of its animal registration system and an animal identification and traceability system. In Africa, FAO supported Mauritius TCP/MAR/3703/C2) to design an animal identification system and provided recommendations on the associated information technology infrastructure and capacity building. FAO continued to implement a project in Georgia (GCP/GEO/009/SWI) for the establishment of a national animal identification and traceability system. The project is primarily supported by the Governments of Switzerland and Austria, with additional support from the Government of Georgia and FAO, and will run until 2023. CJN continued to provide countries technical support to improve animal identification, performance data recording and artificial insemination networks in Asia, Africa and Latin America. Animal identification toolkits were provided to several countries according to ICAR (International Committee on Animal Recording) standards and guidelines. During the reporting period, radio frequency identification (RFID) ear tags and rumen boluses were supplied to three countries<sup>32</sup> to enable identification of individual animals of local breeds for subsequent phenotype recording. The toolkit is used by Indonesia in a community based breeding programme for the improvement of native beef cattle, by Mongolia for animal identification and recording the cashmere production in ten local goat breeds and by Cameroon for a community breeding programme to improve mutton production in indigenous small-holder sheep flocks.

FAO is supporting several countries to improve the management of local livestock populations. The regional TCP "Conservation and development of dual-purpose cattle breeds in Eastern Europe" (TCP/RER/3604) involved cooperation among Armenia, Georgia and Ukraine and included a component for development of breeding programmes for the targeted breeds in each country. A project in the Lao People's Democratic Republic (TCP/LAO/3607) aimed to improve the capacity of government staff to support livestock keepers and other stakeholders involved in the management of local breeds. A project in Togo was designed to improve milk production through the enhancement of artificial insemination services (TCP/TOG/3605/C2). A project in Mauritania (UTF/MAU/026/MAU) supported the establishment and operation of a research centre for local dromedary camel populations.

Other projects included actions to complement and promote the sustainable use of animal genetic resources. The project in Chad (TCP/CHD/3706/C2) sought to improve the competitiveness of the local meat value chain. The project in the Bahamas (TCP/BHA/3701/C1) supported capacity development of an integrated agroecological production system for small ruminant livestock. Gabon (TCP/GAB/3702) and Kyrgyzstan (TCP/KYR/3703) each had a project targeting local family poultry production systems, whereas Tonga (TCP/TON/3602) had a project involving both cattle and sheep production.

Three countries had multiple projects related to sustainable use of animal genetic resources for food and agriculture. Djibouti (TCP/DJI/3603; TCP/DJI/3704/C3; GCP/DJI/004/EC) had three such projects, while Cuba (GCP/CUB/017/GFF; GCP /CUB/018/GFF) and Azerbaijan (UTF/AZE/010/AZE; UTF/AZE/009/AZE) each had two.

<sup>31</sup> <http://www.fao.org/3/i5702e/i5702e.pdf>

<sup>32</sup> Cameroon, Indonesia, Mongolia.

Other countries are receiving FAO support through projects that include the contribution of applied animal genetics to the broad goal of increasing food security. Among these countries, the Democratic People's Republic of Korea had a project (TCP/DRK/3604) on improving pig breeding. Nepal (UTF/NEP/073/NEP) benefited from FAO technical assistance in the management of local and exotic goat and chicken genetic resources. Myanmar included distribution of improved local breeds of livestock in a project (UNJP/MYA/702/WFP) aimed at increasing the access of vulnerable communities to more stable sources of food.

FAO has continued its work in support of small-scale livestock keepers and pastoralists. Specifically, with extra-budgetary support from Germany (GCP/GLO/536/GER; GCP/GLO/311/GER), FAO has continued to operate the Pastoralist Knowledge Hub<sup>33</sup> to improve the capacity of pastoralist livestock keepers and facilitate communication among them. The Hub brings together pastoralist networks and organizations working with them in order to promote collaboration and enhance pastoral development and pastoralist-friendly policy interventions. The Hub aims to give pastoralists a voice by strengthening their capacities and by linking their representatives to policy dialogue.

