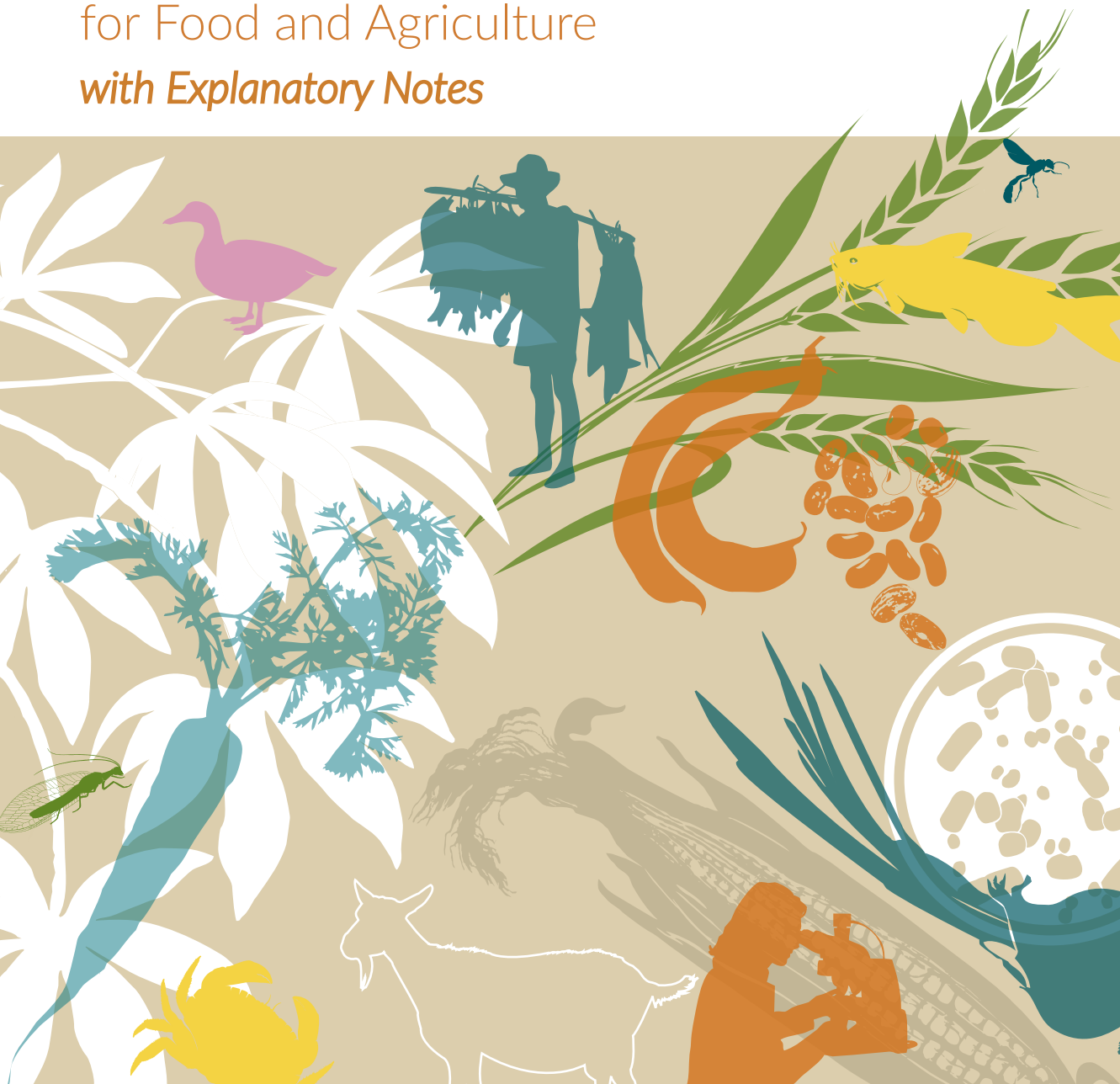
Food and Agriculture Organization of the United Nations

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

ABS Elements

Elements to Facilitate Domestic Implementation of Access and Benefit-Sharing for Different Subsectors of Genetic Resources for Food and Agriculture

with Explanatory Notes



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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
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Preface

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Nagoya Protocol) has been hailed as a giant step towards the implementation of the third objective of the Convention on Biological Diversity (CBD): the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including by appropriate access to them. Implementing this third objective is intended to contribute to the conservation of biological diversity and the sustainable use of its components, the other two objectives of the CBD.

The Nagoya Protocol confronts policy-makers and administrators responsible for its implementation at the national level with a number of challenges. One of these challenges is the Nagoya Protocol's obligation to consider, in the development and implementation of access and benefit-sharing (ABS) measures, the importance of genetic resources for food and agriculture (GRFA) and their special role for food security. The Nagoya Protocol explicitly recognizes the importance of genetic resources to food security, the special nature of agricultural biodiversity, its distinctive features and problems needing distinctive solutions, as well as the interdependence of all countries with regard to GRFA, and the importance of GRFA for sustainable development of agriculture in the context of poverty alleviation and climate change. However, the Nagoya Protocol provides little guidance as to how the special features of GRFA might adequately be reflected in domestic ABS measures.

In 2013, the Commission on Genetic Resources for Food and Agriculture (Commission) of the Food and Agriculture Organization of the United Nations (FAO) put in place a process, the outputs of which are the Elements to Facilitate Domestic Implementation of Access and Benefit-sharing for Different Subsectors of Genetic Resources for Food and Agriculture (ABS Elements). Developed by a Team of Technical and Legal Experts on Access and Benefit-sharing from all regions of the world, the ABS Elements were considered and welcomed by the Commission at its Fifteenth Regular Session (19–23 January 2015) and subsequently welcomed by the FAO Conference, the highest Governing Body of FAO. The Conference of the Parties to the CBD, at its Thirteenth Session, invited Parties and governments to take note of and apply, as appropriate, the voluntary guidelines contained in the ABS Elements.

In 2017, at its Sixteenth Regular Session, the Commission agreed to produce non-prescriptive explanatory notes describing, within the context of the ABS Elements, the distinctive features and specific practices of different subsectors of GRFA, to complement the ABS Elements. This document contains the explanatory notes, as welcomed by the Commission and the FAO Conference in 2019, in shaded boxes to complement the ABS Elements. The ABS Elements with their explanatory notes aim to assist governments considering developing, adapting or implementing ABS measures to take into account the importance of GRFA, their special role for food security and the distinctive features of the different subsectors of GRFA, while complying, as applicable, with international ABS instruments.

Abbreviations and acronyms

ABS	access and benefit-sharing
AnGR	animal genetic resources for food and agriculture
AqGR	aquatic genetic resources for food and agriculture
BC	biological control
BLUP	best linear unbiased prediction
CBA	capture-based aquaculture
CBD	Convention on Biological Diversity
CGIAR	Consultative Group on International Agricultural Research
Commission	Commission on Genetic Resources for Food and Agriculture
FAO	Food and Agriculture Organization of the United Nations
FGR	forest genetic resources
GPA AnGR	Global Plan of Action for Animal Genetic Resources
GRFA	genetic resources for food and agriculture
InGR	invertebrate genetic resources
IPLC	indigenous peoples and local communities
IPPC	International Plant Protection Convention
MAA	material acquisition agreement
MAT	mutually agreed term
MCC	microbial culture collection
MIGR	micro-organism and invertebrate genetic resources
MLS	Multilateral System of Access and Benefit-sharing
MoGR	micro-organism genetic resources
MOSAICC	Micro-Organisms Sustainable Use and Access Regulation International Code of Conduct
MTA	material transfer agreement
NGO	non-governmental organization
OECD	Organisation for Economic Co-operation and Development
PGRFA	plant genetic resources for food and agriculture
PIC	prior informed consent
SMTA	Standard Material Transfer Agreement
SNP	single nucleotide polymorphism
Treaty	International Treaty on Plant Genetic Resources for Food and Agriculture

1 BACKGROUND

Access and benefit-sharing and the Commission on Genetic Resources for Food and Agriculture

1. The Food and Agriculture Organization of the United Nations (FAO) and its Commission on Genetic Resources for Food and Agriculture (Commission) have a longstanding history of dealing with issues related to genetic resources for food and agriculture (GRFA), including access to them and the fair and equitable sharing of benefits derived from their utilization. In 1983, the FAO Conference adopted the International Undertaking on Plant Genetic Resources for Food and Agriculture, which provided a policy and planning framework for the Commission with respect to plant genetic resources for food and agriculture (PGRFA). During the following years, the Commission negotiated further resolutions that interpreted the International Undertaking, and in 1994, started revising the International Undertaking. As a result of this process, the FAO Conference in 2001 adopted the International Treaty on Plant Genetic Resources for Food and Agriculture (Treaty), the first legally binding and operational international instrument on access and benefit-sharing (ABS) for genetic resources.

Convention on Biological Diversity

2. The Convention on Biological Diversity (CBD), adopted in 1992, is the first international agreement that addresses ABS in its objectives and provisions. It recognizes the sovereign rights of states over their natural resources and affirms the authority governments have, subject to their national legislation, to determine access to genetic resources.

Nagoya Protocol

3. The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity (Nagoya Protocol) is a supplementary agreement to the CBD. It provides a legal framework for the effective implementation of the third objective of the CBD, the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources, with a view to contributing to the conservation of biological diversity and the sustainable use of its components, the other two objectives of the CBD.

International regime

4. As recognized by the Conference of the Parties of the CBD at its tenth meeting, the International Regime of ABS is constituted by the CBD and the Nagoya Protocol, as well as complementary instruments, including the Treaty and the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization.[1]

Special features of genetic resources for food and agriculture

5. The special nature of GRFA, which are included in agricultural biodiversity, their distinctive features and problems needing distinctive solutions, is widely acknowledged.[2] The Conference of the Parties to the CBD, at its fifth meeting in 2000, considered the distinctive features of agricultural biodiversity to include the following:

a. *Agricultural biodiversity is essential to satisfy basic human needs for food and livelihood security;*

b. *Agricultural biodiversity is managed by farmers; many components of agricultural biodiversity depend on this human influence; indigenous knowledge and culture are integral parts of the management of agricultural biodiversity;*

c. *There is a great interdependence between countries for the genetic resources for food and agriculture;*

d. *For crops and domestic animals, diversity within species is at least as important as diversity between species and has been greatly expanded through agriculture;*

e. *Because of the degree of human management of agricultural biodiversity, its conservation in production systems is inherently linked to sustainable use;*

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1 COP 10 Decision X/1.

2 For the rationale of ABS measures, see Chapter 5.

f. Nonetheless, much biological diversity is now conserved ex situ *in gene banks or breeders' materials;*

g. The interaction between the environment, genetic resources and management practices that occurs in situ *within agro-ecosystems often contributes to maintaining a dynamic portfolio of agricultural biodiversity.*[3]

6. The Commission considered, at its Fourteenth Regular Session, the distinctive features of GRFA, as given in the Annex to this document.[4] The list of features provides information on the characteristics of the different subsectors of GRFA.[5] It should be noted that the Commission acknowledged the need to further refine this list of distinctive features and to focus on the utilization of GRFA.

Nagoya Protocol and genetic resources for food and agriculture

7. The Nagoya Protocol, in its preamble, explicitly recognizes the importance of genetic resources to food security, the special nature of agricultural biodiversity, its distinctive features and problems needing distinctive solutions, as well as the interdependence of all countries with regard to GRFA and the special nature and importance of these resources for achieving food security worldwide and for sustainable development of agriculture in the context of poverty alleviation and climate change. In this regard, the Nagoya Protocol also acknowledges the fundamental role of the Treaty and the Commission.

8. In its operational provisions, the Nagoya Protocol requires Parties to consider, in the development and implementation of their ABS legislation or regulatory requirements, the importance of GRFA and their special role for food security.[6] Parties shall also create conditions to promote and encourage research which contributes to the conservation and sustainable use of biological diversity, particularly in developing countries, including through simplified measures on access for non-commercial research purposes, taking into account the need to address a change of intent for such research.[7]

9. The Nagoya Protocol leaves room for other international agreements in the field of ABS and it does not prevent its Parties from developing and implementing other relevant international agreements, including other specialized ABS agreements, provided that they are supportive of and do not run counter to the objectives of the

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3 COP 5 Decision V/5, *Annex*, paragraph 2.

4 This annex was amended by the Commission at its Seventeenth Regular Session to extend to all subsectors of GRFA.

5 Throughout this document, unless otherwise specified, "subsectors of GRFA" and "subsectors" are understood as to mean the subsectors of (1) plant genetic resources for food and agriculture; (2) animal genetic resources for food and agriculture; (3) forest genetic resources for food and agriculture; (4) aquatic genetic resources for food and agriculture and; (5) micro-organism genetic resources for food and agriculture; and (6) invertebrate genetic resources for food and agriculture.

6 Nagoya Protocol, Article 8(c).

7 Nagoya Protocol, Article 8(a).

CBD and the Nagoya Protocol.[8] Where a specialized international ABS instrument that is consistent with and does not run counter to the objectives of the CBD and the Nagoya Protocol applies, the Nagoya Protocol does not apply for the Party or Parties to the specialized instrument in respect of the specific genetic resource covered by and for the purpose of the specialized instrument.[9] One of the instruments explicitly acknowledged in the Preamble of the Nagoya Protocol is the Treaty, which has been developed in harmony with the CBD. Beyond this openness to other international instruments, the Nagoya Protocol also states that due regard should be paid to "useful and relevant ongoing work or practices under such international instruments and relevant international organizations, provided that they are supportive of and do not run counter to the objectives of the CBD and this Protocol."[10]

10. The Nagoya Protocol also requires Parties to encourage, as appropriate, the development, update and use of sectoral and cross-sectoral model contractual clauses for mutually agreed terms (MAT) and of voluntary codes of conduct, guidelines and best practices and/or standards in relation to ABS.[11] The Conference of the Parties to the CBD serving as meeting of the Parties to the Nagoya Protocol shall periodically take stock of the use of the model contractual clauses, codes of conduct, guidelines and best practices and/or standards.[12]

The Treaty is a "specialized international access and benefit-sharing instrument" as referred to in Article 4.4 of the Nagoya Protocol. The Treaty has established a Multilateral System of Access and Benefit-sharing (MLS) that, for 64 crops and forages, facilitates access, for the purpose of research, breeding and training for food and agriculture, to *ex situ* genetic materials that are under the management and control of Contracting Parties and in the public domain. In accordance with Article 12.3(h) access to PGRFA found in *in situ* conditions will be provided according to national legislation or, in the absence to such legislation, in accordance with such standards as may be set by the Governing Body. These 64 crops and forages are listed in Annex 1 of the Treaty and were selected according to criteria of food security and interdependence. All genetic resources included in the MLS and which are exchanged using the Standard Material Transfer Agreement (SMTA) for the purposes considered by the Treaty, including those held in the Article 15 institutions, do not fall within the application of the Nagoya Protocol. Furthermore, Contracting Parties to the Treaty can decide to exchange accessions of PGRFA of species not included in Annex I, and PGRFA found in *in situ* conditions, according to the terms and conditions of the SMTA. The Treaty has established the Benefit-sharing Fund as its mechanism for monetary benefit-sharing. The Contracting Parties recognize that facilitated access to PGRFA in the MLS constitutes itself a major benefit of the MLS.

8 Nagoya Protocol, Article 4.2.
9 Nagoya Protocol, Article 4.4.
10 Nagoya Protocol, Article 4.3.
11 Nagoya Protocol, Article 19.1; 20.1.
12 Nagoya Protocol, Article 19.2; 20.2.

Development of the elements to facilitate domestic implementation of access and benefit-sharing for different subsectors of genetic resources for food and agriculture

11. The Commission, at its Fourteenth Regular Session, considered the need for and modalities of ABS for GRFA, taking into account relevant international instruments. It put in place the process that led to the development of these Elements to Facilitate Domestic Implementation of Access and Benefit-sharing for Different Subsectors of Genetic Resources for Food and Agriculture (ABS Elements).[13]

12. The Commission established a Team of Technical and Legal Experts on Access and Benefit-sharing (ABS Expert Team) consisting of up to two representatives from each of the seven FAO regions. As requested by the Commission, the ABS Expert Team:

- Coordinated, with the assistance of the Secretariat, by electronic means as appropriate, to help prepare meetings of the Commission's intergovernmental technical working groups, and based on input from their regions prepared written materials and proposed guidance for the intergovernmental technical working groups;
- Participated in the relevant portions of the meetings of the intergovernmental technical working groups, to help inform and shape the intergovernmental technical working group discussions and output on ABS; and
- Worked after each intergovernmental technical working group meeting with the Secretariat to compile the intergovernmental technical working group outputs into the ABS Elements, and communicated the ABS Elements to their regions for information.

