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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 3 of the Provisional Agenda

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

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DRAFT *SECOND REPORT ON THE STATE OF THE WORLD'S ANIMAL GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

Part 5

Status of preparation

All parts of *The second report on the world's animal genetic resources for food and agriculture* (Second Report) have been drafted. However, Part 4 – State of the art in the management of animal genetic resources – is at an early stage of drafting and will thus not be made available to the Working Group. While a number of sections of the Second Report have been reviewed by FAO and external experts, these sections still need to be revised based on the comments received. Review of the remaining sections remains to be arranged. The whole report needs to be further edited to ensure internal consistency and improve readability. The acknowledgements, preface, executive summary and list of abbreviations and acronyms still need to be prepared. It is foreseen that a full draft of the Second Report will be ready in March 2015.

Part 5

NEEDS AND CHALLENGES

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Part 5 NEEDS AND CHALLENGES

Introduction

This report updates the first report on *The State of the World's Animal Genetic Resources for Food and Agriculture* (first SoW-AnGR) (FAO, 2007a[1]), which for the first time enabled a broad global-scale analysis of needs and challenges in the management of animal genetic resources (AnGR). The final part of the first SoW-AnGR drew together the evidence presented in the other four parts to provide an analysis of the state of development of concepts, methods and technologies related to knowledge of animal genetic diversity, the state of capacity in AnGR management and the major challenges facing livestock development and AnGR management. It ended with a call for stakeholders to accept global responsibility for the sustainable management of AnGR. Much of the analysis presented in 2007 remains relevant in 2014.

In 2007, in response to the first SoW-AnGR, the international community adopted the Global Plan of Action for Animal Genetic Resources (FAO, 2007b[2]) as a rolling plan with an initial time horizon of ten years. The plan includes 23 strategic priorities for action grouped into four priority areas:

1. characterization and monitoring;
2. sustainable use and development;
3. conservation; and
4. policies, institutions and capacity-building.

This updated assessment of needs and challenges highlights changes since 2007 in each of the four strategic priority areas and will serve as an input to the review of the Global Plan of Action.

Since 2007, the importance of genetic resources for food and agriculture, including AnGR, has been highlighted in several major international initiatives and agreements. In 2010, the Conference of the Parties to the Convention on Biological Diversity (CBD) agreed on the Strategic Plan for Biodiversity 2011–2020, including the Aichi Biodiversity Targets.[3] The management of AnGR contributes particularly to the following targets:

> *Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.*
>
> *Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.*

In 2012, the Rio+20 International Environmental Summit of Nations agreed to set new multiyear global objectives to succeed the Millennium Development Goals (2000–2015). Biodiversity featured prominently in the outcome document (*The future we want*):

> *"111. We reaffirm the necessity to promote, enhance and support more sustainable agriculture, including crops, livestock, forestry, fisheries and aquaculture, that improves food security, eradicates hunger, and is economically viable, while conserving land, water, plant and animal genetic resources, biodiversity and ecosystems, and enhancing resilience to climate change and natural disasters. We also recognize the need to maintain natural ecological processes that support food production systems.*
>
> *112. We stress the need to enhance sustainable livestock production systems, including through improving pasture land and irrigation schemes in line*

[1] **FAO**. 2007a. *The State of the World's Animal Genetic Resources for Food and Agriculture*, edited by B. Rischkowsky & D. Pilling. Rome (available at www.fao.org/3/a-a1250e.pdf).
[2] **FAO**. 2007b. *The Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration*. Rome (available at http://www.fao.org/docrep/010/a1404e/a1404e00.htm).
[3] http://www.cbd.int/sp/default.shtml

> *with national policies, legislation, rules and regulations, enhanced sustainable water management systems, and efforts to eradicate and prevent the spread of animal diseases, recognizing that the livelihoods of farmers including pastoralists and the health of livestock are intertwined."*[4]

and subsequently in the post-2015 development agenda:

> *"Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture*
>
> *2.5 by 2020 maintain genetic diversity of seeds, cultivated plants, farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at national, regional and international levels, and ensure access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge as internationally agreed*
>
> *2.a increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development, and plant and livestock gene banks to enhance agricultural productive capacity in developing countries, in particular in least developed countries*
>
> *Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.*
>
> *15.6 ensure fair and equitable sharing of the benefits arising from the utilization of genetic resources, and promote appropriate access to genetic resources;*
>
> *15.9 by 2020, integrate ecosystems and biodiversity values into national and local planning, development processes and poverty reduction strategies, and accounts;*
>
> *15.a mobilize and significantly increase from all sources financial resources to conserve and sustainably use biodiversity and ecosystems*[5].