Artificial insemination using frozen semen technology is an important means of multiplying superior germplasm for sustainable improvement of livestock productivity. CJN provided technical support to assist national artificial insemination programs in six countries.<sup>34</sup> Support was provided in terms of equipment and supplies required for scaling up production of frozen semen, and training was offered on collection and preservation of semen, artificial insemination and early pregnancy diagnosis in cattle. With which genetics?

#### *Research and capacity-building*

Since mid-2019, FAO has served on the Stakeholder Committee of the European Union sponsored research project "SMARTER" (Small ruminants breeding for efficiency and resilience).<sup>35</sup> Project partners include research institutes and breeders' organizations in Europe, as well as China and Uruguay. As a member of the Stakeholder Committee, FAO has had the opportunity to advise the participating scientists on topics of importance to FAO Member Nations and to disseminate relevant research results.

CJN is currently implementing a Coordinated Research Project (CRP) on "Application of nuclear and genomic tools to enable the selection of animals with enhanced productivity traits".<sup>36</sup> The CRP targets the development and application of molecular genetic tools to evaluate, select and breed dairy cattle for rapid but sustainable improvement of milk productivity in member states. Research contracts have been awarded to institutes in ten countries.<sup>37</sup> Experts from Austria, Kenya, Italy and the United States of America are also providing technical support.

The CJN-APHL established an in-house low-cost genotyping facility. The facility supported genome-wide screening of cattle to assist national dairy cattle breeding programmes in nine countries.<sup>38</sup> Between 2018 and 2020, CJN implemented six national training courses on artificial insemination and techniques for monitoring of reproductive hormones. Additional information about these courses is provided in Annex 3.

#### *Awareness-raising and information*

Many local breeds and their production systems provide ecosystem services beyond the production of animal source foods and other products. These services are often underappreciated or entirely

<sup>33</sup> <http://www.fao.org/pastoralist-knowledge-hub/en>

<sup>34</sup> Cambodia, Cameroon, Nigeria, Papua New Guinea, Paraguay, Togo.

<sup>35</sup> <https://www.smarterproject.eu>

<sup>36</sup> <https://www.iaea.org/projects/crp/d31028>

<sup>37</sup> Argentina, Bangladesh, China, India, Kenya, Peru, Serbia, South Africa, Sri Lanka, Tunisia.

<sup>38</sup> Argentina, Bangladesh, Burkina Faso, Columbia, Paraguay, Peru, Serbia, Sri Lanka and Uruguay.

unrecognized. To help increase awareness of these services, FAO prepared and published in scientific journals several articles regarding livestock and ecosystem services. FAO also produced other scientific publications related to the sustainable use of animal genetic resources, which are also listed in Annex 4.

FAO collaborated with the Government of Germany in the preparation of technical sessions of the International Congress on the Breeding of Sheep and Goats,<sup>39</sup> which was a hybrid virtual/physical meeting held October 2020 in Bonn. FAO identified speakers and chaired two sessions on animal genetic resources and provided a plenary talk entitled “The role of small ruminants in poverty reduction and rural development”.

In 2017 the United Nations adopted a resolution<sup>40</sup> declaring 20 May to be World Bee Day. Since that time, FAO has each year organized events to commemorate World Bee Day<sup>41</sup> and to raise awareness of the importance of honey bees and other pollinators for food and agriculture.

### C. Strategic Priority Area 3. Conservation

#### *Institutional and technical support*

The FAO is providing technical support to Bahrain in the conservation of local breeds as part of a multi-faceted livestock TCP (UTF/BAH/006/BAH) “Support to eradication of animal diseases and zoonosis and conservation of animal genetic resources”. The previously mentioned national projects in the Lao People’s Democratic Republic (TCP/LAO/3607) and Cuba (GCP/CUB/017/GFF; GCP/CUB/018/GFF) and the regional TCP (TCP/RER/3604) in Eastern Europe (Armenia, Georgia and Ukraine) include components on the conservation of animal genetic resources.