13. The elaboration of the ABS Elements and the work of the Commission's intergovernmental technical working groups built upon and benefited from inputs received, at the Commission's invitation, from governments and relevant stakeholders.[14] In 2015, the Commission, at its Fifteenth Regular Session, welcomed the ABS Elements and invited countries to consider and, as appropriate, make use of them and to provide feedback on their use.[15] The FAO Conference, the highest Governing Body of FAO, echoed the Commission's sentiment and welcomed, at its Thirty-Ninth Session, the ABS Elements and invited Members to consider and, as appropriate, make use of them.[16]

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13 CGRFA-14/13/Report, paragraph 40.

14 CGRFA/TTLE-ABS-1/14/Inf.2; CGRFA/TTLE-ABS-1/14/Inf.3 Rev.1.

15 CGRFA-15/15/Report, paragraph 22.

16 C 2015/REP, paragraph 52.

Introduction to the different subsectors of genetic resources for food and agriculture

Animal genetic resources[1]

The livestock industry is a well-established, fast-growing sector. Animal husbandry has been practised worldwide for more than 10 000 years, leading to the development and use of a wide range of breeds under diverse production systems. Substantial technical changes occurred in animal breeding at the end of the eighteenth century, leading to breed development, establishment of herd books and formation of breeder societies. Major developments in quantitative genetics in the mid-twentieth century supported the introduction of science-based tools to estimate breeding value, such as the selection index, and later the best linear unbiased prediction (BLUP) and animal model, which resulted in enhanced selection response and genetic progress in pure-bred populations. The rapid development of molecular genetics enabled the introduction of marker-assisted selection. DNA sequencing helped to determine the genetic backgrounds of many production traits and other important traits in livestock species. Single nucleotide polymorphism (SNP) discovery and analysis led to the introduction of genomic selection. In the commercial production of meat and eggs, science-based cross-breeding methods and selection towards enhanced heterosis were introduced to enhance the yield and profitability of livestock production. Dissemination of genetic progress accelerated with the introduction of biotechnology and reproduction technologies, in particular artificial insemination.

In general, two major processes led to breed development. The first relied on adaptation of livestock populations to specific environmental and husbandry conditions within extensive and mixed production systems. This resulted in the formation of many local breeds worldwide. The second major process was based on the selection of animals for their ability to yield specific products, especially under improved nutrition and management conditions. This led to the development of highly performing, international breeds for commercial production.

Animal genetic resources for food and agriculture (AnGR) are used by a wide range of stakeholders and the level of concentration and specialization of breeding activities is quite variable within the sector both at species and regional levels. Traditionally, the management of AnGR and breeding lies in the hands of livestock keepers who combine breeding and production functions within the same populations. This can be done at a fairly local scale, selecting the animals to form the next generation from locally available herds and flocks,

[1] This section draws on Background Study Paper Nos. 43 & 59.

or at a regional or national scale by forming a common breeding population through breeding associations or herd book societies. In recent decades, a highly specialized breeding sector has developed for some livestock species and in some regions of the world. In the poultry sector in particular, relatively high reproduction rates and other biological features have enabled a large-scale breeding industry to enhance genetic improvement and the supply of birds of high genetic potential to producers. Similar structures are present in the pig sector, although to a lesser extent, and also emerging in the dairy sector.

Only about 40 species are used in livestock production, with some of them making a rather small contribution to total food production. The "big five" species – cattle, pig, sheep, goat and chicken – provide the majority of animal-origin food products. The role of wild relatives of domesticated species in livestock breeding is currently negligible.

Since the 1980s, the livestock sector has been under severe pressure to enhance total contributions to food production. The driving force of this phenomenon, termed the Livestock Revolution,[2] was the growing demand for animal-origin products and the increase of intensive commercial production in developing countries. Between 1980 and 2014, global meat and milk production increased by 234 percent and 170 percent, respectively. The Livestock Revolution resulted in a significant shift of livestock production from temperate zones to the tropics and subtropics. The production increase was fostered by importation of highly selected genetics, while in many cases native breeds were not improved through national breeding programmes.

FAO estimates[3] show that in order to feed 9.1 billion people in 2050, annual cereal production will need to rise to about 3 billion tonnes and annual meat production will need to reach 470 million tonnes if the current trends in consumption continue.

While animals are mainly used for food production and other provisioning services (e.g. fibres, pelts and traction), it is important to underline the fact that they also provide regulatory and supporting ecosystem services (e.g. nutrient recycling and weed control) in a diverse range of agroecosystems. They also have important cultural values (e.g. identity, wealth and status, recreation and sports), which tend to be especially important in extensive and mixed production systems.

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[2] See Delgado, C.H., Rosegrant, M., Steinfeld, H., Ehui, S. & Courbois, C. 1999. *Livestock to 2020. The next food revolution*. IFPRI Food, Agriculture, and the Environment Discussion Paper 28. Washington, DC, International Food Policy Research Institute.

[3] FAO. 2009. *How to feed the world in 2050*. (avaliable at http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf).

Aquatic genetic resources[1]

Aquaculture is a relatively new industry, with major developments having occurred in the last 60 years, although there are some forms such as carp farming that can be traced back thousands of years. The growth rate of aquaculture has been 8–10 percent per annum for the last 20 years, and today 50 percent of finfish consumed are farmed. Farmed fish production now exceeds beef production worldwide. While aquaculture in marine and coastal areas is gaining importance, the overwhelming majority of global aquaculture production is still from inland areas.

Two parallel approaches are taken to satisfy consumer demand and increase food supply: domestication of new species and effective genetic management and genetic improvement of species that are already produced commercially. The number of species items registered with production data by FAO grew from 70 in 1950 to almost 600 in 2018. Some of the most commonly farmed species are salmonids, tilapias, carps, oysters and shrimp, representing three major taxonomic groups: finfish, bivalve shellfish and decapod crustaceans.

Genetic improvement of domesticated fish is still nascent, but the rapid development of the industry is increasingly dependent on the use and exchange of aquatic genetic resources for food and agriculture (AqGR). Different kinds of genetic technologies are used to improve production, including captive breeding, selective breeding, hybridization and chromosome set manipulation. Genetic modification has been used only to a very limited extent. Since aquaculture and genetic improvement of AqGR is such a new undertaking, many farmed species are genetically very close to their wild relatives. Thus, the wild type, i.e. the non-domesticated and non-genetically improved type, continues to play an important role in aquaculture production and breeding. In some cases, these stocks may be in a poor conservation status. The reliance on the wild type in aquaculture thereby provides an incentive to conserve these species and their habitats.

An exception to the continued need for wild species for aquaculture production is the production of some of the species most commonly farmed in industrialized agriculture, such as Atlantic salmon and white-leg shrimp. For these, the need for genetic infusion from the wild has been nearly eliminated, and genetic improvements take place through breeding programmes and exchanges between commercial breeders.

The main source of genetically improved AqGR for aquaculture of these species is large commercial farms or breeding centres. In aquaculture, small farmers have not had the opportunity to domesticate and genetically improve species for

[1] This section draws on Background Study Papers Nos. 45 & 59.

of salmon and shrimp, have relied on funding, technology and access to improved AqGR, and are often in the hands of larger businesses. Genebanks for AqGR are still scarce, and publicly financed genebanks are generally available only for a few of the most commonly used species in aquaculture.

Aquaculture has a high number of stakeholders along the supply chain from genetic improvement to farming and the sale of products, ranging from smallholder producers to large-scale companies. While AqGR are primarily used for food production, they are also used for other purposes, for example in the production of fish and other animals to be released into natural or modified waters for restocking and stock enhancement, as bait fish for both commercial and recreational fisheries and in the farming of ornamental fish.

Forest genetic resources[1]

The exploration, assessment and movement of forest reproductive material have a long history in the forest sector. Early provenance trials revealed the existence of "geographical races" within tree species and also that the initial origin of the seed has a major influence on the survival and performance of tree planting efforts. Numerous international provenance trials have been established for many tree species to test the performance of tree germplasm from different countries/regions. Subsequently, the results of these provenance trials have had a large influence on the demand for seed from certain sources as compared to others and were a reason for many germplasm transfers between countries and regions. Provenance trials have also provided incentives for the conservation of forest genetic resources (FGR). Provenance testing is not complete in all species and all countries.

One of the main uses of FGR is direct use as reproductive material (in the form of seeds, cuttings and other propagating parts of a tree) for reforestation, afforestation or establishment of agroforestry systems. The extent to which FGR are used in systematic exploration and breeding programmes varies greatly among different tree species. Systematic exploration and improvement started some 50 years ago for several fast-growing tree species used in plantation forestry (e.g. pines, acacias, eucalypts) in industrial and smallholder plantings. For various temperate and boreal tree species, exploration and assessment efforts started more than 200 years ago, although more systematic improvement programmes were initiated in the course of the twentieth century. More recently, tree breeding has begun to encompass a range of biotechnological techniques, including marker-assisted breeding.

[1] This section draws on Background Study Papers Nos. 44 & 59.

For the majority of other tree species, improvement efforts still remain limited and are mostly restricted to provenance trials and the selection of seed stands. In general, forest-tree breeding is limited by long generation intervals and breeding cycles, such that most species are still within the first generations of genetic improvement. However, genetic gains per generation can be quite substantial due to the fact that forest tree species are undomesticated and have high levels of genetic diversity that provide the opportunity for high selection intensity. Some species, such as tropical eucalypts, acacias and some pines, are progressing relatively rapidly because of shorter generation intervals (typically less than ten years) and early-selection techniques. The genepools of tree species in breeding programmes can have large effective population sizes and often have highly fragmented populations. According to the level of improvement involved, reproductive material of forest tree species may be obtained from a wide variety of sources. For example, the collection of seeds from wild stands and natural populations for mass propagation of plantations or forest regeneration is still common. Additionally, seed orchards, special facilities associated with organized breeding programmes, are managed specifically for seed production. The genetic material produced in these orchards has usually been tested and selected in trials across different sites and climatic conditions, and may be optimized for specific commercial traits, such as wood volume, pulp yield, biomass yield or leaf oils. Large-scale nurseries producing tree seedlings and/or cuttings are often managed by large companies or state agencies, but small-scale nurseries operated by farmers and local communities are often the main source of tree seedlings in rural areas, especially in areas where no commercial forestry is practised.

Some *ex situ* collections of FGR have been established for conservation and research purposes and are usually managed by public or semi-public research institutions. While the movement of FGR around the world has a long history and the proportion of exotic forest reproductive material used for plantation and afforestation is quite high, considerable differences exist between species with regard to their involvement in international exchange of germplasm and the extent to which they have spread outside their natural distribution ranges. For example, several fast-growing plantation species, such as acacias, pines and eucalypts, have been moved extensively throughout the world and are now cultivated far beyond their natural distribution ranges. Also, some tropical high-value specialty timber species, such as mahogany, Spanish cedar and teak, are grown as exotics in many countries.

Although the exchange of some species, such as agroforestry tree species, may have taken place on a smaller scale, their distribution to countries beyond their native ranges has played an important role in the development

of the sector. However, for many species, exchange of genetic material has been limited to date and takes place mainly at a regional level or between countries sharing the same climatic conditions. Various species are also used largely within their natural native forests and are only exchanged very occasionally, for example for specific research purposes.

In all these cases, it should be noted that the capture of any economic value takes time. Unlike most agronomic crops, trees must be grown for many years before they can be harvested for food or fibre. Often the economic benefits arising from the transfer of genetic material are hard to determine as they have to do with forest health and other ecosystem goods and services.

Aspects of FGR to consider when dealing with access and benefit-sharing: [2]

- FGR are often undomesticated species and populations.
- Forest species migrate on their own (albeit slowly) and do not recognize borders.
- There is a long history of moving species around the world. Many plantation programmes depend on exotic species (e.g. *Pinus*, *Eucalyptus*, *Gmelina*).
- Many of the benefits derived from forests are "ecosystem services" and are difficult to value. Unlike production crops, it is difficult to put a monetary value on what may come from a breeding or restoration programme.
- The benefits derived from tree breeding take decades to realize. Breeding intervals range from 10 to 15 years, plantation ages can range from 8 to 40 years. A temperate forest tree breeding programme would need close to 35 years to see any real economic value from a material transfer (maybe less if the seed could be sold for increased value, but the economic benefit is not well documented).
- Unlike agricultural crops, a forest does not generally produce a new crop every year; however, there is a growing number of high value non-timber forest products (including fruit, seed and leaf material) that can contribute to food security.
- Disease resistance is a key trait for which exotic germplasm is often needed. Aspects to consider include:
  - sometimes the benefits are simply the establishment of a healthy forest, with no plans for harvest in some cases;
  - often the disease for which resistance is sought through breeding programmes originates from the same region as the germplasm (i.e. the problem originated from the source of the resistance).

[2] CGRFA/WG-FGR-3/14/Report, Appendix D.

Plant genetic resources[1]

PGRFA have been used and exchanged since the beginnings of agriculture, some 10 000 years ago. Farmers and farming communities have planted, selected and exchanged seeds and vegetative propagating material, and a combination of natural and artificial selection has domesticated plant species and adapted them to the changing needs of farming and consumption. Migration, trade and colonization spread many species beyond their regions of origin, which spurred further selective pressures. Since the mid-nineteenth century, professional seed suppliers, followed by specialized plant breeders and biotechnologists, have developed advanced methods for selecting PGRFA at the phenotypic, genotypic and molecular levels to further shape crops and contribute to advanced agricultural systems and the production and supply of agricultural products and cultivars with distinctive characteristics.

PGRFA are maintained *in situ*, on-farm and *ex situ*. A considerable amount of crop genetic diversity is held in farmers' fields and in the breeding pools of specialized plant breeders. Many wild relatives of today's crops are conserved in protected areas or within agricultural ecosystems. In addition, much of the diversity originally found *in situ* has been collected and stored in *ex situ* facilities. The establishment of these collections was initiated at the end of the nineteenth century by plant breeders and associated research concerned about the loss of genetic diversity. They are mainly held by public genebanks at national level and by international research centres, with some of the most relevant collections being managed by the centres of the Consultative Group on International Agricultural Research (CGIAR). Overall, it is estimated that approximately 7 million accessions of PGRFA are stored *ex situ*, and these collections play an important role in the functioning of the sector. Apart from the public genebanks, PGRFA are also held *ex situ* in the breeding collections of a variety of entities including private individuals, universities and private companies. However, the extent of these private collections is mostly unknown and the stored genetic material may not be publicly available.

The sector using PGRFA for breeding purposes is quite diverse and its organization is highly dependent on the crops bred and on the geographic area and type of user group targeted. Large private corporations increasingly dominate the commercial seed market for some of the major and high-value crops, such as maize and major vegetables. Medium- and smaller-sized breeding companies continue to operate, including in smaller seed markets for commercially less attractive crops, such as some self-pollinating crops, for example wheat and oats. Public-sector institutions at national and international levels continue to play a major and important role in breeding and variety development, both for crops not

[1] This section draws on Background Study Paper No. 59.

served sufficiently by the private sector, such as cassava, rice, sorghum, chickpea, groundnut, wheat and barley, and for crops grown in marginal environments or by resource-poor farmers who are not likely to be reached by the commercial sector, such as yams, sweet potato, edible aroid, pigeon pea, cowpeas, pearl millet and finger millet. At the level of research for breeding, including rather fundamental research as well as pre-breeding, both large and small biotechnology companies, sometimes integrated with plant breeding and seed production, and universities are the main players. Other users of PGRFA for breeding include farmer groups and civil society organizations supporting them. They may contribute to the reintroduction of PGRFA from genebanks into farming systems, sometimes combined with participatory plant breeding or participatory variety selection activities involving both farmers and trained breeders.

Different types of PGRFA may be used in plant breeding and cultivar development. The development of new cultivars is usually based upon the use of advanced genetic material, as it is a costly and time-consuming process to bring less-advanced material to the same performance levels. However, old cultivars, landraces and crop wild relatives may be used to introduce particular traits into breeding populations. The genetic diversity contained in landraces and traditional cultivars may also be used for base-broadening activities and for the development of cultivars adapted to less-favourable environmental conditions and low-input production systems.

Historically, crops and PGRFA have been widely exchanged throughout the world, and many people in many different places have contributed in one way or another to the development of today's crop genetic diversity. As a consequence, an important part of current crop production relies on the use of introduced genetic resources and all countries depend to some extent on genetic diversity that originated elsewhere.

The current international flow of PGRFA takes place in many different forms, for example, through the exchange of germplasm samples from *ex situ* collections, through the sale of commercial seed and vegetative propagating material, and through transfers within companies or as part of international breeding nurseries with material under development. The international exchange of genebank accessions amounts to several tens of thousands of transfers annually and plays an important role in conservation, research and development, both in developing and developed countries. At the same time, it has to be noted that the majority of genetic material used directly in breeding and variety development comes from the breeding pools within one region and new "exotic" material is only occasionally accessed.

The modalities for the exchange of PGRFA depend on the crop in question and on the type of exchange partners. Generally speaking, the trend is

towards more-formalized exchange practices, mainly through material transfer agreements (MTAs). Transfers of germplasm samples from genebanks are, for instance, increasingly regulated by MTAs. Contracting Parties to the Treaty have agreed to use a standard contract, the SMTA, for each transfer of material falling under the coverage of the MLS under the Treaty.