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, a supplementary agreement to the CBD, entered into force in October 2014. It provides a legal framework for the implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources.

In order to monitor progress in the implementation of the Global Plan of Action, the Commission on Genetic Resources for Food and Agriculture adopted indicators measuring both the state of implementation ("process indicators") and the outcome in terms of AnGR diversity ("resource indicators).[6] The process indicators were monitored in 2012[7] and 2014[8] based on country reporting and the resource indicators are calculated biennially[9] based on data entered by countries into the Domestic Animal Diversity Information System (DAD-IS[10]).

The major global challenge of the twenty-first century is to sustainably feed a growing population that is expected to reach 9 billion in 2050: the so called "2050 challenge to our global food system"[11]. Further increase in production is needed. At the same time, the ecological footprint of food production

[4] http://www.uncsd2012.org/content/documents/727The%20Future%20We%20Want%2019%20June%201230pm.pdf
[5] http://sustainabledevelopment.un.org/focussdgs.html
[6] http://www.fao.org/Ag/AGAInfo/programmes/en/genetics/Targets_and_indicators.html
[7] http://www.fao.org/docrep/meeting/027/mg044e.pdf
[8] http://www.fao.org/3/a-at136e.pdf
[9] http://www.fao.org/3/a-at135e.pdf
[10] http://fao.org/dad-is
[11] http://www.iatp.org/documents/the-2050-challenge-to-our-global-food-system

needs to be reduced and the quantity and quality of natural resources and biodiversity sustained. There is a need to reduce waste, increase efficiency in the use of water, feed and energy and reduce greenhouse gas emissions and pollution of land, air and water. Ecological and economic challenges are increasingly interconnected and global. Collaboration and cooperation across boundaries has never been more important.

SECTION A: CHALLENGES POSED BY LIVESTOCK SECTOR TRENDS

Economic, social and environmental trends in the livestock sector continue to pose many challenges to the sustainable management of AnGR. Rapid growth in demand for animal products has been a major driver of change in the livestock sector in recent decades, particularly in some developing regions, and the associated changes in livestock production systems have had a major effect on AnGR management and often posed a threat to diversity. Traditional production systems that harbour diverse genetic resources have been marginalized and a narrow range of exotic breeds have become more widely used. In some circumstances, these breeds have been indiscriminately crossed with locally adapted breeds, a development that is regarded as a major threat to AnGR diversity in many countries. Growth in global demand for animal-source foods is expected to continue over the coming decades, although at a slower pace overall. Africa and South Asia are predicted to be major centres of growth in demand. Both are resource-constrained regions where smallholder and pastoral production is still widely practised and where smallholder milk production has historically been strong. Both are also home to a wealth of locally adapted AnGR.

Economic and market-related factors are frequently highlighted by stakeholders as threats to AnGR. Shifts in market demand or increasing competition may mean that particular breeds can no longer be raised profitably. Shifts of this kind are part of social and economic change, and there are always likely to be some breeds that are at risk of falling out of use and declining towards extinction. However, there may also be measures that can be taken to reduce economic threats, either by "valorizing" individual at-risk breeds via marketing initiatives, genetic improvement or the identification of new roles, or by more general policy measures such as eliminating support measures that create favourable economic conditions for breed replacement.

Climate change is placing increasing pressure on the livestock sector, especially on production systems that depend heavily on the state of the local ecosystems. Livestock are recognized as contributors to climate change, but also as an entry point for climate change mitigation. Grazing systems in arid and semi-arid areas are likely to be particularly severely affected, but mixed farming systems will also need to adapt. These systems harbour many locally adapted livestock breeds that possess particular characteristics that enable them to thrive in harsh conditions. These breeds, and other AnGR, increase the options available for adapting production systems to the effects of climate change. However, climate change also poses threats to AnGR diversity, for example, because of the increased risk of breed loss through natural disasters. It remains difficult to predict how climate change will affect the future of livestock production and what the consequences will be for AnGR diversity. The uncertainty of climatic projections is a major constraint, but there is also frequently a lack of data on breeds' characteristics, distributions and their production environments. Information about the level of threat posed to AnGR by disasters and emergencies remains limited.