Since 2018, African Swine Fever has swept through many Asian countries, putting local pig genetic resources at risk due to both the disease itself and eradication programmes put in place to prevent its spread. FAO supported Vietnam in the cryoconservation of five local pig breeds to help ensure their protection against loss. The project was based on the collection, culture and preservation of somatic cells from 100 animals in a short time and at a low cost. In addition, Vietnam reported breed characteristics of these five breeds in DAD-IS and uploaded cryoconservation and population size data for reporting on Indicators 2.5.1b<sup>42</sup> and 2.5.2<sup>43</sup> of Sustainable Development Goal 2 (zero hunger).

#### *Research and capacity-building*

From 2016 to 2020, FAO was a member of a consortium consisting of collaborators from Europe and several African and South American countries that implemented the project “IMAGE – Innovative Management of Animal Genetic Resources”. The project was financially supported by the European Union. IMAGE aimed to improve the management and *ex situ* conservation programmes for animal genetic resources and increase the utilization of germplasm stored in gene banks. In particular, FAO was responsible for two major tasks: (i) benchmarking of gene bank protocols and standards; and (ii) organization of exchanges and capacity building towards third countries. With regard to the first task, FAO undertook a global survey of gene banks and their management practices, especially with regard to quality management. Results of the survey and subsequent analyses were published in a scientific journal.<sup>44</sup> With regard to the second task, FAO oversaw the technical aspects of organizing

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<sup>39</sup> <https://sheepandgoats2020bonn.org/programme/>

<sup>40</sup> RES/72/211.

<sup>41</sup> <http://www.fao.org/world-bee-day/en/>

<sup>42</sup> <http://www.fao.org/sustainable-development-goals/indicators/251b>

<sup>43</sup> <http://www.fao.org/sustainable-development-goals/indicators/252>

<sup>44</sup> <https://doi.org/10.1089/bio.2019.0128>



four training workshops, two each in Latin America<sup>45</sup> and North Africa.<sup>46</sup> More details about the training courses are contained in Annex 3. FAO also collaborated on a survey and analysis of the materials stored in several gene banks in Europe and Africa, the results of which were published in a scientific journal.<sup>47</sup>

Technologies for conservation of animal genetic resources, especially for cryoconservation, have advanced substantially in recent years. Many of these technologies are referred to in document *Recent developments in biotechnologies relevant to the characterization, sustainable use and conservation of genetic resources for food and agriculture*.<sup>48</sup> To facilitate adoption of recent advances in animal gene banking and to complement and update the FAO guidelines on *Cryoconservation of animal genetic resources*<sup>49</sup> in 2012, FAO has prepared the documents *Cryoconservation of animal genetic resources for food and agriculture*<sup>50</sup> and *Innovations in cryoconservation of animal genetic resources - Draft technical guidelines*<sup>51</sup> and made them available for review by the Working Group. The draft guidelines were prepared in cooperation with authors and reviewers from the IMAGE project and from around the world.

FAO has continued to participate in the Conservation Genetics Specialist Group (CGSG) of the International Union for Conservation of Nature (IUCN). The CGSG serves as a focal point for the conservation genetics community for wildlife and provides advice on genetic policy and management to the IUCN and expert knowledge and assistance to other IUCN specialist groups. Participation in the group allows the sharing of experiences in the conservation genetics of livestock and wildlife. In 2020, the CGSG launched the initial phases of preparing guidelines for biobanking and gene-banking of wildlife species. FAO contributed to the preparation of a draft outline and shared the previous FAO Guidelines on *Cryoconservation of animal genetic resources*<sup>52</sup> as reference material.

#### *Awareness-raising and information*

FAO attended and contributed to the XIX, XX and XXI Simposio Iberoamericano de Conservación y Utilización de Recursos Zoogenéticos, in Ecuador (October 2018),<sup>53</sup> in Brazil (November 2019)<sup>54</sup> and a virtual meeting in December 2020, respectively. FAO also participated actively in the Third World Conference on Sheep,<sup>55</sup> which was organized in China and held virtually. In addition to a welcome speech, a plenary lecture entitled “The state of global gene banking of animal genetic resources” was presented.