The MLS includes "all PGRFA listed in Annex I [of the Treaty (64 crops and forages)] that are under the management and control of the Contracting Parties and in the public domain" (Article 11.2). It includes such PGRFA voluntarily included by natural and legal persons. All PGRFA under the MLS are made available with the SMTA. PGRFA held by the International Agricultural Research Centres of the CGIAR and other international organizations under Article 15 are made available under the terms and conditions of the MLS. Many genebanks voluntarily provide access to their collections using the same terms and conditions regardless of whether their accessions are listed in Annex I of the Treaty or not. Exchange among commercial breeders is free (in the case of the use of commercial cultivars for further breeding) or regulated by commercial material transfer agreements. Exchange among farmers is limited by distance and social factors, but is generally free.

Micro-organism and invertebrate genetic resources[1]

Micro-organism and invertebrate genetic resources (MIGR) have been used as food and as tools in agricultural production for millennia.

Micro-organism genetic resources[2]

The number of micro-organism genetic resources (MoGR) currently used for food or agricultural applications is small relative to the huge number of species potentially useful, in part because of technical limitations to the culturing of many living micro-organisms. Agricultural applications of MoGR are nevertheless quite diverse: soil fertility improvement and plant growth promoting agents; biological control; beneficial symbiosis in the digestive tracts of livestock; production of chemicals of direct benefit to agriculture; catalysts in agro-industrial processes; and understanding and surveillance of microbial, plant and animal (including fish) pathogens. Food applications are also quite varied: traditional or industrial ermentation; dairy production; probiotics; feed additives; production of chemicals of benefit to food production, including vitamins and organic acids;

[1] This section draws on Background Study Paper Nos. 46, 47 & 59.
[2] This section draws on Background Study Paper No. 59, pp. 9–10.

environmental damage remediation and purification of soils and water; and understanding and surveillance of health-hazardous micro-organisms, such as food toxins and food-borne pathogens.

Use of MoGR is mainly carried out by screening large quantities of naturally occurring micro-organisms or microbial resources conserved in purified form in *ex situ* collections. Synthetic biology may involve genetic improvement, but this remains a marginal phenomenon although it may grow in the future.

Microbial culture collections (MCCs) are at the heart of the sector. All known culture collections with major holdings in food and agriculture belong to the public sector or are non-profit organizations with major governmental funding. They fulfil several objectives: procurement of cultures and *ex situ* conservation of micro-organisms; provision of authentic microbial cultures to industries and academic and research institutes; provision of identification, freeze-drying and other microbiology-related services; depository of cultures deposited for patent purposes; and research on microbial diversity, taxonomy and related areas. Many large MCCs are situated in OECD countries. Many countries are actively involved in collecting and exchanging micro-organisms internationally, and microbial collections from non-OECD countries represent an important and growing subset in the overall network of culture collections. MoGR currently used in agriculture and food systems have been collected both from tropical and subtropical species-rich agro-ecosystems and from non-tropical areas.[3]

Because each MCC contains an important set of unique strains (an average of 40 percent of the strains in each collection are unique), collaboration and exchange among MCCs is common.[4] These exchanges, as well as flows from *in situ* to *ex situ*, occur in all geographical directions. Whereas historically these exchanges were quite informal, there has been a noticeable evolution towards formalization in recent decades.[5] In particular, MCCs are moving increasingly towards the use of legal instruments: acquisition agreements when acquiring materials and MTAs when distributing them. Some important limitations, especially on further distribution to third parties, generally apply even for non-commercial research purposes, mainly for quality-management purposes and to address biosecurity issues. When commercial development is involved, additional agreements with the MCC, the initial depositor and/or the country of origin may be required, with the general understanding that recipients of materials have the responsibility to take all steps necessary for compliance with ABS measures as they may apply to the material, including with regard to prior informed consent from the country of origin. Exchange between qualified MCCs may involve

[3] Background Study Paper No. 46, chapter II.

[4] Background Study Paper No. 46, chapter II.

[5] Background Study Paper No. 46, chapter II.

simplified procedures. Both OECD and non-OECD collections include clauses related to legitimate/legal exchange in their MTAs, which allow public culture collections that comply with strict quality-management criteria to further distribute microbial research material that they have received from other public MCCs (so-called legitimate exchange). The European Biological Resource Centres Network and the Asian Consortium of Microbiological Resources are making efforts to make the cultures available within the networks with few restrictions. However, in response to growing commercial opportunities and to financial restrictions on government spending on culture collections in some countries in the 1990s, this club model is threatened. Some MCCs have departed from the sharing and collaborating practices and have introduced restrictive MTAs even for exchange between MCCs.[6]

The culture collection community has developed a distinct body of codes of conduct, standards for best practices and model documents addressing specific aspects of access and benefit-sharing.[7]

Invertebrate genetic resources used for biological control[8]
Invertebrates play a key role in agricultural systems. They participate in essential soil processes, provide biological control (BC) of crop pests, are used for silk, food or feed production or provide pollination from which many of the world's most important crops benefit in terms of yield and/or quality.[9]

These Explanatory Notes consider under the term invertebrate genetic resources (InGR) primarily invertebrate BC agents. Invertebrate pollinators are covered by the notes relating to AnGR. Aquatic invertebrates used for food are covered by the notes relating to AqGR. InGR used for other purposes of relevance in agriculture could be addressed in future work.

The BC of pests plays an important role in integrated pest management approaches in the food and agriculture sector. It is based on the use of natural enemies of pests, often referred to as BC agents. These are predators, parasitoids of invertebrate pests, entomopathogenic nematodes, and herbivores that attack weeds.

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[6] Background Study Paper No. 46, chapter II.

[7] For an overview: McCluskey, K. *et al.* 2017. *The U.S. Culture Collection Network responding to the requirements of the Nagoya Protocol on Access and Benefit Sharing.* mBio 8, Table 1. DOI: 10.1128/mBio.00982-17.

[8] This chapter draws on Background Study Paper. No. 59, pp. 9–12.

[9] Cock, M.J.W. *et al.* 2012. The positive contribution of invertebrates to sustainable agriculture and food security. *CAB Reviews*, 7(043): 1–27. DOI: 10.1079/PAVSNNR20127043.

There are two main categories of BC. Classical BC is the introduction of one or more BC agents, usually from a pest's area of origin, to control the pest in an area it has invaded. Once introduced, the BC agent becomes established, reproduces and spreads. The BC agent then continues to have its effect on the target pest without the need for any further interventions. Augmentative BC involves the production and release of BC agents – indigenous or exotic – into specific crop situations, where they control the target pest, but are not expected to persist from one cropping cycle to the next.[10]

The research and development process leading to the use of a new BC agent involves various steps that require access to genetic resources. The largest number of exchanges of genetic material takes place in the early stages of research and development, when it is necessary to study the target pest and its natural enemies. Preliminary surveys of the target pest and its natural enemies will often need to be carried out in several countries, and specimens of pests and natural enemies normally need to be exported for identification and taxonomic studies. Detailed studies on natural enemies to assess their potential as BC agents can, in part, be carried out in the source country, while host-specificity studies involving plants or animals not naturally occurring in the source country are best carried out in quarantine in the target country or in a third country. Overall, only a small fraction of all the species found and studied will actually be recommended for use and released as BC agents. Once a specific BC agent has been identified and is being applied for BC purposes, there is little need for further exchange of genetic material.[11]

The type of genetic material used in BC consists primarily of living organisms used as BC agents. Organisms are mostly collected *in situ* and exported as live specimens. Product development does not normally include genetic improvement of the BC agent as such. Usually, at most, it entails discrimination between populations in terms of biological characteristics that affect their adaptation to the target country or target pest. As a consequence most of the genetic diversity used in BC can be regarded as wild.

A particular feature of classical BC is the public good nature of its activities. As classical BC agents establish and reproduce themselves in the target environment and from that point on are freely available, it is not possible to make continuous profit from their production and release. Consequently, classical BC is run by the public sector, mainly through national and international research institutions paid by governments or development agencies. Augmentative BC, in turn, is a relatively recently developed activity. The history of commercial mass production and sale of natural enemies spans less than 50 years. It is carried out

[10] Background Study Paper No. 47.
[11] Background Study Paper No. 47.

by a relatively small number of companies worldwide, of which most are located in developed countries and the majority are medium- or small-sized. Even though augmentative BC agents are mainly produced for high-value crops such as greenhouse vegetables and ornamentals, the average profit margin is usually quite low. While the development of rearing, distribution and release methods is mainly carried out by commercial producers, public research institutions and universities sometimes play an important role in the early stages of research and development.

The international exchange of genetic resources relevant for BC plays a critical role in the functioning of the sector. The introduction of BC agents especially in classical BC, is often linked to the use of exotic genetic material, as it follows the movement of target crops and pests around the world. In fact, the great majority of classical BC transfers are intercontinental, which is to be expected as the target pests are themselves introduced species, often of intercontinental origin. Once a BC agent has been used successfully in one country, the opportunity is often taken to repeat the success in other countries through redistribution of the agent. Consequently, the international flow of genetic resources related to BC has been quite significant, involving several thousand BC-agent species from more than a hundred countries, and introductions into an even higher number of countries.[12]

As the BC sector is composed of a small number of actors, exchanges of genetic material have essentially been regulated through informal means, mainly by professional networks, which may be institutionalized or simply operate at a personal level. However, the informal character of exchange practices does not necessarily mean that no terms and conditions apply. Established "customary" practices for use and exchange may, for example, foresee the sharing of results obtained from the use of the material or, in the case of research, the joint publication of results. In addition, in the augmentative BC sector, exchange practices are also regulated through classical commercial practices such as licensing production (i.e. larger augmentative BC companies license production to smaller companies as a way of facilitating the establishment of new companies in new countries to supply new markets).[13]

[12] Background Study Paper No. 47.
[13] Background Study Paper No. 47.

2

OBJECTIVE OF THIS DOCUMENT

14. The overall objective of this document is to assist governments considering developing, adapting or implementing legislative, administrative or policy measures for ABS to take into account the importance of GRFA, their special role for food security and the distinctive features of the different subsectors of GRFA, while complying, as applicable, with international ABS instruments.

3

CONSIDERATIONS FOR DEVELOPING, ADAPTING OR IMPLEMENTING ACCESS AND BENEFIT-SHARING MEASURES FOR GENETIC RESOURCES FOR FOOD AND AGRICULTURE

15. In developing, adapting or implementing ABS measures addressing GRFA, governments may wish to consider taking the following steps:

I. Assessment of the concerned subsectors of genetic resources for food and agriculture, including their activities, socio-economic environments and use and exchange practices

a) Distinctive features of genetic resources for food and agriculture

As a first step, governments may wish to analyse the distinctive features of the subsectors of GRFA as they present themselves in their countries. Attempts to identify the distinctive features of agricultural biodiversity were made by the fifth meeting of the Conference of the Parties of the CBD[17] and by the Commission at its Fourteenth Regular Session.[18] Both bodies stressed: the essential role of GRFA for food security; the dependence of many GRFA on human intervention or influence; the high degree of interdependence between countries for GRFA; the fact that many

[17] COP 5 Decision V/5, *Annex*, paragraph 2.
[18] CGRFA-14/13/Report, *Appendix E*.

GRFA have been shaped, developed, diversified and conserved through human activities and practices over generations; the relevance of *ex situ* conservation, to varying degrees depending on the subsector of the GRFA; the relevance of *in situ* conservation to the conservation of all GRFA to maintain a dynamic portfolio of agricultural biodiversity.

b) Different forms of utilization of subsectors and variations within subsectors of genetic resources for food and agriculture

Governments may also wish to take into account the different forms and existing practices in which the different subsectors of GRFA make use of GRFA.

Tree breeding is sometimes carried out by cooperatives that pool the resources of collaborators through joint breeding programmes. Governments may wish to reflect this common *modus operandi* of modern tree breeding in their ABS measures with a view to encouraging and supporting through them the pooling of FGR and facilitating the sharing of benefits arising from their utilization, including through cooperation agreements that go beyond ABS.

c) Legal, policy and administrative measures, including existing practices

Some subsectors of GRFA have developed specific practices for the use and exchange of genetic resources for research and development purposes; others, such as PGRFA falling under the Treaty's Multilateral System of Access and Benefit-sharing (MLS), are covered by specific administrative or sometimes even legal measures.

The Treaty covers all PGRFA. Its MLS also covers a few tree crops (apple [*Malus*]; breadfruit [*Artocarpus*]; citrus [incl. *Poncirus* and *Fortunella* as root stock]; coconut [*Cocos*]) and some forages that are woody plant species. Under the Treaty, access to these genetic resources shall be provided pursuant to a SMTA for the purpose of utilization and conservation for research, breeding and training for food and agriculture, provided that such purpose does not include chemical, pharmaceutical and/or other non-food/feed industrial uses.[1]

[1] Treaty, Article 12.3(a).

Analysing existing commercial and research practices, as well as regulatory measures addressing the use and exchange of GRFA for research and development, will assist governments in the preparation of ABS measures that make use of and are in line with existing practices and thus avoid, to the extent possible and

appropriate, the creation of additional administrative procedures. Governments may also wish to take into account the national legal framework of relevance to the implementation of ABS provisions, including property law, contract law and other laws, as applicable.

d) Possible implications of the scope, including subject-matter and temporal scope, of ABS measures

Governments may wish to analyse in some detail the implications of the scope, including the subject-matter and the temporal scope, of their ABS measures. With regard to the temporal scope of ABS measures, governments may wish to consider, in particular, the implications of applying ABS measures to materials originating from other countries that have been collected prior to the entry into force of their ABS measures.

e) Flows of germplasm, including international flows, within the different subsectors

The extent of the historical and current exchange of germplasm and the proportion of exotic diversity used vary between the subsectors of GRFA. While AnGR and PGRFA have extensively been exchanged, in other subsectors this may not be the case. While some of the most relevant species have been moved extensively throughout the world, others are just starting to be farmed in aquaculture or are only used within their natural habitats in native forests for the time being, and their exchange has been limited so far. In developing, adapting or implementing ABS measures, governments may wish to consider carefully the relevance of germplasm flows for the subsectors relevant to food and agriculture in their countries and possible future changes of germplasm flows due to climate change.

AnGR are widely exchanged throughout the world with well-established protocols and markets for exchange. Livestock keepers and breeders in many parts of the world have contributed to the development of these breeds, and today livestock production in most regions depends on AnGR that originated or were developed elsewhere. Currently, major flows of germplasm in the commercially most relevant species take place between developed countries or from developed to developing countries. Genetic material of some breeds adapted to tropical and subtropical environmental conditions is exchanged from developed to developing and among developing countries. In contrast to the commercially relevant breeds that are widely exchanged, most breeds are used locally and are not involved in international exchange. This may change, as traits needed to respond to future challenges of livestock production may be found in locally adapted breeds. This may not only increase the exchange of AnGR overall but could possibly in the future also lead to some flow of germplasm from developing to developed countries.

The need to adapt livestock production to future challenges also highlights the importance of effectively conserving the full range of existing diversity, *in situ* and/or *ex situ*. Genetic diversity can be lost both at the level of breeds, when local breeds fall out of use and hence risk extinction, and at the within-breed level, when the effective population size of widely used breeds becomes too small because of the extensive use of a limited number of sires or parent animals.

Aquaculture is an important and expanding industry in both developing and developed countries. The flows of germplasm go in all directions: South–North, North–South, South–South and North–North.

Chile, for example, is the second largest producer of farmed salmon although salmon does not occur naturally in the southern hemisphere. African tilapia is mainly produced in Asia, and the Pacific oyster, which is the basis for the oyster industry both in North America and Europe, was introduced from Japan. Due to the growing number of species being domesticated, international exchanges of AqGR are expected to increase in numbers and quantity.

Global transfers of forest genetic resources have been a common practice for centuries.[1] They have been used to grow trees for various purposes, including the production of wood and non-wood products, the restoration of forests or watershed management.

Acacia seeds from Asia and Oceania were exported to southern Africa. *Eucalyptus camaldulensis* and *Eucalyptus globulus* were introduced from Australia to 91 and 37 other countries, respectively.[2] *Theobroma cacao* was introduced from the neotropics to tropical regions of Africa and Asia beginning in the sixteenth century. In several countries, provenance trials of many tree species were established during the last century with seeds originating from other countries. Although in more recent times the documentation of germplasm transfer of agroforestry trees has improved, much information, especially on the origin of provenances, is still unknown.

[1] Background Study Paper No. 44.
[2] CAB International. 2014. *Forestry Compendium*. Wallingford, UK.