Given the major roles of small-scale livestock keepers and pastoralists in maintaining AnGR diversity, factors that undermine the sustainability of smallholder and pastoralist production systems constitute significant threats to AnGR. These threats may include both market-related factors (e.g. competition from large-scale producers or exclusion from markets because of difficulties in meeting the specific requirements of retailers and consumers) and problems related the degradation of (or lack of access to) natural resources. The importance of livestock-keeping to the livelihoods of many of the world's poorest people and the major significance of livestock-keeping areas (e.g. grasslands) in the provision of ecosystem services (carbon sequestration, water cycling, provision of wildlife habitats, etc.) implies that the sustainable development of pastoralist and smallholder production systems is a challenge that

extends beyond the immediate field of AnGR management. Balancing different objectives may not be easy. However, there may be scope for synergies in efforts to promote AnGR-management, livelihood and environmental objectives.

One trend affecting the livestock sector in many parts of the world is a movement of people out of livestock keeping and into alternative employment. In most countries, small-scale livestock keeping is unlikely to disappear in the short or medium term. However where trends of this type are strong, AnGR associated with particular traditional types of livestock keeping or particular communities may be threatened.

International gene flows have continued to expand over recent years. Exchanges are still dominated by North–North and North–South exchanges, with importers taking advantage of the genetic improvements in production achieved in the world's most advanced breeding programmes. The share of global imports accounted for by imports into Southern countries has increased in some subsectors. This represents a large increase in gene flows of high-output international transboundary breeds from the North to the South. For many developing countries, South–South gene flows are also significant. Countries are increasingly concerned about the effects of international gene flows on the diversity of their livestock populations and recognize that the establishment of exotic breeds and the production systems needed to maintain them can be problematic in terms of the additional resources and management skills required and the vulnerability of the animals to diseases, feed shortages and so on. Effective management of gene flow and effective use of imported genetics involve all the main elements of AnGR management: characterization of breeds and production environments to ensure that they are well matched; well-planned breeding strategies; monitoring of outcomes in terms of productivity and genetic diversity; measures to promote the sustainable use and conservation of breeds that may be put at risk of extinction; and adequate policies and legal frameworks.

SECTION B: CHARACTERIZATION AND MONITORING

Characterization and monitoring are the foundations of the sustainable management of AnGR. However, in most regions of the world, there are still major gaps in the coverage of characterization activities and hence major gaps in knowledge about the characteristics of AnGR. There are also major gaps in programmes for monitoring trends in breed population and hence the current risk status of many breeds is unknown. These gaps in knowledge inevitably hamper the sustainable use, development and conservation of AnGR.

In many countries the basic task of establishing a full inventory of national breeds across the full range of mammalian and avian livestock species has not been completed. For many recognized breeds, phenotypic characteristics – morphology, performance in specific production environments, degree of adaptation to specific diseases or climatic challenges, and so on – have been inadequately studied. Gaps are particularly prominent in developing countries, which means that the characteristics of the locally adapted breeds of these countries have been poorly described and that the comparative performance of different breeds in the prevailing production conditions of these countries has been inadequately assessed. Detailed description of the typical production environments has been undertaken for a limited number of breeds, precluding even the application of basic intuitive or heuristic approaches to breed comparison. Within breeds, advanced technologies such as the prediction of breeding values for individual animals and genomic selection have a huge potential – but require phenotypic data. If developing countries lack characterization and performance data, they will be unable to take advantage of new technologies of this kind.

Since the time the first SoW-AnGR was prepared, the number of national breed populations recorded in the Domestic Animal Diversity Information System (DAD-IS), has increased. However, breed-related information remains far from complete. For almost two-thirds of all reported breeds, risk status is unknown because of a lack of recent population data. Trends in the global state of AnGR diversity cannot therefore be monitored precisely. However, the available data indicate that erosion is ongoing. Missing population data remains the biggest weakness of the current monitoring system for monitoring the global state of AnGR diversity. Another concern is the non-coverage of cross-bred and

non-descript populations, which make up a large part of livestock populations worldwide. To obtain a more comprehensive picture, all livestock populations, regardless of their level of cross-breeding, need to be included in the monitoring system.