### **D. Strategic Priority Area 4. Policies, institutions and capacity-building**

#### *Institutional and technical support*

Strategic Priority 17 of the Global Plan of Action is to “Establish Regional Focal Points and strengthen international networks”. FAO continued to collaborate with NC-AnGR and regional stakeholders to maintain and strengthen Regional and Subregional Focal Points or networks in Asia, the Near East and Africa. FAO has been a regular participant in meetings and other activities organized by the European Regional Focal Point for Animal Genetic Resources (ERFP), where it has reported on activities related

<sup>45</sup> Argentina (22 trainees) and Colombia (40 trainees).

<sup>46</sup> Egypt (27 trainees) and Morocco (20 trainees).

<sup>47</sup> <https://doi.org/10.3390/d11120240>

<sup>48</sup> CGRFA/WG-AnGR-11/21/Inf.12.

<sup>49</sup> <http://www.fao.org/3/i3017e/i3017e00.pdf>

<sup>50</sup> CGRFA/WG-AnGR-11/21/3.

<sup>51</sup> CGRFA/WG-AnGR-11/21/Inf.4.

<sup>52</sup> <http://www.fao.org/3/i3017e/i3017e00.htm>

<sup>53</sup> <https://espoeh.edu.ec/index.php/component/k2/item/2965-xix-simposio-iberoamericano-de-conservaci%C3%B3n-y-utilizaci%C3%B3n-de-recursos-zoogen%C3%A9ticos.html>

<sup>54</sup> <https://www.cpap.embrapa.br/xx-simposio-iberoamericano/index.html>

<sup>55</sup> <https://www.bagevent.com/event/6871118/p/432685>

to the management of animal genetic resources for food and agriculture. These events have included the annual General Assemblies of the ERF and meetings of permanent working groups on information and documentation and *ex situ* conservation. FAO also continued its collaboration with the Regional Focal Point for Latin America and the Caribbean. FAO organized or contributed to seven regional meetings for NC-AnGR in the reporting period. More details can be found in Annex 2.

With regard to support at the national level, project (TCP/LAO/3607) in the Lao People's Democratic Republic included a component on capacity building. Technical support was provided to the Government of Sudan in the initial steps of their preparation of a National Strategy and Action Plan for the management of animal genetic resources.

CJN continued its efforts to improve the laboratory capacity of member states to enable implementation of advanced DNA-based technologies for efficient management of locally available animal genetic resources. Institutional and technical support were provided to 14 countries<sup>56</sup> for establishing/strengthening molecular genetic laboratories through provision of necessary equipment and laboratory supplies under the framework of national and regional TCPs. CJN provided technical support in setting up a new nucleic acid sequencing facility at the Unite de Genetique Animale, Institut de l'Environnement et de Recherches Agricoles, Centre de recherches environnementales et de Formation (INERA-CREAF) in Burkina Faso. This new facility has attracted the attention of neighbouring West African countries and is playing an active role in providing training on application of DNA marker technology for characterization and improvement of local livestock breeds. CJN experts also undertook field support missions to install equipment and conduct onsite training to laboratory personnel in many of these neighbouring countries, with the objective to put in place fully equipped and functional facilities for genetic characterization and application of gene-based tools for sustainable use and development of animal genetic resources.

FAO collaborated with the European Master in Animal Breeding and Genetics programme,<sup>57</sup> co-funded by the European Union, which provides stipends for developing-country participants and support the generation and dissemination of knowledge. During the period since the last session of the Working Group, FAO has presented guest lectures at member universities and proposed topics on animal genetic resources for student theses.

#### *Awareness-raising and information*

FAO continued its collaboration with the European Federation of Animal Science (EAAP) in events that raise awareness about animal genetic resources for food and agriculture, particularly through cooperation in the planning and presentation of EAAP annual meetings. At the 69th Annual Meeting of the EAAP held in Dubrovnik, Croatia, in August 2018, FAO, ERF and EAAP's Working Group on Animal Genetic Resources organized a special session entitled "Adding value to local breeds". The session included two invited and nine contributed presentations, including one by FAO. The three organizations also organized two special sessions at the 70th Annual EAAP Meeting, which took place in Ghent, Belgium, in August 2019. One session was entitled "What to conserve?" and the other was on "Awareness of the importance of genetic resources". A joint session on "Governance of Genetic Resources" chaired by FAO was also organized at the 71st Annual EAAP Meeting, held virtually in December 2020. All sessions were well attended, including by NC-AnGRs.