Today, the agriculture of virtually all countries is heavily dependent on supply of PGRFA from other parts of the world. Crops such as cassava, maize, groundnut and beans, which originated in Latin America but have become staple food crops in many countries in Africa south of the Sahara, demonstrate the interdependence of crop species between developing countries; the same applies for vegetables, for example tomatoes. Even though many countries hold a significant amount of plant genetic diversity for food and agriculture in their genebanks and farmers' fields, in the long term, they are likely to require access to additional diversity from the crop species' centres of diversity or cultivars bred elsewhere. There is a continued need for exchange of PGRFA therefore.

Micro-organism genetic resources

Most micro-organisms can easily be spread by host organisms, by wind or water, or attached to any organic material. However, the "ubiquity" of micro-organisms does not mean that every strain can be found everywhere. There is growing recognition that micro-organism can exhibit biogeographical patterns in spite of their widespread availability. This means that certain micro-organisms are only available in specific habitats and cannot be found elsewhere.[1]

Besides this interdependence in access to *in situ* MoGR, there is interdependence with regard to material stored *ex situ* in MCCs. The largest MCC, with approximately 25 000 strains, holds less than 2 percent of the total number of strain holdings in the collections united under the World Federation of Culture Collections (WFCC) and only an estimated 1.5 percent of the total biodiversity of unique strain holdings in the WFCC. Many collections have specialized in various areas of microbial research and it is this specialization and the resulting creation of internationally recognized reference culture collections used and referred to in most follow-up research that has led to close international collaboration and exchange of materials and, thus, to a situation that has been considered "functional interdependency in access to *ex situ* strains on a global scale."[2]

Invertebrate genetic resources for biological control

Similarly, throughout the history of BC, BC agents that proved effective in one country have been forwarded to other countries affected by the same pest problem. The international exchange of genetic resources relevant for BC thus plays a critical role in the functioning of the BC sector. The great majority of classical BC transfers are intercontinental, which is to be expected as the target

[1] Background Study Paper No. 46, p. 31.
[2] Background Study Paper No. 46, p. 32.

pests are themselves introduced species, often of invasive alien species. The international flow of genetic resources related to BC has therefore been quite significant, involving several thousand BC agent species from more than a hundred countries, and introductions into an even higher number of countries.[3]

[3] Background Study Paper No. 47, Annex I.

f) Possible gaps in access and benefit-sharing measures

In reviewing existing ABS measures, governments may wish to identify any gaps with regard to GRFA or related activities and determine the need for additional regulatory measures. Similarly, governments may wish to identify GRFA or related activities that may merit exclusion or modified measures.

II. Identification and consultation of relevant governmental entities and non-governmental stakeholders holding, providing or using genetic resources for food and agriculture

In the development, adaptation or review of ABS measures, governments may wish to identify and consult relevant governmental and non-governmental stakeholders, providing or utilizing GRFA, including farmers and indigenous and local communities, gene banks and collections, research institutions and private-sector entities. It is particularly important to consult government entities responsible for different subsectors of GRFA. The purpose of such consultations may be manifold, as they may: help raise awareness among stakeholders; allow policy- and decision-makers to get an insight into the specificities of the different subsectors of GRFA and the existing practices of using and exchanging genetic resources; inform potential users and providers of traditional knowledge associated with genetic resources and of genetic resources that are held by indigenous and local communities about their rights and obligations; help facilitate the implementation of future ABS measures.

The competent national authority for ABS will often not be the national authority that is responsible for livestock and animal breeding or animal health and, therefore, it may benefit from direct consultations with relevant governmental authorities and stakeholders.

The livestock sector is characterized by a wide range of stakeholders, including individual livestock keepers and breeders, pastoralists and their associations, breeding and herd book associations, the breeding industry, breeding and research centres, conservation farms and facilities, genebanks, universities, researchers, extension and veterinary services, non-governmental organizations

(NGOs), and relevant regulatory national authorities. All these stakeholders should be consulted in the development and implementation of ABS for AnGR. Their involvement will be important to allow ABS policy-makers and regulators to gain insight into the specificities of livestock research and development and existing use and exchange practices of the subsector in order to avoid regulatory restrictions that unnecessarily impede the use, development and conservation of AnGR and disrupt established AnGR exchange practices.

The national competent authority for ABS will often not be the national authority that is responsible for aquaculture/fisheries. As most stakeholders in aquaculture have limited knowledge of ABS and the implications of ABS for their sector, consultations could help to raise the awareness of the subsector and allow policy- and decision-makers to get an insight into the specificities of aquaculture research and development and existing use and exchange practices of the subsector.

The national competent authority for ABS will often not be the authority that is responsible for the forest sector. As most stakeholders in the forest sector have limited knowledge of ABS and the implications of ABS for their sector, consultations could help to raise the awareness among stakeholders and allow policy- and decision-makers to get an insight into the specificities of forest research and development and existing use and exchange practices of the subsector.

Responsibility for the Treaty may often lie with the agriculture national authorities and responsibility for the Nagoya Protocol with environmental authorities. It is therefore possible that certain (uses of) of certain PGRFA fall in the competence of one authority, whereas (other uses of) other PGRFA fall in the competence of a different national authority. Direct consultations among relevant governmental entities and non-governmental stakeholders are therefore critical and should possibly also seek to clarify the allocation of responsibilities among different national competent authorities.

It is important to note that in most countries research and development on MIGR lies in the hands of very different stakeholders. These include academic researchers, the private sector, and business associations representing specific stakeholders. This subsector's stakeholder groups are highly diverse due to the diverse roles of MIGR in sustainable agriculture: for example as plant growth promoting agents; for biological control; in the digestive tracts of livestock; for the production of biopesticides of direct benefit to agriculture; as catalysts in agro-industrial processes; for understanding and surveillance of microbial plant and animal (including fish) pathogens; and environmental damage remediation and purification of soils and water. MoGR may also be used for food processing, such as traditional or industrial fermentation, the production of alcohols, dairy products, probiotics and feed additives; the production of biological components of benefit to food and feed production (vitamins, organic acids, enzymes, etc.) and understanding and surveillance of health-hazardous micro-organisms, such as food toxins and food-borne pathogens. MIGR are essential for important soil processes and provide BC of crop and animal (including fish) pests.

All these stakeholders should be consulted in the development and implementation of ABS for MIGR. Their involvement will be important to allow policy-makers and regulators to gain insight into the diversity and specificities of MIGR and related research and development activities. Existing use and exchange practices should be taken into account as well as best practices that are either already in use or have been proposed by stakeholders.

III. Integration of access and benefit-sharing measures with broader food security and sustainable agricultural development policies and strategies

ABS measures for GRFA may be considered in the wider context of sustainable agricultural development and food security. Not always will those responsible for ABS also be in charge of sustainable agricultural development and food security strategies. It is important to coordinate different policy areas and goals and integrate them into a broader and consistent agriculture strategy.

Farm animals play an important role in providing food, sustaining livelihoods and providing countries with a variety of economic outputs. In parts of the world that are non- or hardly arable, keeping farm animals is a necessity. Examples of livelihoods that depend solely on livestock keeping include reindeer herders in the tundra, yak herders in Asia's high-altitude zones, keepers of Bactrian camels and dromedaries in deserts and nomadic keepers of cattle, sheep and goats in semi-arid steppes and savannahs. Livestock may be especially important for poor

people, who derive multiple benefits from their animals. Livestock contribute to the availability of food at the household level, both for direct consumption and for the supply of products and services that are sold to buy other types of food and goods. Livestock development provides opportunities to achieve poverty alleviation and enhance livelihoods in low-input production systems, for example through provision of environmental services and the further development of niche market products. At the same time, some livestock production systems use fodder that is suitable for human consumption. Moreover, they may also deplete natural resources such as water and land. Maintaining livestock diversity is crucial to efforts to cope with challenges related to climate change.

In many countries, ABS measures have been or are being developed as stand-alone legislation or policy. It is, however, important to develop ABS measures in harmony with related policies, such as agricultural-development or poverty-reduction strategies and other livestock policies, and to integrate them with these policies. It is likewise important to involve the livestock sector from the outset in the development and implementation of ABS measures to ensure that policy-makers have a full understanding of the domestic livestock sector, current flows of AnGR and potential implications of ABS measures for domestic livestock production. ABS measures for AnGR do not need to constitute stand-alone legislation. They can fall under various policies and regulations developed in other sectors.

Aquaculture is an adaptive and resilient farming practice that provides both direct and indirect benefits in terms of food security and poverty alleviation. In many developing countries, fish provide a significant source of high-quality animal protein and farmed fish is often traded and consumed locally. Besides, poverty can be reduced and food security increased through the economic activity that aquaculture brings to communities regardless of whether the fish is consumed locally. Both fish farming itself and the industry processing farmed fish may provide employment opportunities for large numbers of people in developing countries, including rural women. Thus, ABS measures for AqGR should form part of broader food-security considerations and relevant policies, including habitat policies.

While the rapid development of the aquaculture industry has meant that environmental, veterinary and sanitary regulation have not always followed suit, regulations are increasingly being introduced. This includes the regulation of introductions of AqGR from other countries and ecosystems. Such regulations, including legislative, administrative and policy measures as well as codes of practice could be used to address or could make reference to ABS for AqGR, with a view to reducing the bureaucratic burden and streamlining administrative procedures.

Trees have an important role in contributing to food security. They rarely provide a complete diet, but the supply of fruits, nuts and leaves is a crucial complement to agricultural production, especially during drought, famine, disasters and conflicts. Natural forests are also critical for the survival of forest dwellers, including many indigenous peoples. Forests provide key goods and services to the agricultural community in that they help deliver clean water to agricultural lands and provide habitats for pollinators. Farmers increase food security by retaining trees on agricultural land, by encouraging natural regeneration and by planting trees and other forest plants. For most of the year, herders in arid and semi-arid lands depend on trees as a source of fodder for their livestock. Thus, forests, trees and agroforestry systems contribute to food security and nutrition in many ways, even though such contributions are often poorly reflected in national development and food-security strategies. There is the potential to reduce poverty and increase food security through commercial forestry. Thus, ABS measures for FGR should form part of broader food-security considerations and relevant forestry policies.[1]

Forests provide various ecosystem services and FGR are important in both adaptation to and mitigation of climate change. Some traits related to adaptation, such as drought tolerance, are and will be of increasing importance, including for relevant selection and breeding programmes using local and exotic materials. In this context, marginal forest populations are especially important to the conservation and use of valuable FGR. Research on genetic diversity is crucial as it facilitates the identification and use of the most suitable materials in reforestation and restoration projects, contributing to the mitigation of climate change in the future.

The risk of spreading pests and diseases through transfer of tree germplasm is often considerable. Restricting the spread of these pests and diseases continues to be a major challenge and is the objective of phytosanitary measures. Such measures, as well as codes of practice, could make reference to ABS for FGR, with a view to reducing the bureaucratic burden and streamlining administrative procedures.

[1] See Background Study Paper No. 44, p. 21.

PGRFA play a key role in providing food, feed and fibre. They play multiple roles in helping ensure food security, for example producing more and better food for rural and urban consumers, providing healthy and more nutritious food, and enhancing income generation and rural development.

In many countries, ABS measures have been or are being developed as stand-alone legislation or policy. It is, however, important to develop ABS measures in harmony with other relevant policies, such as agricultural development or poverty reduction strategies, and to integrate them with these policies. It is likewise important to involve the plant-breeding and production sectors from the outset in the development and implementation of ABS measures to ensure that policy-makers have full understanding of the plant sector, exchanges of PGRFA and potential implications of ABS measures for plant production. Some countries have included ABS measures in laws on intellectual property rights by including requirements to disclose the origin of the material when applying for plant variety protection or patents.

In many countries ABS measures have been or are being developed as standalone legislation or policy. It is, however, important to develop ABS measures in harmony with related policies, such as regulatory frameworks for biological control, pesticides and food safety and policies, such as food security strategies, and to integrate them with these policies. The integration of approval procedures should, however, not lead to delays or unnecessary bureaucracy in the process of product development. It is likewise important to involve the different communities behind the various functional groups of MIGR from the outset in the development and implementation of ABS measures to ensure that policy-makers have a full understanding of the taxonomic complexity and multiplicity of functions of the sector, of its current use and exchange practices and of potential effects ABS measures may have on research and development of MIGR.

The International Plant Protection Convention (IPPC) has a broad overlap into biodiversity issues. The Glossary of phytosanitary terms defines pests as "[a]ny species, strain or biotype of plant, animal or pathogenic agent injurious to plants or plant products" and defines plants as "[l]iving plants and parts thereof, including seeds and germplasm."[1] The IPPC obliges National Plant Protection Organizations to carry out surveillance of growing plants, including both areas under cultivation and wild flora for pests[2] with the object of reporting the occurrence, outbreak and spread of pests, and of controlling those pests.[3] ABS measures for MIGR should be aligned with obligations under the IPPC. Other regulatory frameworks in the biomedical and veterinary sectors are relevant to disease-causing micro-organisms and to invertebrates as vectors of diseases.

[1] Glossary of phytosanitary terms. ISPM 5.
[2] IPPC Convention, Article IV.2.
[3] IPPC Convention, Article VIII.1.

IV. Consideration and evaluation of options for access and benefit-sharing measures

Based on an assessment of the concerned subsectors of GRFA, including their activities, socio-economic environments and use and exchange practices, and following appropriate consultations with relevant stakeholders and consideration of different options for ABS measures, governments may wish to develop, adopt or implement their ABS measures.

V. Integration of implementation of access and benefit-sharing measures into the institutional landscape

ABS measures cut across different sectors of genetic resources and GRFA, which are often the responsibility of different ministries and competent authorities. Governments may wish to consider using the existing infrastructures of sectors and subsectors for the implementation of ABS measures rather than creating new and additional administrative layers. Using and adapting, as appropriate, existing structures, administrative procedures and sectoral practices may facilitate the smooth operationalization and implementation of ABS measures. It is important to minimize the transaction costs for providers and users of implementing and complying with any ABS measures.

Existing arrangements for forest governance could be used for the implementation of ABS measures for FGR. Examination of existing and past practices demonstrates that the implementation of ABS measures differs widely by country and by entity within a country. In some countries, a central authority may oversee the implementation of ABS measures and the ABS competence for FGR could be delegated to the national forest agency or forest research institute, given its expertise, its knowledge of stakeholders and its responsibility for the implementation of other FGR-related rules or regulations. In other countries, the authority is not centralized and the ABS measures vary widely from the use of phytosanitary certificates only to official agreement on terms of benefit.

Historically, the agricultural sector has been a primary regulator of micro-organisms and invertebrates in most countries. As the regulatory environment gets more complex, the integration with wildlife and biodiversity regulatory frameworks is causing confusion for stakeholders. While in many countries one single competent authority is responsible for ABS for all genetic resources, several specialized authorities could share the responsibility for ABS. Whether such sharing of ABS competences is useful will depend on the institutional landscape and other country-specific circumstances.

VI. Communication of, and awareness-raising regarding, access and benefit-sharing measures for potential providers and users of genetic resources for food and agriculture

Communicating and raising awareness of ABS measures to potential providers, holders and users of GRFA are essential. Various communication and awareness-raising tools may be considered. Effective communication and awareness-raising strategies usually combine different communication tools and aim to provide stakeholder-specific information whenever necessary.

Like other subsectors, the livestock community is in many cases not yet aware of ABS and its potential implications for research and development. On the other hand, countries providing AnGR will increasingly expect recipients/users of their resources to be aware of and comply with applicable ABS measures. Similarly, research partners of international research projects will expect each other to understand and fully comply with relevant national ABS measures.

Awareness-raising measures at national level should target breeders, researchers and policy-makers in particular. Events such as animal shows, meetings of breeder associations and relevant scientific conferences provide excellent opportunities to provide information on ABS to relevant stakeholders and information multipliers. Breeder associations and research organizations may wish to establish and maintain an ABS help desk and facilitate communication with the national competent authority. Information could also be disseminated through publications, newsletters, the Access and Benefit-Sharing Clearing-House[1] and other media and information channels. Biocultural Community Protocols as well as the ABS Elements may serve as awareness-raising tools.

[1] https://absch.cbd.int/

Awareness-raising measures at national level should target breeders and farmers, indigenous peoples and local communities, scientists, taxonomists, the private sector, botanical gardens and genebanks. Events such as relevant scientific conferences and meetings of plant-breeder associations and seed fairs provide excellent opportunities to provide information on ABS to relevant stakeholders and information multipliers.

The global distribution and exchange of micro-organisms that are publicly available for research is mainly in the hands of MCCs. Various initiatives of MCCs, such as Micro-Organisms Sustainable Use and Access Regulation International Code of Conduct (MOSAICC),[1] have led to an increased awareness among MCCs of the potential implications of ABS for the distribution and use of MoGR.

MTAs, which are nowadays used by most MCCs, usually impose the responsibility for complying with applicable ABS measures on the recipient of materials. In other words, receiving material from an MCC does not usually imply that the material can be freely used. Commercial uses of the material are often prohibited unless explicitly authorized. It is furthermore the recipient's sole responsibility to obtain necessary intellectual property licences and ABS permits, as applicable.[2]

Raising the awareness of ABS measures, and improving relevant knowledge, of recipients of materials from MCCs, for example on the occasion of scientific conferences and workshops, might be useful. More specifically, it will be important to guide and possibly assist stakeholders as to how they may obtain the information needed to initiate the necessary approval procedures.