Breed effect is one of the many factors that influence the composition and quality of animal-source foods. Interest in the relationship between breed diversity and human nutrition has increased to some extent in recent years. Some comparative studies that assess the effect of breed *per se* and identify nutritional differences by controlling for other factors have been undertaken. However, high-quality studies that disentangle genetic and environmental factors particularly for locally-adapted breeds are lacking.

SECTION C: SUSTAINABLE USE AND DEVELOPMENT

While the majority of countries report that they have at least some livestock breeding progammes in place, the information provided in the country reports suggest that these programmes are often in a rudimentary state – or in some cases non-existent in the sense of organized progammes involving the establishment of breeding goals, recording of performance and subsequent selection of animals for mating and efficient distribution of improved genetic material.

Policies in place aimed at improving the state of livestock breeding are widespread, but in many countries these policies focus mainly on the introduction of exotic breeds for use in cross-breeding, sometimes paying little attention to the establishment of breeding programmes at national level. Introducing exotic AnGR can help countries to boost their output of livestock products. However, great care is needed to ensure that these resources are managed appropriately. Exotic breeds are sometimes introduced into production environments where they fail to flourish or prove to be risky investments. Moreover, indiscriminate cross-breeding – often with exotic genetic material – is one of the most widely reported threats to the survival of locally adapted genetic resources. Developing a national breeding strategy can be very challenging, particularly given that the information needed in order to assess the relative costs and benefits of different approaches is often unavailable. The existence of these knowledge gaps underlines the importance of strengthening efforts to characterize breeds and their production environments and the need to keep track of trends and drivers of change in the livestock sector.

While interest in expanding the use of exotic breeds is practically universal in developing countries, a number have also recognized the need to take greater advantage of the characteristics of their locally adapted breeds, particularly given the challenges associated with climate change and the ongoing need for livestock that are suitable for use by small-scale producers in low-input production systems. In this context, breeding programmes for locally adapted breeds offer a potential means both of supporting rural livelihoods and of helping to keep a diverse range of breeds in use and hence available as resources for the future. In many countries, however, the underlying preconditions for the establishment of breeding programmes remain weak, particularly the organizational structures needed to facilitate the involvement of livestock keepers and the relatively high levels of knowledge and technical skills needed to plan and implement programmes successfully. Experience indicates that while breeding programmes can be initiated by governments and research organizations, the involvement of breeders' associations and/or commercial companies increases the likelihood that they will be sustainable in the longer term.

One significant development in recent years has been a growing interest among developing countries in establishing animal identification programmes for health and traceability, driven by the economic incentive of potential export markets and the need to ensure equivalent levels of product safety. These systems may serve as the basis for more comprehensive programmes that include performance and pedigree recording.

Much of the potential of AnGR diversity remains untapped. For example, the inclusion of genetic elements in disease-control strategies has achieved some successes, but knowledge of the genetics of resistance and tolerance remains inadequate. The urgency of adopting more holistic alternative

strategies is increasing continually as greater numbers of microbicides are losing their efficacy. A sign of the commercial recognition of health and other functional traits is that measures of health, robustness and other non-direct performance traits have acquired an increasing share in selection indexes used in breeding programmes in developed countries.

A range of different activities can both help to increase the benefits derived from AnGR and to help maintain genetic diversity for future use. Many breeds that are not at present valued in mainstream livestock production have characteristics that make them potentially valuable in the supply of products valued by a subsection of the market (niche products) or in the provision of public goods. Niche marketing of products from locally adapted breeds is relatively widespread in Europe and contributes both to sustaining diversity and to rural livelihoods. Well-managed livestock can contribute to the provision of a number of ecosystem services, including those related to landscape management and the maintenance of wildlife habitats. Because of their ability to thrive in the relevant ecosystems, locally adapted breeds are often effective providers of services of this kind. Harnessing these roles to promote the ongoing use of locally adapted breeds is not straightforward, because the benefits provided are not valued by the market. In this context, the emergence of the concept of payments for ecosystem services approaches is an interesting development that potentially has a role in the sustainable use of AnGR.