FAO has collaborated with the Iberoamerican Network for Conservation of the Biodiversity of Local Domestic Animals (Red CONBIAND)<sup>58</sup> to build capacity on the estimation of population sizes of breeds with a focus on Latin America and the Caribbean and delivered keynote speeches at Red CONBIAND's annual symposia.

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<sup>56</sup> Burkina Faso, Cambodia, Cameroon, Dominican Republic, Eritrea, Indonesia, Mexico, Mongolia, Pakistan, Papua New Guinea, Paraguay, Senegal, Sri Lanka, Togo.

<sup>57</sup> <https://www.emabg.eu/>

<sup>58</sup> <https://conbiand.site/>

FAO is providing support to the IAEA in organizing the *International Symposium on Sustainable Animal Production and Health – Current Status and Way Forward*.<sup>59</sup> The symposium was originally planned as an in-person event in June 2020 at IAEA, but was postponed due to the global COVID-19 pandemic and will now be held virtually from 28 June to 2 July, 2021. The symposium will include several sessions that address issues related to the management of animal genetic resources for food and agriculture.

FAO continues to maintain DAD-Net as an informal global forum for the discussion of issues relevant to the management of animal genetic resources. In addition, several and regional subgroups are monitored by collaborating institutions. The number of subscribers continues to increase steadily, and the network remains active, with hundreds of messages exchanged annually. As of February 2021, more than 3 380 people from 155 countries were subscribed to the network. From 2018 to 2020, nearly 400 messages per year were exchanged through DAD-Net. DAD-Net continues to be a unique and effective means of sharing experiences, disseminating information and facilitating informal discussions among individuals involved in the management of animal genetic resources for food and agriculture.

FAO served as guest editors for the special issue *Sustainable Management of Animal Genetic Resources*<sup>60</sup> in the open-access scientific journal *Sustainability*. As of March 2021, the issue included 8 articles, with several others awaiting finalization. FAO also serves on the editorial board of *Genetic Resources*,<sup>61</sup> a new open access scientific journal that was launched by the European Union-sponsored GenRes Bridge<sup>62</sup> project. The journal, which is also cost-free for authors, will help to replace the *Animal Genetic Resources* journal, which FAO was forced to discontinue due to a shortage of human and financial resources. *Genetic Resources* also accepts articles on other types of agrobiodiversity. All issues of the *Animal Genetic Resources* journal will remain available online<sup>63,64</sup> indefinitely.

FAO officers have participated as invited speakers at a number of international conferences and meetings of organizations or projects with programmes related to the management of animal genetic resources for food and agriculture. These meetings have included in-person, virtual and hybrid events, with the latter two types representing the majority since the start of the global COVID-19 pandemic. Physical meetings were held in locations spread throughout the world, including Azerbaijan, Belgium, Brazil, Botswana, China, Croatia, Cuba, Ecuador, France, Germany, Greece, Hungary, Italy, Mauritania, Morocco, Spain and Tunisia.

At its 27th Session, the Committee on Agriculture (COAG), a technical governing body of FAO, recommended to establish a COAG Sub-Committee on Livestock (Sub-Committee).<sup>65</sup> At its 165th Session,<sup>66</sup> the FAO Council recommended that the 42nd Session of the FAO Conference endorse the Sub-Committee's establishment. The Sub-Committee will serve as an intergovernmental forum with a mandate to discuss and build consensus on livestock issues and priorities and advise COAG and, through it the FAO Council and the FAO Conference, on technical and policy programmes and activities needed to optimize the contribution of the sector to the realization of the 2030 Agenda for Sustainable Development, including poverty alleviation, increased food security, enhanced nutrition, and sustainable environment and livelihoods.<sup>67</sup> Future interaction between the Sub-Committee and the Working Group on matters of mutual interest is foreseen.