The BC community has also made serious progress in formulating best practices for ABS for InGR.[3] These best practices could be shared through the Access and Benefit-Sharing Clearing-House.

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[1] http://bccm.belspo.be/projects/mosaicc

[2] See, for example, the Belgian Co-ordinated Collections of Micro-orgamisms Material Transfer Agreement.

[3] Mason, P.G. *et al.* 2018. Best practices for the use and exchange of invertebrate biological control genetic resources relevant for food and agriculture. *BioControl*, 63(1): 149–154. DOI: 10.1007/s10526-017-9810-3 and Smith, D. *et al.* 2018. Biological control and the Nagoya Protocol on access and benefit-sharing – a case of effective due diligence. *Biocontrol Science and Technology.* DOI:10.1080/09583157.2018.1460317.

VII. *Ex ante* assessment and monitoring of the effectiveness and impact of access and benefit-sharing measures for genetic resources for food and agriculture

Possible implications, side-effects and implementation difficulties may often be anticipated through scenario-based testing of policy measures. Given the many challenges and innovations associated with ABS measures, governments may wish to carry out such tests and/or monitor effects by agreeing on a set of relevant indicators and mechanisms for stakeholder feedback.

4

ACCESS AND BENEFIT-SHARING FOR GENETIC RESOURCES FOR FOOD AND AGRICULTURE: THE INTERNATIONAL LEGAL FRAMEWORK

16. In establishing their national frameworks on ABS for GRFA, governments need to be aware of their legal obligations. Essentially three international instruments make up the global framework for ABS for genetic resources: the CBD, the Nagoya Protocol and the Treaty. It is noted that the three instruments are legally binding only for their Contracting Parties.[19]

Convention on Biological Diversity

17. The CBD requires its Contracting Parties to take legislative, administrative or policy measures, as appropriate, with the aim of sharing in a fair and equitable way the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Parties providing such resources.[20] Access to genetic resources shall be subject to prior informed consent (PIC) of the Contracting Party providing such resources that is country of origin of such resources or has acquired them in accordance with the CBD, unless otherwise

[19] For lists of Parties, see: for the CBD, http://www.cbd.int/information/parties.shtml; for the Nagoya Protocol, http://www.cbd.int/abs/nagoya-protocol/signatories/default.shtml; for the Treaty, http://planttreaty.org/list_of_countries.

[20] CBD, Article 15.7.

determined by that Party.[21] Access, where granted, shall be on MAT.[22] Potential benefits to be shared also include: access to and transfer of technology using genetic resources; participation in biotechnological research activities based on the genetic resources; and priority access to the results and benefits arising from biotechnological use of the genetic resources.[23]

Nagoya Protocol

18. The Nagoya Protocol is a supplementary agreement to the CBD and provides a legal framework for the effective implementation of the third objective of the CBD on benefit-sharing, in support of its other two objectives, namely the conservation and sustainable use of biodiversity. The Nagoya Protocol applies to genetic resources and to traditional knowledge associated with them. It aims to achieve the fair and equitable sharing of benefits, by setting out provisions governing access (for Parties requiring PIC), appropriate technology transfer and funding; and it sets out compliance provisions. (More detailed information on the Nagoya Protocol is provided throughout this document).

International Treaty on Plant Genetic Resources for Food and Agriculture

19. Like the CBD and the Nagoya Protocol, the Treaty is based on the premise that states have sovereign rights over their genetic resources and that the authority to determine access to these resources lies with national governments. Under the Treaty, the Contracting Parties exercised their sovereign rights to establish the MLS, to facilitate access and the sharing of monetary and non-monetary benefits arising from the use of PGRFA through standardized conditions as set out in the Standard Material Transfer Agreement (SMTA). While the Treaty applies to all PGRFA, its MLS applies only to PGRFA set out in Annex I to the Treaty that are under the management and control of the Contracting Parties and in the public domain.

The Treaty is often quoted as a model for ABS for genetic resources. It provides a comprehensive international agreement for PGRFA in harmony with the CBD, which standardizes conditions of access and the modalities of benefit-sharing. It also, in its Article 9, addresses Farmers' Rights. The Treaty also considers information sharing as non-monetary benefit-sharing. Countries that have not yet done so should seriously consider becoming Contracting Parties to the Treaty.

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21 CBD, Article 15.5; 15.3.
22 CBD, Article 15.4.
23 CBD, Articles 15.7; 16; 19; 20; 21.

Relationship between the Nagoya Protocol and specialized international access and benefit-sharing instruments

20. The Nagoya Protocol states that where a specialized international ABS instrument applies that is consistent with, and does not run counter to the objectives of the CBD and the Nagoya Protocol, the Nagoya Protocol does not apply for the Party or Parties to the specialized instrument in respect of the specific genetic resource covered by and for the purpose of the specialized instrument.[24] The Treaty is such a specialized international ABS instrument that is consistent with and does not run counter to the objectives of the CBD and the Nagoya Protocol.

21. It should be noted that the Nagoya Protocol shall be implemented in a mutually supportive manner with other international instruments relevant to the Nagoya Protocol. Due regard shall also be paid to useful and relevant ongoing work or practices under such international instruments and relevant international organizations, provided they are supportive of and do not run counter to the objectives of the CBD and the Nagoya Protocol.[25]

In addition to these legally binding instruments, other instruments, such as the Global Plan of Action for Animal Genetic Resources (GPA AnGR), are worthy of being considered in the development and implementation of ABS measures for AnGR. The GPA AnGR, prepared by the Commission and adopted by the International Technical Conference on Animal Genetic Resources for Food and Agriculture in 2007, provides the international framework for the inventory, characterization, monitoring, sustainable use and conservation of AnGR as well as for capacity-building for improved management of these resources.

Through the Interlaken Declaration on Animal Genetic Resources countries committed themselves "to facilitating access to [animal genetic] resources and the fair and equitable sharing of the benefits arising from their use, consistent with relevant international obligations and national laws".[1] The Interlaken Declaration also recognizes private ownership and individual breeder improvement of genetic resources and their discretion in how they may choose to sell and maintain their property.[2] Among the main aims of the GPA AnGR is "to promote a fair and equitable sharing of the benefits arising from the use of animal genetic resources for food and agriculture, and recognize the role of traditional knowledge, innovations and practices relevant to the conservation

[1] Interlaken Declaration, paragraph 4.
[2] Interlaken Declaration, paragraph 12.

[24] Nagoya Protocol, Article 4.4.
[25] Nagoya Protocol, Article 4.3.

of animal genetic resources and their sustainable use, and, where appropriate, put in place effective policies and legislative measures". In addition, the GPA aims "to meet the needs of pastoralists and farmers, individually and collectively, within the framework of national law, to have non-discriminatory access to genetic material, information, technologies, financial resources, research results, marketing systems, and natural resources, so that they may continue to manage and improve animal genetic resources, and benefit from economic development".[3]

The GPA AnGR provides, as one of the actions of its Strategic Priority 3, Establish and strengthen national sustainable use policies, for the development of "approaches, including mechanisms, to support wide access to, and the fair and equitable sharing of benefits arising from the use of animal genetic resources and associated traditional knowledge".[4]

GPA AnGR Strategic Priority 4, *Establish national species and breed development strategies and programmes*, proposes as one action the provision of "information to farmers and livestock keepers to assist in facilitating access to animal genetic resources from various sources".

According to the GPA AnGR "appropriate conservation measures should ensure that farmers and researchers have access to a diverse gene pool for further breeding and research".[5]

GPA AnGR Strategic Priority 9, *Establish or strengthen* ex situ *conservation programmes*, proposes the establishment of "modalities to facilitate use of genetic material stored in *ex situ* gene banks under fair and equitable arrangements for storage, access and use of animal genetic resources".[6]

With regard to international policies and regulatory frameworks relevant to AnGR, GPA AnGR Strategic Priority 21 proposes review of "the implications and impacts of international agreements and developments relevant to access to animal genetic resources and sharing the benefits of their use upon animal genetic resources stakeholders, especially livestock keepers".[7]

The Funding Strategy for the Implementation of the Global Plan of Action for Animal Genetic Resources, adopted by the Commission in 2009, aims to enhance the availability, transparency, efficiency and effectiveness of the

[3] Global Plan of Action for Animal Genetic Resources, paragraph 15.
[4] Global Plan of Action for Animal Genetic Resources, Strategic Priority 3, Action 2.
[5] Global Plan of Action for Animal Genetic Resources, paragraph 37.
[6] Global Plan of Action for Animal Genetic Resources, Strategic Priority 9, Action 3.
[7] Global Plan of Action for Animal Genetic Resources, Strategic Priority 21, Action 2.

provision of substantial and additional financial resources, and to strengthen international cooperation to support and complement the efforts of developing countries and countries with economies in transition in the implementation of the GPA AnGR.

The GPA AnGR, together with its Funding Strategy, could provide the basis for ABS arrangements that facilitate access to AnGR and ensure at the same time fair and equitable sharing of benefits.

Members reaffirmed their commitment to the implementation of the GPA AnGR in 2017 and, in adopting FAO Conference Resolution 3/2017, invited countries "to consider the distinctive features of the subsector of animal genetic resources for food and agriculture in domestic access and benefit-sharing legislation, where appropriate, taking into account international developments in access and benefit-sharing".[8]

[8] C 2017/REP, Appendix D.

5

RATIONALE OF ACCESS AND BENEFIT-SHARING MEASURES FOR GENETIC RESOURCES FOR FOOD AND AGRICULTURE

22. Considering that GRFA are an integral part of agricultural and food production systems and therefore play an essential role in achieving food security and sustainable agricultural development, and that the international exchange of GRFA is essential to the functioning of the sector, ABS measures may be instrumental in furthering the achievement of food security and improving nutrition. There is general consensus that food and nutrition security requires effective conservation of GRFA and that the effective conservation of GRFA requires their continued use by farmers (including smallholders), indigenous and local communities, research institutions, breeders and other stakeholders. Therefore, ABS measures aimed at achieving food security and the conservation of GRFA should aim to facilitate and actively encourage the continued use and exchange of GRFA and benefit-sharing.

23. There is also agreement that the conservation and sustainable use of GRFA are essential to the sustainable development of agricultural production. Productivity, adaptability and resilience of agro-ecosystems depend on the diversity of GRFA.

Continuous availability of AnGR research and development is indispensable to further enhance the output, sustainability and efficiency of animal production and thereby contribute to food security and nutrition and rural development. Countries may wish to perform *ex ante* cost–benefit analysis in considering development of ABS measures and to identify what ABS regulations would do for users (breeders/producers) in the country as well as for sellers of AnGR. Countries may consider the potential benefits to AnGR gene flow in the absence of ABS measures or due to the exemption of AnGR from the access measures, when exchange of AnGR is based on private contracts.

The conservation of local and regional breeds is also of cultural importance and essential to maintaining traditional lifestyles, for example of many pastoral peoples and other farming communities.

Continuous availability of PGRFA for research and development is indispensable for the improvement of crops. PGRFA offer the potential to provide variable traits that can help meet future challenges such as the need to adapt crops to changing climatic conditions or disease outbreaks. Continued access to PGRFA is therefore important to meeting the rising food demand of a growing population and the challenges of predicted environmental changes. This includes access to neglected and underutilized crops, given their importance for nutrition.

While the importance of access to PGRFA and AnGR is obviously indispensable for the improvement and adaptation of crops and livestock and, thus, for food security, the importance of MIGR for food security may be less obvious to some. The reason might be that for a long time the services provided by soil micro-organisms and natural enemies of pests, among many others, have been taken for granted and therefore received little attention in agricultural management. ABS measures aimed at achieving food security and the conservation of MIGR could therefore, as an objective, also mention the facilitation of exchange, sustainable use and conservation of MIGR as an important contribution to food security.

6

ELEMENTS OF ACCESS AND BENEFIT-SHARING MEASURES FOR GENETIC RESOURCES FOR FOOD AND AGRICULTURE

24. Under the Nagoya Protocol, Parties shall consider, in the development, adaptation and implementation of their ABS measures, the importance of GRFA and their special role in food security.[26] The ABS Elements for national ABS measures for GRFA highlight those areas of ABS policy that may deserve particular attention from the perspective of research and development in food and agriculture.

25. National ABS measures for GRFA should be simple and flexible. *Simplicity* is a challenge given the complexity of the matter and given the variety of situations in which GRFA may be accessed, transferred to others, further improved and used for research and development. *Flexibility* is therefore necessary to allow administrators to adjust the implementation of ABS measures to new and newly identified situations and challenges. ABS measures should leave sufficient flexibility to accommodate new and newly identified situations without having to revise the legislation as such. ABS measures should therefore allow for an evolutionary implementation approach that allows improvement of the operation of the ABS system through practice, self-perfection and innovation. Parties to the Nagoya Protocol need to establish clear and transparent measures to implement it. Developing and implementing ABS measures is a *work in progress* and so is the development of these ABS Elements.

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[26] Nagoya Protocol, Article 8(c).

26. National measures on ABS for GRFA may be associated with considerable transaction costs for administrators and stakeholders, and governments may wish to assess and minimize them in developing, adapting or implementing these measures.

27. In designing legislative, administrative or policy measures for ABS that reflect the special needs of GRFA, governments may wish to address a wide range of issues, addressed further below, to facilitate the domestic implementation of ABS for the different subsectors of GRFA:

I. Institutional arrangements;
II. Access to and utilization of GRFA;
III. Access to traditional knowledge associated with GRFA;
IV. Fair and equitable sharing of benefits;
V. Compliance and monitoring.

I. Institutional arrangements

28. ABS measures will often specify the institutional arrangements for the management of ABS. Depending on the structure of a state, the form of government, the international ABS instruments to which the state is a party and, where relevant, the jurisdictional division of responsibility, and, depending on the ABS measures chosen, one or several competent authorities may be tasked with the administration of ABS measures. These may be either existing or new authorities. Several authorities within one country may also share the responsibility according to the geographical origin of the resource, the purpose for which it is to be accessed and utilized, the involvement of traditional knowledge associated with the genetic resource, the rights indigenous and local communities may have over the resource or any other criteria that seem appropriate and practical.

- Each Party to the Nagoya Protocol has to designate a single national focal point responsible for liaison with the CBD Secretariat and providing relevant information to applicants.[27]
- Parties to the Nagoya Protocol also have to designate one or more competent national authorities responsible for granting access and advising on applicable procedures and requirements for obtaining PIC and entering into MAT.[28]
- The same entity may fulfil the functions of both focal point and competent national authority.[29]
- Where more than one competent national authority for the Nagoya Protocol is designated (e.g. for different subsectors of GRFA) the national focal point must provide information about their respective competencies and mandates.
- Under the Treaty, facilitated access is provided pursuant to the SMTA

[27] Nagoya Protocol, Article 13.1.
[28] Nagoya Protocol, Article 13.2.
[29] Nagoya Protocol, Article 13.3.

adopted by the Treaty's Governing Body.[30] In practice, most Parties to the Treaty have national focal points, and institution(s) actually providing access to MLS material do so only upon acceptance of the SMTA by the recipient of the material.

29. To clarify institutional arrangements around ABS for GRFA, governments may wish to:

- Take stock of existing institutions and institutional arrangements that are potentially relevant;
- Decide on the allocation of institutional responsibility for various aspects of ABS as they apply to different subsectors of GRFA;
- Put in place mechanisms and/or procedures for communication and coordination between designated institutions; and
- Publicize and provide information about the resulting institutional arrangements.

30. Whatever institutional arrangements are chosen, it is of pivotal importance that the institutional arrangements are clear and transparent, and that adequate coordination and information exchange mechanisms are in place. Users of genetic resources need to know when PIC is required, whom they have to ask for PIC and with whom they may negotiate MAT, if this is what the ABS measures require. Where several, e.g. federal and state, authorities are involved in one and the same decision, the authorization procedure may quickly become complicated and time-consuming, and transaction costs may increase considerably. To avoid overly burdensome institutional arrangements, it would be useful to identify existing arrangements that may be used to address PIC and MAT. Where several authorities are involved in the approval procedures, governments may wish to consider designating one lead authority or national clearinghouse to oversee the whole chain of partial approvals, communicate with the applicant and ultimately grant one cumulative authorization once all relevant authorities have given their green light.

Responsibility for the national ABS framework is often with one single competent authority. In fact, national interim reports on the implementation of the Nagoya Protocol show that many countries have chosen to select a single competent authority for ABS, rather than taking a sector or subsector-specific approach to ABS. However, several authorities within one country may share the responsibility for ABS and thus ABS for AnGR may fall under the competence of a specialized authority dealing with livestock matters. Whether such sharing of ABS competences is useful will depend on the institutional landscape and other country-specific circumstances.

[30] Treaty, Article 12.4.