SECTION D: CONSERVATION

Information on threats to AnGR diversity remains far from complete. The risk status of the majority of breeds is classified as “unknown” and even where population trends are monitored, detailed assessments of threats to specific breeds are not common. This clearly constrains the development of effective conservation programmes and the prioritization of breeds for conservation. Given the complexity of the drivers of change affecting the livestock sector and the potential for rapid shifts in the management of AnGR, there is a need for national early-warning and response systems that can rapidly identify threatened breeds and allow quick and well-defined action to be taken.

Conservation activities have become more widespread over the last ten years. Few countries report that they have no conservation measures of any kind in place. However, many breeds remain inadequately covered by conservation programmes. Major gaps remain both in *in situ* and in *ex situ* conservation programmes. Funding, infrastructure and capacitiy remain major obstacles to the establishment of gene banks in countries which lack such facilities. Establishment of gene banks at subregional or regional level is a potential strategy, but would require agreements on material transfer and identification of locations that are considered “safe” by all parties. *In situ* programmes can involve a diverse range of different activities, including those that aim to create demand for the products and services provided by at-risk, breeds, those that support and incentivize livestock keepers that raise at risk breeds, those related to breeding programmes, and those that involve promoting participation and empowerment at community level. Careful assessment of livestock sector trends and the characteristics of particular breeds and production systems will help countries and other stakeholders to identify the appropriate *in situ* strategies for particular circumstances.

SECTION E: POLICIES, INSTITUTIONS AND CAPACITY-BUILDING

Without effective institutions, it is difficult to strengthen AnGR management programmes. Many countries report major gaps and weakness in their institutional frameworks for AnGR management. Nonetheless, there have been several positive developments in recent years, including the more widespread establishment of specifically AnGR-focused institutional structures and policy instruments, in particular the appointment of more National Coordinators for the Management of AnGR and the development of national strategies and action plans for AnGR. The establishment of

several additional regional and subregional focal points for AnGR over recent years has strengthened cooperation and capacity to undertake AnGR management actions at supranational level.

Legal and policy frameworks relevant to AnGR management have been supplemented by a substantial number of new instruments over recent years. However, effective implementation remains a problem for many countries. In many cases, the basic prerequisites for effective implementation remain weak or absent. Physical and organizational infrastructure, stakeholder participation, and knowledge and awareness of AnGR related issues are often inadequate. Financial constraints and a lack of well-trained human resources are reported to be widespread and serious constraints in all areas of AnGR management. Communication and coordination between different stakeholders in AnGR management and in the wider agricultural, rural development and environmental sectors often needs to be improved. Smallholders and pastoralists are often neglected by the private sector, but are also poorly served by public policies and programmes and have little voice in policy development.

There is a big gap between the state of the art in the use, development and conservation of AnGR and the current level of management capacity in many countries. Better education and training of development professionals, livestock keepers and other stakeholders, in animal breeding and all aspects of AnGR management is needed. Integrating education and research across disciplines and across geographical boundaries and establishing partnerships spanning academic institutions, ministries and private industry – particularly between developed and developing countries – will help to decrease the gap.

In 2007, by adopting the Global Plan of Action and the Interlaken Declaration, governments

> *"confirmed their common and individual responsibilities for the conservation, sustainable use and development of animal genetic resources for food and agriculture; for world food security; for improving human nutritional status; and for rural development."*[12]

Governments recognized the need both for "substantial and additional financial resources" and for predictable allocation of resources. While awareness has increased, some advances are reported in all areas of AnGR management and some countries have mobilized additional resources, sufficient funding has not yet been mobilized, particularly at national level. Governments must demonstrate the sustained political will needed to ensure the successful implementation of the Global Plan of Action, including through the provision of sufficient financial resources. If this does not happen, genetic erosion is likely to continue and world's livestock biodiversity will remain underutilized and underdeveloped. Much of its potential to contribute to sustainably increasing food production will remain unrealized.

[12] **FAO**. 2007. *The Global Plan of Action for Animal Genetic Resources and the Interlaken Declaration*. Rome (available at http://www.fao.org/docrep/010/a1404e/a1404e00.htm).