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<sup>59</sup> <https://www.iaea.org/events/aphs2021>

<sup>60</sup> [https://www.mdpi.com/journal/sustainability/special\\_issues/Animal\\_Genetic\\_Resources\\_sus](https://www.mdpi.com/journal/sustainability/special_issues/Animal_Genetic_Resources_sus)

<sup>61</sup> <http://www.GenResJ.org>

<sup>62</sup> [www.genresbridge.eu](http://www.genresbridge.eu)

<sup>63</sup> <http://www.fao.org/animal-genetics/resources/journal/en/>

<sup>64</sup> <http://journals.cambridge.org/action/displayJournal?jid=AGR>

<sup>65</sup> C 2021/21, paragraph 19.

<sup>66</sup> CL 165/REP, paragraph 18 a).

<sup>67</sup> C/2021/21, paragraph 19.

**Annex 1****Expert meetings contributing to the development of guidelines, manuals and projects**

Meeting	SPA	Date	Location	Countries of participating experts
CJN Regional Coordination Meeting on “Decreasing the parasite infestation rate of sheep”	1,2	March 2018	Heredia, Costa Rica	Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Paraguay, Peru, Uruguay, Venezuela
CJN Research Coordination Meeting on “Application of nuclear and genomic tools to enable for the selection of animals with enhanced productivity traits”	1,2	December 2018	Vienna, Austria	Argentina, Austria, Bangladesh, China, India, Italy, Kenya, Peru, Serbia, South Africa, Sri Lanka, Tunisia
CJN Consultancy Meeting on “Advances in nuclear and genomic tools to improve livestock productivity – Technology Gaps and new approaches for application in developing countries”	1,2	October 2019	Vienna, Austria	Austria, Brazil, Ethiopia, France, India, Italy, Kenya, Netherlands, United States of America
CJN Final Coordination Meeting of the Regional ARCAL Technical Cooperation Project on “Decreasing the Parasite Infestation Rate of Sheep”	1,2	December 2019	Buenos Aires, Argentina	Argentina, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Peru, Paraguay, Uruguay and Venezuela

**Annex 2****Global and regional workshops for National Coordinators for the Management of Animal Genetic Resources**

Title of workshop	SPA	Dates	Location	List of countries participating
Meeting of the ERFP working groups on “information and documentation” (organized by ERFP)	1,3	May 2018	Padova, Italy	Albania, Croatia, France, Greece, Germany, Italy, Latvia, Montenegro, The Netherlands, Poland, Serbia, Slovakia, Spain
24th General Assembly of the ERFP (organized by ERFP)	4	August 2018	Zagreb, Croatia	Albania, Austria, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Montenegro, Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, Serbia, Sweden, Ukraine, United Kingdom
Meeting of the ERFP working groups on “information and documentation”; “In situ conservation” and “Ex situ conservation” (organized by ERFP)	1,3	May 2019	Madrid, Spain	Albania, Bulgaria, Croatia, Czechia, France, Germany, Greece, Iceland, Italy, Latvia, Lithuania, Netherlands, Norway, Poland, Portugal, Serbia, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom
25th General Assembly of the ERFP (organized by ERFP)	4	August 2019	Ghent, Belgium	Albania, Austria, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, France, Germany, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, North Macedonia, Montenegro, Netherlands, Norway, Poland, Slovakia, Slovenia, Spain, Serbia, Sweden, Switzerland, Ukraine
Meeting of the Regional Focal Point for Latin America and the Caribbean	1,4	November 2019	Corumba, Brazil	Argentina, Chile, Dominican Republic, Nicaragua, Panama, Paraguay

Title of workshop	SPA	Dates	Location	List of countries participating
Meeting of the ERFP working groups on “information and documentation” organized by ERFP)	1,3	April 2020	Virtual	Albania, Bulgaria, Cyprus, Czechia, France, Greece, Italy, Montenegro, Netherlands, Norway, Poland, Portugal, Serbia, Slovakia, Slovenia, Sweden, Ukraine, United Kingdom
Online General Assembly of the ERFP (organized by ERFP)	4	September 2020	Virtual	Albania, Armenia, Austria, Bulgaria, Croatia, Cyprus, Czechia, France, Germany, Greece, Iceland, Ireland, Italy, Lithuania, North Macedonia, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Serbia, Sweden, Switzerland, Turkey, United Kingdom