Adaptation to distinctive features of sectors and for sectoral competent authorities can be beneficial. Thus, a potential result of consultations between the responsible ministries, the central ABS competent authority and the aquaculture authority could be delegation of ABS competence to the latter for ABS related to AqGR.

If ABS legislative, administrative or policy measures in countries that are regulating their own genetic resources provide for subsector-specific provisions for FGR, policy-makers will have to look into the scope of "FGR". Issues to be considered include whether FGR-specific ABS measures should apply to all FGR that contribute directly or indirectly to food security. FGR could thus include all established use and exchange practices for forest reproductive and genetic material (e.g. seeds, seedlings, rooted cuttings, genes) ranging from tree species providing tree fruits, other edible products for humankind and livestock, and/ or species providing other services relevant to food and agriculture (erosion control, water storage and filtration, soil fertility improvement, wind shelter, biodiversity conservation, bee forage for honey, nitrogen fixation, shade, etc.) to trees that allow foresters to generate income from non-food forest products (timber, fibre, clothing, shelter, energy, tannin, resin, ecotourism, etc.). In many cases, trees will, of course, serve several purposes at the same time or their originally envisaged purpose will change, which may raise the question of how access to FGR for utilization should be regulated in such cases.

Responsibility for the national ABS framework is often with one single competent authority. In fact, national interim reports on the implementation of the Nagoya Protocol show that many countries have chosen to select a single competent authority for ABS, rather than taking a sector- or subsector-specific approach to ABS. However, several authorities within one country may share the responsibility for ABS and thus ABS for PGRFA may fall within the competence of a specialized authority dealing with plant production. Whether such sharing of ABS competences is useful will depend on the institutional landscape and other country-specific circumstances.

Under the IPPC, National Plant Protection Organizations carry out surveillance of growing plants, including both areas under cultivation and wild flora, for pests,[1] with the objective of reporting the occurrence, outbreak and spread of pests, and of controlling them.[2] Responsibility for ABS measures for specific MIGR could therefore lie with the National Plant Protection Organizations. Whether such sharing of ABS competences is useful will depend on the institutional landscape and other country-specific circumstances.

[1] IPPC Convention, Article IV.2.
[2] IPPC Convention, Article VIII.1.

II. Access to and utilization of genetic resources for food and agriculture

31. In developing, adapting or implementing ABS measures dealing with access to GRFA it is necessary to specify:

(i) the categories of genetic resources covered by the access provisions;
(ii) intended uses triggering the application of access provisions;
(iii) the authorization procedures applicable, depending on the category of genetic resource and the purpose for which the resource is to be used.

(i) Categories of genetic resources covered by access provisions

32. In the CBD and the Nagoya Protocol, the term "genetic resources" means "genetic material of actual or potential value" and genetic material means "any material of plant, animal, microbial or other origin containing functional units of heredity."[31] This definition is also mirrored in the Treaty, which defines "plant genetic resources for food and agriculture" as "any genetic material of plant origin of actual or potential value for food and agriculture".[32] Parties to the Treaty should make sure that their ABS framework addresses their obligations under the Treaty.

Temporal scope of access measures for genetic resources for food and agriculture

33. There is an international debate about the temporal scope that national ABS measures could or should have. The Nagoya Protocol, in the absence of any rules to the contrary, does not prevent its Parties from applying their national ABS measures to utilizations or access to genetic resources that fall outside the scope of the Nagoya Protocol. However, with regard to resources outside the scope of the Nagoya Protocol, Parties cannot necessarily rely on the support of user country compliance measures, as set out in Articles 15 to 18 of the Nagoya Protocol, or compliance measures in non-Parties.

[31] CBD, Article 2.
[32] Treaty, Article 2.

Aquaculture is a predominantly new industry that is still dependent on wild species and has few and relatively new *ex situ* facilities for genetic resources. Because of the newness of the industry, the temporal scope of ABS measures is not a particularly relevant topic for aquaculture.

Genetic resources provided by countries of origin/countries that acquired them in accordance with the Convention on Biological Diversity

34. Parties to the CBD will usually apply their access measures to genetic resources for which they are the country of origin or that they have acquired in accordance with the CBD. "Country of origin of genetic resources" means the country that possesses those genetic resources in *in situ* conditions.[33] "*In situ* conditions" means conditions where genetic resources exist within ecosystems and natural habitats, and, in the case of domesticated or cultivated species, in the surroundings where they have developed their distinctive properties.[34]

35. In the case of many GRFA, it may be difficult to determine with certainty the country of origin. GRFA have been widely exchanged across regions, countries and communities, often over long periods of time. Many different stakeholders, including indigenous and local communities, farmers, researchers and breeders have contributed to the development of GRFA, in different places and at different points in time. In fact, the maintenance and evolution of many GRFA depend on continued human intervention, and their sustainable utilization in research, development and production is an important instrument with which to ensure their conservation.

The "country of origin" of a PGRFA is not necessarily its "centre of origin". ABS measures could provide guidance as to the circumstances under which domesticated crops are considered to have developed their "distinctive properties" within or outside the area of jurisdiction to which the ABS measures applies.

ABS measures could also provide guidance as to whether or to what extent "distinctive properties" (CBD, Article 2) are those properties that make domesticated or cultivated species "clearly distinguishable from any other variety", as provided in Article 7 of the 1991 UPOV Act.

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33 CBD, Article 2.

34 CBD, Article 2.

The Nagoya Protocol requires PIC of the Party providing genetic resources "that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention." ABS measures could clarify whether PIC (and MAT) are also required where genetic resources have been received from a country other than the country of origin and have been collected prior to the entry into force of the Nagoya Protocol. ABS measures could point out that, in addition to national ABS laws, recipients of genetic resources have to comply with conditions they accepted under bilateral agreements, such as MTAs.

It will sometimes be difficult if not impossible to determine with certainty the country of origin of MIGR, and especially of those occurring *in situ*. Genetic resources, in particular MIGR, may have several countries of origin.

36. ABS measures need to be clear as to which GRFA are covered by the relevant access provisions.

Privately versus publicly held genetic resources

37. While the Treaty's MLS addresses only PGRFA "that are under the management and control of the Contracting Parties"[35] and materials brought within the purview of the Treaty by other holders,[36] the Nagoya Protocol does not make the distinction between genetic resources that are under the management and control of government and other categories of genetic resources.

38. Given that significant amounts of GRFA are privately held, in particular in sectors such as the livestock sector, ABS measures need to be clear as to whether they apply to privately held or only to publicly held GRFA. ABS measures may have a significant impact on the exchange of such GRFA. Such laws may also need to clarify the hierarchy or relationship of different types of proprietary, including intellectual property, and quasi-proprietary and other rights related to genetic resources.

Genetic resources versus biological resources

39. The Nagoya Protocol covers "genetic resources" and their utilization.[37] However, some ABS measures also cover "biological resources" and their utilization. Governments should reflect on whether the inclusion of biological resources in ABS measures and their use beyond utilization, as addressed in the Nagoya Protocol, has any effect on the use of and access to GRFA.

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35 Treaty, Article 11.2.
36 Treaty, Articles 15; 11.3.
37 CBD, Article 2.

Genetic resources held by indigenous and local communities

40. The Nagoya Protocol also addresses, as a special case, genetic resources held by indigenous and local communities. The Protocol requires Parties in such cases to take measures, in accordance with domestic law, as appropriate, with the aim of ensuring that the PIC or approval and involvement of indigenous and local communities is obtained for access to genetic resources where they have the established right to grant access to such resources.[38]

41. ABS measures implementing the Nagoya Protocol may foresee procedures for the PIC or approval and involvement of the indigenous and local communities where they have the established right to grant access to such resources. Community PIC, as such, is a challenging, although not completely new, concept. National measures should address how PIC or approval and involvement of indigenous and local communities may be obtained, taking into consideration indigenous and local communities' customary laws, community protocols and procedures, as applicable.

(ii) Intended uses triggering the application of access provisions

Research and development on the genetic and/or biochemical composition of genetic resources for food and agriculture

42. Some national ABS measures apply to specific uses of genetic resources, i.e. to their use in research and development. The Nagoya Protocol provides that "access to genetic resources for their utilization shall be subject to the prior informed consent of the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the Convention (…)" unless otherwise determined by that Party.[39] "Utilization of genetic resources" means "to conduct research and development on the genetic and/or biochemical composition of genetic resources, including through the application of biotechnology (…)."[40]

43. Other ABS measures cover further uses that trigger the application of access provisions. Under those measures, the acquisition of genetic resources for certain purposes other than research and breeding may require PIC, for example the use of genetic resources for the extraction of specific compounds. The measures often refer to "biological resources", meaning that the resources are not used for their genetic composition, but as an end product or commodity. The rationale for such a broad definition is the experience that compounds used in the pharmaceutical and cosmetic industries are often extracted from agricultural products sourced through intermediaries from local markets at local prices that at times do not reflect the actual market value of the extracted compounds.

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[38] Nagoya Protocol, Article 6.2.
[39] Nagoya Protocol, Article 6.1.
[40] Nagoya Protocol, Article 2(c).

44. A broad definition of purposes that would capture a whole range of activities that typically and regularly happen with agricultural commodities in the course of food production will obviously imply that access provisions would apply to a possibly large number of transactions where for the time being the assumption of buyers of such commodities in most countries might be that in such cases the sales contract manifests the ABS agreement. In fact, the sales contract might or might not satisfy ABS requirements according to national measures.

45. For non-Parties to the Nagoya Protocol there is also the option of a different approach.

AnGR made available for direct use, e.g. for consumption (eggs), slaughter orfattening or production of semen for reproduction, can also be used as genetic resources (for research and development, including breeding). Some countries are concerned that genetic resources that have been accessed without PIC and MAT could end up being used for research and development. Their ABS measures therefore regulate access to genetic resources for both direct use and research and development.

However, regulating access to AnGR for direct use may have a significant impact on trade in animals for slaughter and animal reproductive materials (e.g. semen, embryos) and therefore on food security. If ABS measures do not regulate access to AnGR for direct use, they could still require the user to obtain PIC and share benefits should the intention change and animals or reproductive materials originally intended for direct use end up being used for research and development.

AqGR often reach the market in a form in which they may be used both as a “biological resource” (e.g. for human consumption) or as a genetic resource (i.e. for research and development, including breeding). Regulating access to AqGR used as “biological resources” may have significant impact on trade in fish and aquatic plant commodities, and therefore on food security. Several ABS laws leave the exchange of biological resources unregulated; however, if a biological resource is subsequently used for research or development, they require the user to request a permit and to share potential benefits.

FGR often reach the market in a form in which they may be used as a commodity (e.g. for planting or for food) or for research and development. Some countries are concerned that commodities that have been accessed without PIC and MAT could end up being used for research and development. Their ABS measures therefore regulate access to genetic resources for both: use as a commodity and for research and development. However, regulating access to FGR used as a commodity may have a significant impact on trade of forest reproductive material. If ABS measures do not regulate access to commodities, they could still require the user to request a permit and share benefits should the intention change and the commodities be used for research and development.

PGRFA made available for direct use, e.g. for consumption or multiplication, can often also be used for research and development, including breeding. There is a concern that genetic resources that have been originally accessed for direct use could end up being used for research and development. Some laws therefore require PIC and MAT for access to genetic resources for both research and development and direct use.

However, regulating access to PGRFA for direct use may have a significant impact on trade in seeds and even foods and therefore on food security. If ABS measures refrain from regulating access to PGRFA for direct use, they could still require PIC and benefit-sharing when the intention changes and seeds or foods originally intended for direct use are subsequently used for research and development.

As with commodity crops there are some micro-organisms and invertebrates that are treated as a commodity for food or fibre for use. Some have raised a concern that although originally accessed for direct use, such commodities could end up being used for research and development. InGR, such as insects and snails, made available for direct use, e.g. for trade, consumption or multiplication, can often also be used for research and development, including breeding. A micro-organism requested as reference culture may be used for bioprospecting studies. However, regulating access to MIGR for direct use may have an unwanted impact on trade. If ABS measures refrain from regulating access to MIGR that may be directly used, they could still require PIC and benefit-sharing where the intention of the recipient changes and MIGR originally intended for direct use are used for research and development.

It also needs to be recognized that invertebrates and micro-organisms regularly cross international borders unintentionally through commodity trade.

Most MCC nowadays require depositors to indicate the country of origin of materials they wish to deposit. It appears that most MCC also require information regarding the PIC of the country of origin of the material.[1] Many MCC also require recipients of material to comply with the relevant ABS provisions of the country of origin, often irrespective of whether the material has been collected and deposited prior to or after the entry into force of the Nagoya Protocol. This means that MTAs of MCC might at times require PIC and MAT for materials that are excluded from the scope of ABS measures under the jurisdiction under which the MCC operates. ABS measures and MCC MTAs could clarify if PIC and MAT are required for research and development on pre-Nagoya MoGR.

[1] Background Study Paper No. 46, p. 49.

Development of genetic resources in the course of agricultural production

46. If the activities triggering access provisions are limited to "utilization" within the meaning of the Nagoya Protocol, certain typical uses of GRFA, for example the growing of seeds in order subsequently to use the harvested products for human consumption clearly do not qualify as utilization and therefore do not trigger the application of access provisions.

47. Other activities regularly performed with respect to GRFA are more difficult to classify. The question may arise as to whether selection and reproduction of PGRFA by a farmer or farming community based on phenotypic traits and not entailing any genetic methods, qualify as "utilization". Similarly, fish farming while serving the purpose of producing fish for human consumption may simultaneously, through natural selection due to the hatchery environment, contribute to the genetic development and, indeed, domestication of the fish. Provenance trials that help to identify tree seedlings best adapted to the conditions of a specific planting site may simply serve the purpose of reforestation and the production of timber on sites that are similar to the test environment; on the other hand, provenance research is also important for planned breeding within and between species. The use of cattle embryos or bovine semen for reproduction and, ultimately, dairy or meat production may be considered as falling outside the boundaries of "utilization". However, the selection of semen-donor bulls and the selection of offspring for multiplication may entail aspects of research and development. Subject to national measures, the assumption of stakeholders when selling genetic material in the form of semen, embryos, etc., will often be that its value as a genetic resource is already reflected in

its price, and that the buyer will be free to use it for further research and breeding.[41] If, however, the planned use of such material qualifies as "utilization," as defined by national measures, access requirements may apply.

48. Many GRFA are being shaped, developed and improved through their continued use in agricultural production. Where "research and development" and agricultural production occur in tandem, it may be difficult to distinguish "utilization" from activities related to the production of agricultural products for sale and human consumption. ABS measures could provide guidance as to the treatment of these cases, for example by listing examples of activities/purposes of use that fall under "utilization" and other examples that fall outside the definition of "utilization". Further technical guidance will be important to facilitate the implementation of national ABS measures.

There is a need to clearly identify activities related to AnGR that are considered "utilization" and those which are not. States should review and identify activities associated with AnGR that can be considered "utilization". Activities based on or involving the identification of various phenotypic, genetic or biochemical characteristics of accessed AnGR are usually considered research and development. On the other hand, trade in live animals or their reproductive materials, using or improving reproductive biotechnology methods in given species (artificial insemination, embryo transfer, gonad grafting) and the multiplication of animals for commercial production, as well as the fattening of animals for slaughter or keeping them for milk or egg production, will clearly not qualify as "utilization" and, therefore, dependent on the applicable laws, not trigger the application of ABS measures.

Policy-makers may also wish to address the "re-utilization" of AnGR previously generated through "utilization" with PIC and MAT. If "re-utilization" requires PIC and MAT just like the first utilization of AnGR, this could in the future create "permit pyramids" and complicate the future "utilization" of AnGR. In such circumstances, animal breeders might choose to avoid, rather than to use, conserve and further improve, the respective AnGR. Governments could consider distinctive solutions to this issue, including through supporting the development of subsector standards building on current best practices, such as the breeders' exemption in the plant sector, or putting in place multilateral solutions.

[41] CGRFA Background Study Paper No. 43. 2009. *The use and exchange of animal genetic resources for food and agriculture*, p. 28.

While practices, such as the capture of live material from the wild and its subsequent use in aquaculture, usually termed capture-based aquaculture (CBA), might not clearly qualify as "research and development" and therefore not trigger the application of ABS measures, aquaculture may simultaneously contribute to genetic improvement and therefore be considered "research and development". ABS measures could therefore draw a clear line between activities related to AqGR that are considered to be "utilization" and those that are not.

Provenance trials that help to identify seedlings best adapted to the conditions of a specific planting site may simply serve the purpose of reforestation and the production of wood or non-wood products on sites that are similar to the test environment. On the other hand, provenance research is an important component of tree breeding and is often considered "research and development".[1] ABS measures could therefore draw a clear line between FGR-related activities that are considered to be "utilization" and those that are not.

[1] See J. Koskela, B. Vinceti, W. Dvorak, D. Bush, I.K. Dawson, J. Loo, E.D. Kjaer, C. Navarro, C. Padolina, S. Bordács *et al.* 2014. Utilization and transfer of forest genetic resources: a global review. *For. Ecol. Manage.*, 333: 22–34.

There is a need to clearly identify activities related to PGRFA that are considered "utilization" and those that are not. Plant breeding is generally considered "utilization". However, it is less clear whether farmer-breeding or activities like mass or pure-line selection of seeds or the creation and selection of spontaneous crosses or mutations are considered "utilization".

On the other hand, trade in PGRFA for direct use as seeds or food/feed will usually clearly not qualify as "utilization", and therefore, dependent on the applicable laws, not trigger the application of ABS measures.

Policy-makers may also wish to address the "re-utilization" of PGRA previously generated through "utilization" with PIC and MAT. If "re-utilization" requires PIC and MAT just like the first utilization of PGRFA, this could lead to complex stacking of obligations and complicate the future "utilization" of PGRFA. In such circumstances, plant breeders might choose to avoid, rather than to use, conserve and further improve, the respective PGRFA, creating a situation that would be in striking contradiction to the Second Global Plan of Action for Plant

Genetic Resources for Food and Agriculture, which encourages breeders to pursue base-broadening strategies that seek to widen the genetic diversity in plant breeding programmes and in the products of such programmes. Governments could consider distinctive solutions to this issue, including through supporting the development of subsector standards building on current best practices, such as the breeders' exemption in plant variety protection legislation, or putting in place multilateral solutions.

There is a need to clearly identify activities related to MIGR that are considered "utilization" and those that are not. It is important to note that there are certain "upstream" activities that are related to (or carried out in support of) research on MIGR but are not "utilization" as such, e.g. the maintenance and management of collections for conservation purposes, including storage, rearing, multiplication, identification and evaluation of MIGR. Similarly, the mere description of genetic resources in phenotype-based research, such as morphological analysis or the diagnostic use of a well-known gene sequence for identification, might normally not qualify as utilization. Therefore, not every study of an MIGR may be considered as utilization.[1]

[1] See Table 1 in Smith, D. *et al.* 2018. Biological control and the Nagoya Protocol on access and benefit-sharing – a case of effective due diligence. *Biocontrol Science and Technology*. DOI: 10.1080/09583157.2018.1460317 for an overview of activities and their possible qualification.

Research and development for food and agriculture

49. In light of Article 8(c) of the Nagoya Protocol, governments could consider treating access to and utilization of genetic resources differently if they are intended to contribute to food and agricultural research and development. One option would be for a country not to require PIC for such resources. Alternatively, special procedural requirements, or benefit-sharing standards, could apply or a special authority could, for example, be responsible for ABS. ABS measures making this distinction, could consider whether they should or should not include non-food/feed agricultural products.[42] However, drawing a distinction between food/feed and non-food/feed agricultural products faces the difficulty that at the stage of research and development the purpose for which the outcome will ultimately be used will often be unknown. Many agricultural products may be and are used for both food and non-food purposes. Nonetheless, ABS measures could, for example, exempt from "research and development for food and agriculture" research and development that is intended exclusively to serve non-food/feed purposes.

[42] See Treaty, Article 12.3(a).

To acknowledge the special role of GRFA for food security, governments could consider treating access to and utilization of genetic resources differently if they are intended to contribute to food and agricultural research and development. One option would be to waive the PIC and MAT requirements for access to AnGR for research and development in the livestock sector.

To acknowledge the special role of GRFA for food security, governments could consider treating access to and utilization of genetic resources differently if they are intended to contribute to food and agricultural research and development. The Treaty provides a comprehensive ABS regime that policy-makers may wish to opt for with respect to non-Annex 1 crops. In fact, a steadily growing group of countries have chosen the Treaty as a special regime for the most important PGRFA. For PGRFA currently not covered by the Treaty's MLS, policy-makers could provide for simplifications, such as to apply the terms and conditions of the SMTA or even waive PIC and MAT requirements.

To acknowledge the special role of MIGR for food security, governments could consider, in line with Article 8(c) of the Nagoya Protocol, treating access to and utilization of them differently if they are intended to contribute to food and agricultural research and development. It is important to note that no country is under an obligation to restrict access to genetic resources within its jurisdiction.

Commercial/non-commercial research and development

50. ABS measures sometimes distinguish between commercial and non-commercial utilization of genetic resources. Non-commercial utilization often benefits from softer authorization requirements and simpler authorization procedures. PIC is often required for both forms of utilization. However, in the case of non-commercial utilization, recipients are sometimes given the option of not negotiating the sharing of monetary benefits immediately, if they agree to get back to the provider and negotiate monetary benefit-sharing should their intent change. Countries should consider how to identify triggers that signal when change of intent occurs and how to address such changes of intent.

In the livestock sector, non-commercial research aims to develop methods focusing on agricultural development, thus providing societal benefits and benefits to farmers (research to improve methods of genetic improvement and selection, research on adaptation and disease resistance of AnGR) and methods for control measures (veterinary checks, food safety and traceability). Public research is fundamental for the livestock sector, and has transitioned to precompetitive research on methods, including sequencing and genotyping, that are freely available.

Commercial research carried out by the breeding industry is focused on methods for genetic improvement of traits of interest (e.g. yield and content of products, reproduction, health, longevity, efficiency of using inputs) and improvement of husbandry conditions (feeding, housing, health care). This research is usually conducted on privately owned genetic stocks (selection) or outsourced (management).

Many activities in the plant-breeding sector ultimately aim at the development of a product and might therefore be considered "commercial". The plant-breeding sector might therefore not greatly benefit from a distinction between commercial and non-commercial activities and simplifications granted by ABS measures for the latter. However, policy-makers could consider excluding non-commercial plant breeding research from the application of their ABS measures which, however, would require a clear definition or specification of activities falling under such an exemption.

Many activities related to MIGR for food and agriculture ultimately aim at the development of a product and might therefore be considered "commercial". Depending on the definition of the term "commercial", the sectors using MIGR for research and development might not greatly benefit from a distinction between commercial and non-commercial activities and simplifications granted by ABS measures for the latter. However, policy-makers could consider, in line with Article 8(a) of the Nagoya Protocol, excluding certain research and development activities from the application of ABS measures.

51. The distinction between commercial and non-commercial utilization, which is particularly important for taxonomic research and encouraged by the Nagoya Protocol,[43]

[43] Nagoya Protocol, Article 8(a).

might have limited application in the case of certain aspects of agricultural research and development that aim at improving agricultural and food production and therefore might qualify, in most cases, as commercial utilization. However, the distinction may be significant for taxonomic research used to build frameworks for distinguishing pests and pathogens and alien taxa from indigenous, or beneficial or harmless taxa.

Exemption of specific activities

52. ABS measures may also exempt certain utilizations of genetic resources from any ABS requirements. For example, the exchange of genetic resources within and among local and indigenous communities and small-scale farmers, as well as exchange practices within nationally recognized research networks, could be exempted from any access requirements and, possibly, the ABS measures as such.

(iii) Authorization procedures

53. The Nagoya Protocol provides that access to genetic resources for their utilization shall be subject to the PIC of the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the CBD, unless otherwise determined by that Party.[44]

Prior informed consent

54. Many variations of authorization procedures exist and governments may therefore wish to consider advantages and disadvantages of the different options and adapt procedures to the different categories of genetic resources and the different purposes for which they are intended to be used. The Nagoya Protocol does not provide in any detail how PIC should be granted and thus leaves its Parties, within the boundaries of Article 6.3 of the Nagoya Protocol, considerable flexibility as to how the authorization procedure may be designed. Parties to the Nagoya Protocol may also provide for different types of authorization procedures depending on the user. In any event, it is important that the procedures be streamlined and clear for providers and users alike. The selection of different types of authorization procedures given below does not claim to be exhaustive.

Standard and fast-track prior informed consent

55. Governments may wish to establish standard procedures and, in addition, fast-track procedures for certain situations, e.g. for access to certain materials; for materials that are to be used for certain purposes, e.g. research and development for food and agriculture; for access by certain stakeholders, e.g. farmers; or for combinations of these scenarios.

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[44] Nagoya Protocol, Article 6.1.

Fast-track procedures could be foreseen in ABS legislation (as well as MTA and material acquisition agreements, MAAs) for emergency cases, for example for MIGR required for biocontrol or plant and animal health in line with Article 8(b) of the Nagoya Protocol.[1]

[1] See, for example, MOSAICC, section I.2.

Implicit prior informed consent

56. ABS measures may also provide for implicit informed consent procedures for specific materials, purposes, stakeholders or other situations. In this case, access to and utilization of genetic resources could proceed without an explicit PIC by the competent authority. Implicit PIC does not rule out the possibility of benefit-sharing. Relevant ABS measures could provide, for example, that in the case of implicit PIC, the recipient has to agree with the competent authority on the terms and conditions of benefit-sharing prior to the commercialization of a product derived from the genetic resource.

Standardization of prior informed consent (and mutually agreed terms)

57. A typical regulatory response to the high number of transfers of GRFA and the recurrent exchange events in the food and agriculture sector could be the standardization of access procedures, terms and conditions. The Treaty already establishes a fully functioning precedent for this approach through its SMTA.

The most common trade in AnGR is carried out between breeders and farmers, which is based on bilateral agreements, and the price usually reflects the value of the animals or their biological material. In the past, such transfers did not require PIC or MAT.

If a country chooses not to exempt AnGR from its ABS measures, the authorization process to obtain PIC will depend on the established ABS framework and the provider of the AnGR. To ensure efficiency in view of the high number of exchanges, standardization of PIC and MAT might be helpful.

Currently, the exchange of AqGR is primarily regulated through commercial contracts. Because most genetically improved aquatic species are fertile and can be easily reproduced, contracts often restrict the use of AqGR and prohibit their use for rival breeding programmes. Current business practices in the aquaculture

industry may provide inspiration for the design of the terms and conditions of ABS agreements for AqGR.

Despite the limited attention to ABS in the aquaculture sector, there have certainly been cases where the provider of the original AqGR benefited from the results of research and development performed by a third party on the AqGR. Sharing research and development results with the provider of AqGR will therefore often be a standard condition of ABS agreements.

The SMTA of the Treaty offers a ready-made and tailor-made solution for PIC and MAT. For PGRFA that are not exchanged by using the SMTA, bilateral case-by-case arrangements should not be considered the only possible alternative. The application of the SMTA to non-Annex 1 PGRFA is an option. ABS measures could allow for the conclusion of framework agreements covering a whole range or type of accessions and providing for modalities for the sharing of benefits derived from the utilization of all such accessions.

Best practices, model MTAs and MAAs have been developed for various subsectors of MIGR.[1] These models may inspire the development of MTAs and MAAs that stakeholders of the relevant subsectors may agree on with a view to facilitating ABS and avoiding the need to conclude bilateral agreements on a case-by-case basis. ABS measures could allow for, and indeed encourage, the use of MTAs and MAAs for MIGR and model contractual clauses, as envisaged by Article 19.1 of the Nagoya Protocol.

[1] For an overview: McCluskey, K. *et al.* 2017. *The U.S. Culture Collection Network responding to the requirements of the Nagoya Protocol on Access and Benefit Sharing*. mBio 8, Table, DOI:10.1128/mBio.00982-17; Mason, P.G. *et al.* 2018. Best practices for the use and exchange of invertebrate biological control genetic resources relevant for food and agriculture. *Biocontrol*, 63: 149–154. DOI: 10.1007/s10526-017-9810-3, Supplementary information.

58. A good starting point for the use of standardized procedures and conditions could be already existing pools of GRFA, for instance in the form of collections and gene banks, provider and user communities and networks. Their established exchange practices may offer useful models to build upon, as they often include the use of an agreed set of conditions and modalities, sometimes even formalized in the form of codes of conduct, guidelines or material transfer agreements.

59. ABS measures may establish standard ABS conditions for specific materials, purposes, stakeholders or other standard situations. Recipients accessing and using specified genetic resources, for example for specified research/development purposes, would have to abide by a set of access and benefit-sharing conditions predefined in the ABS measures. Given the variety of resources, the variety of purposes for which they may be used and the variety of stakeholders, standardization of ABS may not work as an overall solution for all GRFA. However, for specific types of utilization of genetic resources that usually generate a similar scale of benefits, standardization of ABS may be a viable option and, in addition, a powerful instrument to attract recipients who prefer abiding by a set of predefined ABS standards over having to negotiate bilateral ABS agreements on a case-by-case basis.

60. The standardization of PIC (and MAT) procedures may, if the agreed standards are adequate and have been developed in line with existing practices and upon consultation with relevant stakeholders, help to reduce transaction costs considerably, and may also help to speed up the administrative decision-making processes.

Framework prior informed consent (and mutually agreed terms)

61. As the international exchange of genetic material is a longstanding practice in the food and agriculture sector, many stakeholders rely on it, and business practices have been structured accordingly, often characterized by transnational specialization and division of labour. The different stakeholders managing and using GRFA are interdependent and GRFA are often exchanged in the framework of close working collaborations and partnerships, with many stakeholders acting as intermediaries in the value chain, i.e. being neither the original provider nor the end user of a specific GRFA.

62. ABS measures may accommodate these practices by providing for the possibility of concluding framework agreements that authorize access to and utilization of a specified range of genetic resources, possibly limited to specific purposes, provided benefits are shared as and when agreed. In this case, users would not have to request access for each genetic resource separately but would possibly still have to notify every accession they actually accessed and used for research and breeding to provide legal certainty to users and facilitate monitoring of compliance with the framework agreement. The framework PIC may be particularly appropriate for sectors that exchange large amounts of germplasm among the different stakeholders along the value chain during research and development.

III. Access to traditional knowledge associated with GRFA

63. Under the Nagoya Protocol, in accordance with domestic law, each Party shall take measures, as appropriate, with the aim of ensuring that traditional knowledge associated with genetic resources is accessed with the PIC or approval and involvement of the indigenous and local communities holding such traditional knowledge, and that MAT have been established.[45] It is important to note that these requirements apply to

[45] Nagoya Protocol, Article 7.

traditional knowledge associated with genetic resources irrespective of whether genetic resources are being made available at the same time.

64. The Protocol requires that, in accordance with domestic law, Parties take into consideration indigenous and local communities' customary laws, community protocols and procedures with respect to traditional knowledge associated with genetic resources. National focal points shall provide, where possible, information on procedures for obtaining PIC or approval and involvement, as appropriate, of indigenous and local communities. Further guidance may well be required as to how PIC or approval and involvement of indigenous and local communities may be obtained. In the case of traditional knowledge associated with GRFA, much of this knowledge may be shared by several communities, and national measures need to clarify how in such cases fully valid approval may be obtained.

65. It should be noted that Article 9 of the Treaty, on Farmers' Rights, includes a provision on the protection of traditional knowledge relevant to PGRFA.

Procedures for involving indigenous peoples and local communities (IPLC) in granting access to traditional knowledge on AnGR are diverse and in many countries under development. IPLC should be involved in decisions that concern their traditional knowledge associated with AnGR, and the domestic ABS regulatory measures should respect biocultural community protocols and specific institutional arrangements developed by these communities. In cases where several communities share traditional knowledge associated with AnGR and only one has granted PIC, a mechanism for benefit-sharing involving all relevant IPLCs could be considered, including, where appropriate, a simplified dispute-resolution mechanism. Biocultural community protocols are also useful to support *in situ* conservation of locally adapted breeds, which in some cases may be necessary to maintain endangered breeds and ensure their future availability.

Procedures for involving IPLCs in granting access to traditional knowledge to PGRFA are diverse and in many countries under development. IPLCs should be involved in decisions that concern their traditional knowledge associated with PGRFA, and the domestic ABS regulatory measures should respect biocultural community protocols and specific institutional arrangements developed by these communities. In cases where several communities share traditional knowledge associated with PGRFA and only one has granted PIC, a mechanism for benefit-sharing involving all relevant IPLCs might be considered including, where appropriate, a simplified dispute-resolution mechanism.

IV. Fair and equitable sharing of benefits

(i) Scope of benefit-sharing obligations

66. Many GRFA may have been collected long before the application of national ABS measures. For these resources, the question is no longer whether or under what conditions they may be accessed, as access has already occurred. ABS measures should be clear as to whether they require the sharing of benefits arising from new or continued uses of genetic resources or associated traditional knowledge accessed prior to the ABS measures having been put into place. As noted above, there is an international debate on the temporal scope of the Nagoya Protocol.

AnGR have been widely exchanged throughout the world and most breeds are of mixed ancestry. Livestock keepers and breeders in many parts of the world have contributed to the development of these breeds, and today livestock production in most regions depends on AnGR that originated or were developed elsewhere. Over generations, AnGR have been integrated into domestic livestock populations.

It is important to note that there are no examples of any benefit-sharing arrangements for AnGR, or associated traditional knowledge, accessed prior to the entering into force of the Nagoya Protocol, or prior to the introduction of national ABS measures. It would be extremely difficult, if not impossible, to track the progeny of past-imported farm animals.