**Annex 3****Technical training**

Training	Date	Location	List of participating countries (number of participants)
CJN national training on “Improving proficiency of semen laboratory and technicians’ skills in doing artificial insemination in cattle”	February 2018	Ouagadougou, Burkina Faso	Burkina Faso (11 participants)
IMAGE post-graduate training course on “Conservación y Gestión de Recursos Zoogenéticos”	March 2018	Balcarce, Argentina	Argentina, Colombia, Peru (22 participants)
CJN national training for “Improving technicians’ skills to improve artificial insemination services quality in Madagascar”	March 2018	Antananarivo, Madagascar	Madagascar (16 participants)
CJN national training course on “Bull semen collection and preservation in Togo”	May 2018	Agou, Togo	Togo (19 participants)
CJN regional training course on “Genetics of parasite resistance in sheep and goats: Application of genomics and DNA marker information to improve small ruminant breeding”	September to October 2018	Seibersdorf, Austria	Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Paraguay, Peru, Uruguay, Venezuela (20 participants)
IMAGE post-graduate training course on “International course in management and handling of animal genetic resources and germplasm banks”	October 2018	Bogotá, Colombia	Argentina, Colombia (40 participants)
Global DAD-IS training for National Coordinators for the Management of Animal Genetic Resources	February 2019	Rome, Italy	No participant list available
CJN-Regional Training Course on Statistical Analysis of Data Related to Gastro-Intestinal Parasite Management in Sheep and Goat (RLA5071)	May 2019	Heredia, Costa Rica	Argentina, Bolivia, Costa Rica, Cuba, Dominican Republic, Mexico, Paraguay, Peru, Uruguay and Venezuela (19 participants)

Training	Date	Location	List of participating countries (number of participants)
CJN national training course on “Strategies for data collection and animal sampling related to genetic characterization of livestock breeds”	June 2019	Kokopo, Papua New Guinea	Papua New Guinea (19 participants)
CJN regional training course on “Genetics of parasite resistance in sheep and goats: bioinformatics analysis of genomic data to assess population structure, genotype-phenotype association and genomic prediction”	July 2019	Seibersdorf, Austria	Argentina, Bolivia, Brazil, Costa Rica, Cuba, Dominican Republic, Mexico, Paraguay, Peru, Uruguay (19 participants)
CJN national training course on “Cattle artificial insemination in Zimbabwe”	July to August 2019	Bulawayo, Zimbabwe	Zimbabwe (34 participants)
CJN national training course on “Automated sequencing and genotyping for animal genetic characterization”	August 2019	Ouagadougou, Burkina Faso	Burkina Faso, Niger, Senegal and Zimbabwe (15 participants)
CJN national training course on “Artificial insemination and pregnancy diagnosis in cattle”	September to October 2019	Kokopo, Papua New Guinea	Papua New Guinea (40 participants)
IMAGE post-graduate training course on “Management of livestock and poultry genetic resources within the scope of climate change”	November 2019	Giza, Egypt	Egypt (27 participants)
CJN national training course on “Implementation of bioinformatics tools and techniques for breeding and management of Argentinian sheep”	November 2019	Buenos Aires, Argentina	Argentina (10 participants)
CJN national training course on “Cattle artificial insemination in Togo”	November 2019	Lome, Togo	Togo (40 participants)



Training	Date	Location	List of participating countries (number of participants)
IMAGE post-graduate training course on "Biobanking for sustainable management of farm animal resources: Novel approaches in genomics, reproductive technologies and economics"	January 2020	Beni Mellal, Morocco	Morocco, Nigeria, Sudan, Tunisia (20 participants)
CJN national training course on "Genetic evaluation of livestock"	March 2020	Lome, Togo	Togo (16 participants)

**Annex 4****Publications since the Tenth Session of the Working Group***FAO documents*

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