PGRFA have been widely exchanged throughout the world, and actors in many different places have contributed in one way or another to the development of today's crop genetic diversity. As a consequence, an important part of current crop production relies on the use of the genetic diversity from other places, and all countries depend to some extent on genetic diversity that originated elsewhere.

67. Governments may wish to consider carefully the implications of expanding the scope of their ABS measures to previously accessed GRFA or traditional knowledge. As most countries are using GRFA originating from other countries, ABS measures covering previously accessed GRFA could lead to considerable uncertainty regarding the status of such resources and, more importantly, severely discourage potential users from utilizing such GRFA for research and development.

(ii) Fair and equitable

68. The fair and equitable sharing of benefits arising from the utilization of genetic resources is a key component of ABS measures. Benefits may include monetary

and non-monetary benefits. According to the Nagoya Protocol, benefits arising from the utilization of genetic resources, as well as subsequent applications and commercialization, shall be shared in a fair and equitable way with the Party providing such resources that is the country of origin of such resources or a Party that has acquired the genetic resources in accordance with the CBD.[46] Such sharing shall be on MAT. Bilateral case-by-case negotiations of MAT for GRFA may entail high transactions costs and therefore not be practical. Providers and users of GRFA may therefore wish to rely on model contractual clauses, codes of conduct, guidelines, best practices and/or standards developed for their sector or subsector. Benefits shared under the MLS of the Treaty include: the exchange of information, access to and transfer of technology; capacity-building; and the sharing of benefits arising from the commercialization of PGRFA.[47] Some of these benefits are specified in the SMTA of the Treaty.

The fair and equitable sharing of benefits arising from the utilization of genetic resources is a key component of ABS measures. Benefits may include monetary and non-monetary benefits.

With respect to the livestock sector, there are established practices for the exchange of AnGR, and various types of private contracts and standard clauses used by the subsector. ABS measures may take these commercial exchange practices into account.

(iii) Beneficiaries

69. Identifying the proper beneficiary or beneficiaries may be particularly difficult in the case of GRFA. The innovation process for many GRFA, in particular PGRFA and AnGR, is usually of incremental nature and based on contributions made by many different people in different places at different points of time. Most products are not developed out of an individual genetic resource, but with the contributions of several genetic resources at different stages in the innovation process.

70. Sharing the benefits in a fair and equitable way and sharing the benefits with the proper beneficiary may therefore become a major challenge for most subsectors of GRFA, including aquatic and forest genetic resources where breeding technologies play an increasingly important role. Depending on the extent to which genetic resources and associated traditional knowledge contribute to a final product, it may become difficult to determine the fair and equitable sharing of benefits with the different countries and indigenous and local communities that contributed genetic resources and/or traditional knowledge. Where it is difficult to determine the country of origin of GRFA, the question may arise as to whether several countries may be considered the country of origin of a genetic resource where the genetic resource has acquired its distinctive properties in the natural surroundings of these countries.

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[46] Nagoya Protocol, Article 5.1.

[47] Treaty, Article 13.2.

71. Various options for accommodating the incremental nature of the innovation process typical of many GRFA may be considered. There may be circumstances in which providers and users are best positioned to negotiate benefit-sharing among themselves. Alternatively, benefits could, for example, be decoupled from individual providers or accessions, pooled in a national benefit-sharing fund or other cooperative arrangements and be distributed in line with agreed policies and disbursement criteria. This option could be considered, in particular, for the distribution of benefits among different beneficiaries at national level (e.g. the state and various indigenous and local communities). However, where the genetic resources originate from different countries, governments may wish to consider how to reflect the interests and views of the countries involved in the benefit-sharing models, including through the use of multilateral solutions.

Processes to develop AnGR are incremental in nature and are based on contributions of many people in different countries at different points of time. They involve continuous exchange of AnGR that are beneficial to farmers/breeders at each step of the breeding process.

Further globalization of animal breeding has enhanced the availability of highly producing AnGR, without restrictions, worldwide, and on a commercial basis. This has supported rapid enhancement of animal production in developing countries and improved food security.

However, there is also a need for increased access, availability and affordability of adapted and improved genetic material for small-scale farmers. At national levels, benefit-sharing mechanisms may involve returning improved breeding stock from selection programmes, in good sanitary state, to the original owners. At the global level, benefit sharing may be facilitated by projects supported by the Funding Strategy for the implementation of the Global Plan of Action for Animal Genetic Resources.

(iv) Monetary and non-monetary benefits

72. The terms and conditions of monetary and non-monetary benefit-sharing will often depend on the particularities and specificities of the subsector, the species, the concrete intended use, etc. However, access to GRFA will always be a benefit in itself, as is stated for PGRFA in Article 13(1) of the Treaty, and governments may wish to consider how to address forms of utilization that restrict subsequent access. The mutual exchange of GRFA may be an option that governments may wish to consider, as it would allow for access to GRFA without having to negotiate the sharing of monetary benefits and yet offers substantial benefits to both sides.

73. Considering the important non-monetary benefits of GRFA, such as characterization data, research results, capacity-building and technology transfer, ABS

measures for GRFA may identify non-monetary benefits that are of particular relevance to the food and agriculture sector. The Nagoya Protocol lists research directed towards food security, taking into account domestic uses of genetic resources in the country providing genetic resources, as well as food and livelihood security benefits, as possible non-monetary benefits.[48]

While ABS arrangements will sometimes require that monetary benefits be shared as they accrue, some countries may consider opportunities for non-monetary benefit-sharing, as time spans between access to FGR and the generation of benefits may be extremely long. Sharing data is one way to provide value in many cases. Countries may wish to consider monetary benefit-sharing exemptions to promote work on endangered tree species.

(v) Sharing benefits through partnerships

74. As international exchange of genetic material is a longstanding practice in the food and agriculture sector, many stakeholders rely on it, and business practices and scientific collaboration partnerships have been structured accordingly. The different stakeholders managing and using GRFA are interdependent and GRFA are often exchanged in the framework of close working collaborations and partnerships, with many stakeholders acting in the value chain being neither the original providers nor the end users of the GRFA. To manage the sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, ABS measures may allow for benefit-sharing arrangements to be part of broader research partnership agreements. Such framework agreements (see above, paragraphs 61–62) may cover a range of genetic resources. Conversely, governments may wish to consider regulating exchanges of GRFA that could adversely impact the diversity of local GRFA.

With respect to AnGR, the sharing of research results is of key importance, as it contributes to the generation of public knowledge on AnGR. Much of the resulting knowledge products and data are freely available. Other forms of non-monetary benefits that could be shared in cooperation agreements include the provision of information on the estimated breeding value of sold breeding stock and on its requirements in terms of management conditions and husbandry practices. Non-monetary benefits may also include capacity development, provision of extension services and technology transfer and cooperation in setting up *in situ* and *ex situ* conservation programmes.

[48] Nagoya Protocol, Annex, sections 2(m); 2(o).

In the AnGR sector a number of global consortia have been established to further AnGR research and knowledge exchange, for example the Swine Genome Sequencing Consortium, the International Goat Genome Consortium, the International Research Consortium for Animal Health and networks such as European Gene Bank Network for Animal Genetic Resources.

If ABS measures consider provenance trials as "utilization" they could still accommodate this specific form of research and development by providing for the possibility of concluding framework agreements that authorize access to and utilization of a range of FGR for such trials and addressing benefit-sharing for all partners contributing to the trials.

ABS measures could encourage stakeholders to address ABS issues, where possible and appropriate, including through use of the SMTA or other ABS agreements, as part of scientific partnership agreements. Partnership agreements could make individual ABS permits on a case-by-case basis for single transfers unnecessary and, at the same time, encourage joint research activities going beyond the exchange of PGRFA.

ABS measures could encourage stakeholders to address ABS issues, where possible and appropriate, as part of scientific partnership agreements and within existing informal and formal networks. It has been argued that "informal cooperative networks of biological control practitioners around the world, involving scientists working with government agencies, intergovernmental organizations, international agricultural research centres, universities, industries, etc, are best suited to assist biological control practitioners for the free multilateral exchange of invertebrate biological control agents."[1] The difficulty of working with micro-organisms and invertebrates and the special skills required may make the sharing of non-monetary benefits, including capacity building, particularly relevant.

[1] Mason, P.G., *et al.* 2018. Best practices for the use and exchange of invertebrate biological control genetic resources relevant for food and agriculture. *Biocontrol*, 63: 151, DOI: 10.1007/s10526-017-9810-3.

(vi) Global multilateral benefit-sharing mechanism

75. Parties to the Nagoya Protocol have agreed on a process to consider the need for and modalities of a global multilateral benefit-sharing mechanism, which may be relevant to benefit-sharing for GRFA.[49]

V. Compliance and monitoring

76. There are different types of compliance measures in the area of ABS, including: compliance of countries with an international instrument such as the Treaty or the Nagoya Protocol; compliance of users with PIC and MAT; and compliance with domestic legislation of the providing country. With regard to the third type of compliance, the Nagoya Protocol requires each Party to take appropriate, effective and proportionate legislative, administrative or policy measures to provide that genetic resources utilized within its jurisdiction have been accessed in accordance with PIC and that MAT have been established, as required by the domestic ABS legislation or regulatory requirements of the other Party. Parties to the Nagoya Protocol shall also take measures to address non-compliance with user country measures and cooperate in cases of alleged violations.[50] To support compliance, Parties to the Nagoya Protocol shall also take measures, as appropriate, to monitor and to enhance transparency about the utilization of genetic resources, which shall include the designation of one or more checkpoints.[51] It should be noted that under the Treaty, access shall be accorded expeditiously without the need to track individual accessions.[52]

Sometimes the unknown origin of AnGR in older collections, genebanks or in herds may make it difficult to determine the countries of origin during the checks of user compliance.

77. Compliance measures may pose challenges to the food and agriculture sector if the ABS status of GRFA used in breeding is unknown to users. Governments may wish to consider distinctive solutions to this problem, including through supporting the development of subsectoral standards building on current best practices, such as the breeders' exemption, or putting in place multilateral solutions.

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[49] Nagoya Protocol, Article 10; Decision NP-1/10 & Decision 2/10.
[50] Nagoya Protocol, Article 15 & 16.
[51] Nagoya Protocol, Article 17.
[52] Treaty, Article 12.3(b).

ANNEX

DISTINCTIVE FEATURES OF GENETIC RESOURCES FOR FOOD AND AGRICULTURE – revised

The distinctive features of GRFA requiring distinctive solutions for ABS are presented below in seven clusters. They aim to reflect an equilibrium between all subsectors of food and agriculture. Not every feature is necessarily applicable to each and every GRFA and the various subsectors often have different features. Further detailing of subsector-specific features may still be developed.

The features are distinctive, but not necessarily unique to GRFA. While other genetic resources may share with GRFA some of the features listed below, the specific combination of these features distinguishes GRFA from most other genetic resources.

For the purpose of this table InGR are considered invertebrate BC agents. Invertebrate pollinators are considered AnGR. Aquatic invertebrates used for food are considered AqGR. InGR used for other purposes of relevance to agriculture could be addressed in future work.

		AnGR[1]	FGR[2]	PGR[3]	AqGR[4]	MoGR[5]	InGR[6]
A. The role of GRFA for food security	A.1 GRFA are an integral part of agricultural and food production systems and play an essential role in achieving food security and the sustainable development of the food and agriculture sector.	+	+	+	+	+	+
	A.2 Plant, animal, invertebrate and micro-organism GRFA form an interdependent network of genetic diversity in agricultural ecosystems.	+	+	+	+	+	+
B. The role of human management	B.1 (a) The existence of most GRFA is closely linked to human activity and (b) many GRFA can be regarded as human-modified forms of genetic resources.	+	-	+	-/+	(a): - (b): -/+	-
	B.2 The maintenance and evolution of many GRFA depend on continued human intervention, and their sustainable utilization in research, development and production is an important instrument with which to ensure conservation.	+	-	+	+	-	-
C. International exchange and inter-dependence	C.1 Historically, GRFA have been widely exchanged across communities, countries and regions, often over long periods of time, and a relevant part of the genetic diversity used in food and agriculture today is of exotic origin.	+	-	+	-/+	-	+
	C.2 Countries are interdependent with regard to GRFA and act both as providers of some GRFA and as recipients of others.	+	+	+	+	+	+
	C.3 The international exchange of GRFA is essential to the functioning of the sector, and its importance is likely to increase in future.	+	+	+	+	+	+

		AnGR[1]	FGR[2]	PGR[3]	AqGR[4]	MoGR[5]	InGR[6]
D. The nature of the innovation process	D.1 The innovation process for GRFA is usually of incremental nature and the result of contributions made by many different people, including indigenous and local communities, farmers, researchers and breeders, in different places and at different points in time.	+	+	+	-/+	-	-
	D.2 Many GRFA products are not developed out of an individual genetic resource, but with the contributions of several GRFA at different stages in the innovation process.	0	-	+	-/+	-	-
	D.3 Most products developed with the use of GRFA can in turn be used as genetic resources for further research and development, which makes it difficult to draw a clear line between providers and recipients of GRFA.	0	+	+	+	+	+
	D.4 Many agricultural products reach the market place in a form in which they may be used both as biological resources and as genetic resources.	0	+	+	-/+	+	+
E. Holders and users of GRFA	E.1 (a) GRFA are held and used by a broad range of very diverse stakeholders. (b)There are distinct communities of providers and users with respect to the different subsectors of GRFA.	+	-	+	-/+	(a): + (b): +	(a): - (b): +
	E.2 The different stakeholders managing and using GRFA are interdependent.	+	+	0	+	-	-
	E.3 A significant amount of GRFA is privately held.	+	-	0	+	-	-
	E.4 An important part of GRFA is held and can be accessed *ex situ.*	0	-	+	-/+	+	-

		AnGR[1]	FGR[2]	PGR[3]	AqGR[4]	MoGR[5]	InGR[6]
	E.5 An important part of GRFA is conserved *in situ* and on farm under different financial, technical and legal conditions.	+	+	+	+	+	+
F. GRFA exchange practices	F.1 The exchange of GRFA takes place in the context of customary practices and existing communities of providers and users.	+	+	+	-/+	+	+
	F.2 Extensive transfer of genetic material between different stakeholders along the value chain occurs in research and development.	+	-	+	+	-	-
G. Benefits generated with the use of GRFA	G.1 (a) While the overall benefits of GRFA are very high, (b) it is difficult to estimate at the time of the transaction the expected benefits of an individual sample of GRFA.	0	+	+	+	(a): -/+ (b): +	(a): - (b): +
	G.2 The use of GRFA may also generate important non-monetary benefits.	(b): +	(a): -	+	+	+	+
	G.3 The use of GRFA may lead to external effects going far beyond the individual provider and recipient.	(b): +	+	+	+	+	+

Note: The Intergovernmental Technical Working Groups on Animal, Aquatic, Plant and Forest Genetic Resources and the Expert Group on Micro-organism and Invertebrate Genetic Resources, in reviewing the distinctive features, highlighted features particularly relevant (marked in the table above by plus signs [+]) or less (or not) relevant (marked in the table by minus signs [-]) to their respective subsectors. Features considered as neutral to a subsector are marked by zero [0]. Distinctive features which a Working Group considered particularly relevant to a subgroup of its subsector and less (or not) relevant to other subgroup(s) are marked by plus and minus signs (-/+).

[1] CGRFA/WG-AnGR-10/18/Report, *Appendix* B.I.
[2] CGRFA/WG-FGR-5/18/Report, paragraph 22.
[3] CGRFA/WG-PGR-9/18/Report, paragraph 38.
[4] CGRFA/WG-AqGR-2/18/Report, *Appendix B.*
[5] CGRFA/EG-MIGR-1/18/Report, *Appendix C.*
[6] CGRFA/EG-MIGR-1/18/Report, *Appendix C.*

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity has been hailed as a giant step towards the implementation of the third objective of the Convention: the fair and equitable sharing of benefits arising out of the utilization of genetic resources, including by appropriate access to them. Implementing this third objective is intended to contribute to the conservation of biological diversity and the sustainable use of its components, the other two objectives of the Convention.

The Protocol confronts policy-makers and administrators responsible for its implementation at the national level with a number of challenges. One of these challenges is the Protocol's obligation to consider, in the development and implementation of access and benefit-sharing measures, the importance of genetic resources for food and agriculture (GRFA) and their special role for food security.

The Elements to Facilitate Domestic Implementation of Access and Benefit-Sharing for Different Subsectors of Genetic Resources for Food and Agriculture aim to assist governments considering developing, adapting or implementing access and benefit-sharing measures to take into account the importance of GRFA, their special role for food security and the distinctive features of their different subsectors, while complying, as applicable, with international instruments.

This publication contains the original ABS Elements as well as the explanatory notes describing, within the context of the ABS Elements, the distinctive features and specific practices of the different subsectors of GRFA. The explanatory notes were welcomed by the Commission on Genetic Resources for Food and Agriculture and the FAO Conference in 2019.

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